AUTOMOTIVE INDUSTRIES

THE AUTOMOBILE

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Continental Motors will be on exhibition at the Chicago Automobile Show, Coliseum Gallery 50-51.

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Continental Motors

STANDARD POWER FOR TRUCKS, AUTOMOBILES AND TRACTORS

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TO

VOLUME XLIV

(Jan. 6 to June 30, 1921)

OF

Automotive Industries

Every effort has been made to present in these pages a table of contents for six months' issues of AUTOMOTIVE INDUSTRIES that it may serve as a guide to the authoritative current and reference articles printed. This index will also serve as a reference for those who wish to use the news pages of this publication as a guide to the history of the material development of the industry. This work is in keeping with our efforts to make this publication entirely representative of the great industry.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLIV NEW YORK—THURSDAY, JANUARY 6, 1921 No. 1

Are Your Dealers Discontented? A Good Many Dealers Are!

We have heard so much about discontent and the prospective shakeup in dealer representation that we have obtained intimate opinions from 13 representative men. We believe these replies form a very important contribution to the research that must be made into the subject of automotive vehicle selling.

By Clyde Jennings

A FEW days ago there came into the Class Journal office a man who wanted to talk over the prospects of manufacturing a car. This man has a completely equipped factory; a satisfactory (to him) design of a car that has successfully made the experimental runs. What he needs is a dealer organization. When that is completed, he will be ready to give the word to begin manufacturing as soon as he thinks the selling situation is right.

What we want really to tell is **this man's plan for building up a dealer organization.** He has spent several months studying the situation as it presents itself and here is his conclusion:

> **There are many good dealers and distributers who are disgusted with the methods under which they have been working. They believe that they have been threatened, forced to do this and that, and have been given no voice whatever in the preparation of the article that they must pass on to the public. I am going to nose about among dealers and distributers, pick out some of these men and put them into my organization. I want 20 distributers and I am going to make these men into a selling board and the last word on the car design and method of selling will be their word. In other words they will come into my organization as directors, representing their dealers, and have a voice in the making of the article they are to sell.**

A FEW weeks ago the Uruguay legislature passed a bill making unlawful a merchandising contract with a foreign firm that could be cancelled by a 60-day notice.

The reason for this action is said to have been the cancellation of a sales contract between an American automotive manufacturer and an Uruguayan dealer. In this case, so it is reported, some vehicles shipped to this dealer before the cancellation notice was mailed did not reach him until after the cancellation became effective. The idea that influenced the legislators was that this dealer's investment in his business and the effort he had put into building up a good will were swept aside **without a hearing of his side** of the case.

THESE two incidents would indicate that manufacturers have been somewhat high handed in their dealer operations. The two incidents might be

construed to indicate that the present methods could be improved. Of course, none of us expects that any manufacturer will ever build a dealer organization that will be 100 per cent efficient and contented. Human nature has not reached that point as yet.

But it is reasonable to expect that the state of mind of the dealers and distributers would be such that a prospective manufacturer would not expect to build a worthy organization on the ruins of another's structure, and that legislatures need not be called in to protect dealers.

Now what are the facts as to the present state of mind of the dealers? There is only one place to find the answer, and that is the men most concerned—the dealers.

So the question was put to some of the most important dealers and distributers in the country. The question was asked by a man who knows the men who wrote the replies we will quote. The questioner knows these men well, he knows their families and their homes and so the men are truthful to each other.

We will say further, these men did not know that they were writing for publication, nor do they belong to the same organization. Probably 25 cars are handled by these men, as several of them sell more than one line of automobiles.

The question was this:

In your opinion do you believe that there will be a general shakeup of dealer representation? Will dealers quit their lines for the reason that they believe that they have not had a square deal from their factories? What, in your opinion, will happen?

Now come the answers. They are an important document, as important a document, I believe, as has ever been contributed to the sales end of the automotive business. Remember, in reading what follows, that you are reading the testimony of men who have sold motor cars for years. Some of them have been in the business twenty years, and all of them long enough to become recognized units in the business. They are not interlopers, nor are they mere observers. They are the men who have given a good account of themselves on the firing line.

Surely it is time for some manufacturers to stop, look and listen when such opinions are given by the best men in the business.

Just to keep the question in front of you as you read the replies, we repeat it here:

In your opinion do you believe that there will be a general shakeup of dealer representation? Will dealers quit their lines for the reason that they believe that they have not had a square deal from their factories? What, in your opinion, will happen?

1—I believe there will be a general shakeup and have talked with some of the distributers and factory branch managers and it is safe to assume that there will be a general shakeup and many of the dealers will be bothered. Here's what happened:

In many cases during the non-delivery period, many dealers have taken on lines on which they could get deliveries or hoped to, and where they previously carried one or two lines, they are now carrying four or five. In many instances they have done this, believing they have not received a fair deal from their factories. In most instances, perhaps, it was the fact that the factories could not make delivery. What is going to happen is this:

Many of the dealers who have been handling certain lines for many years will change and go on to other lines because of special and extra inducements given by these manufacturers to beat out the "other fellow." Of course, some of the better lines will not suffer from this materially, but some will. It will be a question here of the survival of the fittest.

2—No doubt there will be some changes to take place among the dealers, part of which will be caused by the desire of the factories to get better connections and part by the fact that some dealers who have sold cars that are more or less undesirable will endeavor to obtain better connections.

I believe this situation will be very much like the recent labor situation. When there are plenty of jobs it is rather hard to hold laboring men in line. In other words, a little competition should do no harm. It is my belief that there are a number of dealers in some cases handling very excellent lines who have no more right to success in business than I have to a place in heaven.

Anyone who is familiar with the automobile industry can testify that in no industry is there such a large number of men who are apparent successes but who, as a matter of fact, have been carried along by the current. No doubt, when it becomes a matter of selling automobiles rather than telling the people when you can give them a car, many of this class of dealers will be eliminated.

For many years I have found it very hard to understand how some fellows have been able to remain in business when you take into consideration the methods pursued in their various establishments. Some of the so-called successful automobile establishments remind one very much of the old-fashioned livery stable and one of the second-rate at that.

It must be taken into consideration that there are many distributers and dealers, as well as manufacturers in the business who had no right to start in the first place. Due to an over-liberal credit situation which existed up until about a year ago, many dealers started in the business on a very extensive scale on a very limited capital. I have a very intimate knowledge of one outfit that started on barely enough money to unload one carload of automobiles. Due to some particular good fortune, this concern has been able to remain in business and has at last got its finances on a rather substantial basis.

I believe that in the future to handle the automobile business, it will require more capital. In other words, fellows who have started in the past would be unable to duplicate the feat.

This, undoubtedly, will result in a more substantial class of dealers with better methods and more profit to all who are in the industry.

3—Dealers who have been handling several different lines will quit all but possibly two lines. In some cases, they will handle only one line.

4—Dealers cannot afford to quit their lines, even though many have just grievances. At present, factories hold the reins and distributers and dealers alike must comply with their wishes and accede to their demands.

5—My opinion is that there is going to be some awful change. I have received quite a few letters from distributers and dealers with whom I was not connected at all in the business world, who have told me that they were waiting for the time to come when the cars would be plentiful and they could tell the manufacturers to go to hell.

I am giving you this just as they put it to me.

My opinion is that if the manufacturer does not do something soon to get his dealer organization together and regain their confidence that the different manufacturers will be bidding against each other trying to get the best representative, because he, the manufacturer, will get desperate and will do these things in order to save his factory organization.

6—There will be no shakeup in our dealers. Our factory has been running almost continually. I do know, though, of a lot of dealers who are dissatisfied with the service they receive from their factory and are willing to jump to some other make of car, but the dealers who are handling cars made by reputable manufacturers will not give up their agencies and the factories are not increasing the number of dealers, so we hardly know what will become of the dealers who want to jump.

I imagine that a lot of dealers are going out of business. I know that a lot of Blank dealers are going to and have, either because they could not get the cars, the cars were no good, made bad deals, and cut prices and did not know how to conduct their business.

7—Some dealers who have good lines and are not well financed will, undoubtedly, be forced out, and the dealers with poor lines who are well financed will ease into the place vacated by the former. This is natural. I do not believe that dealers will quit their present lines unless for the purpose of securing a better one.

The successful automobile man is an optimist and lives in the belief that things will change for the better to-morrow. They look forward to improved relations with the factory on the theory that "further up the creek you go, the better the fishing."

8—I do believe there will be a general shakeup of dealer representation when cars become more plentiful, but I do not think that this will take the form of changing agencies. Rather the dealer will go out of business, because I am satisfied that there are too many dealers and too many manufacturers in this business at this time.

9—The need of education in the automobile dealer industry along merchandising principles, as laid down by other successful lines of business, when automobile dealers have to sell their cars, will bring forth many changes and shakeups because the dealer does not know how much it costs him to do business. Dealers will quit more on this account than because they have not been treated fairly.

In most cases, their organizations will have become so badly disrupted they will not know who or what to blame. Furthermore, there are many dealers and distributers organizations who are handling the product of certain manufacturers whose unfairness has caused them loss of money, prestige and so forth, who will switch from their present position to take on the line of automobiles from the manufacturer who has a clearer vision of the automobile industry which the dealer or distributer occupies.

10—There is going to be quite a change in dealer representations throughout the country, as I believe that the dealer who is well organized, which includes sufficient financial backing, will be in a position to obtain the pick of agencies.

There are many dealers who have not received a square deal from their factories and I believe that if this financial stringency continues that many dealers will be forced to retire, and this will leave the better dealers to command something from the factories and they will be in a position that they have never been in before.

11—I think the time is not yet here when dealers will give up standard profitable lines, no matter how they might feel. If the factories impose conditions which dealers find it hard to meet and still handle their outputs, some readjustment will have to take place. One factory, for instance, imposes a $15 national advertising charge on every car which we must pass on to the customer. I think the manufacturers of less known cars will suffer seriously under present conditions of contracts in view of coming competition and fall-off in the market.

12—This is entirely problematical in my mind. It is to be presumed that there will be several changes both from the dealer viewpoint and the factory viewpoint. Both may be justified. We are looking forward to some changes in our own distributing organization of dealers. Dead-wood is appearing; that is, those who cannot sell, but were able to take orders. We must have sellers in a buyers' market.

13—It is natural that every factory will look for the best dealer representation it can find. If it finds its present dealer complaining against the treatment received it will either mollify him or look elsewhere. The standard lines always will be well represented. I believe the average dealer continues to do business as long as possible with the factory he is familiar with, and **I believe that statistics will show that most cancellations are made by the factories.**

Yes, there are more questions.

This article and those to follow delve more deeply into the question of dealer-manufacturer relations than anything heretofore put on paper. The frankness and honesty of the replies to the questions must be their own defense. No names will be given in this treatment of the question. But we will endeavor to make plain to the manufacturer just what his dealer thinks about a number of very important topics, such as:

The bad taste left after the allotments in 1919.

Introduction of new models.
Careless factory inspection.
Poor assembly.
Price changes.
Dealer contract.

You will note in reading these answers that six men are outspoken in the opinion that there will be a big shakeup among dealers, while only three are outspoken against it and at least a part of the three give the opinion as referring only to the organizations they represent.

You will also note that five of these men speak out squarely that the dealers have not had a square deal.

According to A. P. Young, writing in *Engineering* (London), if a spark gap be connected to an alternator or transformer designed to produce about the same voltage as that generated by a magneto (say 10,000) at the usual frequency of 50 per second, owing to the comparatively slow rate of application of the voltage, the spark voltage will be much less than with a magneto, in which latter the secondary voltage builds up extremely rapidly. The ratio between the spark voltage with magneto current with an ordinary alternating current of 50 cycles per second is frequently known as impulse ratio.

New Model Lexington Car Uses Ansted Engine

Model T chassis similar to model S except for new engine. Latter is high speed type with overhead valves, novel rocking valve gear, and vacuum oil control. Large well heated inlet manifold cast integral with exhaust header. Hand brake is mounted on transmission. Makers set good precedent by furnishing more detailed specifications than are customary.

By J. Edward Schipper

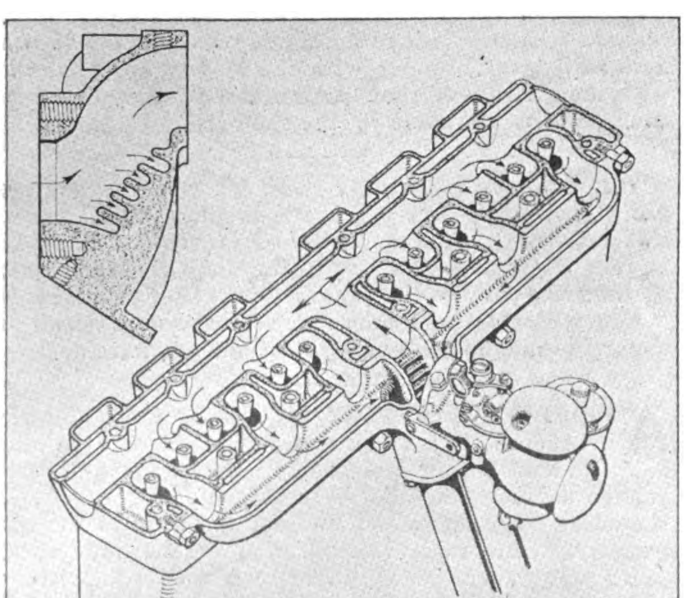
A NEW make of engine, the Ansted, features the new model of Lexington car. Otherwise, the new chassis is very similar to the model S (which will be continued), though the wheelbase has been considerably lengthened. For the present the new chassis will be fitted with seven-passenger and closed bodies only.

The Ansted engine is a valve-in-head type and is designed for operation at high rotative speeds, hence it is capable of giving considerably more power than the L head engine formerly used, though it is of the same piston displacement. Its maximum output of 73 hp. is obtained at 3200 r.p.m. It is of 224 cu. in. displacement and the maximum brake horsepower per cubic inch of displacement is 0.325.

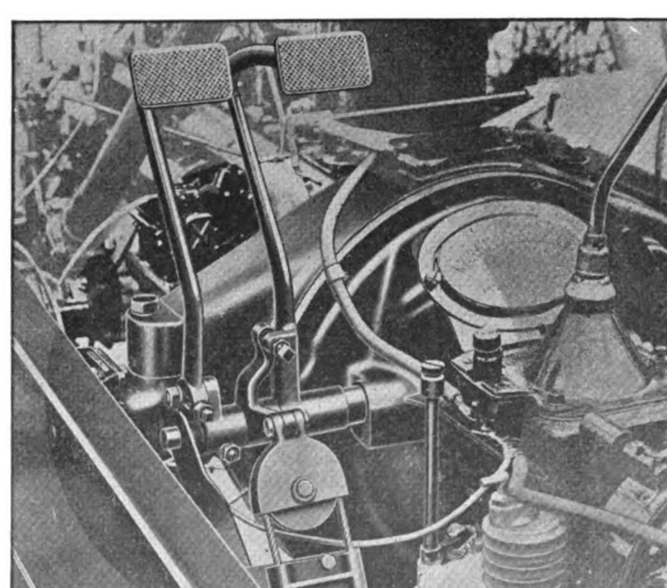
The cylinder barrels and upper half of the crankcase are in one casting, which makes a good manufacturing job. All finished surfaces of the block are at right angles or parallel to the bottom face of the cylinders. The water jackets are carried the entire length of the cylinder wall, and there are water spaces between adjacent cylinder barrels. The pressed steel underpan acts as an oil reservoir. The timing gear cover plate is so fashioned as to provide a suitable support for the electric generator.

The piston is a light cast iron shell, well ribbed and provided with only two rings. The piston pin is fastened in the connecting rod and bears in the piston pin bosses. There is a deep groove around the piston at the pin and there are two horizontal grooves on each side of the piston pin hole, so that oil scraped off the cylinder wall may be fed into the piston pin bearing. The two piston rings have a stepped joint and are provided with saw cuts to keep down oil leakage and also to assure perfect packing. Two of these rings were found to do the work of the three used on the experimental cars. The pistons have crowned heads and are machined on all exterior faces.

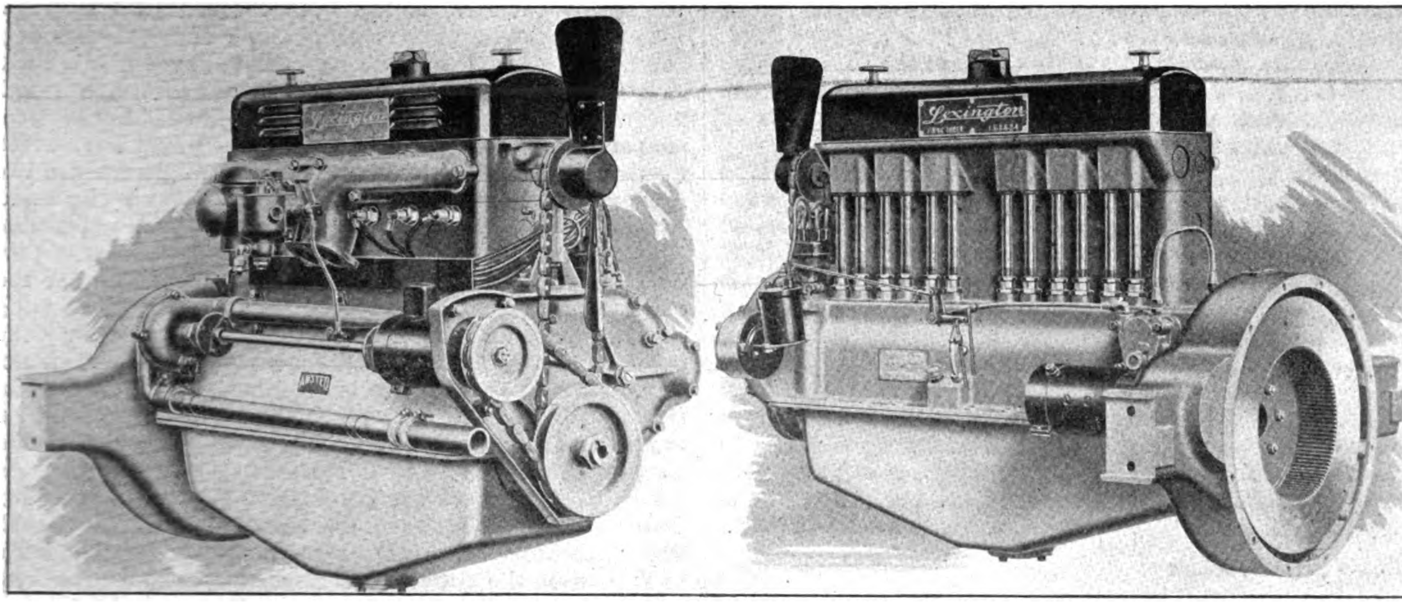
The connecting rod big end is lined with babbitt cast directly into the rod in order to insure good cooling of the bearing surfaces. In assembling, the rods are all weighed on a scale and grouped so that the differences in the weights of the big ends will not exceed 1/10 oz. In this weighing operation the piston pin end is mounted on a stationary knife edge and the big end on another knife edge located on the scale pan of the balance.



Sectional diagram of combined intake and exhaust manifolds, showing the vaporizing device employed on the Ansted engine used in Lexington car



Pedal controls, showing new equalizing device used on foot brake cables



The Ansted engine used in Lexington model T cars, showing belt drive for fan, generator and water pump

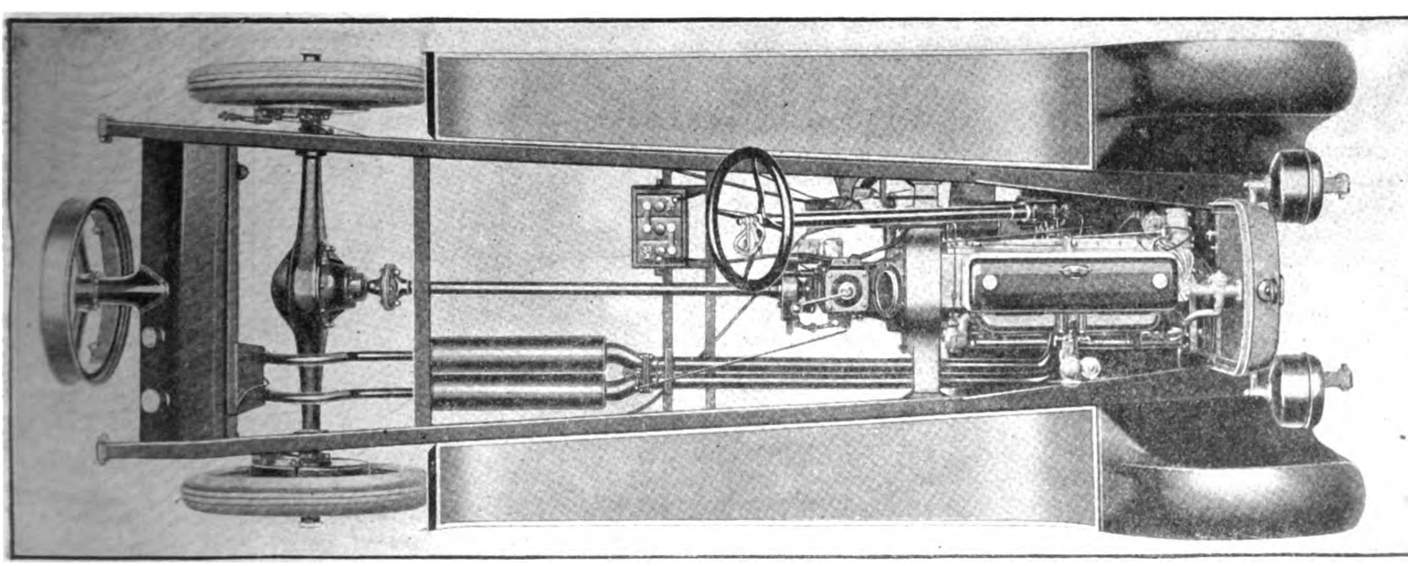
The crankshaft is unusually stiff and is very carefully balanced on a Carwen balancing machine before it is sent to the assembling department. The shaft is drop forged and has three main bearings. These are stepped so as to make the boring and reaming more economical and accurate. The bearings are assembled with a 0.006-in. shim between the case and the caps. They are reamed to size before the engine is run and do not have to be scraped or burned in. The front and rear bearings are provided with annular oil supply grooves, but aside from these there are no grooves in any of the main or connecting rod bearings.

The crankpins all have 0.4375-in. holes through their centers and the connecting holes from the main bearings to the pins and between the adjacent pins are all 11/32 in. in diameter. The crank cheeks are unusually heavy in section. Care has been taken to prevent oil leakage at both the front and rear ends of the crankshaft. At the front end there is a thrower ring on the inside of the crankcase, and a series of thin cork washers in the timing gear cover. At the rear end of the shaft there is an oil thrower ring turned integral with the shaft. Supplementing this there is a return thread on the shaft. At the rear end of the main bearing there is a small drain groove to prevent the oil under pressure from working out around the oil thrower ring.

The valve gear is unique in that the valve rocker arms are so mounted that their fulcrum points provide a variable rocker arm ratio from 1.265 to 3.047 to 1, which causes the valve to start and stop slowly, but to obtain greater and more rapid lift than would be possible with a constant ratio rocker arm. This prevents valve clatter at high engine speeds. Double valve springs are used to prevent synchronism between the valves and the rest of the mechanism from causing floating.

The valve tappets are easily accessible, as the tappet guides are held in place merely by the push rod inclosing tube. The tubes which inclose the push rods and through which the engine breathes are not fixed in place, but are pushed up into a counterbore in the bottom of the cylinder head and have a nut at the bottom end which presses down against the valve tappet guide. The latter is thereby held in place by the tube and the push rod completely inclosed. The valve tappet guides are grouped in pairs and have between them a small fillister head screw which prevents their turning in the cylinder casting.

The valve mechanism, including the rocker arms, is



Plan view of the series T Lexington chassis

completely inclosed, and the breather is located in the pressed steel valve cover on the top of the cylinder head. This insures a plentiful supply of oil to the valve rocker arms and the cup in the rocker arm is always full of oil. Valve clearance can be adjusted while the engine is running, which is said to be a great convenience.

A conventional three-bearing camshaft is used. The valve timing is as follows. Exhaust closes and intake opens at 10 deg. past top dead center; exhaust opens 50 deg. ahead of bottom dead center and intake closes 57 deg. after bottom dead center. The front bearing does not support the camshaft directly, but through a sleeve which carries the ignition distributor gear at its rear end and a flange at the front end. To the latter the camshaft gear is secured with four cap screws. End play is taken up at the forward end by a phosphor bronze thrust washer, which can be adjusted by a set screw in the timing gear cover. The flange on the camshaft collar takes the thrust in the other direction against the camshaft bushing.

The Fuel Vaporizer

A horizontal Rayfield carbureter is bolted to the combined intake and exhaust manifold on the right side of the engine. The mixture leaving the carbureter strikes a series of ribs that are heated by the exhaust and are directly in line with the incoming mixture. The mixture is deflected upward over them by the shape of the manifold and because of this change in direction, the heavier particles of unvaporized gas are thrown out of the mixture and precipitated on the ribs where the heat of the exhaust vaporizes them. The intake manifold measures 1¾ in. in diameter at all sections, hence the gas velocity is not sufficient to sweep unvaporized particles of the fuel off of the vaporizing ribs. The use of separate exhaust pipes and mufflers for each group of three cylinders prevents the overlapping exhaust from interfering.

One of the features of the lubricating system is the control of the oil pressure by vacuum. When the throttle is nearly closed and the engine is running light but little lubricant is needed. At such times there is a high vacuum in the intake manifold and the vacuum operated piston controlling the oil by-pass valve is raised against spring pressure, thus opening the oil by-pass. The oil pressure is thereby reduced and excessive oiling and smoking are prevented.

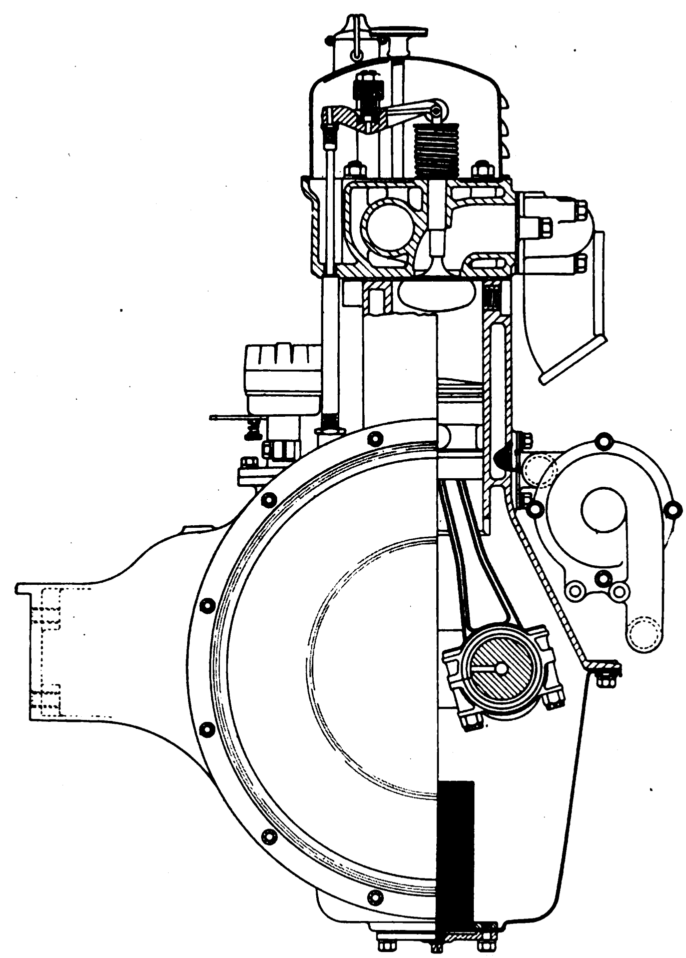
The oil pressure regulator is located at the front end of the crankcase immediately over the oil groove in the front main bearing into which the oil passing through the crankshaft is discharged. The plunger, which acts as a valve, extends down into the crankcase to the bearing groove. The piston is located in a small cylinder casting on the outside of the case. This cylinder is connected to the intake manifold. The system operates at a maximum pressure of 40 lb. per sq. in. The oil level in the crankcase is determined by means of a bayonet type gage.

A Rayfield regulator is used for the thermostatic control of the cooling system. The water is circulated by a new type of screw or turbo-impeller pump which gives a good head of water at low speeds and yet does not give excessive circulation at high speeds. The pump is open so that thermal circulation takes place if the pump drive fails. The pump is located at the rear end of the engine and is driven through the electric generator and a small shaft with two fabric universal joints. The water enters the cylinder jacket through a distributor pipe with three outlets, the object being to assure uniform distribution of water with consequent uniform cylinder temperature.

The use of only two timing gears and belt drives for the auxiliary apparatus is quite a departure from conventional practice. It has been found that two gears with 1.25-in. face and a spiral angle of nearly 24 deg. can be made from steel and iron and kept quiet if a third gear is not meshed with them. The gears are rough hobbed and then finished on a Fellows helical gear shaper. The fan, generator and water pump are driven by Graton & Knight 28 deg. V link belts. There are two independent belt drives, one for the fan and the other for the generator. The fan is mounted on an adjustable support, and adjustment for the generator drive is provided for by using a standard S. A. E. mounting for the electric generator, whereby the generator can be swung through quite an arc. This feature makes necessary the two universal joints between generator and water pump.

The new Ansted engine is combined with a transmission forming a unit powerplant and has a new design of multiple disk clutch which is now being made by the Lexington company. It contains five driving and six driven disks. There are ten floating Raybestos moulded friction rings in between the metal disks of saw steel. The Raybestos disks just clear the driven clutch drum so that when the clutch is released they cannot drop into the teeth of the driving member. Teeth of 10-12 pitch are cut on the inside of the driving and on the outside of the driven clutch members. The teeth on the clutch plates and the drums are formed on a Fellows gear shaper.

The most marked change in the chassis is the lengthening of the frame to give a 128-in. wheelbase in place of 120-in. The section of the side frame channel is now practically 9 in. in depth with 2-in. flanges, top and bot-



Transverse section of Ansted engine, showing "rocking chair" type of rocker arm used to increase and decrease valve acceleration in opening and closing

tom. The running boards are bolted to the bottom of the frame, thus giving it additional lateral strength. A cross member is carried from the underside of the running boards across the frame to prevent sag in the running boards and to stiffen the frame. The frame side members are now straight, the frame tapering from front to rear. This makes it possible to rest the body directly on the edge of the frame side members.

Both the emergency and the service brakes are unusual in their construction. The hand brake operates upon a drum located on the rear of the transmission. The foot brake operates on drums attached to the rear wheels, and is in the form of contracting bands. The hand brake is operated through a spring tensioning device so that it is possible to bring the car to a stop with very light pressure. The foot brakes are operated by a cable guided to each rear wheel by a heavy tube attached to the frame. The brake cables pass through loops or guides on the axle tubes and therefore are not affected by the slight rotation of the axle when the brakes are applied. Fabric universal joints connect the three speed selective gearbox with the rear axle. The drive is Hotchkiss type. The transmission is completely fitted with anti-friction bearings. The counter shaft and spigot bearings are furnished by Hyatt, while the main shaft bearings are New Departure.

The new body lines are very distinctive. The low hung effect of this body is obtained by carrying the doors right down to the frame line and cutting into the body sill to permit the door to shut. Sears-Cross locks are used in all the doors and dowel pins are provided in the side of the sill to hold the doors in position. This design is made possible by the deep, stiff frame.

A triangular instrument board located in the center of the cowl carries the ammeter and oil pressure gage, speedometer, switches and two-way valve for controlling the tilt of the head light.

The schedule of prices is as follows: Seven-passenger touring, $2985; four-passenger Sedanette, $4150; seven-passenger Salon Sedan, $4250.

Detail Specifications Model T Lexington Car

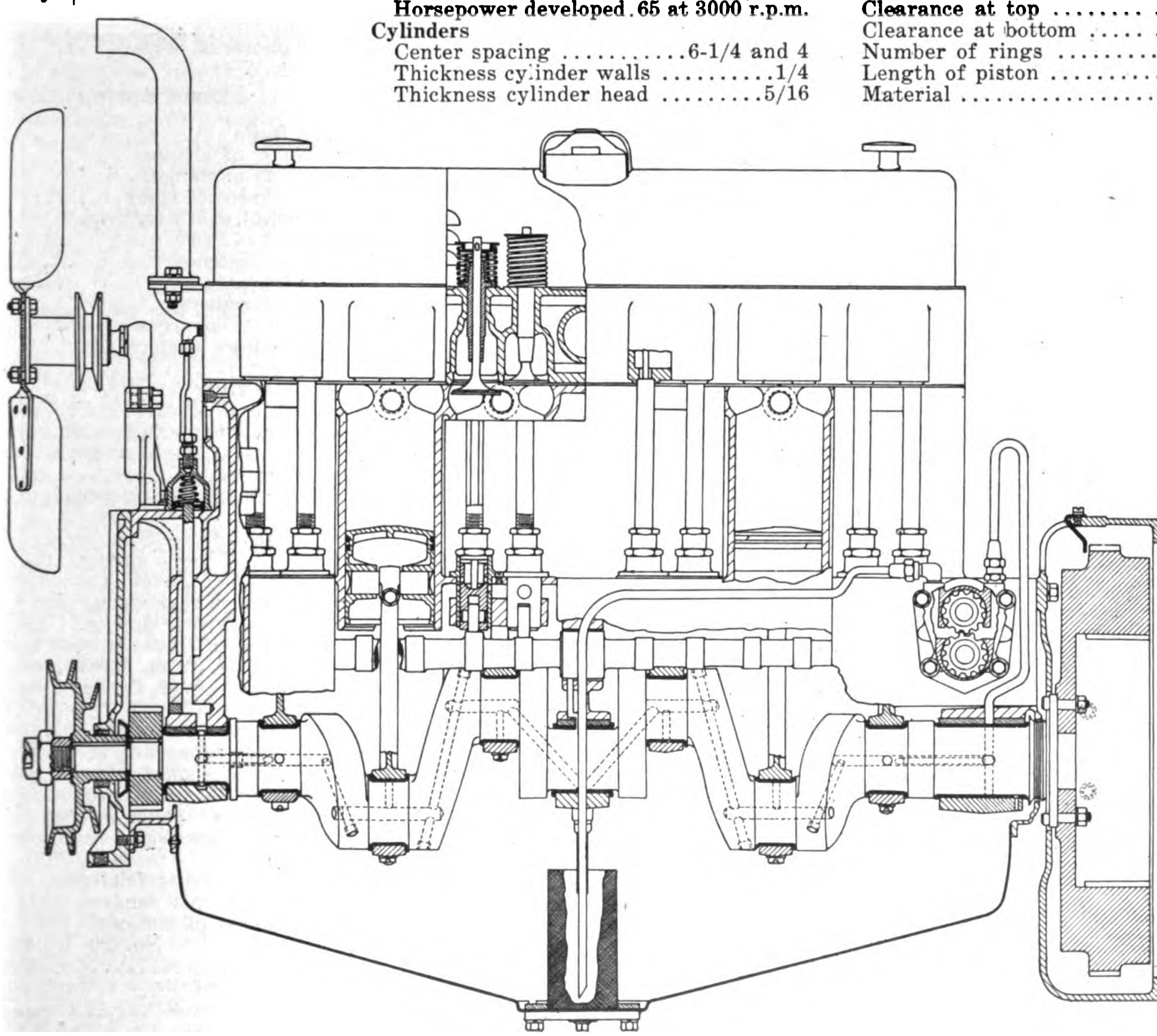
(All Dimensions in inches.)

Engine

General
- Bore 3-1/4
- Stroke 4-1/2
- Number cylinders 6
- Compression .... 80 lb.
- Clearance volume .... 10.5 cu. in.
- Piston swept vol. .... 37.3 cu. in.
- Total piston displacement .. 224 cu. in.
- Horsepower by S. A. E. formula .. 25.39
- Horsepower developed . 65 at 3000 r.p.m.

Cylinders
- Center spacing .... 6-1/4 and 4
- Thickness cylinder walls 1/4
- Thickness cylinder head 5/16
- Thickness water jacket-walls 3/16
- Mean water jacket space 13/16
- Material .... Cast iron

Pistons
- Thickness— head, 1/8; walls, 1/16
- Clearance at top .... .009 to .013
- Clearance at bottom .... .003 to .004
- Number of rings 2
- Length of piston 3-17/32
- Material .... Cast iron



Longitudinal section of Ansted engine, showing arrangement of oil pump, and flywheel with internal teeth to mesh with teeth on driven clutch plates

Piston Pins
Outside diameter .... .873
Inside diameter ....9/16 to 11/16
Material..No. 1020 S. A. E. steel, annealed and case hardened

Connecting Rod
Length center to center 8-1/2
Diameter cap bolts 7/16
Thickness of web 5/32
Thickness of flange 3/16
Width flanges 5/8
Material ....D. F. steel

Crankshaft
Front b'r'ng..1-3/4 dia. x 2-31/64 long
Second b'r'ng...2-1/4 dia. x 2-3/8 long
Third bearings....2-3/8 by 3-1/8 long
Crankpin ....2-1/4 dia. by 1-1/2 long
Cr's sec. long crank arm....3-⅛x1-¾
Cr's sec. short crank arm..2-¾x1-1/16
Diameter flywheel flange 4-7/8
Thickness flywheel flange 3/8
Material ..D. F. steel .40 to .50 carbon

Crankshaft Bearings
Thickness of shell 3/32
Material..........Babbitt-bronze back

Camshaft
Diameter 1-1/8
Frnt bearing..2-1/8 dia. by 1-1/4 long
Second bearing
1-3/4 dia. by 1-1/2 long
Third bearing ....1 dia. by 2 long
Diameter gear flange 3
Width of cam face 5/8
Radius follower circle 8437
Material..D. F. steel No. 1020 S. A. E.
Material camshaft bearing
Phosphor bronze S. A. E. No. 26

Valves
Clear diameter 1-5/8
Diameter of valve stem... .310 to .311
Lift .... .415
Material ....E. W. P. alloy

Valve Springs
Total load—main spring...45 to 50 lb.
Total load aux. springs....23 to 28 lb.
Material .....Round steel spring wire

Timing Gears
Pitch 10
Width of face 1-1/4
Number of teeth in crankshaft gear.33
Material of crankshaft gear...C. R. S.
Number of teeth camshaft gear....66
Material camshaft gear ....C. I.

Flywheel
Pitch diameter 15.750
Width 3-9/32
Thickness of web 1/2
Teeth ....126—8-10 pitch
Face 1-1/8
Material ....Semi-steel

Crankcase
Thickness side walls 3/16
Thickness top 3/16
Thickness legs 3/16
Thickness ends 1/4
Material ....Cast iron
Cast integral with cylinder block

Water Pump
Diameter of paddle.....3.994 to 3.996
Width of paddle .... .499 to .501
Number of blades 10
Material .... Red brass

Radiator
Area front ....375 sq. in.
Thickness ....2-3/4 in. core
Capacity water system ....17 qt.

Carbureter
Make ....Rayfield
Size ....1-1/2 horizontal

Clutch and Transmission

Clutch
Diameter of disk ....8-5/8 in.
Number of disks 10
Width of facing 1-1/16
Thickness of facing 1/8
Material facing ....Thermoid
Spring pressure ....240 to 270 lb.

Transmission Gears
Const. mesh primary ....15 teeth
Const. mesh secondary ....27 teeth
Low speed primary ....27 teeth
Low speed secondary ....15 teeth
Second speed primary ....20 teeth
Second speed secondary .....22 teeth
High speed, telescoping......15 teeth
Reverse primary ....12 teeth
Reverse idler ....17 teeth
Pitch of gears 6-8
Width of gear face 3/4
Material of gears...Oil hardened steel

Reduction in Transmission
Reverse ....4.05 to 1
Low ....3.24 to 1
Second ....1.636 to 1
High ....Direct

Total Reduction
Reverse ....18.73 to 1
Low ....14.98 to 1
Second .... 7.56 to 1
High .... 4.625 to 1

Shafts
Diameter primary shaft (six spline)
1.475
Material primary shaft
S. A. E. steel No. 1045
Diameter section secondary shaft
1.188
Material secondary shaft
S. A. E. steel No. 1045

Bearings
Primary drive shaft, front
No. 1209 ball bearing
Primary drive shaft, rear
No. 306 ball bearing D. R.
Secondary shaft, front
Hyatt roller bearing
Secondary shaft, rear
Hyatt roller bearing
Reverse shaft ....Bronze bushing

Rear System

Axle Housing
Thickness center section 3/8
Diameter center section 12-7/8
Thickness tubes 3/16
Diameter tubes 2-41/64
Distance between spring centers.41-1/2
Material of housing .....Pressed steel

Shafts
Diameter of propeller shaft......1-3/4
Material ....Nickel steel tube
Diameter of live axles 1-3/8
Material ......No. 3125 S. A. E. steel

Driving Pinion
Pitch 3.47
Face 1-5/16
Number of teeth 8
Material ....Steel forging

Ring Gear
Pitch 3.47
Face 1-5/16
Number of teeth 37
Ratio ....4.625 to 1
Material ....Steel forging

Differential Pinions
Pitch 5.7
Face 11/16
Number of teeth 10
Material ....Steel

Differential Gear
Pitch 5.7
Face 11/16
Number of teeth 18
Material ....Steel

Brakes
Diameter of service (foot) brakes..16
Width of service brakes 2
Diameter emergency (hand) brake...8
Width emergency brake 2
Material lining..Compressed Thermoid
Material brake drum....Pressed steel

Bearings
Hubs ....No. 310 S. Row Ball
Differential, r. and l...No. 210 R. & T.
Driving pinion, rear....No. 305 Radial
Driving pinion, front..No. 406 R. D. T.

Hubs
Diameter flange 8-1/4
Thickness flange 1/4
Material flange ....Mall. iron
Diameter bolt circle 6-3/4
Number of bolts 6
Diameter of bolts 11/16

Front Axle

Front Axle Forging
Depth of center web 2-1/4
Width of flanges 1-1/2
Thickness of web 3/16
Distance between spring centers.28-1/2
Distance c. to c. king pins.......51-¾
Material ....D. F. steel

Steering Knuckles
Diameter of spindle—maximum.2-1/4
minimum.. .786
Material ....D. F. steel

King Pin
Length of king pin 6-29/64
Diameter of king pin 3/4
Material ......No. 1020 S. A. E. steel

Front Wheel Bearings
Inside hub bearings .....No. 308D. R.
Outside hub bearing ....No. 304 S. R.

Front Wheel Hub
Diameter of flange.............7-1/2
Thickness of flange...............1/4
Material of flange...........Mall. Iron
Diameter bolt circle.................6
Number of bolts....................10
Diameter of bolts..................3/8

Frame, Springs, Etc.

Side Rails
Depth of channel................7-3/4
Width of flanges............1-1/2 to 3
Thickness of stock.................1/8
Overall width (of frame)
23-3/8 to 45-1/2
How fastened ....Hot riveted
Material ....Pressed steel

Cross Members
Number of cross members...........3
Thickness of stock.................1/8
Material................Pressed steel

Steering Gear
Diameter wheel.....................18
Diameter steering shaft.........1-1/8
Number of teeth in gear...........17
Pitch 5/8
Length of steering arm..........7-1/2

Springs
Length of front spring.............34
Width of front spring...............2
Number of leaves in front spring....7
Length of rear spring..............56
Width of rear spring................2
Number of leaves in rear spring....10
Material—Front, Vanadium steel;
Rear, Carbon steel

Wheels
Front wheel (tire size)...34 by 4, cord
Number of spokes in front wheel..10
Width of spokes in front wheel..1-3/8
Rear wheel (tire size)....34 by 4 cord
Number of spokes in rear wheel....12
Width of spokes in rear wheel...1-3/8

Fenders
Width of front fenders............10
Width of rear fenders.............10
Thickness of material
No. 20 U. S. G. (.038)
Material................Pressed steel

Gasoline Tank
Where located ....Rear
Main supply....................17 gal.
Thickness of material.....No. 20 gage
Material...............Pressed steel

Putting the Factory to Work on Service Jobs

Most factories have idle equipment and space. All lines of vehicles need more and better service. Here is a suggestion which, if applied, will enable manufacturers to use both space and equipment advantageously.

By Clyde Jennings

THE idea that service is the biggest single factor affecting the future of automotive transportation is gradually gaining recognition. New ideas for organized service and a realization that manufacturers must be responsible for the service in recognized shops and that it is their obligation to better the service in all shops (and do their utmost to eliminate the "gyp") are developing.

But the mail brought the other day an announcement which we believe will have a widespread influence for good. Also it probably will provide employment for some idle factory space and equipment. The idea is so good that we are going to pass it on. It is well worth the manufacturers' consideration. Here is the communication:

> There is a popular idea that after four or five years' use a motor truck must be sold to the junk dealer. This is entirely wrong and a very wasteful theory.
>
> We all know that there is a large number of the component parts of a good motor truck which really never wear out, or on which the wearing parts can be easily renewed. Such parts as the following represent quite a large proportion of the value of a truck, and are just as good at the end of four or five years as they were to begin with: Axles, wheels, frame, frame castings, gasoline tank, steering gear, radiator, carburetor and magneto, transmission case, clutch housing, etc.
>
> Motors with a large number of moving—and consequently wearing—parts, need overhauling and replacement from time to time as is only reasonable. Tires of course have to be replaced, and springs will eventually lose their life. Transmission gears may wear and need replacement. But there is no justification for practically throwing away so much valuable material that doesn't wear out at all.
>
> The work of RECONDITIONING a used truck is a much bigger proposition than what we usually mean by an annual overhauling, and can only be properly undertaken by the factory that originally built the truck.
>
> RECONDITIONING calls for the following:
>
> 1. All cylinders to be rebored and standard oversized pistons fitted, with the understanding that if the motor needs a very large number of new parts in order to put it in first-class shape, with a consequent considerable cost, in some instances it is more advisable to install a complete new engine.
> 2. Brand new tires should be fitted on all wheels.
> 3. All springs should be renewed, and all parts including transmission gears that are not as good as new should be replaced by new parts.
> 4. The testing of a RECONDITIONED truck should be as exhaustive in all respects as the testing of a new machine.
> 5. The factory should give its original guarantee as given on a new truck covering any machine RECONDITIONED at the factory.
>
> You are doubtless aware that in locomotive practice locomotives are RECONDITIONED at regular intervals, and by this means the life of the railway locomotive is almost indefinite, some engines being in active service for twenty or thirty years. The same policy is applicable to trucks.
>
> The work of general overhauling a truck can be handled by our dealers, but the work of RECONDITIONING, which is quite different, is a factory operation. It begins with the entire dismantling of the chassis and the inspection of all parts, the rejection of those that are imperfect and their replacement by new parts, the reassembling of the chassis and the same road test and final inspection and factory guarantee as goes with a new machine.
>
> The result of this is that the RECONDITIONED machine goes back to its owner ready to make a fresh start.
>
> We are prepared to undertake this work at the factory and on trucks owned in the vicinity of Detroit, we are prepared to give immediate estimates of the cost of such work. and on trucks that are located at a distance from Detroit, we are willing to send an expert to inspect and make an estimate, providing that if the truck is sent to us for RECONDITIONING we will make no charge for the time and expenses of our expert's appraisal, but if it is decided not to have the work done, we will expect our customer to pay the traveling expenses only occasioned by our expert's trip.
>
> The railroads are moving freight very freely at the present time and trucks can be shipped into Detroit from a radius of 500 to 1000 miles at a freight expense of probably not more than from $50 to $100 each way, and under existing conditions the railroads will deliver them to us quickly and they will get back to you quickly when we ship them out again. We invite immediate correspondence on this proposition, as it is difficult to cover it fully in one letter, but all Acason owners will, we are sure, appreciate the economical possibilities of the plan herein outlined.
>
> In some cases when desired trucks of previous years' models can be reconstructed and brought up to the specifications of our 1920 new series with 4-speed amidships transmission, etc.
>
> Particulars of our recommendations on these points can be given to each individual owner.
>
> ACASON MOTOR TRUCK COMPANY.

This idea can be applied to other vehicles than trucks. Before the big manufacturing rush came, a motor car factory located outside the Detroit district had excess paint shop space except in the very busy season. It was the practice of this factory to solicit among its dealers painting jobs. The amount of such work sent to the factory was surprising. Cars were driven several hundred miles for this work and many owners who had refused to listen to the solicitor who wanted to repaint the car in a dealer's shop gladly accepted the invitation to have the vehicle repainted in the factory.

Probably the belief that the vehicle would be better painted in the factory was unfounded, but it existed. While the chassis was waiting for the painting, it was examined, a statement of condition, the price for making needed repairs and any advice the factory experts saw fit to give. This became a source of considerable revenue, helped small dealers and had a good effect on owners.

A New Dual Reduction Truck Axle

Latest model of Mack truck uses Hotchkiss drive and novel spring mounting. Emergency brake on propeller shaft and service brakes on wheels. Makers consider dual reduction superior to worm drive, which is discontinued. Continue chain drive model, regarded best of three types.

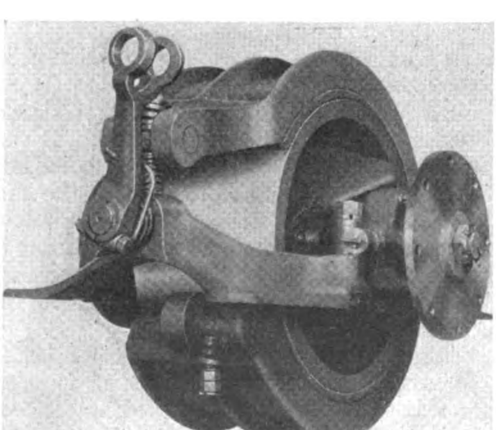
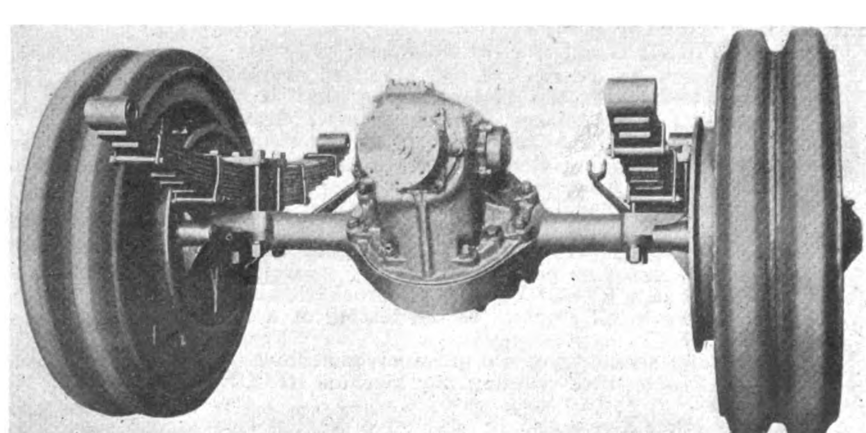
By P. M. Heldt

CHAIN drive for motor trucks has one ardent supporter in the American truck industry—the International Motor Co., manufacturers of Mack trucks. The large trucks of this company always have been fitted with chain drive exclusively, while the smaller trucks, known as Model AB, have been built with either chain or worm drive, at the customer's option, for the past several years. The company has never been very enthusiastic about the worm drive, but in view of the public demand for shaft drive, it furnished worm drive trucks when asked for. Ever since the introduction of the AB truck, the engineering staff of the company has been making a study of different forms of shaft drive, both European and American, and has built and tested various experimental rear axles. It has now decided to discontinue the worm drive and to offer instead a dual reduction drive axle. The chain driven AB model will also be continued.

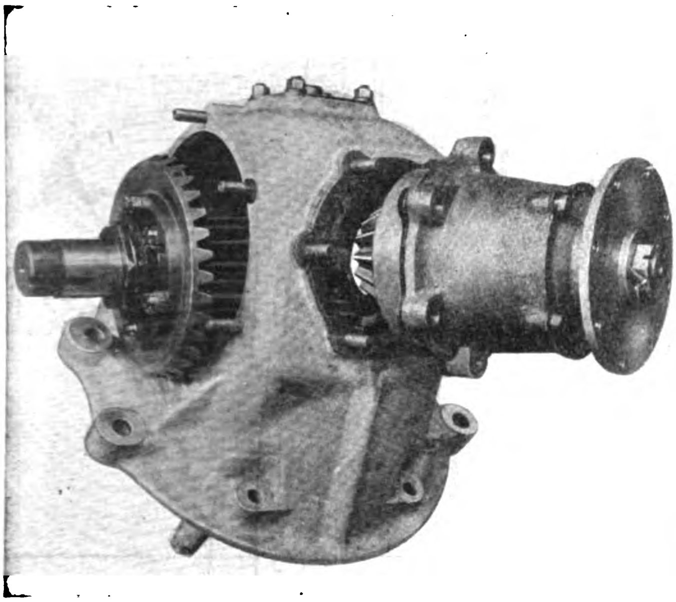
The dual reduction axle has a drop-forged housing of the double banjo type, and this is said to be the only drop forged axle housing extending from hub cap to hub cap that is made in America to-day. The yoke at the center of the axle housing is placed at an angle of 45 deg. instead of vertically or horizontally. This brings the plane of greatest strength of the housing substantially parallel with the direction of the severest shocks on the axle, and has the further advantage of increased road clearance. Incidentally this arrangement of the rear axle yoke places the gear train at an angle and produces a straight line drive. A double reduction axle is naturally somewhat heavier than a worm driven axle, and in order to reduce this extra weight to a minimum, the gear carrier and cover plate, which are secured to opposite sides of the yoke of the axle housing, are made of aluminum alloy. As is customary in such axles, the first reduction is by a pair of bevel gears, and the second by a pair of spur gears, the spur ring being mounted on the differential. The spur pinion is formed integral with the jackshaft, and the bevel gear is mounted thereon in a most secure manner. All of the shafts in the rear axle are mounted on Timken tapered roller bearings. The bevel pinion shaft is supported by a cast steel carrier, which is bolted to the aluminum gear carrier. All bearing adjustments are made with the aid of shims. That is, instead of having a screw adjustment locked by means of a dog or key, the adjusting collar is screwed up tight against shims, and if it is desired to make an adjustment one or more of the shims have to be removed. This same method of adjustment is used on the jackshaft on which the bevel gear is mounted. All bearing adjustments can be made without disturbing the assembly of the parts, and either the differential, jackshaft or pinion-shaft can be removed without disturbing any of the other parts.

The gear carrier is held in position on the rear axle housing by four studs passing through the metal of the yoke. These studs serve also to hold the cover plate in position. In addition to these four studs, there are four bolts which pass through the flanges of the gear carrier and the cover plate but not through the metal of the axle housing. They serve to distribute the holding down pressure uniformly over the flange of the gear carrier. The axle housing is forged of chrome nickel steel, with the wheel spindles and the spring saddles integral. The driving shafts are of chrome vanadium steel.

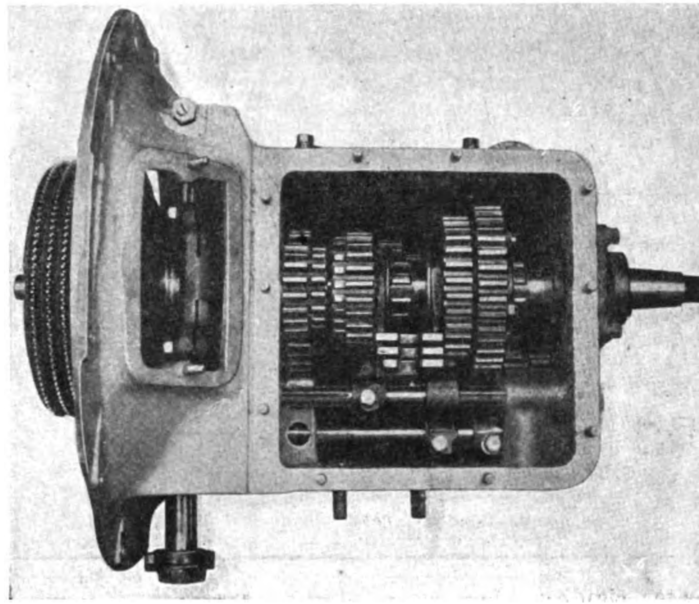
The Hotchkiss drive being used, it was thought necessary to provide exceptionally heavy springs and the most secure fastenings for same to the axle housing. In this connection the integral spring saddles of the axle housing offer quite an advantage. The spring is held to the sad-

To the left—Substantially constructed transmission brake, provided with bearings in each side, and heavy drop-forged shoes. To the right—Rear axle assembly, showing inclined position of banjo housing



Assembly of gear reduction in separate housing bolted to rear axle. Note facility with which units are dismantled



Transmission and clutch. Interrupted spline construction used to give greater rigidity and ease in sliding of gears

dle by means of four heavy studs, which pass through the saddle and through a spring pressure plate, and are provided with 1 in. nuts at the bottom of the spring saddle. As the driving thrust is transmitted through the springs, there is a considerable tendency to displace the spring lengthwise relative to the saddle. It was not thought expedient to rely on the center bolt of the spring to take care of this thrust, as is often done. Instead, the main leaf was formed with a circular ridge around the center bolt hole, which mates with a counter-sunk slot in the spring pressure plate. There is a similar slot at the center of the spring saddle, and a corresponding circular ridge on the bottom of the smallest leaf.

The Hotchkiss drive, of course, imposes increased load on the springs and all parts thereof, and this has been taken fully into account in the design of the axle. The spring eyes are 1¼ in. in diameter and are provided with self-lubricating bushings. At the forward end the spring bolt is supported in the bracket at both sides of the spring. There are two rebound clips on each side of the axle, and the bolt of each clip passes through an eye formed on one of the intermediate leaves, the clip being free on the spring, so as not to interfere with the spring action. The rear springs are 54 in. long and 3½ in. wide.

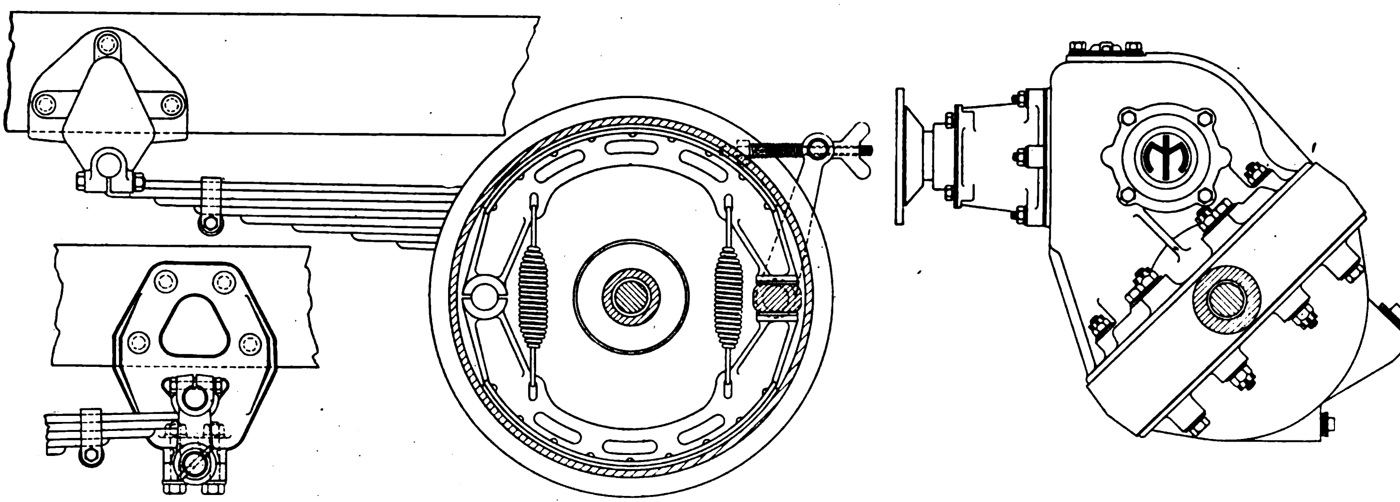
An oil filler is cast onto the cover plate of the axle housing, and this serves also as a level gage in filling the axle with oil. For the lubrication of the bevel pinion shaft bearings, an oil trough is cast in the upper part of the housing, into which oil is thrown by the revolving differential and crown gear. This oil flows by gravity through a suitable passage to the bearings. The road clearance is 10¼ in.

Four different gear ratios are offered with the dual reduction axle, viz., 5⅞, 7.6, 9¼ and 10¾. A change in gear ratio is quite easy to make, as the axle does not have to be dismantled, nor the adjustment of the differential disturbed. The only gears affected are the bevels, and only two new parts are required to get a new gear ratio, viz., the pinion shaft and the bevel gear. The pinion shaft is removed from the front and the jackshaft through the side. The new pinion shaft is installed and a new bevel gear substituted for the old one on the same jackshaft, by means of six bolts.

The adoption of the dual reduction axle has been accompanied by several other changes in design. One of the most noteworthy is in connection with the brakes. The truck is provided with a transmission brake and two rear wheel brakes, but, contrary to ordinary practice, the rear wheel brakes are the service brakes and the transmission brake is the emergency brake. The result of this is that ordinarily the braking effort is applied directly to the wheels and does not have to be carried through the transmission gear. Another reason for making the rear wheel brake the service brake is that with a given effort the driver cannot produce such a strong braking effect with the rear wheel brakes as with the transmission brake, and he is therefore less likely to abuse the tires.

The transmission brake is mounted on a short shaft carried on a one-piece drop forged frame, which completely surrounds the brake drum and is bolted to two cross members. The propeller shaft, therefore, is really in three sections, and four universal joints are used. These joints are much larger than those heretofore used by the International Motor Co., and the strain on them is correspondingly reduced. The transmission brake is 11 in. in diameter and 6 in. wide. It is of the contracting type, the sectors consisting of heavily ribbed drop forgings to which asbestos lining is secured by flat head screws. Each brake covers only about 100 deg. of the drum circumference, this comparatively small angular span having been found desirable to prevent excessive wear at the ends of each sector. The lining of each sector measures 6 x 12 in. The brake is operated by means of a double armed lever, whose axis extends across the chassis frame, the two arms being linked to the upper sector on one side and to the lower sector on the other side of the center. All bearing surfaces on the operating mechanism are liberal.

The new dual reduction AB truck will share with the chain driven model a number of other improvements, such as the new engine crankcase having 3 gal. oil capacity, as compared with 1⅞ gal. on the old engine, and the new Mack unit powerplant clutch and transmission, both built complete in the New Brunswick plant. In general design, this transmission is similar to the stock transmission formerly used, but it incorporates a number of improvements. The main shaft is splined, the splining being of the interrupted type, in which the gears are guided on ground surfaces between two sets of splines. This is said to give a much easier sliding action and



Spring anchorages, rear wheel brake and side elevation of rear axle. Note inclined position of differential housing

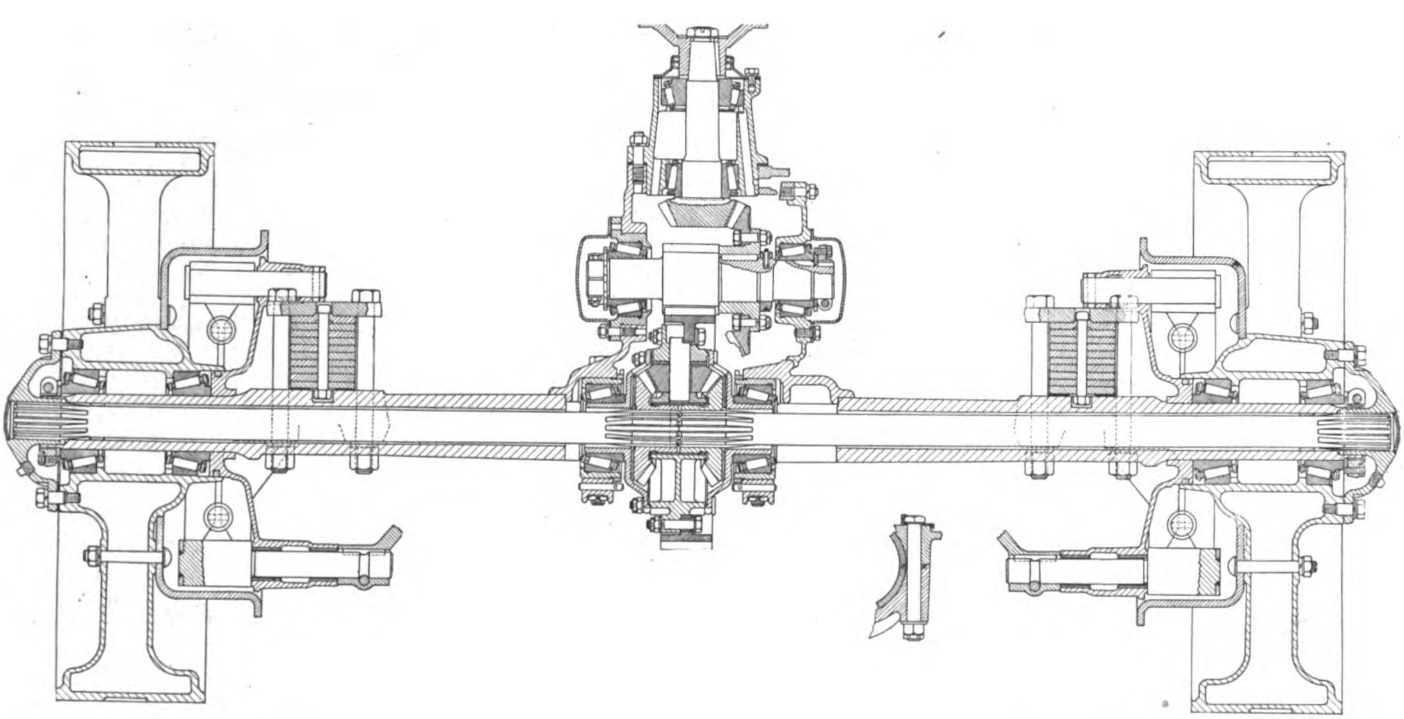
greater rigidity. The case is larger and holds more lubricant. An extension counter-shaft with a keyed power take-off is standard equipment. The standard S.A.E. tire pump mounting is provided on the side of the case to receive a pump for the inflation of pneumatic tires. The control has been simplified by the elimination of the reverse latch trigger. Instead, the lever is one solid piece and the reverse lock is released by depressing the entire lever.

A demonstration of three Mack model AB trucks was given before a number of trade paper representatives in the upper part of New York City on Dec. 15. The three trucks were equipped with chain, worm and dual reduction drive, respectively. They were all built to the same specification as to weight (approximately 5800 lb.), power delivered to the final drive, and gear ratios, the motors all being governed to 1275 r.p.m.

It was announced at the trial that one of the three engines had shown slightly greater power than the others and this had been put in the worm drive truck. The total reduction ratios were alike to within one per cent. (two being 9.25 and one 9.20). In each test three trials were made, with different drivers, so as to eliminate the personal equation. In the first test the trucks were allowed to coast down a slight incline with gears in neutral and all brakes released, and to run themselves out on the level at the bottom of the decline. Both the distance coasted on the level and the time from the start to the stop were measured. The results, averaged, were as follows:

Truck type.	Distance coasted on level.	Time from start to stop.
Chain	49 ft. 2 in.	1 min. 16 sec.
Worm	26 ft. 7 in.	1 min. 57 sec.
Dual red.......	45 ft. 2 in.	1 min. 16 sec.

In the second test, held on Exterior Street, the Bronx, the trucks were started from a point at the bottom of a hill averaging 16 per cent for its entire length of 80 yards, there being one point, about 30 yards from the top, where the grade is 18 per cent. The three trucks were started from the bottom of the hill, one at a time. Each was put



Horizontal section through rear axle, showing mounting and arrangement of bevel and spur gears in double reduction

in second gear as soon after the start as possible, and note was taken of the points where the drivers were forced to shift back to first gear. The time taken for the complete ascent of the hill was also taken. The results, averaged, were as follows:

Truck type.	Distance to shift to 1st speed.	Time to shift to 1st speed.	Elapsed time.
Chain	153 ft. 5 in.	29.6 sec.	51 sec.
Worm	16 ft. 7 in.	5.6 sec.	57 sec.
Dual red...	104 ft. 5 in.	22.3 sec.	52.6 sec.

In the third test all of the trucks were run, one at a time, part-way up the hill and left standing for 2 min. in order to allow the oil to drain off the gears of the final drive. The drivers were then given the signal to start and to ascend the hill as quickly as possible, notations being made of any changes in gear. All three trucks ascended the hill on first gear, the chain driven truck requiring 31 sec., the worm truck 32 sec., and the dual reduction truck 31 sec. A speed and acceleration test was made on a level course on Anderson Avenue, from Jerome Avenue north to West 162d Street. The trucks were started from a line, one at a time, and were accelerated as fast as possible, the distance and time in which the maximum speed was reached being noted. There was an observer on each truck, and the governor cover had been removed, so as soon as the observer noted the governor closing on direct drive—which showed that the maximum truck speed had been reached—he would pull a string and a vertically arranged chalk pistol on the truck frame would discharge, making a white mark on the roadway, so that the distance from the starting point could be accurately measured. The results with the three trucks, averaged for three trials, were as follows:

Truck type.	Time to full acceleration.	Distance to full acceleration.	Elapsed Time.
Chain	14.3 sec.	174 ft.	21.3 sec.
Worm	16.7 sec.	190 ft. 1 in.	21.6 sec.
Dual red...	15.3 sec.	181 ft. 2 in.	21.6 sec.

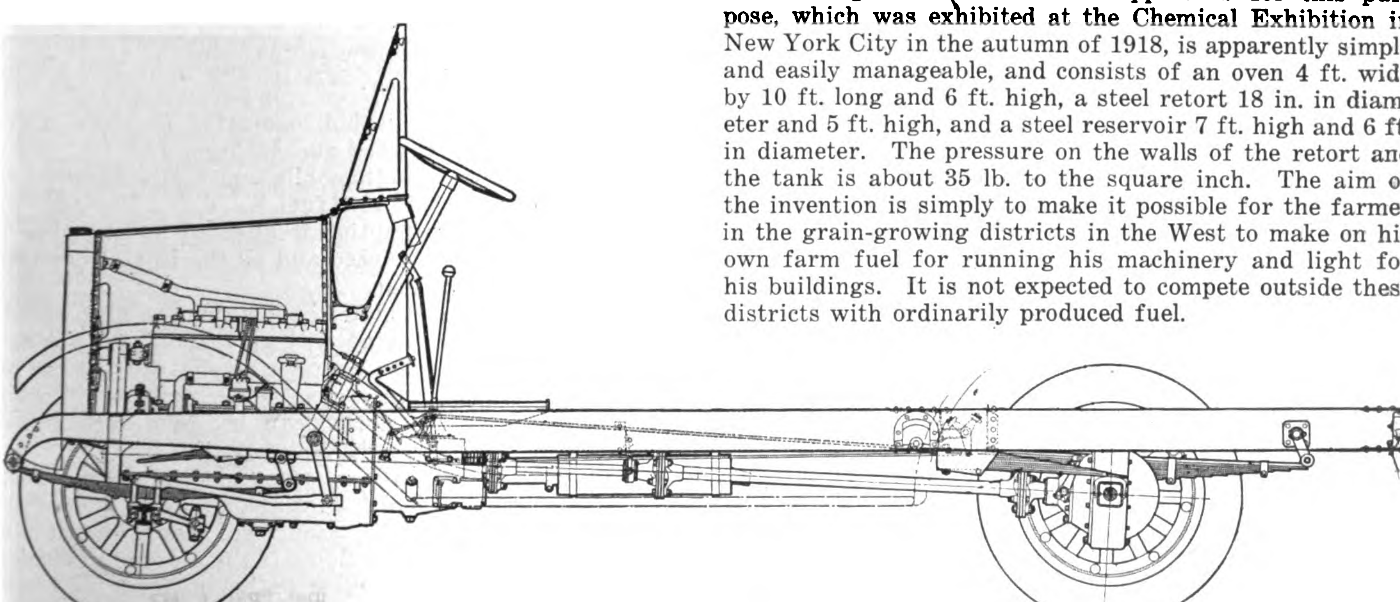
The fifth test was an obstacle test, the truck being backed up to a 6-in. curbstone, and an endeavor made to lift the rear end over the obstacle without rolling or bumping. The chain driven truck was lifted over the curb three times in succession without difficulty. The worm driven truck would not climb the curb without bounce, while the dual reduction went over without any great difficulty. In the final test the three trucks were hitched through a dynamometer to a truck anchored in the roadway, and the maximum drawbar pull which the trucks were capable of exerting was observed. Three successive attempts were made with the trucks, and the drawbar pulls registered, averaged, were as follows: Chain, 3700 lb.; worm, 2633 lb.; dual reduction, 2833 lb.

A New One-Ton Speed Truck

A NEW commercial car, designated the Akron multitruck, will be turned out by the Thomart Motor Co. It is of the speed truck type, with pneumatic tire equipment (34 x 5 in. cord) and has a rated capacity of 1 ton. The engine is a four cylinder block type, 4½ x 5 in., with force feed lubrication and three point suspension. The clutch is a dry disk type and the gearset affords three forward speeds. Unit powerplant construction is used. The propeller shaft is made up in two sections with three fabric universal joints, the central joint being supported by a floating ball bearing. The rear axle is a semi-floating spiral-bevel-gear driven type, and the Hotchkiss drive is used. The frame is of pressed steel, the channel section being 5⅞ in. deep. In addition to the primary set of semi-elliptic springs there are quarter-elliptic auxiliary springs secured to the under side of the frame channels, the free ends of which come down on the spring pressure plates when the truck is heavily loaded. The truck has a wheelbase of 133½ in. and has a speed of 30 to 35 m.p.h. It comes regularly equipped with Westinghouse electric generator and starter. A one year guarantee is given.

Motor Fuel from Straw

COMMENTING on press reports relative to the production of gas and motor fuel for lighting and power purposes from straw, the British Commercial Counsellor in Washington states that the apparatus for this purpose, which was exhibited at the Chemical Exhibition in New York City in the autumn of 1918, is apparently simple and easily manageable, and consists of an oven 4 ft. wide by 10 ft. long and 6 ft. high, a steel retort 18 in. in diameter and 5 ft. high, and a steel reservoir 7 ft. high and 6 ft. in diameter. The pressure on the walls of the retort and the tank is about 35 lb. to the square inch. The aim of the invention is simply to make it possible for the farmer in the grain-growing districts in the West to make on his own farm fuel for running his machinery and light for his buildings. It is not expected to compete outside these districts with ordinarily produced fuel.



The Akron 1-ton truck chassis

Significance of Alcohol in the Motor Fuel Problem

The probable shortage of gasoline and the limited capacity of the country for the production of alcohol and benzol renders desirable the use of a synthetic fuel containing all three constituents. Data on the characteristics and advantages of such a fuel are set forth in this article.

By Burnell R. Tunison*

THE growth of the petroleum industry has been nothing short of phenomenal, but the production of gasoline has been made to keep pace with the automotive industries, only with the greatest difficulty. The production of crude petroleum has increased about 90 per cent during the last ten years. Due to better refining methods; to casinghead gasoline; to cracking processes and other contributing factors, the production of gasoline during the same period has increased approximately 550 per cent. According to the United States Bureau of Mines during the year 1918 the production of this fuel was over 3,570,000,000 gal. and in 1919 the production was nearly 4,000,000,000 gal.

The National Automobile Chamber of Commerce states that last year the volume of the automotive business was represented by the prodigious sum of $3,166,834,600. This is surely one of our major industries involving an invested capital of over a billion dollars, employing 300,000 persons who receive annually approximately $375,000,000. There were 7,500,000 motor vehicles in use this year, or one to every fourteen persons in the country. Assuming an average motor car mileage of 3,000, the total mileage is 22,500,000,000 miles per annum. If each motor vehicle carried an average of three persons the total passenger mileage was 67,500,000,000. The total passenger mileage of all our railroads during 1919 was 46,145,070,650.

In two years the end point of the average gasoline has been raised from 392 deg. F. to 425 deg. F., or an increase of 33 deg. F.

The United State Geological Survey is authority for the statement that the petroleum resources of the country have been depleted to the extent of approximately 40 per cent, and that the remaining six and one-half billion barrels at the present rate of consumption will last only sixteen to eighteen years. But the rate of consumption will continually increase.

There is unanimous agreement among those in the automotive and petroleum industries that there is a real internal combustion engine fuel problem before us now. It is clearly evident that unless some partial solution of this problem is found the progress of the automotive industries will be seriously impaired. This would be a disastrous blow to the economic equilibrium of the nation.

Now that the problem is generally recognized, what are some of the possible remedies which may assist in its solution?

It has been said that benzol and coal tar products will assist. Even under war time stimulation the production of distillates suitable for motor fuel amounted to less than 75,000,000 gal. At present, if all these products were used as motor fuel, which is impossible because of their many other important uses, the fuel thus made available would be less than 100,000,000 gal. per year.

This article, written by a chemist connected with the United States Industrial Alcohol Co., outlines the advantages of and need for using synthetic fuel containing alcohol, and gives data regarding the performance of engines using such a fuel.

In an early issue we will publish an article by Prof. H. B. Dixon of the University of Manchester, a British authority on combustion phenomena, in which are presented the results of basic research into the properties of alcohol and its behavior during combustion when used alone and in combination with other hydrocarbons.

Alcohol has real value as a motor fuel. That it has not been a factor in America up to the present time has been due to an economic condition rather than to inherent difficulties in its use.

Some of the conclusions of the Department of Agriculture on the use of alcohol are:

1. The ordinary engine can be run on alcohol without material change.
2. When run on alcohol, operation is more nearly noiseless than when run on other fuel.
3. For air cooled automobile engines, alcohol is especially suitable as a fuel.
4. The fuel consumption is affected by the time of ignition, by the speed and by the initial compression of the charge.
5. The economy is better at low than at high speeds.
6. The average engine will give about 10 per cent more power when burning alcohol but at the expense of a greater fuel consumption. Twenty per cent more power can be developed by especially adapting the engine to the fuel.

The time is not far distant when alcohol must become a factor as a motor fuel. That alcohol cannot meet the situation at once is readily seen from a consideration of our present alcohol production. If the alcohol producing capacity of the country were to be utilized for motor fuel purposes only 100,000,000 gal. annually would be made available.

*From a paper read before the Washington Section of the American Chemical Society.

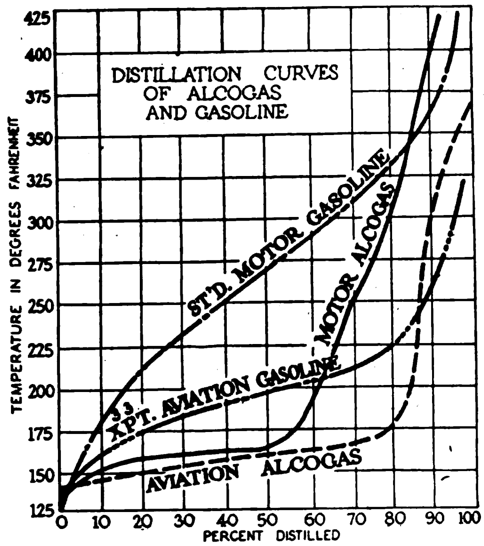


Fig. 1

The combined coal tar distillate and alcohol production of the nation would amount to less than 5 per cent of our motor fuel requirements. There is a limit to the quantity of coal tar distillates which can be produced. We have not yet realized that limit and larger quantities of coal should be carbonized in by-product recovery ovens so that these distillates will be available for motor fuel purposes.

We can and must make more alcohol. This necessity is not dependent upon natural reservoirs or deposits. We all realize that alcohol can be produced from any material containing starch or sugar. Even large quantities of waste cellulose material can be utilized for the production of alcohol for motor purposes.

The Present Solution

Knowing that no one remedy is going to be the solution of the problem, consideration should be given to the various factors contributing to it. There must be a complete co-operation between the designer and builder of automotive apparatus, the user, and the industries which supply the fuel. The designer and the builder should sacrifice power, speed and accelerating ability for efficiency. The motor car of the future should run the greater portion of the time at nearly full load conditions in order to secure the maximum efficiency. There should be material reduction in the weight of car and engine parts and a more logical proportioning of engine speed to car speed. The user should not demand high speed and rapid acceleration. He should be willing to change gears more frequently.

The producers of motor fuel should co-operate to produce a fuel which permits of higher compression ratios without the difficulties of "knock." Higher compression ratio means not only greater thermal efficiency but less weight per unit of power; and by proper design the possibility of smaller engines.

It has been conclusively demonstrated by prominent automotive engineers that the present day motor fuel is far from ideal and has very serious limitations. Efficiency is now demanded and high efficiencies are not possible with our present fuel.

Petroleum products, benzol, or alcohol when used alone are not entirely satisfactory. Each possesses distinct advantages when used in internal combustion engines. Alcohol and benzol both have certain disadvantages which will preclude their use alone in the engines of the near future. It is possible, however, to make a combination of these fuels in such a manner as to derive the natural advantages of the several components. Such a fuel including gasoline and some of the heavier distillates would indeed be a step forward.

Benzol and similar coal tar distillates possess desirable properties as motor fuels. They can be used in high compression engines and there are few detonation difficulties. In an engine cylinder benzol ignites slowly and burns in such a manner that detonation does not take place. Large quantities of carbon are formed, however, which render it undesirable, when used alone. The freezing point of benzol when not mixed with other fuels is 40 deg. F. This renders unmixed benzol unsuitable for winter use. Its use with petroleum mixtures is also undesirable inasmuch as petroleum distillates have little controlling influence over the physical or chemical properties of the benzol mixed with them.

On the other hand, it is possible to make mixtures of alcohol and benzol which show very remarkable properties. The presence of the alcohol has a marked effect on the freezing point of the mixture as well as on the formation of carbon.

Alcohol is one of the most stable fuels known, but in order to obtain best performance with it alone it is essential to use engines with very high compression ratios. The fact that alcohol has a latent heat of evaporation of 385 B. T. U. per pound as compared to 170 B. T. U. per pound for benzol and approximately 190 B. T. U. per pound for gasoline, renders it unsuitable for starting an engine in cold atmospheres. Furthermore, the low vapor pressure of alcohol as compared to other fuels makes it difficult to use in low temperatures unless blended with other components. Alcohol starts to burn very rapidly in an engine cylinder, but does not increase its rate of combustion as do the petroleum products. It can be readily seen that when alcohol is carefully blended with other fuel components which possess the qualities which it lacks, a very desirable fuel is the result.

Nearly every country in Europe to-day is seriously engaged in research work in connection with alcohol as a fuel for internal combustion engines. There is no question but that alcohol will play a very important part in the fuel of the future. The importance attached to alcohol as a fuel factor in England, France, Germany and Italy is so great that these countries are spending large sums of money to support investigations which the respective governments have called upon their best scientists and engineers to make. This work is relative to sources and processes for producing alcohol on a large scale.

Many investigators have been quick to realize the importance of alcohol as a fuel. As a result, there have been many attempts to produce satisfactory fuel mixtures containing alcohol as an important component, with the

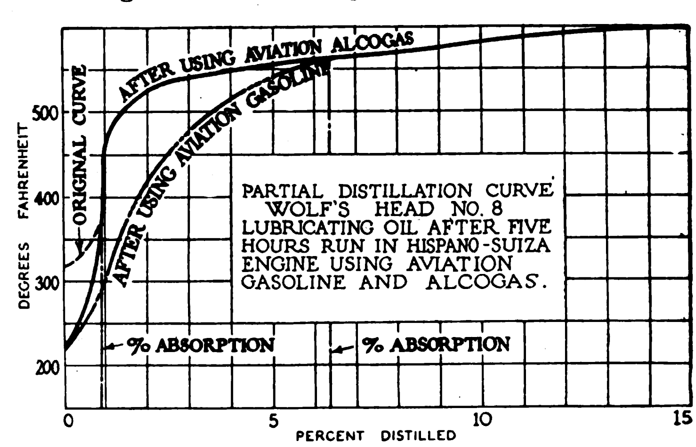


Fig. 2

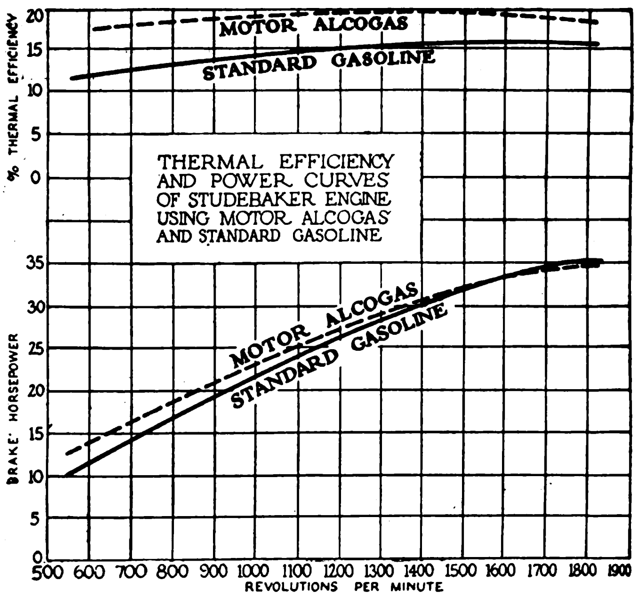


Fig. 3

hope of realizing the advantages accruing from it. In almost every case, however, these attempts have proven unsuccessful, due entirely to their impracticability or failure to meet all the present or future requirements, or both. One successful synthetically blended fuel, in which alcohol with all its advantages plays an important part is being produced in limited quantities under the trade name "Alcogas." This fuel combines among others, the advantages of petroleum distillates, coal tar distillates, and alcohol. For commercial reasons the exact formula is not given, but the components have been so chosen and proportioned that each renders the maximum assistance to the others in meeting the many fuel requirements for both present and future engine designs. The practicability and usefulness of this fuel is adequately supported by results of official tests conducted by the Bureau of Standards, the U. S. Navy, U. S. Air Mail Service, Columbia University and by the experience of many individual users of the fuel in trucks, passenger cars, marine engines, etc.

In Fig. 1 are shown the distillation curves of two grades of alcogas as compared with those for export gasoline and standard motor gasoline. It will be noted that the initial boiling point is approximately the same for all these fuels. The homogeneity of alcogas is clearly indicated by the distillation curves. In the case of the more volatile grade almost the entire volume is distilled over at the initial boiling point, while more than 50 per cent goes over at the same temperature in the case of the motor fuel. This factor is a very important one as regards crankcase contamination and oil consumption. Under actual flying tests conducted by the U. S. Air Mail Service with alcogas between New York and Washington, for a period of six months, the average oil consumption was about 40 per cent less than when using gasoline.

To determine the comparative percentage of fuel absorption by oil for alcogas and gasoline, a five-hour full power run was made with each, using a Hispano-Suiza engine, a partial distillation of the oil, before and after using being made. The results are shown in Fig. 2. The absorption in the case of alcogas was 0.9 per cent while in the case of gasoline it was 6.33 per cent. This is a very important consideration, especially as regards efficiency of lubrication and the life of engine parts and the engine as a whole.

Fig. 3 shows the fuel consumption, thermal efficiency and b. hp. obtainable on a standard four-cylinder Studebaker engine, after setting the carbureter for an air-fuel ratio to give maximum thermal efficiency. The maximum horsepower for both alcogas and gasoline is approximately the same at maximum engine speed, but the power is slightly greater at all lower speeds when using alcogas.

Fig. 4 shows the fuel consumption in pints per b.hp.-hr. for alcogas as compared with gasoline for an air-fuel ratio giving the leanest possible mixture. The mean fuel consumption for this condition is 1.00 pt. per b.hp.-hr. for alcogas and 1.17 pt. for gasoline. This represents a saving of nearly 15 per cent.

The following table shows the limiting conditions of mixture for alcogas and gasoline.

Table of Air-Fuel Mixture Properties

	Gasoline	Alcogas
1. Richest mixture on which engines will operate over the speed range employed	9.7	9.15
2. Leanest mixture on which engines will operate over the speed range employed	14.9	16.0
3. Chemically correct ratio	14.7	12.3
4. Per cent of air chemically required present in 1	66	75
5. Per cent of air chemically required present in 2	102	130
6. Ratio for maximum power	13.2 to 11	12.5
7. Ratio for maximum efficiency	14.9	16
8. Per cent of air chemically required present in 6	90 to 75	102
9. Per cent of air chemically required present in 7	102	130

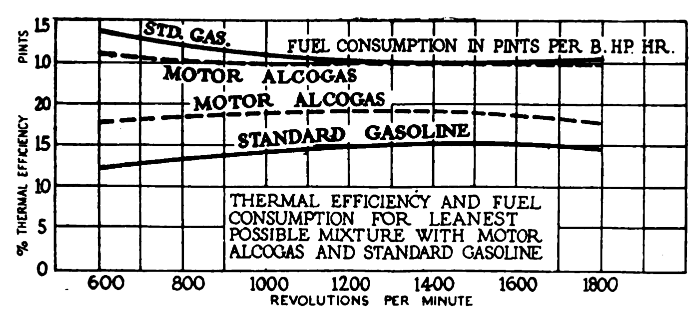


Fig. 4

From the above it will be noted that gasoline has practically no range on the lean side of the best mixture, while with alcogas the range is about equally divided, the total being over one and a half times as great as for gasoline.

From the above discussion it is evident that alcogas is an entirely practical fuel meeting the requirements of present day engines besides possessing many very important advantages. Probably its most important advantage is its applicability to the very high compression engines of the future.

In Fig. 5 are shown the results of tests made by the Bureau of Standards on a standard Liberty engine using alcogas at various altitudes up to 25,400 ft. The engine was equipped with special pistons to give a compression ratio of 7.2 to 1. The curves show the increase in power and economy resulting from this compression ratio as compared to a ratio of 5.6 to 1.

Conclusions

Alcogas is only one of the many blended fuels proposed to aid in the solution of our motor fuel problem. No synthetic fuel will probably be the ultimate solution

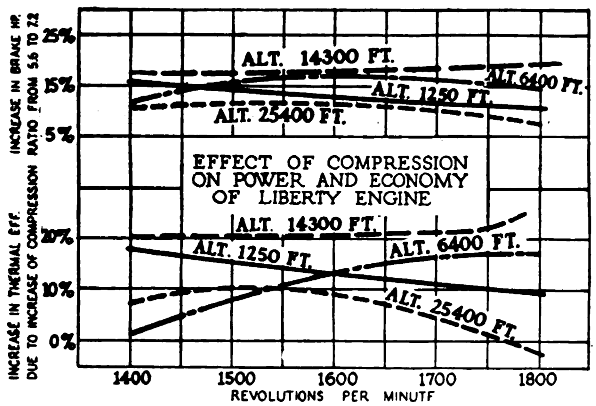


Fig. 5—Fuel used, Alcogas

of the problem, but they will all assist in postponing the day when we can no longer depend entirely upon petroleum resources.

In engine design, construction and use it is impossible to jump from the present day petroleum fuel to alcohol. Blended fuels can be efficiently and effectively utilized in present day engines and will meet existing requirements. Future developments will very probably take the direction of slower speed engines, higher compressions, longer stroke, etc., which are the qualities required for the efficient utilization of alcohol fuels.

In the near future it is hoped that this country will emphasize and encourage the production of alcohol for motor purposes as well as the use of blended fuels so that when the day approaches when our petroleum resources are exhausted, we shall have ample capacity for the production and utilization of fuel alcohol.

Petroleum

THE production of petroleum involves a higher proportion of waste than is found in the mining of coal, with far more serious consequences because the domestic supply is altogether inadequate for meeting the present requirements of the country and the domestic resource is rapidly suffering depletion. Less than half of the oil underground is raised to the surface; there has long been an overproduction in respect to the higher types of uses, prompting the surplus to be used for crude purposes in the place of coal and water power. The responsibility for these conditions lies with the small-unit competitive type of mining prevalent in the United States, whereby the geologic unit or pool is arbitrarily divided into many small holdings separated by vertical boundary planes. Petroleum is a migratory mineral, moving underground in the direction of lower pressure, and hence each individual producer is forced to race with his neighbor for the extraction of the product. Thus not only is production in each new field quickly forced beyond the handling facilities of the moment, but much of the oil underground is permanently placed beyond reccvery by this discordant type of production. There is a drift toward commercial integration and individual co-operation in petroleum mining, but with insufficient rapidity in view of the resource size.

The transportation of petroleum makes use of an extensive system of pipe lines, thousands of miles in length, spread over half of the country, connecting points of production with refineries, markets, and seaports. The efficiency attained in the transportation of petroleum energy is in marked contrast to that characteristic of coal energy and should point the way to the reconstruction of the latter, whose faults are now throttling the commodity transportation of the country as well as contributing to unhealthy urbanization and sectionalization.

The utilization of petroleum is far in advance of coal in that the bulk of crude petroleum now produced is separated into its chief components—gasoline, kerosene, fuel oil and lubricants—whereas coal is employed dominantly in the raw state. Here again the oil industry points to the analogous need for a coal refining industry to separate coal into mobile forms of energy and commodities. The utilization of the various petroleum products displays various degrees of efficiency, with the greatest discount applying to the low-use products such as fuel oil. The by-product actualities held in petroleum are not yet adequately utilized, nor are the by-product potentialities sufficiently developed. The most important immediate problem in connection with petroleum utilization is involved in the rapidly mounting demand for motor fuel, a circumstance requiring a rapid diversion of fuel oil from its present rôle of steam-raising fuel to that motor fuel—a change which may be brought about by a co-ordinated development of cracking methods of distillation and adaptations on the part of internal combustion engines to a lessened dependence upon volatility. The adequate growth of automotive transportation on land and sea and in the air would seem to be involved in the successful handling of this issue.—*From a paper by C. G. Gilbert and Joseph E. Pogue presented before American Society of Mechanical Engineers.*

The Havre-Paris Pipe Line

FOR the purpose of delivering petroleum from Havre to Paris, a pipe line 126 miles long is being constructed for the Compagnie Française de Transport des Mazouts et Petroles. Except for one-tenth of the distance the line will follow the Route National from Havre to Paris. The pipe, which is to be 10 in. in diameter, is to be laid along the edge of the road 3 ft. below the surface. At Havre and Paris there will be ten tanks of a capacity of 55,000 barrels each, and six tanks of a similar capacity will be stationed along the route at the pumping stations. The latter will be provided with apparatus for heating heavy oil so that it may flow easily.

An interesting point in the plans for construction is that arrangements have been made to utilize trench-digging machines, which were sent to France for the American Army, and were taken over by the French Government when the latter acquired the American Army stores. The pipes, tanks and pumps required for the undertaking are being sent from America.

THE Society of Motor Manufacturers and Traders (Great Britain), has voted a sum of $125,000 (nominal exchange) for the formation of a fund to be known as the "S. M. M. T. Trust Fund" which will be used for the purpose of granting relief to persons considered eligible as having contributed to the encouragement, promotion, or protection of the motor trade. In addition, the Society has voted a further sum of £5,000 to the Cycle and Motor Trades Benevolent Fund, bringing the total contribution of the Society to that Fund to nearly £14,000.

Steel Spoked and Disk Wheels Popular on British Cars

Wire wheels still favored for high grade cars but wood wheel is almost extinct. Pressed steel spoked type used extensively on small medium priced cars. Several types of disk wheel employed. Corrugated disks are hard to clean and are being abandoned. Demountable rims uncommon.

By M. W. Bourdon

ON British cars the wood type of wheel is practically extinct, for only one or two makers will use this type in 1921. The wire spoked wheel is still favored for high-grade cars, the principal makers of this type being Rudge-Whitworth and Dunlop, both of whose designs are probably well known in the United States.

Unquestionably the most popular type of wheel for small, medium priced cars is the pressed-steel hollow-spoked variety, of which Sankey was the originator. The Sankey wheel consists essentially of two pressings, each forming half the rim, spokes and hub, these being welded together at the vertical center line. There is one other part, however, consisting of a unit which forms lateral webs in the spokes, which is inserted between the halves before they are welded together. The hub of the complete wheel is drilled for tubular distance pieces, through which pass the threaded studs holding the wheel to the hub in casting by means of exterior nuts, this being the favored method of fastening detachable wheels of this variety.

Some few failures of the Sankey wheel are said to have occurred through the tire pressure separating the two portions of the units forming the rim. This shortcoming is made a great deal of by a competitor who has entered the field against Sankey, namely Goodyear (no connection with the Goodyear Tire Co.). To overcome this drawback Goodyear welds a complete rim between two steel pressings resembling those of the Sankey.

Detachable flange rims are comparatively rare in England, though there is one well-known popular make, the Warland. This has a detachable flange secured by bolts, but this flange merely locates a transversely split rim with a loose segment which can be removed and the ends of the main portion drawn together for easy fitting or removal of clincher tires. Sankey has, however, recently introduced a detachable flange rim for a wheel of the pressed steel hollow spoked variety, the method of construction otherwise being identical with that of his original pattern.

A novel type of wheel construction is that introduced by Smith-Parfrey, originally wood wheel builders. It is

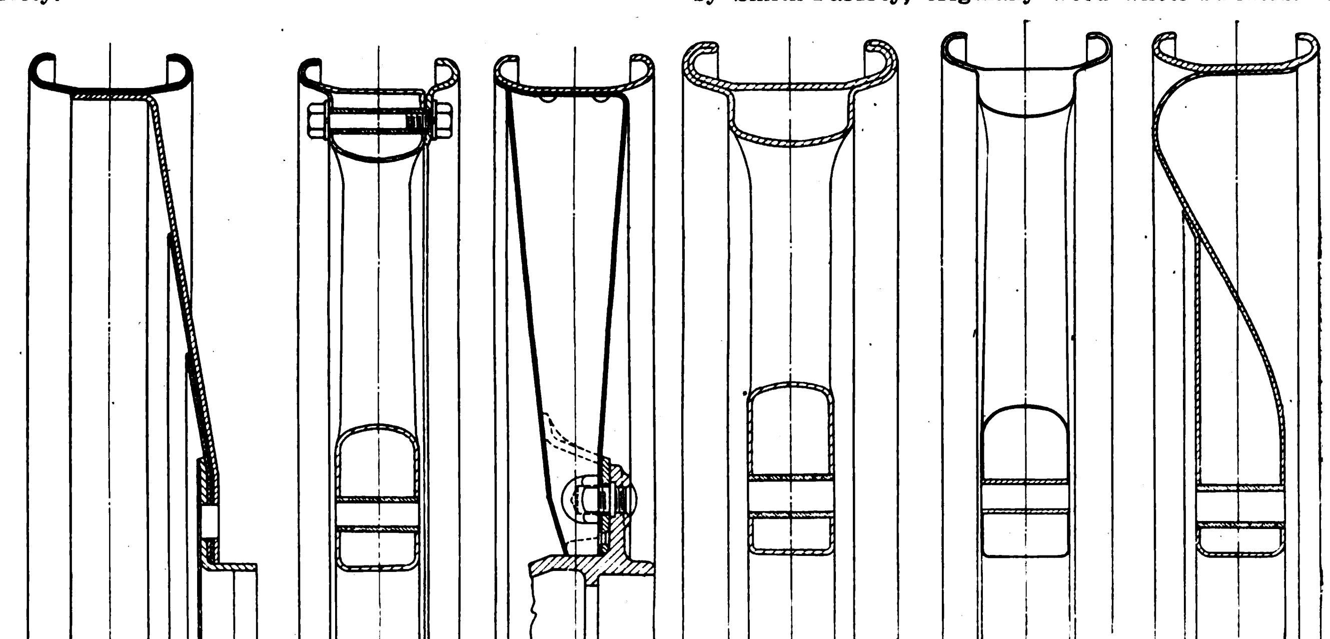
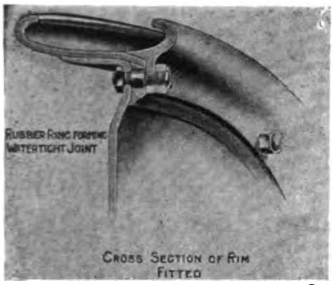
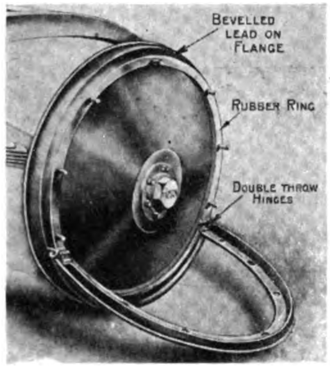


Fig. 1 *Fig.* 2 *Fig.* 3 *Fig.* 4 *Fig.* 5 *Fig.* 6

Fig. 1—The Riley laminated disk wheel. Fig. 2—The Sankey hollow spoked wheel with detachable clincher flange. Fig. 3—Section of the Goodyear corrugated disk wheel. Fig. 4—Section of the Sankey pressed steel hollow spoked wheel, which consists of two units welded at the center line. This is the original of its type. Fig. 5—The Goodyear pressed steel hollow spoked wheel, which has a separate and complete rim welded between the two units forming the felloe, spokes and nave. Fig. 6—Part section of the Sankey dual disk wheel. This is used by some makers with the flat surface outward, though the curved surface is normally intended to form the exterior



Section of Rapson hinged flange rim and disk wheel



Rapson hinged flange rim and disk wheel

built up, as shown in an accompanying sketch, of flat steel plates shaped at one end so that the combined units form the hub, the outer ends of the spokes being riveted and welded to a rim base of flat section. Strength for weight, there does not seem any advantage in this system, nor does it present any benefit in cleaning. It is put forward for both cars and trucks.

In regard to disk wheels, these are gradually becoming more popular with both makers and users, and not infrequently wire spoked wheels are enclosed by detachable aluminum disks. Two car manufacturers make their own disk wheels, namely Armstrong-Siddeley and Riley. The first named has attached to the rim by welding and riveting a disk with a very large hole in the center, the inner diameter of the disk in the case of rear wheels overlapping the brake drum and being secured to it by studs and nuts. In the case of front wheels the disk is bolted to inner disks secured to the hub.

Riley has a laminated disk built up of three disks increasing progressively in diameter. All are secured to the wheel hub, but only the larger one extends to the rim, where it is spot-welded. The laminations are also spot-welded together. The Riley design somewhat resembles the Michelin, except that the latter has a single disk tapering in section.

Sankey is making a disk wheel for quite a number of car manufacturers, but this is a dual disk, as shown in the section herewith, the main unit extending from hub to rim and being considerably dished toward the center. At the back of the main disk there is a second, flat-surfaced disk, welded to the other, the two together forming a hub varying in width according to size of wheel as a whole.

The Goodyear wavy disk wheel, which first came into prominence when it was adopted for Angus Sanderson cars in 1919, has not found a great deal of favor, and, although it is being continued, the makers are shortly introducing a flat disk type. It has been found that the wavy disk, as might have been expected, is almost as difficult to clean as a spoked wheel, and while it fails to present any advantages in that respect, it certainly has none in appearance, the corrugations giving a distinctly clumsy effect, both when the wheel is stationary and when running.

Another make of disk wheel is the Lynton. This has a flat disk of uniform thickness offset from the rim center and is riveted and welded to the tire rim. Lynton has for many years past made a disk wheel consisting of two plates, between which the tire rim is clamped. The inner plate is fixed to the hub, the outer one being detachable, thus providing a demountable rim effect.

Dunlop has recently introduced a corrugated disk wheel, but it is considered doubtful whether this will obtain any popularity. Although it probably is considerably stiffer than a flat disk, the multitude of corrugations is a distinct disadvantage in the matter of cleaning. A separate hub plate, to which the corrugated disk is welded, is used.

Rapson has recently put forward a disk wheel with two-thirds the rim flange hinged to the remainder to facilitate tire manipulation. This is shown in perspective and in section in accompanying illustrations.

Although the vast majority of British wheel makers specialize entirely upon wheels and rims for clincher tires, the possibility of straight-side tires being popularized in the near future has not been overlooked, and Dunlop, for example, is making the new corrugated disk wheel for both clincher and straight-side tires. There has, however, been no indications of any great move toward straight-side tires by British car makers or users.

A point in favor of the disk wheel of the single disk type is that it allows the point of tire contact with the ground to be more easily brought under the axis of the steering pivot. Armstrong-Siddeley, Riley, and one or two other makers have taken advantage of this, fitting vertical pivots immediately over the point of tire contact. Users confirm the claim for peculiar ease of steering and freedom from shock, even when compared with steering lay-outs having inclined pivot pins with their prolonged axes extending to the tire contact centers.

A New Type of Piston Ring

A PISTON ring of unusual construction has recently been designed and tested by Harry B. Johnston of Seattle. The ring is approximately triangular in section and but two rings are used per piston. The cylindrical face of the ring fits the bore of the cylinder. A second face at right angles to the axis of the piston is disposed toward the head of the piston in the case of the upper ring, and toward the skirt in case of the lower ring. The third face is inclined at an angle of 35 deg. and fits against a correspondingly inclined surface of the groove. The ring is given only a slight spring to hold it against the cylinder wall, but the pressure existing in the combustion chamber is admitted to the spaces between groove and ring, thus forcing the ring against the cylinder wall to maintain a gas-tight joint. The wedging action of the tapered face of the ring against the inclined face of the groove is said to increase the effectiveness of the seal. It is claimed for the ring that it effects an increase in power development as compared to conventional rings and prevents oil pumping as well as leakage of fuel into the crankcase of the engine.

Piston ring depending chiefly on gas pressure to maintain seal

Three Post-War Wolseley Chassis

Two are four-cylinder models of 10 and 15 hp. respectively, and the third is a 20 hp. six-cylinder model of earlier design but somewhat modified, and of quite different design from the fours. The "Fours" have overhead camshafts with blade-spring drive. Battery ignition is standard.

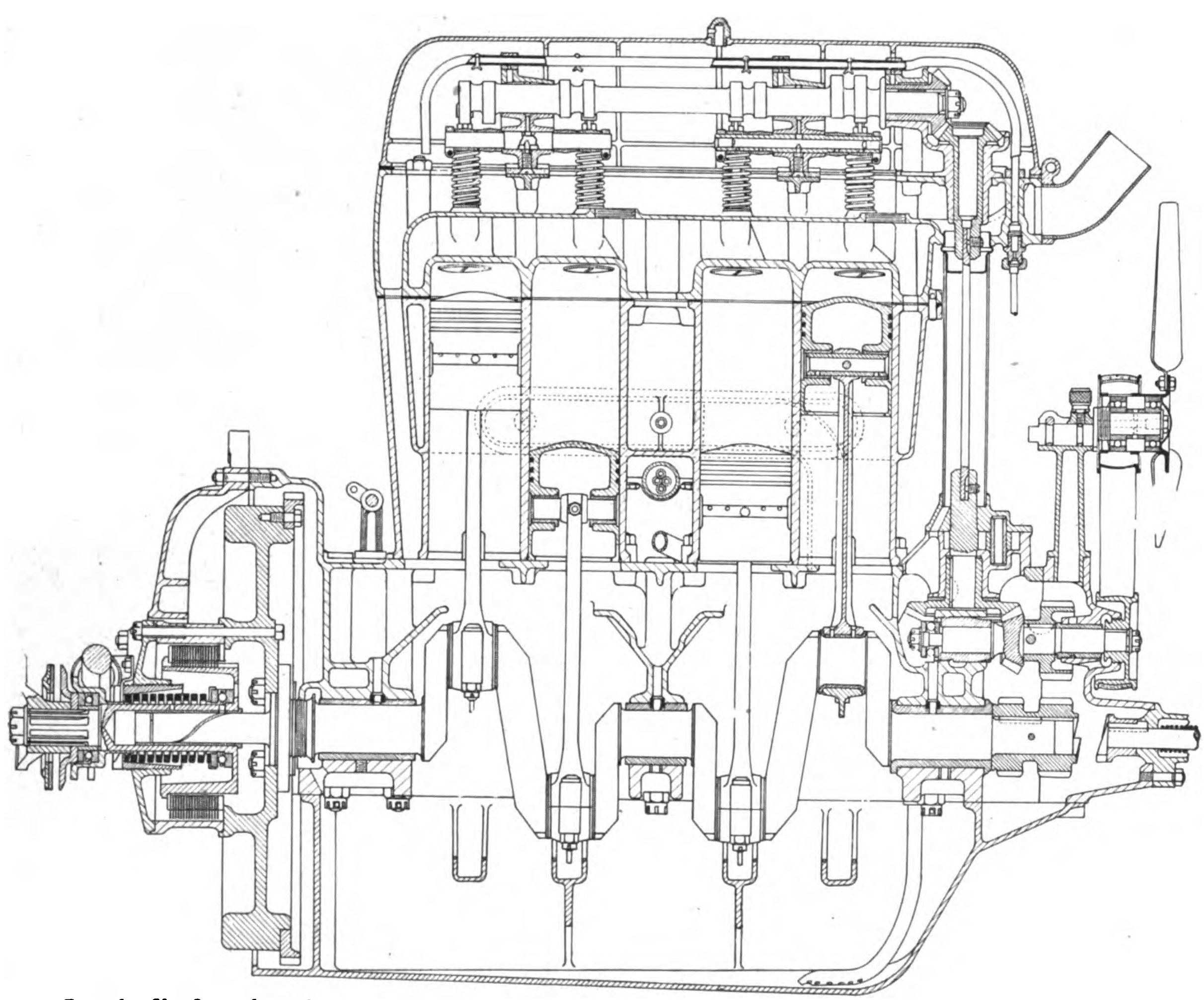
By M. W. Bourdon

THE three units of the post-war Wolseley range were shown at last year's Olympia Show and created a large amount of interest, but production and other difficulties prevented deliveries being commenced until quite recently in respect of the two smaller types, though the six has not been so belated.

Chief interest attaches to the 15 hp. model, made for four passenger bodies. It departs in almost every detail from pre-war Wolseley practice, has a high efficiency overhead camshaft engine and the complete chassis form weighs only 1800 lb. The special features of the engine are embodied also in the smallest model, a light runabout with a four-cylinder engine having a bore and stroke of 2 9/16 x 3¾ in. and being one of the best finished and best sprung of its type on the road. Its selling price is now $2,700 complete.

The 15 hp. chassis has, then, a four-cylinder 80 x 130 m.m. (3⅛ x 5⅛ in.) engine with a detachable head carrying the camshaft and valves. The cylinder block is of cast iron, and is bolted to the top part of the aluminum crankcase. The camshaft (like the crankshaft) is carried in three bearings and has the valve rockers pivoted on a shaft immediately below it, the cams applying to projections on the rockers situated midway in the length of the latter; the rockers are, in fact, of inverted T shape with the cams applying to their single member.

A somewhat involved form of drive is used for the camshaft. First there is a silent chain which runs on three sprockets, on crankshaft, water pump shaft and countershaft respectively. The countershaft carries a bevel pinion meshing with another pinion at the lower end of the vertical drive which latter carries just above the bottom



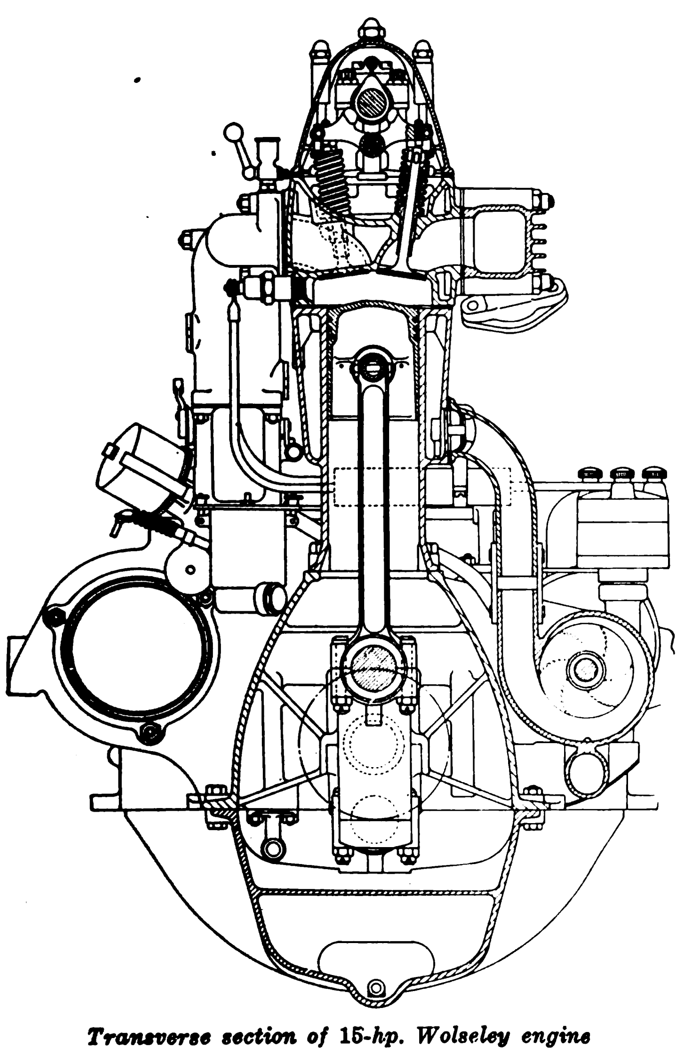
Longitudinal section of Wolseley 15-hp. (3⅛ x 5⅛ in.) engine, showing spring blade camshaft drive

bevel pinion the primary gear wheel of the oil pump. At the upper end of the driveshaft another bevel gear meshes with one on the front end of the camshaft. A special feature is a spring blade coupling 7 in. in length between the separate upper and lower ends of the drive shaft, the object being to afford a certain amount of flexibility in the camshaft drive to induce silent valve operation.

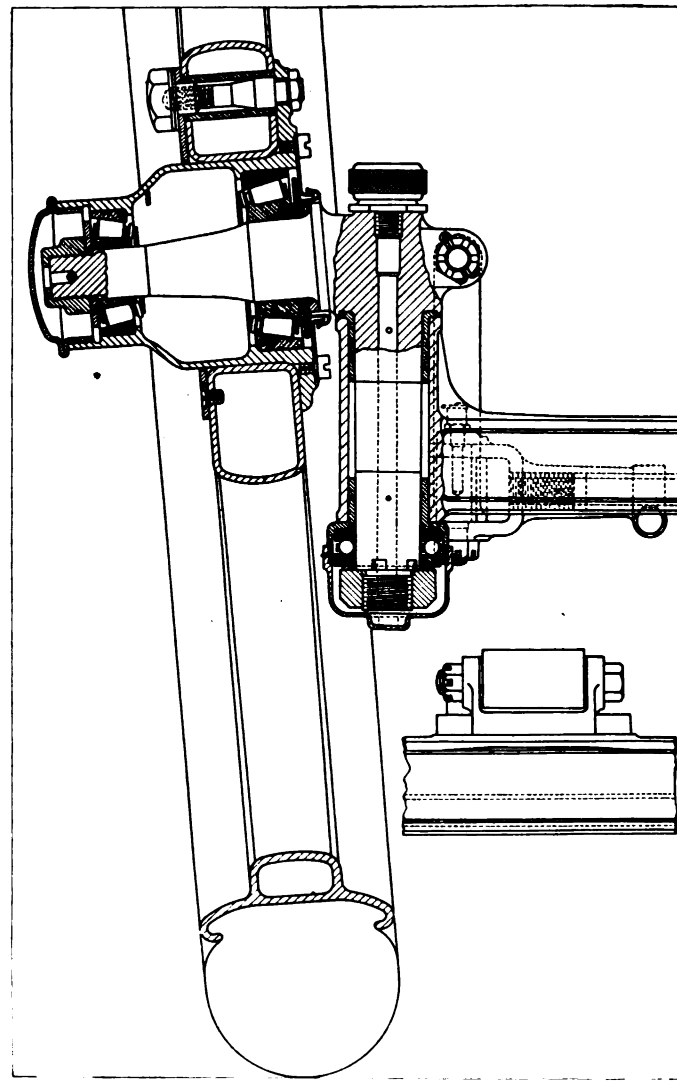
Dynamo-battery ignition is standard, but most of the chassis delivered hitherto have had magneto ignition. Whether magneto or dynamo be used (the latter as a unit with contact breaker and distributer), it is driven by a rearward extension of the water pump shaft on the left of the crankcase, the spark plugs being on the right and the cables passing across through a tunnel in the center of the cylinder block at the lower end of the barrels.

Lubrication is on the trough system for the connecting rod bearings and pistons, but large catch pits are formed over each main journal and oil is fed directly into these. The aluminum pistons have three rings with the hollow piston pins floating in bronze bushes in the bosses, the pins being fixed in the connecting rod small ends by ¼ in. bolts passing right through. From the oil pump, a copper pipe leads to the camshaft bearings and from the latter oil runs through drilled holes in the brackets to the bearings of the hollow rocker shaft and to the rockers themselves. Surplus oil returns to the crankcase through an external pipe at the rear end of the head casting and through the tube enclosing the vertical driveshaft at the front. Provision is also made for a direct oil lead to the silent chain and to an indicator on the instrument board.

There are separate exhaust and inlet manifolds on the left and right respectively of the head casting, the carbureter with vacuum feed being a Wolseley edition of the S. U. bellows pattern. A claim of a fuel consumption of 30 miles to the Imperial gallon is made.



Transverse section of 15-hp. Wolseley engine

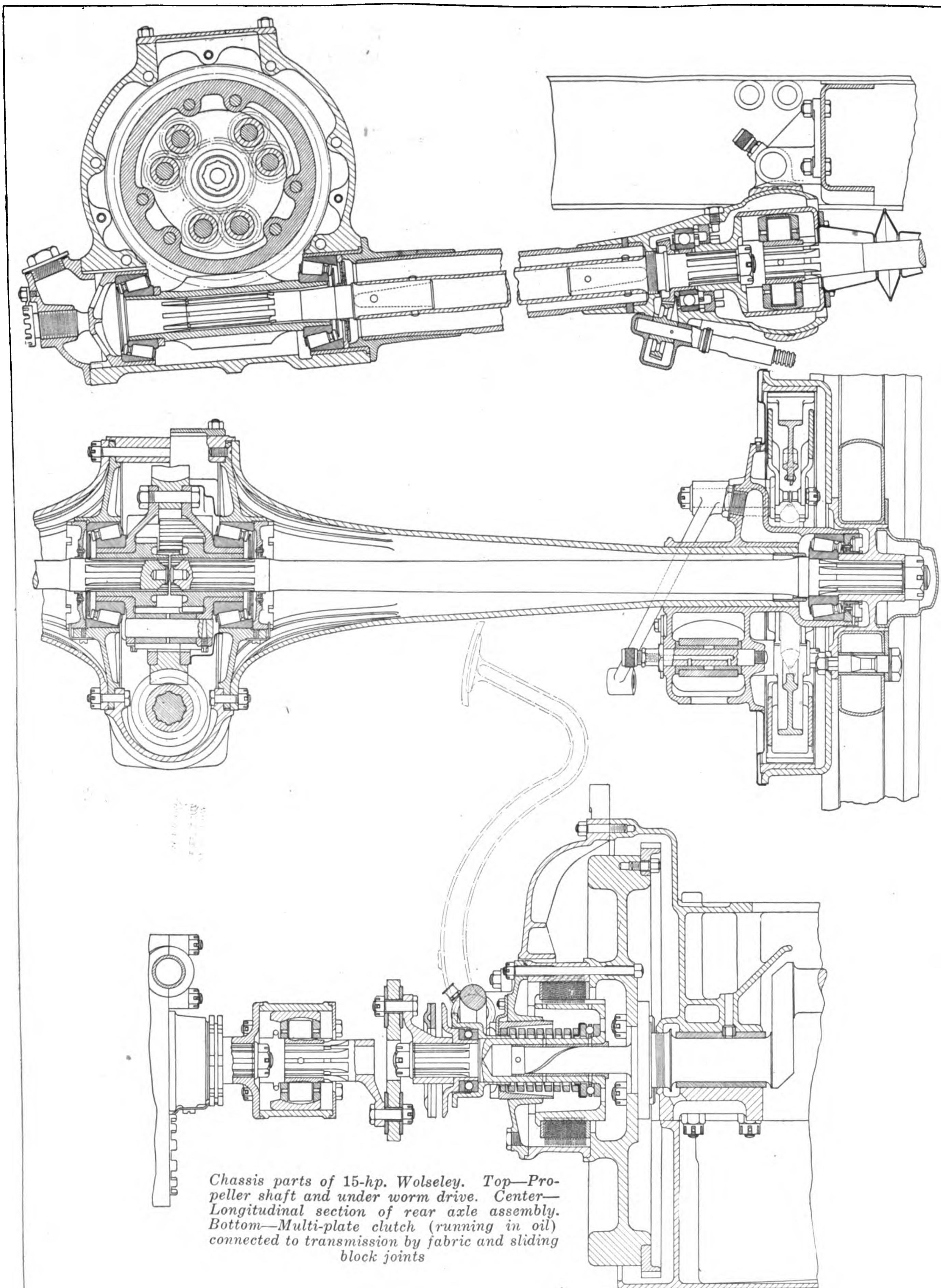


Wolseley front wheel and ball-thrust steering knuckle

The flywheel is completely enclosed, its casing supporting the starting motor alongside the right of the crankcase, which is carried by four arms extending to the main frame. A multiplate clutch running in oil is used, with a coupling shaft having sliding block and fabric disc joints. The three-speed gearset with right hand control is supported by tubular and pressed steel cross members, at one point from the former in front and at two points from the latter. Behind the gearset a short exposed coupling shaft with a fabric disk point at the front end leads to the enclosed sliding block type universal at the head of the propeller shaft, the latter being enclosed in a torque tube with a spherical mounting slung below the center of a pressed steel cross member.

Under-worm drive (4.8 to 1) is used in the rear axle, which latter has an aluminum center with tapered steel extensions. The axle is of the non-floating type with Timken roller bearings throughout, this type of bearing also being used in the gearset, except for the pilot, which has a plain bush. Front wheels also run on Timkens with a ball thrust for the steering pivots.

Both sets of brakes apply within the 14 in. wheel drums of pressed steel, the latter having steel rings shrunk into them to provide a wearing surface. In each brake drum there are four segments in the same plane, opposite pairs being actuated by hand lever and pedal, the shoes all being 1¾ in. wide.



Chassis parts of 15-hp. Wolseley. Top—Propeller shaft and under worm drive. Center—Longitudinal section of rear axle assembly. Bottom—Multi-plate clutch (running in oil) connected to transmission by fabric and sliding block joints

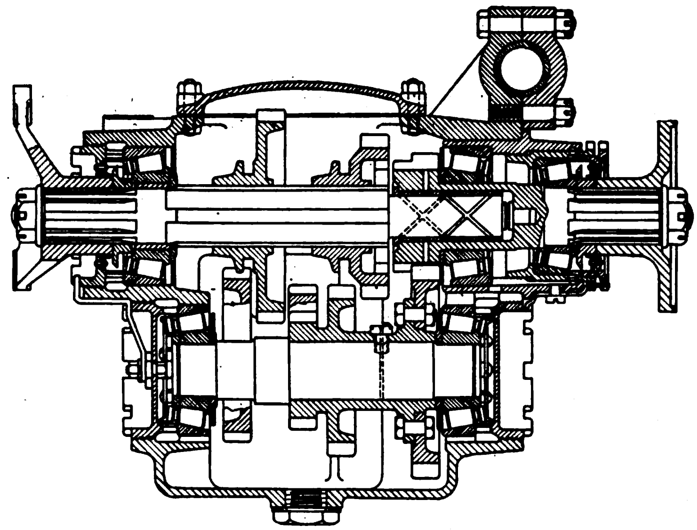
Another special feature (for a car of this size) is the use of quarter elliptic springs, these having been tried out on the 10 hp. model in pre-war times with great success.

The steering is of the worm and worm wheel type, the housing being mounted on the front arm of the crankcase on the right with a transverse drag link to the left hand swivel lever. Pressed steel hollow spoke wheels are standard with 815 x 105 mm. (32 x 4 in.) tires, the wheelbase being 118 in. and the track 52 in.

With its standard type four-passenger open body and the usual full equipment, the 15-hp. Wolseley sells at $4500, and it is currently reported that a substantial increase may occur in the near future.

The principal point wherein the 10-hp. model differs from the 15-hp. is that it has its three-speed gearset as a unit with the worm driven rear axle. Originally it had a unit cast cylinder block and crankcase; but these are now separate, the latter in aluminum.

In almost every main detail the 20-hp. six-cylinder is different from the 15-hp. It has its cylinders cast in threes with integral L heads, magneto ignition, four-speed gearset, transmission brake, open propeller shaft, cantilever rear springs and wire wheels. Where it bears resemblance is in the trough system of lubrication, aluminum pistons, vacuum feed, multiplate clutch, amidships position of gearset, and worm drive. It weighs 2460 lb. (chassis only), has a wheelbase and track of 138 in. and 54 in. and sells at $6300 with a five-passenger body.

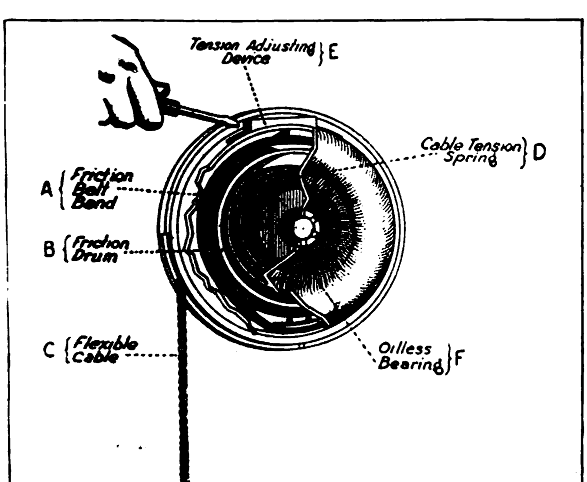


Three-speed gearset used on 15-hp. Wolseley

A Friction Band Shock Absorber

A SHOCK absorber acting only on the recoil of the spring is manufactured by the Gilman-Davis Mfg. Co. An adjustable friction belt band engages with a friction drum and any tendency of the body and the axle of the car to suddenly separate, causes a sufficient tightening of the friction belt band upon the drum to counteract the thrust and retard the upward movement. This result is accomplished by the frictional contact between the free end of the band and the drum and by the forward movement of the opposite end of the band by the rotation of the drum.

On the other hand, when body and axle approach each other, the tension of the flexible cable is released and the spring is permitted to return the drum. Coincidently the friction between the free end of the friction belt and the stationary drum, co-operating with the reverse movement of the opposite end of the band, loosens the band sufficiently to allow the drum to be returned by the spring. The tightening and the release of the friction belt band are automatic at the beginning of each forward or reverse movement of the drum. Adjustment of the band tension can be made with a screw driver.



The Gilman shock absorber

Repairing the Ford

THE Ford automobile is in such universal use and there are so many of them to be found that the business of repairing them assumes gigantic proportions. J. Howard Pile, in his recently issued book, "Modern Methods of Ford Repairing" (U. P. C. Book Co., New York), describes methods and tools which will facilitate the standard repairs. Competition is so keen and the margin of profit so small that the work must be done efficiently or the profits will turn to losses.

In the compilation of this service manual, the author has studied factory and shop methods from many angles, and the reader is given the benefit of observations covering many of the most profitable and efficient Ford service stations in the country. This material was first published in a serial in Motor World, but it has been revised and brought up to date and there is considerable material in the book that did not appear in serial, such as wiring diagrams of all the starting and lighting systems that were put on the Ford car before the FA starting and lighting system became standard equipment.

The size of the book is such that it can be carried in the pocket, the pages being 6½ x 4½. Beside the twenty-four wiring diagrams, there are 135 illustrations of special tools, equipment and devices and the pages run to 251, including a complete index of all operations and subjects.

British Production Methods Show Improvement

Many British manufacturers have made a decided improvement in their production methods, but there are still a number of high-priced, low-value cars on the market. In the British automobile industry it is considered discreditable to use stock parts. It is the general opinion that every self-respecting manufacturer must make all component parts of his cars.

By M. W. Bourdon

THERE are still a number of British firms who have not departed appreciably from their pre-war designs, and among these may be mentioned Sunbeam, Vauxhall, Arrol Johnston, Daimler, Rolls Royce, and Star. But such firms have not, up to the present, experienced any difficulty on that account, for they have sold all the cars they could make on the excellence of their reputations, and at any price, within reason, they have cared to demand.

But with increasing competition from makers who have thoroughly up-to-date designs which, in many cases, such as Austin, Crossley, Angus Saunderson and especially the new 18-hp. Phœnix, which is an excellent production job, have resulted or will result in reduced costs of production, the hands of the more conservative manufacturers will probably be more or less forced in the not far distant future. As supply continues to gain on demand the prospect of the pre-war standards of design being more generally superseded becomes nearer at hand, for there is plenty of scope for closer co-operation between designer and production engineer.

No surprise will be felt if before this time next year there is introduced the true post-war models of certain of the firms which are still making merely a modified pre-war car. The home market will before long approach the present saturation point so far as some of the comparatively high priced (or low value) cars are concerned, and if their makers are to keep their heads above water they will have to produce designs more adaptable to economical production. In his tours through some plants the writer has been astounded at the lack of evident endeavor to simplify design from the production standpoint.

The policy frankly adopted by one maker, if not actually advocated by him, of "letting buyers do the testing" of new models is not general; nor is it singular—unfortunately for both maker and user. Unfortunately for the latter for two reasons, one of which is obvious but the other not so clear. This policy may enable production of new types to commence earlier than would be the case if the experimental chassis were put through prolonged tests, but it cannot surely be so economical in the end; it has, in some cases, to the writer's personal knowledge, involved serious alterations to or replacements of patterns, jigs and special tools, and these must clearly be paid for by someone—if not by the maker, then by buyers.

Wolseley, Armstrong, Siddeley and a few others who introduced post-war chassis at the 1919 Show have been objects of contumely in some quarters for not having commenced deliveries until so many months later. But there has been "method in their madness" which should be to their subsequent advantage, even though they have lost immediate benefit.

Doubtless many who rushed deliveries of post-war chassis not thoroughly tried out were encouraged to do so by the need for revenue to keep plants going and by the clamoring of the public for new cars last year and until the end of the past summer. The former has indeed been a spur in some instances, but one that has been ineffective nevertheless, and as a result financial difficulties are being experienced in some quarters, while rumors of troubles to come are by no means infrequent and not always ill-founded.

Some if not a large proportion of the new firms who rushed into the automobile industry for the first time last year are currently reported to be *in extremis*, and although in certain instances the trouble has arisen from difficulty in obtaining material, from the molders' strike and from labor difficulties in general, in others it has developed from faulty design, bad organization and a lack of experience.

There is, therefore, in prospect a "weeding-out" of unstable concerns, not necessarily brought about by a "slump," but by mismanagement, unjustified optimism, lack of capital at the outset, or any combination of the three.

Multiplication of Models

It is to be noticed that a few British firms have changed their pre-war policy of endeavoring to cater for many markets with several models of different sizes. But the plan of specializing on one type has by no means received general approval as the following will show:

Daimler has three models, two with identical engines and gearsets but differing appreciably at various points of the chassis; the third with a larger engine and a heavier type altogether.

Star has two models issuing from one plant and two more from an allied and adjacent factory.

Humbers have three models, and though two are identical in engine and gearset they differ almost everywhere else; the third is entirely different.

Vauxhall has two models with different engines and chassis, but not entirely dissimilar, one being a "general purpose" model and the other a high efficiency sporting type.

Vulcan has three, two somewhat alike and the third bearing no resemblance.

Wolseley has three, all different, though two have the same system of overhead valve operation on engines of entirely different dimensions.

In addition, Daimler, Star and Vulcan produce truck chassis, the first and last one model each with detail variations, and Star three models.

Divergencies in Detail

As briefly indicated, in many cases where more than one model is produced there is very little opportunity—nor is there much endeavor—to make either main or subsidiary units adaptable to the different chassis. We find chassis with both unit power plants and separate gearsets issuing from the same maker; subframes and no subframes; cone and disk clutches; right-hand and central gear controls; vacuum and gravity fuel feed systems; magneto and battery ignitons; L head and overhead valves; open and enclosed propeller shafts; and so on indefinitely. It seems as though some firms cannot make up their minds as to which alternative in each case is the better, and though it is apparent that one system of construction in a particular part may not be suitable for two entirely different chassis types, that is not always, by any means, accountable for the divergent practice.

It will be accountable to most people, for example, why Daimlers fit a honeycomb radiator with the filler inside the bonnet on one model and a tubular radiator with a normally positioned filler on another model, both having identical engines; why they use two ball-bearing star universals on the propeller shaft of one of these cars, and a block and star at front and back respectively on the other. It cannot be said that one model is an earlier type than the other and therefore does not embody the latest approved practice. This is doubtless the reason in a few instances, but it does not hold good in the majority; it would certainly seem that there is only too frequently no endeavor to cheapen production by utilizing identical parts where possible for two or more models.

High Standard of Performance

But despite all the foregoing, British cars and British production methods are improving, there can be no question of that. Whether they are improving as fast as they might is another matter. The established British maker is, at least, far-seeing in one respect, if not generally; he is not attempting to turn out cars that he has reason to believe will do him no credit. He may adopt designs bad from a production standpoint and he may get down to production in his limited way (judged by American standards) without giving his new models a six or twelve months' testing; but, with a very few exceptions, he will not allow immediate gain by shoddy work to jeopardize his reputation. Nor will he "design down to a price" without consideration for his future interests.

In most branches of engineering the British manufacturer is inclined to be conservative, but it is only fair to give him credit for turning out "good goods" when he does adopt a new design or accessory. So the British automobile engineer usually sets himself a fairly high standard in engine efficiency, workmanship and finish. Most of his customers buy cars to keep and use for many years. Eighty per cent, too, take pride in the appearance of their cars, externally and under the hood, and therefore expect a finish which will do them credit. They like individuality to a certain extent, and therein the British maker gives them perhaps more than they need, generally designing and making every main unit to his own ideas.

Attitude Toward Stock Components

There is no pronounced expansion of the components side of the industry. One or two quite small concerns who have yet to make a name for themselves have commenced to supplement Wrigley in supplying gearsets, axles and steering outfits. But they do not count for very much, and, speaking broadly, the car manufacturer makes every component himself.

Admittedly Dormans and Tylors have turned out a lot of engines during the past eighteen months, but Vulcan, Ruston Hornsby (Dorman) and Angus Sanderson (Tylor) are the chief users of their engines. Both do far more business in truck engines, making, between them, for W & G, A.E.C. and Hallford among others, who, usually, do not advertise the fact that they are fitting engines of other than their own make.

In fact, the frame of mind among concerns and individuals in the British automobile industry is that it is discreditable to use stock components. There is no discredit attaching to Humber, for example, in getting some engines made to their own design by Peter Brotherhood (the general engineering firm whose own tractor did so well at Lincoln); but if they made use of a stock engine they would feel they had reason to be ashamed—they would look upon it as implying that they were not qualified, had not enough brains and experience, to design and make their own.

So with clutches, gearsets and back axles. The general opinion is that no self-respecting manufacturer would do other than use these as designed and produced in his own

No wonder, then, that British cars are highly priced when the foregoing is considered alongside the comparativley small outputs. The writer could mention offhand a score of firms, whose names would convey nothing in the United States, who are turning out small and medium powered cars at the rate varying from only 100 to 500 per annum and who make every component. It is the same in all branches of the industry—private cars, trucks, motorcycles, marine outfits and tractors—all makes have their individual components, apart from accessories such as carbureters, magnetos, etc.

New High-Speed Cutting Tool Alloy

A DEMONSTRATION was recently made at Sheffield, England, of the cutting powers of a new alloy produced by the Cooper Research Co.'s laboratory, Cleveland, Ohio, and known as cooperite. The basis of the material is nickel, and there are added tungsten, silicon, molybdenum, aluminum and zirconium—the latter up to 15 per cent. These ingredients are melted in a crucible furnace, cast into tools, and ground, no heat treatment being required. The material has a fine silky fracture, and, it is claimed, is free from shrinkage and blow-holes. Tools made from it have been tried by the Sheffield Testing Company, with very interesting results. For the tests the tools used were ¾ in. square, depth of cut 3-16 in., traverse per revolution 1-16 in., cutting speed 123 ft. per minute, and the weight of material removed from the test bar 4.85 lb. per minute. One tool ran for 9 min. 6 sec., and another for 14 min. 39 sec., the report in the latter instance being that at that time the tool was "slightly worn, but still cutting," while a tool of high speed steel was said to have been "done up" after 2¾ min. The British rights have been secured by London interests and the alloy will shortly be marketed in England.

Cutting Costs in the Manufacture of Small Units

A detailed study of the parts to be manufactured often reveals opportunities for cutting cost before unknown. This article contains a description of special tools and methods used by a carbureter company in manufacturing the small units which go to make up its product.

By J. Edward Schipper

IN the manufacture of carbureters and other small units, there are many opportunities for cutting costs which are not apparent except when a very close and detailed study is made of the parts to be manufactured. For maximum efficiency, the operator must never wait for the machine. This principle is true from the standpoint of the manufacturer, as well as from that of the operator himself, who is thus afforded every opportunity to make the most out of his premium or piece-work arrangements.

Another consideration which comes up very frequently in the manufacture of small parts, is whether to use hexagonal or round stock. It is oftentimes possible to save money on the stock by using round in place of hexagonal, even where hexagon heads have to be milled on the piece. The time necessary for the "hexing" operation, however, must be taken into consideration.

In the plant of the Zenith Carburetor Co. there are two or three notable examples of marked advances in efficiency by the installation of machines which handle relatively small parts. Fig. 1 illustrates a machine for cutting hexagon heads on round stock. This machine saves the Zenith Carburetor Co. 12 cents per ft. on material alone. The hexagonal stock would weigh 2.89 lb., as compared with 2.54 for the round. The price difference is 2 cents per lb., even on the same sizes, but considering the smaller weight it is possible to use with the round material, the money saved on stock is 12 cents per ft.

Furthermore, with hexagonal stock it is necessary that the nut or hexagon be the largest part of the piece. There are times when this proves inconvenient, from an assembling and accessibility standpoint, as is the case on the Zenith carbureter, where the parts are close together. The pieces manufactured on this machine have a hexagon 5/8 in. across the flat and of 1/4 in. depth. The machine is a duplex type, cutting on one side while loading on the other, and turns out 20 of these per minute. It operates so quickly that the number turned out per minute is entirely dependent on the skill of the operator in loading and unloading; he cannot quite keep up with the machine.

Efficient Machine Work

As will be seen from Figs. 1 and 2, there are two independent drives, one for the cutter spindle and the other for the feed, and for rotating the work holding spindle. The cutter is 5 in. in diameter with fifty ordinary straight teeth. It is made of high speed steel and has turned out 150,000 pieces without being reground. The machine has a cam feed operated by a drive independent of the cutter drive. It is started by the operator pulling a lever, and the cam feed is so arranged that a quick motion of the swinging arm carries the work up to the feed; then the cam moving the swinging arm goes out of operation and allows the work to follow the contour of the master cam, which is identical with the shape to be cut on the piece. That is, the master cam may be hexagonal or square, or any other shape. This master cam rotates with the work when it is moved over by the swinging arm cam, and comes in contact with a hardened block on the machine which acts as the cam guide, the cam traveling according to its contour on this hardened block, thus moving the swinging arm to and fro.

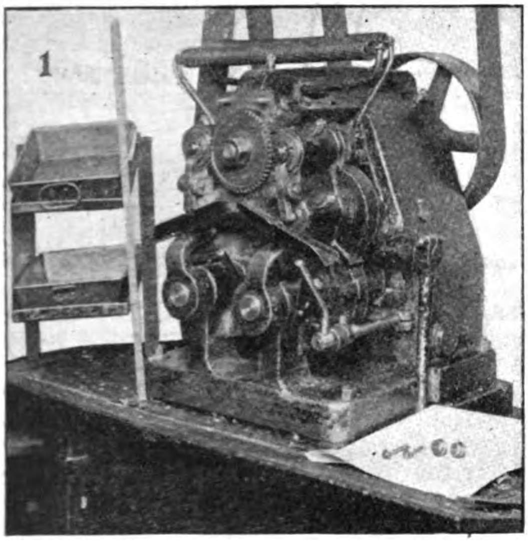
Table Operating Cam

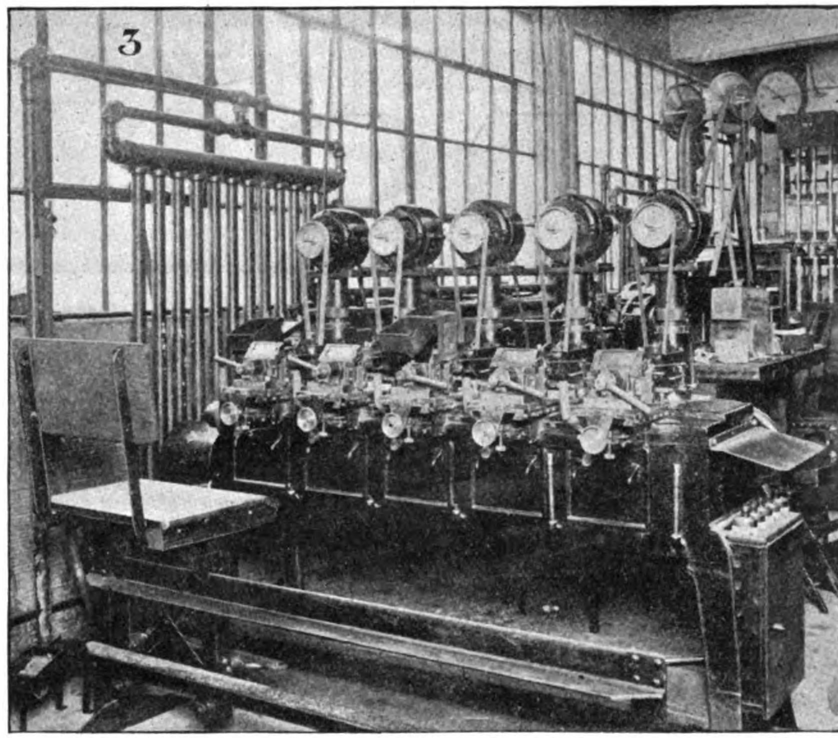
After the work has made two revolutions, the table carrying cam comes into operation again and moves the work away from the cutter so that the operator can remove it. The table has a quick motion away from the work, due to the shape of the table-operating cam. This is a one-revolution cam swinging the table quickly to the work, releasing it for the master cam to take up the action, then picking it up again after the cutter has done its work, and restoring it to its normal position. The table with its master cam is held against the hardened block by a spring, the action of which prevents bouncing and chattering. The spindle holding the master cam at one end and the piece at the other is geared 2 to 1 off the table camshaft.

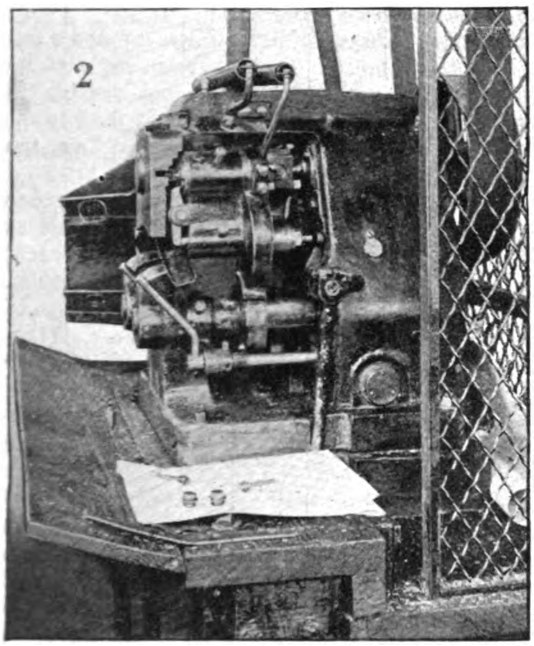
This machine, which has been patented by the Zenith Carburetor Co., has a cutting speed of 800 ft. per min. on brass and 100 ft. per min. on steel. It operates at high speed taking a very light chip, this having been found to give the best result with the brass composition used for carbureter parts.

Another machine used by the Zenith company for manufacturing small brass parts, is used for slotting the throttle shaft. This machine cuts a slot 1 1/4 in. in length by 1/8 in. wide in a 5/16-in. shaft. In order to give a layout which is sufficiently fast for the operator, a bank of machines is used with a chair placed on a track in front of the bank of five machines. The operator is thus able to slide rapidly up an down the row of machines and keep all of them in operation. A good operator can keep eight of these machines busy under normal conditions.

With this bank of five machines it is possible to slot four shafts per minute. The advantage of this machine over stock machines for the purpose is that the work is brought rapidly into position by the machine itself, instead of being screwed into position by a hand-operated, cross feed before the automatic speed of the machine comes into operation. By means of a cam the table is brought quickly up to the cutter and then the slow feed starts. When the cut is completed the table is backed rapidly away and the







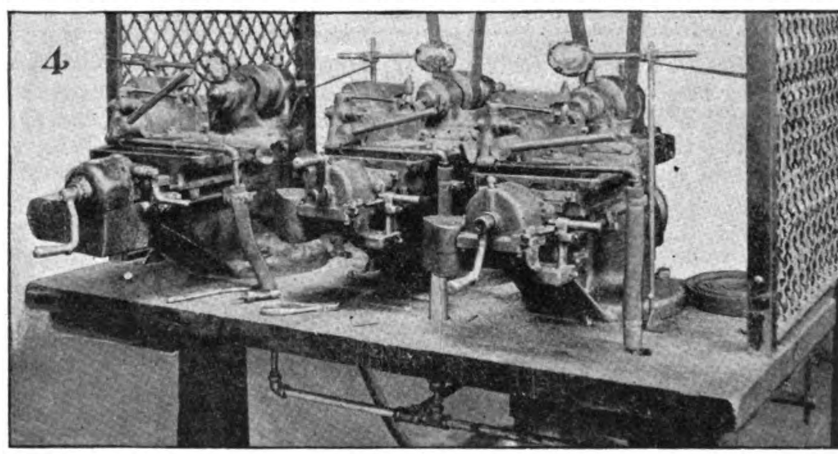


Fig. 1—Special machine for cutting hex or square heads. Machine is capable of turning out 20 pieces per minute, cutting on one side while loading on the other. Two sample pieces, one with a hex head and the other with a square head, are shown adjacent to the machine The guard plate in front of the cutter is removed. Fig. 2—Another view of the machine for cutting hex and square heads. Note the spring on top of the machine for keeping the swinging arm cam in contact with the hardened block on the machine, as described in the text. Fig. 3—Bank of five machines specially designed for cutting slots in Zenith carbureter shaft Fig. 4—Machines replaced by special machine for cutting slots in Zenith carbureter throttle shaft. These machines must be brought into position by hand rotation. On the improved machines the automatic arrangement quickly brings the table into position, after which the slow feed comes into control

mechanism stops, permitting removal of the finished piece and the insertion of a blank. It is then restarted by the operator. A very ingenious feature on this machine is a safety cap which comes down over the cutter, as the work is being backed away, so that while this is revolving continuously, there is no danger of cutting the operator's hand while placing the work in position.

The spindles are driven by independent electric motors at 10,000 r.p.m. The feed camshaft is driven by a single motor, which is located at the side of the machine and drives the one-revolution cam which brings the tables up to their work, gives the necessary slow feed for this operation and then, when the cut is complete, rapidly backs the work off and stops the machine until it is restarted by the operator.

The object aimed at in these machines and which is being pursued throughout the factory, is to have the machine do every bit of the work of which it is at all possible to relieve the operator. The stock machines replaced by the second machine described are shown in Fig. 4. The rotary hand feed necessary to bring the table up to the work before the automatic feed picks it up, is illustrated. This, of course, has the disadvantage of being slower, more irksome for the operator, far less foolproof and much more apt to cause breakage of tools. These are highly specialized machines, of course, and their specific features would not be adapted for other installations. They serve to relieve the operator of muscular and mental strain, for his own benefit and for that of the firm. He is not required to concentrate to the same degree, with the result that mistakes are less likely to occur. Furthermore, the work is done more rapidly and, consequently, production is greater than with the general type of stock tools.

The FORUM

The Proper Method of Measuring Starting Torque of Engines

Editor AUTOMOTIVE INDUSTRIES:

It is now common practice for automotive engineers to use the winter cranking torque of an engine as the determining factor in selecting a suitable starting motor, as it is well known that the winter conditions are the most severe to be met. In addition, the battery performance is much lower in winter than in summer, and this in turn lowers the performance of the motor. While engineers agree on the above, I find that there is a diversity of opinion as to the nature of cranking torque performance of an engine at low temperature and as to the proper method of measuring same.

It frequently happens, when an engine is very cold, that it is very hard to break the moving parts loose. This fact, along with tests where an oscillographic curve is taken of the starting motor current, will at first lead one to believe that the most severe condition is the break away, and that, consequently, the locked torque of the starting motor is the important characteristic to be considered.

It is my opinion that when the above break away condition exists, it is due to the presence of moisture in the crankcase, same having frozen at the low temperature, or in some cases where different kinds of metals are used in bearing caps, crankcase, etc., the bearings contract so as to actually seize the shaft.

Tests in which the writer has participated would indicate that at low temperature the cranking torque of an engine is proportional to the cranking speed, and the lower the temperature the greater will be the relative increase in torque with speed. Such being the case, it becomes apparent that it is not so much the locked torque as the speed-torque characteristic of the starting motor which is important, for if the motor will crank the engine at the required speed at say 10 deg. Fahr., then there is little chance that it will not meet the break away and summer cranking conditions. The summer cranking speed must, however, be sufficiently high to prevent what has been termed hunting, i.e., prevent the Bendix pinion flying in and out of mesh when going over the compression points.

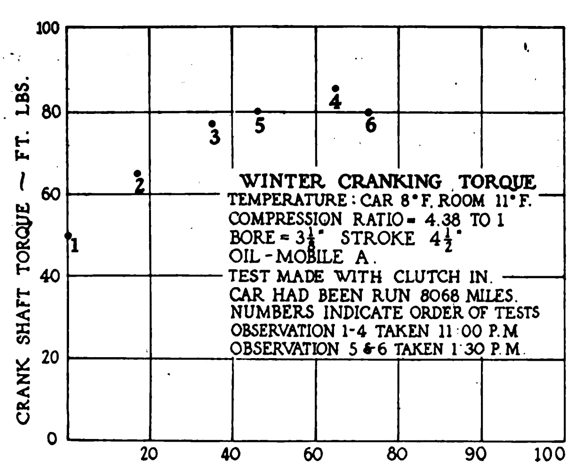
The proper way to measure starting torque is to gradually increase the applied torque until the crank starts to move. The applied torque at this point is equal to the break away torque. The applied torque should then be increased and after the speed becomes constant, the torque and speed observed. Make observation at several different speeds, and from the data obtained a curve may be plotted.

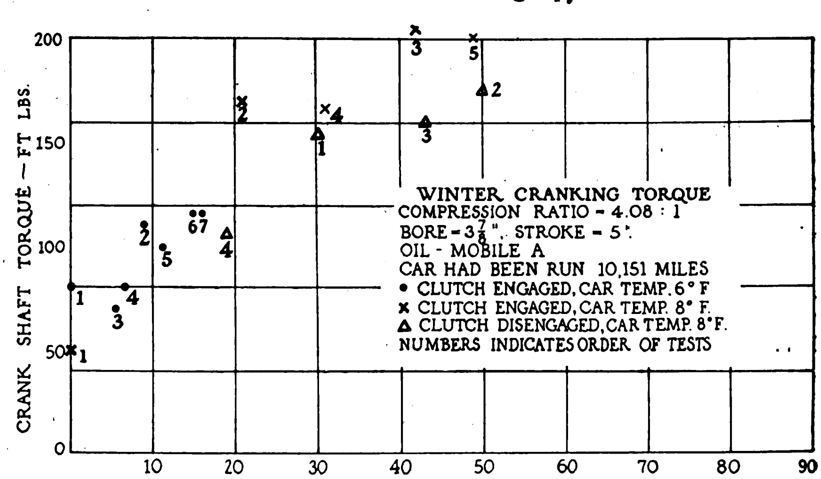
The two enclosed curves represent the winter cranking torque performance of a six-cylinder 207 cu. in. and a six-cylinder 354 cu. in. engine. The tests were made at approximately 10 deg. Fahr. in a large ice box constructed for experimental purposes. Mobile A oil was used in the engines, both of which had been run several thousand miles prior to these tests.

The cooling water was drained from the engines, and they were then run into the ice box, which had been cooled to near zero temperature. The cars were left in over night and the temperature was regulated so that in the morning we had approximately 10 deg. Fahr. The temperature of the battery electrolyte observed as that of the car. Thermometers were also placed in a bottle of oil in the same room.

To measure the torque, we had a calibrated starting motor with back gearing, the back geared shaft connecting to the front end of the crankshaft. The starting motor current was supplied by two six-volt batteries connected so we could throw from two to six cells in series, and in addition we had a rheostat and ammeter shunt in the line so that the current could be regulated and its value observed.

We would first gradually raise the current until the engine shaft would just barely turn over, and the observed current was taken for calculating the break away torque. The line resistance was then decreased and the switch closed. When the speed became constant the current was observed, and so on, until we had the current draw for several different speeds. From the calibration curves we then interpolated current draw to torque for each speed and plotted curves such as those herewith. Later on in the winter we checked the cranking speed of the small car





Cranking torque of automobile engines when cold

after leaving it outdoors over night, and found that the results checked closely with those obtained in the ice box.

All of these tests proved to us that within the range of winter cranking speeds the running torque was greater than the break away torque.

As to the general law that the friction of rest is greater than the friction of motion, I believe that conditions here do not warrant its application. This law I believe applies to friction between solids, whereas we are concerned with the shearing friction of congealed oil. I believe, if you will imagine yourself wading in a tank of congealed oil or similar substance you will have a fairly close idea of the condition in a cold engine, for it seems easy to conceive of the required effort increasing rapidly the faster you try to move.

In making tests of winter starting torque the inertia effect should be eliminated and also any other external influences which might affect the results.

The oscillographic curve method of measuring the starting torque I consider misleading, especially when full battery voltage is applied and the observed starting motor current recorded as the engine comes up to speed. In the first place, this method does not eliminate the inertia effect, which is a big factor, and in the second place the natural starting characteristics of the motor, even without load, would result in a high starting current which diminishes as the speed increases. Take the well-known equation of an electric motor:

$$E = IR + E_c,$$

where E is the applied voltage; E_c, the counter E.M.F. of the motor (which is a function of the speed) and IR the resistance drop in the motor. In starting, E_c is zero; therefore

$$E = IR \text{ and } I = \frac{R}{E}$$

Starting motors have a resistance of 0.006 to 0.008 ohm. Therefore, the current I at starting must be large and the falling off as the speed increases is an electrical characteristic entirely independent of the torque characteristic of the load. Of course, the exact shape of the oscillographic curve would be affected by the load. However, as the speed increases, E_c increases and IR must drop. R being constant, the drop is all in the current.

The principles advanced in this article are based on the assumption that the liquids in the crankcase or cooling system are not frozen solid, which should be the case at 10 deg. if the car is properly taken care of. P. J. KENT.

The Over-Geared Fourth

Editor AUTOMOTIVE INDUSTRIES:

In your editorial on Page 1035 in the Nov. 18 issue on the Question of Over-geared Fourth Speeds, you make some statements to which we would like to take exception.

You intimate that the primary object in using an over-geared fourth speed is to get maximum car speed. Our object in the design and use of a four speed transmission with an over-geared fourth was not primarily to obtain high car speeds, but was to obtain better economy at touring speeds without sacrificing good low speed performance in traffic on direct drive, and also to use a lower engine speed for touring.

We agree with your statement that "from a fuel economy standpoint it is always advantageous to use the highest gear possible, provided it does not pull the engine down to a speed where it runs unsteady and begins to knock." Fuel tests have shown that the gasoline consumption per b.hp. hour increases very rapidly from the one-half load throttle position to the nearly closed throttle position for any given speed. Therefore, if an engine were so geared to the rear wheels that it required nearly half of full engine power at a given speed to propel the car, very good economy would be obtained. It is easier to do this at the higher car speeds generally used for touring, say from 30 to 45 m.p.h., than at speeds used for city driving, since there is less need for quick acceleration at the higher speeds and therefore the engine can be used nearer to its maximum capacity.

In selecting the total reduction between engine and rear wheels, two conditions should be considered, city driving and country touring. One ratio cannot fill these two conditions as well as two when both economy and performance are considered.

A great deal can be said on the subject of gear ratio and its relation to car weight, performance and economy, and it would take several pages to go into this fully. All of these factors must be studied in relation to each other and with the engine characteristics, in order to make the best selection of gear ratio to meet the desired conditions. The fuel consumption curves of engines generally show that the best economy at both ½ and ¼ full load lies within a small range of the engine r.p.m. If the engine is so geared that this range is used for city driving on direct drive, good economy can be obtained, and then by gearing up for touring so as to use approximately the same range of engine speeds for the higher car speeds, good economy can also be obtained for touring. This selection is always a matter of compromise and depends on which feature is preferable, rapid acceleration and hill climbing ability or economy.

For the one who does both city driving and touring, economy is important under each of these conditions and can best be obtained by using a different gear ratio for each condition. The most economical ratio for touring would be altogether too high for city driving and since it is preferable to do city driving on direct, the ratio for touring would be an overgear. The increased noise is not so objectionable at the higher speeds. Therefore, the over-geared fourth is not a feature of luxury, but one of economy, on the car which is used for both city and country driving. HERBERT C. SNOW, *Engineer*,
The Winton Company.

Spare Parts on Export Cars

Editor AUTOMOTIVE INDUSTRIES:

I was much interested in Mr. Jennings's article of the 6th re selling spare parts with export cars.

Naturally, foreign business men do not like to be required to do anything, but, one would suppose that if they were really reliable, they would wish to take up the service end of the business. In any case, I cannot imagine any company with a real desire to build up a lasting export business shipping cars without spare parts any more than they would omit the electrical equipment.

It seems to me that it would be a good plan to include a certain number of the most essential spare parts as part of the equipment with the initial shipment; the cost to be included in the price of the cars. The dealer would not then feel that he had been compelled to do anything, and, after realizing the utility of the spares sent, would in all probability hasten to order a complete stock.

This plan need only be followed where the dealer omits to pay attention to this important matter.

Cobble Hill, B. C., Canada. MILWARD V. HARRIS.

THE British Board of Trade has issued a license under Section 20 of the Companies (Consolidation) Act of 1908 to the British Motor Cycle and Cycle Car Research Association, which has been approved by the Department of Scientific and Industrial Research as complying with the conditions laid down in the Government scheme for the encouragement of industrial research.

The Importance of the Labor Problem Has Not Diminished

The present industrial situation affords manufacturers an exceptional opportunity to put their house in order. When working forces are built up again, effective methods will insure an efficient working force. This article reviews three new books which discuss this phase of production.

THE labor situation at present involves more potent though less obvious dangers than it did six months ago. There are more reasons for labor to be discontented and a more favorable opportunity for the spread of unsound radical doctrines. The fact that labor is not in a position to give voice to that discontent as loudly as at this time last year has given to some the false impression that the whole problem has been solved. As a matter of fact, its growth and complexity has really become greater with the unemployment and social questionings which inevitably accompany it.

The advantageous position which employers occupy in relation to labor, however, provides them with an exceptionally good opportunity to study thoroughly those problems relating to the human element and to apply them effectively.

If employers during the next six months can give a thoroughly square deal to their employees, even though not forced to do so by economic pressure, they may confidently expect better co-operation from labor when business conditions return to normal and labor is again in greater demand. If the favorable opportunity is used for the application of repressive measures, however, a continuation of the fight by labor when it gets in the saddle may be just as confidently expected.

Because the present time is especially favorable to the study and development of effective personnel methods, particular interest attaches to books which bring together the standards of practice in such work insofar as such standards have been developed. Much theory has been written on this subject, some of it well worth reading, but descriptions of practical methods and standards have to a large extent been confined to short articles and specific instances.

Three books have recently been published by the Ronald Press Co. which embody much practical information of value to the man actually engaged in personnel work. The one entitled "Employment Methods," by Nathan W. Shefferman, is worthy of note as being almost the first book on this subject to offer exact and detailed practical help to the employment manager. In contrast to "Personnel Administration," by Tead and Metcalf, reviewed recently in AUTOMOTIVE INDUSTRIES, Shefferman's volume will appeal more to the man actually involved in the operation of employment work than to the theoretical student of industrial affairs. It was said of the Tead and Metcalf book, "If this excellent discussion of principles could be supplemented by a more practical book concerning the actual methods and forms to be used in installing and operating personnel work, the literature on this subject would be much more complete than it now is. The latter phase has not yet been satisfactorily treated. "Employment Methods" is best described briefly by the statement that it does treat all of the practical phases of employment work in a detailed manner.

A part of this book will be elementary for the man familiar with employment work, but its inclusion renders the volume a complete guide for the novice desiring aid in establishing employment work for the first time.

A carefully devised set of forms for use in connection with every phase of employment work is presented and thoroughly explained in the two chapters, "Employment Forms." Unnecessary red tape has been cut out and only essential forms have been included. Sufficient routine is included, however, to enable the employment manager to learn from his records all the details necessary to an intelligent administration of his department.

A few of the forms used in connection with job analysis will appeal to some as being theoretically excellent but somewhat complicated for practical use. The text matter relating to job analysis, however, is very good.

A helpful chapter is that in identification systems. Several complete systems are described and illustrated, each adapted to a different type and size of factory.

A chapter is devoted to a discussion of proper advertising methods as a means for securing workers. It is worth the attention of every employment manager or other executive who ever has occasion to insert want ads in the newspapers or trade journals. Many want ads fail to bring the best returns because they are not prepared in the right way; the wrong key-word is used, too many words are jammed into a small space, the text is not clear, etc. A detailed analysis and description of what constitutes effective "help wanted advertising," together with the best methods of utilizing it, are contained in this section.

Part IV of this volume is devoted to employment methods for the office, and comprises a detailed examination of the systems used by certain concerns which have developed their office employment departments to a high degree.

Being as it is a book of practical methods, "Employment Methods" does not lend itself to review by extensive quotations. It nevertheless very definitely fills a long felt want.

Another book which will be of value to the personnel executive interested in giving particular attention to industrial relationships at this time is "Labor Maintenance," by Daniel Bloomfield. This book does to a large extent for employees' service work what the Shefferman book does for employment methods. Since the matter of employees' service is in itself less practical, however, the book which describes it must necessarily fall below the other volume in this respect. "Labor Maintenance" is of interest chiefly as being a complete summary of all the things which have

been done along this line by various well-known firms throughout the country.

The author recognizes that definite standards for such work are altogether lacking, and he has made little attempt to set up such standards, except in the case of a few fundamentals.

This book will give to the personnel manager a large number of ideas as to activities that might be conducted along this line, and it will give him as well, in many instances, detailed instructions for carrying out these activities.

> **The chapters on Americanization are exceptionally sane, as for that matter is the treatment of that subject in Shefferman's book. "The best and most lasting achievements in Americanization work," Bloomfield says, "have resulted from indirect rather than direct influences. If the spirit and surroundings of the plant definitely suggest Americanism, a large part of the work has been accomplished. . . . Every executive, every foreman and every employee must be impressed with the matter of maintaining American standards with regard to the immediate surroundings of the shop, mine or mill."**

Some of the author's conclusions in regard to housing and community effort on the part of the employer are open to dispute, but contain material well worth discussion. Folk festival and pageants of nations, for instance, may be very effective if rightly conducted, but they may also cause the expenditure of a great deal of money without any adequate return accruing to the organization. This is certainly true in one of the cases cited by the author.

"Labor Maintenance" constitutes the best summary of employee's service efforts thus far published and lays an excellent groundwork for the establishment of more definite standards of practice.

Although it touches very directly upon the labor situation, "Training Industrial Workers," by Roy Willmarth Kelly, makes a somewhat different appeal than do the other two volumes included in this review. While Dr. Kelly's book contains some practical material of use in establishing training work, its chief merit lies in the social background and the social potentialities for industrial training which the author develops in a most interesting and thorough manner.

In his preface appears an excellent summary of the lines along which progress should move in regard to industrial training: "It is essential that private manufacturing establishments should avail themselves of every possible opportunity to secure the assistance of public and private educational institutions. It is essential on the other hand that educators should constantly modify their theories and methods in the light of the needs of progressive industrial concerns."

The development and growth of apprenticeship and modern industrial training is discussed, together with the function and possibilities of the various public and private agencies interested in the training of industrial workers. Executive and foreman training is also treated briefly, as is vocational guidance and the part which the manufacturer may play in it.

The treatment of the educational value of democratic participation in management is an excellent contribution to contemporary thought on this subject. A few pertinent ideas expressed by Dr. Kelly are embodied in the following quotations:

"Because of the general tendencies of the time in state and national government, it is only natural that co-operative management plans should multiply among industrial establishments. The demand for a modification of the old democratic control of the shop was by no means created by the war.

> **"Every thoughtful worker is able to detect evidences of inefficiency on the part of his superiors, and because he knows little or nothing of the real difficulties involved in executive control, he is . . . frequently bitter in his denunciation of the policies of the firm. . . . One of the chief weaknesses of many large concerns is the inability or unwillingness of the leaders to tap the immense reservoir of knowledge and ability possessed by the rank and file of the organization."**

While these three books were written separately, one fact impresses the reader after studying the three. Each author emphasizes, in his own way, the necessity for a thorough analysis of all the factors which go to make up the problem of human relationships before a successful application of any methods can be expected. It is this study, analysis, and experiment which has been emphasized constantly by Mr. Tipper as a primary requisite to the successful solution of the problem of our industrial relations difficulties.

Formulating Formulæ

Do you remember when you studied physics in high school; when facts came on you thick and fast, and when it sometimes seemed impossible to logically reason out the various steps by which the different formulæ were obtained? Did you ever give up in despair, just before examination time, and simply memorize all the formulæ you could lay your hands on? Then go into the examination and solve the problems presented by trying first one formula and then another in the hope that you might by chance find the one that would fit?

Later experience has taught, of course, that such methods can never lead to an intelligent or valuable knowledge of the subject. But somehow or other the formula idea remains with many people long after their high school days. A formula is so convenient. You just substitute certain values, multiply or divide, and there you have it. But in most problems of life values are quite variable and formulæ frequently incorrect in their solutions.

Probably no phase of management has been hindered and misdirected by the formula evil more than that of human relationships in industry. It is so much easier to try one ready made formula after another, than to carefully study and analyze the complicated factors involved in the problem.

Playing upon this too common weakness, many clever men are making a living writing and selling formulæ. A new one appears every day. Read this one that came to a prominent manufacturer recently:

"Enclosed is a folder entitled 'The Power of Knowledge,' that *briefly* points the way for you to obtain a *complete personal mastery* over *every* labor problem in your organization." The italics are the editor's.

Presto! The labor problem is solved. "Ain't it a grand and glo-o-orious feeling?"

Analyzing Present Increase in Individual Labor Efficiency

The visible usefulness of the work being done by any man has a direct bearing upon his productive capacity. Wages alone are not sufficient to urge the fullest use of abilities. If necessity obliges, you will shovel sand all day, but your chief desire will be to escape that kind of work.

By Harry Tipper

A GOOD deal has been said lately regarding the increasing efficiency of the worker, now that the shortage of labor has past and he is beginning to be troubled with the old economic fear of being out of work. This fact has been referred to as an evidence that the labor trouble has past, and is a cause of much satisfaction in many quarters.

As far as it alleviates the difficult situation in which we find ourselves in respect of labor, it is a very satisfactory change, but it should really induce us to analyze the causes of these fluctuations in the efficiency, and find out why it is that the incentive to efficiency is dependent upon the production situation from the standpoint of employment.

We know from experience with many classes of employees, that unless there is some other incentive than the wage, we have not induced the employee to put forward his maximum capacity and we cannot hope to secure a high proportion of that capacity in every-day work unless the wage incentive is supplemented by other points of value in this respect. While the increase in the efficiency of labor in the last few months is a considerable improvement over the previous situation, therefore, it is an illustration of the weakness of our present methods of industrial organization; particularly as it points out the lack of control we have over the production effort of the worker, and the interest which he will have in his work.

Two or three years ago when these articles were started, the statement was made that there is no incentive in human beings merely to work. There is an incentive to useful accomplishment, and it is this incentive which induces the man to labor.

In the days when prisoners in a jail were not given any work, one of the wardens in a Middle Western State conceived the idea that it was demoralizing to have all these prisoners spending their time in brooding and in getting up plots. He felt that there ought to be some occupation for them. He had no means of putting them to a regular occupation, but there was a pile of stones in one end of the prison yard and he set the prisoners to work moving that pile to the other end of the yard and then taking it back again. In the course of a week two men had gone insane, several of the other men were very fractious, and a goodly number were sick.

The diagnosis of the medical men who were called in was mental disturbance due to the irritation of the useless work. It was not, of course, stated in this everyday language, but that was the gist of their diagnosis.

The absolute uselessness of this work was visible to the prisoners. They could not escape it and instead of being an advantage, it became a torture.

No human being will stay on useless work, and the incentive to work is in proportion to the visible usefulness of the work which they are doing.

If I am obliged by economic conditions in my individual case to shovel sand all day, I can do it, and I will make shift to get through with it. But the principal desire on my part will be to escape from that kind of work at the earliest opportunity, and I will probably reach my maximum capacity only as the fear of starvation obliges me to work harder.

The work which the individual worker has to do in industry varies very materially in the degree of visible usefulness. A large part of it is monotonous and repetitive in its mechanical requirements and very narrow in mental requirements. It is not particularly interesting in itself, because there is no visible growth of usefulness while the work is in the hands of the operator. For that reason the principal desire is to escape from the work, to work as few hours as possible and to do no more work than is necessary to maintain their position.

This is not true of all the work in industry by any means, particularly in the metal trades field, there are many jobs where the individual skill of the worker, his judgment, and so forth, enter into the work to such a degree that there is a visible growth in the usefulness and the creative impulse is satisfied by the conditions themselves.

Where observations have been taken in such classes of work, it is to be noted that there is a steady production effort and the relation between the amount of effort and the necessity for hanging on to the job is not so definite. There has been a definite improvement in this respect, in those plants where a concerted effort has been made not only to provide a fair treatment for the workers, but to educate them as to the place of their work in the useful production completed by the plan.

A friend of mine some years ago was general manager of a plant, manufacturing building supplies, particularly copper work and all kinds of special moldings. The plant was being run on the old basis, that as long as you paid the worker a proper wage no other attention was necessary. There was a good deal of dissatisfaction from time to time and a lack of any real esprit-de-corps.

This friend of mine was going over some photographs of the work as it had been installed in one of the important buildings in the State. He thought the men in

the factory might be interested. As he studied the matter his thoughts grew until he finally constructed a bulletin board, in itself an example of the finest work in the plant and the most careful artistic treatment. On this board he showed photographs of the various installations of the work with the names of the men who had been concerned in its manufacture. The pictures created so much interest that the plan was followed out regularly and it was finally extended so that on each job a blue print or a drawing of the completed structure for which the work was required, was put up in each department.

The change in the situation inside of six months was quite remarkable. The usefulness and value of the work which they were doing was impressed upon the workers by this means. They saw the reason for the accuracy which was demanded and the care which they were expected to take in their operations. A sort of renewed spirit of craftsmanship got into the plant and the effect upon the character and value of the output was distinctly noticeable.

Furthermore, difficulties were more easily overcome, and the men proved sufficiently interested in their work so that they were willing to double their efforts in an emergency.

Showing the worker the part which he plays in developing the useful product and the relation which his work bears to the value and the service of that product, is a method of improving industrial relations which has great possibilities.

If the whole value of the potential capacity of the man is to be secured and kept working on his job, the intelligence and sentiment must be captured just as much as the economic interest must be satisfied.

A great deal can be done in capturing the intelligence and the sentiment by this means of education upon the work itself. It is not an easy matter to develop this so that it will be suggestive, agreeable and of value to the organization. It requires a keen knowledge of the workers themselves, a careful understanding of the factory methods and production, and an ability to present the information in such a way that it will not be recognized as education, but simply as general information about their work.

Incentive to useful accomplishment leads to the development of the best capacity of the man, where the usefulness of the accomplishment becomes visible to him. It will be worth considerable time and effort and money to make the usefulness of each industrial job visible to the worker, so that he is provided with a pride in his work, and what it means, with an understanding of the reasons for its accuracy and quality and with a knowledge of the value of speed in its completion.

Tractors in Louisiana

THERE are to-day 5,622 tractors in operation on Louisiana farms. This State, it is said, leads the South in power farming, and no other State of the South, save only Texas. approaching Louisiana in the number of tractors in use. The Louisiana allotment of one popular-priced tractor for the coming year is 4,000, while another manufacturer has placed the allotment of his machines to the same territory at 1,500, so that there should be, before next November, at least 12,000 tractors at work in the Pelican State. In all probability this number will be exceeded by at least 1,000, but the 12,000 is a safe estimate. This means one tractor for every four and one-half farms in the State, there being 54,000 farms in Louisiana.

The rice farmers are the most advanced of all the tractor users. Up to some seven years ago, only a few farmers in Louisiana—and those mainly the large plantation owners—had tractors. The majority of these tractors were in the rice "pocket" as this section of the State is called, while there were few in the sugar "bowl," and virtually none in the cotton "belt."

To-day every successful rice-producer has at least one tractor; many have two, and some are operating three or more. For them, the tractor cultivates the ground, puts embankments around the field to hold in the water, pumps off the water at the right time, cuts the rice when it is ripe, threshes it, sacks it, and, not infrequently, hauls it to market. The only thing the tractor has not been able to do in the rice industry is to stick the plants in the mud. This has to be done by hand.

The larger rice-planters find it advisable to run both large and small tractors, the former for deep-land breaking and operation of threshing machines, and the latter to harrow, to pull the cutters and binders, and tie the grain in bundles for the threshers. Farm power for preparing and cultivating the land and for harvesting and threshing the grain is second only to irrigation in the rice industry, and often is the limiting factor in rice production.

The sugar planters use the tractor not to prepare the land, but to cultivate the growing crop, yet it was some time before the tractor was developed to the point where it could care for the growing cane of various ages as well as cultivate and seed the ground and harvest the full-grown crop. By working with two types of tractor, one for breaking the ground and seeding and harvesting, and the other, a higher machine, for straddling the rows and cultivating the growing cane, the sugar men gradually came into general use of the tractor.

In the sugar district, the most commonly used tractors are the Cletrac, Moline, Universal, Fordson, Rumely and E-B. The rice men are partial to the Advance, Rumely, Case, Avery, Waterloo Boy, E-B, Twin City, I. H. C., Samson, Fordson, Huber, Russell and Wallace.

The application of the tractor to the cotton industry never has gained the momentum it has in the sugar and rice sections, largely because the cotton planters, working on higher, dryer and more easily cultivable ground, have not had occasion to seek machinery to do their work to the extent the rice and sugar men have had to seek it. Far-sighted cotton planters, however, are devoting more and more attention to the tractor, and one of the greatest and most fertile fields for tractor sales lies in the "cotton belt" of Louisiana and Mississippi.

A COMMITTEE of the American Society of Mechanical Engineers recently collected a list of all the organizations in this country which are giving active attention to the problem of labor education. This list indicates that great interest is being taken in this question. Among the prominent agencies applying themselves to this work are: National Metal Trades Association, National Industrial Conference Board, National Association of Corporation Training, National Association of Manufacturers, National Society for Vocational Education, Federal Board for Vocational Education, American Academy of Political and Social Science, American Association for Advancement of Agricultural Teaching, American Technical Association of Pulp and Paper Industries, and several U. S. government departments.

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Wood Conservation—a Necessity

FEW persons who have not given the matter some study appreciate the extent and importance of the wood-using industries or the necessity of conservation in the raw and finished material upon which they are dependent. The value of the products of the primary and secondary wood-using industries is said to aggregate **over ten billion dollars annually, and these industries employ more men than any other single industry in this country. Under these circumstances it is of course a necessity that conservation of forest products be practiced and encouraged by every possible means. A great work in this direction has been done by the Forest Products Laboratory** which is a branch of the Forest Service of the U. S. Department of Agriculture. It is conservatively estimated that the commercial application of research work carried on by the laboratory is already saving the country **$30,000,000 annually.**

The automotive industry is a large user of wood and has profited in no small measure as a result of the work of the laboratory. It could profit to a much greater extent if the value of the work done was more widely appreciated. Information concerning economy and more effective use of lumber (with consequent safety in shipments), economical operation of kilns, preservation and finishing of wood, and much other information of great value along similar lines has resulted from the activities of the laboratory and is being distributed by it to the great good of all users of wood and articles in the construction or packing of which wood or its products are employed.

The Forest Products Laboratory is largely dependent upon Congressional appropriations for its support, and is seeking an appropriation of $400,000 for the coming year. **It should have at least this amount and members of Congress should be made to appreciate the value of the work done and the need of further research,** both from the standpoint of the industries directly benefited and the public which is certain to benefit in a still larger degree. **We urge that our readers look into the matter for their own good and then see that their Congressional representatives are duly informed of their views.** Particulars can be had from the laboratory itself as well as from the Association of Wood Using Industries, Monadnock Bldg., Chicago.

The Engineer as a Citizen

IN the past two or three years much has been written about the desirability of the engineer taking greater interest in civic matters and some engineering organizations have discussed the matter in open meeting without the response that we feel the subject merits. Although city, State and Federal Governments have much to do with applied engineering and government itself can and should be in large measure reduced to a true engineering basis, but few engineers have become prominent in public life and the type of engineer attracted by civic activities has not always been of the best. There are conspicuous exceptions to the rule which simply proves that the engineer who bestirs himself and applies his training in a logical way can with credit take his place in civil affairs, as well as men trained in other professions. Herbert Hoover is one who has done this, and another is James Hartness, Governor-elect of Vermont, an S. A. E. member and a manufacturer whose product is widely used in the automotive industry. Mr. Hartness is a past president of the American Society of Mechanical Engineers, and has recently served as a member of the National Screw Thread Commission on which the S. A. E. and A. S. M. E. are represented.

There is no reason why other engineers should not serve the community in public office, but those who do so will be few if engineers in general do not take a more active interest in civic affairs. Is it not true that the average engineer is so much bound up in his own—frequently very narrow—specialty that he loses perspective and fails to function as a good citizen should?

Suppose the 5000 members of the S. A. E. joined with the many thousands of engineers of other societies and made it a point to take an active interest

in civic matters. The effect of such joint activity would be nation-wide, and the engineer would soon take the place he deserves in the estimation of the public.

During the war the S. A. E. made a splendid name for itself through the whole-hearted co-operation extended to Government engineering activities. Work of similar nature is still being carried on, but neither the S. A. E. nor other engineering societies are taking the active interest in broader governmental matters which the needs of the hour or the importance of the engineering profession demand. Individual effort is commendable, but united effort alone will suffice to give the engineer the standing before the community which will be accorded if he will assert himself and insist upon the systematic application of engineering fundamentals in the conduct of Government affairs.

Fitting Traction Devices to Cast Disk Wheels

DURING the winter, when the road surface is covered with snow and slush, solid tired vehicles require anti-slipping devices applied to their wheels to enable them to get sufficient traction. These traction devices are different from the usual non-skid chains used on pneumatic tired passenger cars in wet weather. Usually they consist of a few lengths of heavy chain which are placed around the tire and wheel rim, and equally spaced around the circumference. In order to prevent the traction chain from slipping on the wheel, its ends must be securely fastened to the inside of the tire felloe or to the spokes. A great deal of difficulty is encountered in this connection owing to variations in design of the wheels. With spoked wheels the problem admits of a ready solution, as fastening hooks can be clamped around the outer ends of the spokes. Lately, however, steel disk wheels have come into extensive use, and in these no provision seems to be made for fastening the non-skid chains. Chains are absolutely essential if the truck is to be kept in service all the year round in this latitude, and the wheel manufacturers certainly could save users a great deal of trouble if they fitted chain attachment hooks to the wheel webs, or at least drilled holes through the wheel webs (according to some standardized plan) for fastening the hooks.

The way to widen the field for the motor truck is to make its use more convenient and less expensive to the owner, and the provision of non-skid hooks on cast disk wheels, while seemingly a minor matter, is a step in that direction.

Is a False Pretense Worth While?

NO man is perfect, of course. Naturally, it follows that human plans are unlikely to be perfect, but that is no excuse for misstatements or pretense even in publicity ventures.

These thoughts are prompted by two form letters which reached this publication a few days ago. Both contained the same hand-written corrections, evidently intended to fool the reader into believing the letter was not duplicated. In each letter the bidder for publicity said, "I made the selection of papers, chiefly the business papers I read myself."

But one of the two letters was addressed to a paper that has been out of existence two years or more! That spoiled the effect of the carefully laid plan. The pretense wasn't worth while, in fact it reacted against the person it was intended to benefit. This is true of pretense, whether practiced in form letter writing or elsewhere. It applies with special force to advertising, and that form of free advertising known as publicity is no exception to the rule.

Transmission Efficiencies

IN a paper recently presented to the American Society of Mechanical Engineers some results of transmission tests are given which are hard to understand. For instance, it is shown that the direct drive of a four-speed transmission is less efficient than any of the lower gears, and this is ascribed to higher gear speed and consequent increased oil churning when driving on direct.

Now, with constant engine or motor speed, as substantially maintained in these tests, and with a transmission of the conventional design in which the constant mesh set of gears is located at the driven end, all the gears on the secondary shaft run at the same speed whether the truck is being driven on "direct" or on any of the lower gears. Also, it is these gears which should have the greatest effect on the power losses due to oil churning, as they usually run submerged in oil, whereas the gears on the primary shaft are above the oil level. About the only explanation for the unusual results obtained that occurs to us is that the transmission was of a type—sometimes used in the earlier years—in which the constant mesh gears are located at the rear end. But if such an unusual type of gear was used we should think it would have been pointed out in the paper. This gear was given up for the very reason that when on direct drive—that is, most of the time, the secondary shaft with its gears is running at about twice engine speed, whereas in the usual type of transmission it runs at only about one-half engine speed under these conditions. That the direct drive is less efficient than the lower gears is not only contrary to the general belief, but contrary to most previous experimental evidence.

ON advertising page No. 142 there is employed a very different sort of copy from that which usually appears in AUTOMOTIVE INDUSTRIES. It is an appeal for all Americans to assist in the rehabilitation of Europe by saving 3,000,000 children from starvation. This advertisement is donated by AUTOMOTIVE INDUSTRIES to this cause. You will find in the last paragraph directions for sending the money and the names listed are your guarantee that the money will be well used.

Automobile Sales at Retail Spotty

Dependent Chiefly on Local Business

Trade Improving in Half of Chief Distribution Centers —Poor in Farm Districts

NEW YORK, Jan. 3.—Retail automobile sales conditions in the leading distribution centers of the country are distinctly spotty. They are dependent upon the local industrial conditions. Where the general trend of trade is upward, sales are improving, but in sections where the slump has not reached bottom the automobile business is at a standstill. In general it can be said that the cities which were the first to feel the full effects of depression and have reached an adjustment, are the first to show signs of recovery. This process probably will continue until normal conditions are restored again throughout the country.

Automobile sales are increasing slowly in most of the great industrial centers, but there has been little actual sign of improvement in the cities which are the trade centers of the agricultural districts. It is logical to assume that the farmer will be a poor prospect until the purchasing power of the dollar comes up to meet the values of the goods the farmer has to sell. The best sales prospects are to be found in cities with diversified manufactures. One industry cities, such as Akron, where depression has hit them at all, have suffered most.

Taken as a whole, the Southwest and the South seem to offer the poorest trade fields at present, while the outlook is most hopeful in the larger cities of the East and Middle West. Dealers in the oil fields of Texas are enjoying the best business in years and sales are normal in Southern California.

New England Business Better

New England, with its thousands of textile mills and shoe factories, was the first to bear the brunt of depression, and it is significant that business is better in Boston. Other industrial centers which show improvement include Buffalo, Cleveland, Detroit and Milwaukee. The effect of the great shrinkage in the value of agricultural products is evidenced by slow sales in Minneapolis, Des Moines, New Orleans and Atlanta.

The "spottiness" of conditions is best shown by the fact that while dealers in Dallas, Texas, territory are thriving as never before, those in Austin, Texas, report very little business. While trade is normal in southern California, it is not so good in the San Francisco territory and it is at a standstill in Oregon.

These facts are disclosed by painstaking investigations by correspondents of

SALES CONDITIONS AT A GLANCE

Here is a birdseye view of retail automobile sales conditions in the principal distribution centers of the United States:

SALES BEST IN YEARS

Dallas, Texas

SALES NORMAL

Los Angeles

SALES IMPROVING

Boston, Buffalo, Cincinnati, Cleveland, Detroit, Denver, Philadelphia, Kansas City and Milwaukee.

SALES AT STANDSTILL

Atlanta, Austin, Tex., Chicago, Des Moines, Indianapolis, Minneapolis, New Orleans, New York and Portland, Ore.

AUTOMOTIVE INDUSTRIES in twenty cities. It is significant that while there has been little increase in actual sales in nearly half the cities covered, the feeling of dealers is much more hopeful than it has been for months. They believe the turn of the tide is near and that the new year will bring a slow but steady improvement, with conditions approaching normal at the close of the first quarter. Their expectations are based upon a marked increase in the size of live prospect lists. If they can sell cars to even half the persons who have announced that they propose to buy in the spring, they will clean out their stocks in a very short time.

Surplus Reports Conflict

There are many conflicting reports regarding the surplus of cars held by manufacturers and dealers. So far as can be learned, however, the stocks on hand in most cases are sufficient to supply the normal trade for not more than two months. Dealers believe that unless the factories are in position to get into production rapidly, there will be a shortage of cars by April. This belief is largely speculative, but it is very generally held and is shared in large measure by the manufacturers themselves. Parts makers are laying in supplies of materials and the producers of complete vehicles do not propose to be caught napping.

Practically all the automobile factories in the country are closed at this time for inventory taking. Most of them have announced that they will reopen this week or next. It is possible that the period of idleness may be extended, but there is no reason to believe the action of Henry Ford in keeping his enormous plants down until Feb. 1 is symptomatic

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New York Dealers Do Not Fear Future

Sales Slack in Holiday Period but Car Shortage Feared in Spring

NEW YORK, Dec. 31.—Automobile sales were practically at a standstill in New York as the year closed. In some lines the month had been fairly good up until Christmas when business dropped off as it always does just before the show—and perhaps a little more so. One or two big factory branches report almost no sales, wholesale or retail, in the final week of the year.

Dealers, however, are showing no signs of lack of courage and are going ahead with extensive advertising plans in connection with the show. Opinion is unanimous that the show will start business, which will show a steady gain until spring. Several distributers declare a shortage of cars in the spring is inevitable unless the public shows an unexpected willingness to accept some of the used cars now glutting the market. In fact, the abundance of used car offerings is an obstacle to new car sales right now, as most of the dealers are declining to do much trading and a large majority of new car prospects are standing firm against purchases with their old cars left out of the transaction.

Business in light trucks is better than it was, which is accepted as a healthy sign of returning business in all lines. Heavy duty trucks are selling very slowly.

BOSTON

BOSTON, Dec. 31—Sales conditions in Boston have improved. The dealers have looked the facts in the face and decided to get down to earth and try what real salesmanship could do. They are selling cars again, not in big quantities, but they are doing some business. Dealers have held conferences with their salesmen and mapped out campaigns instead of sitting down waiting for customers. Salesmen now are calling upon people and talking motor cars like the men who sell insurance, mortgages and other things that are not peddled out over a counter, with the result that those who tackled the job first are getting somewhat ahead of those who lagged behind.

Some of the dealers have been going along doing a very fair business, others pretty fair and more of them very little. There has been a picking up in used cars and trucks also, and it begins to look now as if the new year would see sales slowly increase.

Industrial Centers Best Markets

Slump Crest Past, Detroit Believes

Dealers Feel Sales Stimulation—Continued Upward Trend Expected

DETROIT, Dec. 31—The crest of the slump has been passed is the opinion of a majority of dealers as indicated in the December improvement over that of November. Following are reports by the Packard, Hupmobile, Dodge and Overland distributers.

Simons Sales Co. (Overland) says September was 10 per cent better than last three years; October was 5 per cent better than the last three years; November was 48 per cent less than the last three years and December to date 100 per cent better than November. Guy O. Simons, the president, says that there are more orders on file for delivery in January, February and March than ever before.

H. W. Peter, general manager of the Packard branch sales, said last week was not as good as the same week in November, but prospects for an increase in January will be good followed by a greater increase in February and there will be a big business in March. Summing it all up, Peters said the greatest trouble the Packard Motor Car has, is their used car problem. Every prospect wants to dispose of their old car before taking a new one.

S. E. Comstock, general manager, and T. J. Doyle, Dodge distributer, report an increase in December of 33-1/3 per cent over that of November and $18,000 more in revenues from used cars delivered in December than in those traded in. Doyle sold 47 used cars in November. The wholesale business is not so good because the upstate dealers are having trouble with the local banks. Reports from dealers and salesmen indicate marked improvement in January, to increase in February and begin real business in March.

Williams & Hastings, Hupp distributers, said December was not so good as November, but December is always the worst month in the year and prospects for January show marked improvement which will be steady until spring when the demand will exceed supply.

INDIANAPOLIS

INDIANAPOLIS, Dec. 31—Conflicting opinions of various Indianapolis retail dealers make it impossible to come to any definite conclusions as to immediate future of the local automobile business. Conditions are stationary at present—just about what they have been for some time past with no immediate prospects of a radical change. Cars are being sold at about the same rate as for the past few months. The open fall and winter undoubtedly resulted in stimulating the market for open cars.

BUFFALO

BUFFALO, Dec. 31—The outlook for the automobile business in Buffalo and the surrounding territory during the next three months is decidedly encouraging according to Buffalo's foremost distributers who declared to-day that the number of live prospects is gratifyingly large, that interest by potential buyers is much keener than it was and that an increasingly large number of inquiries are coming in.

CLEVELAND

CLEVELAND, Dec. 31—The retail automobile trade in Cleveland reached its lowest point approximately 30 days ago and the dealers assert there has been a gradual improvement since the early part of December. The trade is much better now than it was in November and the Christmas shoppers boosted business. Some retail business is better in Cleveland than in the district outside of the city.

There has not been a sharp rise in the volume of buying from retailers here, but a slow and moderate growth with enough inquiries to lead dealers to believe that there will not be a backward tendency.

PHILADELPHIA

PHILADELPHIA, Dec. 26—Actual selling conditions here show a slight upward tendency in new passenger cars and somewhat more decided impetus in used cars. Truck sales are dull and accessories are not moving to any appreciable extent. This division of the industry appears to be the worst off unless it is the tire trade.

It cannot be said, however, that there is any recessional movement here as regards the automotive industries. Summing it all up, there is only a little improvement altogether, but this is sufficient with the promise held out of more than usual interest in the passenger car show from Jan. 15 to 22 to cause optimism in the trade not only for the next three months but thereafter.

Kansas City Getting More Calls for Cars

Retail Sales Steadily Increasing —Public More Ready to Spend

KANSAS CITY, MO., Dec. 31—Wholesale distributers of passenger cars are receiving more calls for cars. They report that business is already picking up and gives promise of much expansion shortly. Retail sales in Kansas City have steadily increased during the past few weeks and would be much larger if dealers were willing to make more trades. Nearly every dealer has had more inquiries. One dealer in a moderate priced car said he would have a retail trade above normal if he would take in more used cars. Another dealer in moderate priced cars has had a fair business in new cars, selling a number normal for this season, and a really good business in used cars. Several sales a week are being made by some dealers in higher priced cars.

There is a perceptible relaxation in the public's resistance to spending money, which is being stimulated by the cut price sales in department and clothing stores. Many thousands of people here had made up their minds not to buy anything until after Christmas or after the first of the year and it is believed that when business men take inventory, when salaried men find out whether or not they still have jobs after the first, and people know how they are entering the new year, all business will be more stable and more lively, even though some weak merchants and distributers, not referring to the motor car industry, have to liquidate.

An unusually large proportion of the sales this winter have been to women and most dealers report an extraordinarily large number of women being taught to drive.

MILWAUKEE

MILWAUKEE, Dec. 31—State representatives of automobile companies here are showing increasing orders for spring delivery about 10% above that of a year ago. Local dealers are wrestling with problems of how to dispose of used passenger cars and have thus far been obliged to decline many tempting trades involving new sales. Business is always slow at this time, however, especially on open used cars.

Several dealers are planning special advertising and selling campaigns in

(Continued on page 40)

Buying Is Slack in Farm Districts

South Not Looking for Recovery Soon

Does Not See How Money Can Become More Plentiful Before Next Harvest

NEW ORLEANS, Dec. 31—Retail automobile sales conditions here are almost at a standstill and the upward impetus given by the pre-Christmas show seems to have died out within a week after the show closed. The majority of the dealers admit they have more cars, either in warehouses or in depots, than they can sell. Dealers in cars whose makers reduced prices report that there is some movement in Louisiana, Mississippi and east Texas, but in this city conditions are dull. This dullness is largely due to small receipts for sugar, rice and cotton crops, but dealers profess to believe that after the end of January, when the farmers know more definitely what they are going to get for their crops, business will be better.

The prices for all staple crops, as well as for seafood products and lumber, on which this State's business prosperity depends, are very low to the producer, while labor is high, and it is difficult to foresee just how money can be any more plentiful before another harvesting season, which will be next fall. Dealers in the highest-priced and lowest-priced cars seem to be having a little the best of the automobile business, the middle-priced car doing the least business.

AUSTIN

AUSTIN, TEX., Dec. 31—Automobile dealers in the Austin territory, as well as throughout the cotton growing region of Texas, are feeling the depressing effects of the slump of cotton prices and the consequent slump in general business. Farmers are placing orders for very few cars at this time, a condition that the trade has not felt for several years. Merchants and other business interests dependent to a greater or less degree upon the prosperity of the farmer are likewise holding off in buying cars.

No early improvement in conditions is expected. On the contrary, the crisis has not yet been reached, according to the views of bankers. It is stated by retail dealers that deliveries they are now making are of cars ordered some time ago. There continues to be considerable buying of cars, but chiefly of the cheaper type, which are essential to certain lines of business. Most of the orders come from professional and business men who have not yet felt the effects of the big drop in cotton prices. Little hope is held out that trade conditions will improve during the next three months unless there should be a material increase in the price of farm and range products, which is regarded as unlikely. It is estimated that of the 4,200,000 bale cotton crop which Texas made this year more than 2,000,000 bales are still in the hands of the farmers.

Los Angeles Enjoys Normal Winter Sale

LOS ANGELES, CAL., Dec. 31—Automobile selling conditions in southern California are normal. Both passenger cars and trucks are accumulating and being warehoused, but this has been the history of the industry at this season for years. When dealers in other sections of the country stop deliveries, factories always seek an outlet here, due to climatic reasons, and usually make an extra inducement to the dealers to stock heavily, and unless changes in models are likely the dealers usually comply, so there should be no alarm felt over heavy stocks now on hand.

The Los Angeles bank clearings for 1920 will reach $4,000,000,000, against $1,500,000,000 in 1919. The banks here have rediscounted less paper than those in any city of similar size in the country.

According to reports prospects for automobile business are to be regarded as favorable. December may show a slight falling off in sales, more so than in November, but not in an alarming way. Indications for the next three months show that sales will prove as good as in previous years, January and February usually being light months. November saw more sales than October and only 203 less than September and 19 less than August. The dealers could stimulate the new car business remarkably by loosening up on trade-in allowance, but the used car market is glutted and sales are very poor.

DALLAS

DALLAS, TEX., Dec. 31—There has been no business depression so far as the automobile dealers of Dallas are concerned, nor do indications point to any slack selling period for the next several months. This section of Texas is prosperous and the people are buying more automobiles than ever before, the dealers declare. A new idea was developed in Dallas and other Texas cities during the holidays and that was buy a car for Christmas, and many of them went as Christmas gifts.

Since the recent reductions in prices were made the dealers have enjoyed the

(*Continued on page* 40)

Northwest Buyers Want Cars; No Cash

Sales Practically at Standstill Because of Low Prices for Crops

MINNEAPOLIS, Dec. 31—Summarizing the northwest territory as a whole, automobile business is practically at a standstill. Although locally in large centers there is an improvement in sales, the outlook for the next three months is not bright. The trouble seems to be that the farmer is paying for clothes and food at the same prices he paid six months ago but crop prices are lower and he is therefore holding his products.

The disposition of both the retailer and buyer seems to be favorable toward the purchasing of cars, but the bankers probably will not be able under the present financial conditions to help the deals through. The opinion seems to be that if 30% of the delivery of cars is made, dealers will be doing well. There is a possibility that in some spots December business will be better than that of November, but it is hard to find any bullish opinions. The sudden arrival of winter has reduced the late driving appreciably which will have unfavorable reflex action on the sales situation also.

PORTLAND

PORTLAND, ORE., Dec. 31—The new year means more to automobile dealers here than a few good resolutions. They expect it to mark the turning of a new leaf in business conditions that will affect all lines, the selling of automobiles included, although no sudden wave of buying is looked for the instant 1921 arrives. But the dealers believe it will mark the definite opening of a new era of better times. Probably the orders will not be numerous before mid-February or early March, but almost without exception they expect conditions to be on the upgrade from and after Jan. 1.

This will be in line with normal precedent. November and December always are dull months for the automobile trade in the Pacific Northwest. There always is a good buying trend in February and March. This year the Portland midwinter automobile show, Jan. 10 to 15, is an added factor.

While not many orders are expected from the show, it is expected to give a first-class prospect list from which buyers may be plucked in the spring. Conditions since Nov. 1 have been about stationary, with little buying.

Ford Shaken by Internal Strife

Three Officials Resign Positions

Klingensmith, Brownell and Turrell Sever Connections—Report Large Surplus

DETROIT, Jan. 3—Lack of harmony in the Ford organization, which developed a near rupture at the time of the sensational price cut, has resulted in the resignations of F. L. Klingensmith, executive vice-president and general manager of the Ford Motor Co.; L. H. Turrell, chief auditor, and Charles A. Brownell, advertising manager.

Brownell is leaving ostensibly on account of the health of his wife, but to a representative of AUTOMOTIVE INDUSTRIES admitted yesterday the fact that Charles Sorensen, general manager of Henry Ford & Son, and E. G. Liebold, private secretary to Henry Ford, practically were in control of the big institution.

Further information on the resignations of the three officials was not forthcoming either from Ford or others, though it was stated that the resignations of W. B. Mayo, chief engineer; W. A. Ryan, sales manager, and W. E. Knudson, production manager, had neither been tendered or requested.

It is believed Sorensen will succeed Klingensmith as executive vice-president and will be inducted before the weekend. Ford will devote more time to the Highland Park plant from now on it is declared, and will attempt with the assistance of remaining officials to end the reported chaos in the dealer organization.

The presence of W. C. Durant in Detroit gave rise to a rumor that he might join Ford but officials who would talk pronounced it as without any foundation. Ford was more determined than ever to go it alone, they said, because of the general comment that in the loss of Klingensmith the company lost its greatest asset since Harold Wills quit the organization after a disagreement.

Three Resignations Accepted

Liebold said there was nothing for him to say other than that he had been informed the three resignations had been accepted. He said no successors had been named to Klingensmith, Brownell or Turrell, but added the entire matter would be threshed out and settled in detail this week.

The friction appears to have resulted chiefly from the fact that Henry Ford has maintained his office at the tractor plant at Dearborn to the exclusion of the big Highland Park establishment, where 51,000 of his employees work, and as a result received his only information from the Highland Park plant through Sorensen and Liebold; neither of them in close touch with Highland Park conditions.

It is known that there was bitter opposition to the price slashing from Klingensmith, on whom fell the burden of getting the money when it was needed. Klingensmith and other executives took the position that Ford sales would not be increased by the price cut, and at the same time business for the other manufacturers practically would be killed, thereby adding to public unrest and panicky conditions. Events bore out their prediction. For one week after the cut, Ford sales jumped enormously, but immediately thereafter slumped. Ford dealers throughout the country are overstocked, and it is stated by an official there are 125,000 surplus cars on hand, approximately six weeks' output at the Ford schedule of 4000 a day.

Dealers Aroused by Changes

On the heels of the cut came the removal of territorial restrictions, which put Ford dealers in a most antagonistic attitude and resulted in a chaotic condition in the dealer organization. At the same time the protective clause on prices was lifted, still further endangering the position of the dealers and adding to their already heavy burden. Under conditions as they exist to-day, Ford can cut his price over night and the dealer, with his warehouse and salesroom full of cars, has no protection whatever. He must stand the loss, whereas in the past the thirty-day clause in the dealer contract gave him full protection.

The slump that followed the price cut after the first week, in the opinion of Highland Park executives, made it imperative that the production be curtailed or stopped temporarily until the dealers could unload. Instead, the order went forth to speed up. As a result October proved a record-breaker, from a production standpoint, the company turning out 99,967 cars and trucks. The November output was 93,000 and the December total was 73,000.

In the face of this enormous production, and the fact that dealers already were heavily overstocked, came the official announcement that the company would shut down Dec. 24 to reopen again Jan. 3. Orders to parts makers, who had been closed, were to get into production Monday, Dec. 27, to prepare for the opening of the Ford plant.

Meanwhile the question of finances began to loom, for the reason that there were unpaid dealer drafts amounting to $12,000,000 outstanding, and it is said Klingensmith, whose chief duties lay in

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American Dunlop To Finance Self

Negotiations Are Opened With Bankers in Which British Company Takes Part

LONDON, Dec. 24 (*Special Correspondence*)—Directors of the Dunlop Rubber Co. have reached the conclusion that the time has come for the American Dunlop Co. to finance itself and negotiations to this end now are under way. There has been some perturbation among the stockholders of the British company over the position of the corporation, and to allay apprehension, the directors issued the following statement:

"Within the past few weeks the company has been called upon to assume the responsibility of providing the additional finance required to place the American Dunlop Co. in a position to complete the construction and installation of its factory and to provide sufficient working capital to enable that company to carry out its first year's trading program.

"While the Dunlop Rubber Co. is under no liability to provide this additional finance, the board recognizes that it is in the interests of the company that the American enterprise should be carried on, and in accordance with the statements made at the last meeting of shareholders held on Sept. 10 last, the greater part of the sum of 1,000,000 pounds ($5,000,000) has been remitted during the last few weeks.

"The directors, however, feel very strongly that the American company should now take steps on its own initiative to provide the further funds required to bring the undertaking to completion, and important negotiations, in which this company is assisting, are now pending for this purpose, but it is not expected they will reach finality for several days. The moment a definite statement on the subject can be issued, a full circular will be addressed to the shareholders of the Dunlop Rubber Co. dealing with this matter and with the position of the company generally."

BRAZIL KEEN ON FINES

WASHINGTON, Jan. 3—The Chamber of Commerce of the United States has sent out a warning to American shippers telling them that unless all regulations regarding Brazilian consular invoices are rigidly observed, they result in fines being imposed on consignees in Brazilian ports. It is explained that custom house officials in Brazil receive 50 per cent of all fines levied on consignees taking their wares from custom houses This encourages fines for the slightest deviation from invoice regulations.

DALLAS

(*Continued from page* 38)

best business of years. From the inquiries the dealers are having concerning new models or new cars it would appear a good business in the Dallas territory is assured for the coming year. Dealers say the car priced at from $1,800 to $3,000 is the favorite now. Heavy orders are being placed and the dealers are in a position to care for the business without any great assistance from the bankers.

ATLANTA

ATLANTA, Dec. 31.—Several dealers to-day expressed confidence that business would pick up considerably after the first of the year, but the consensus of opinion is that there will be no return to normal conditions for several months unless cotton should climb to price that is double the present quotation. The holiday business is fairly good considering the recent period of depression and the dealers state many prospects promise to buy early.

In 1921, if all these sales develop, the dealers say the demand will exceed the supply. The next two or three months will witness only the beginning of return to normal conditions, which dealers do not believe will fully materialize before late spring or summer. Very few sales are being made now, and it is certain the trend will not be backward, for money is becoming less tight and the dealers say this will mean slow but gradual increase in sales from now on. All business lines are doing everything possible to restore public confidence.

DENVER

DENVER, COL., Dec. 30—Although many dealers are still gloomy over the present conditions. others point out that December is usually a dull month and some have had reasonably good business during the month at that. The upward trend has already been felt by few during the last few days through sales and prospects, and there is substantial confidence of a gradual gain during the next three months, particularly February and March. Please tell Adair that the selling story is delayed because Heiser is sick, but hopes to give me an interview early next week and has by far the best record in Denver sales right now.

CINCINNATI

CINCINNATI, Dec. 31—Automobile dealers in the Cincinnati territory are optimistic over the prospects for the automobile industry in the future and are confident that business will begin to pick up after the first of the year. This increase is expected to materialize about February 1. From that date on sales are expected to mount so that the trend will be well defined before the end of March. At present there is some activity here but not much.

None of the dealers is figuring on anything like a big business for the regular 1921 season. They realize that the market is or will be glutted with used cars, purchased during last year's scrambles, and that prospects for new cars will necessarily be limited.

It is the opinion of some dealers and especially of manager H. K. Shockley of the Cincinnati Automobile Dealers Association that several manufacturers, who have curtailed their production, will actually find themselves "short" and will have to hold off prospects for a few weeks on deliveries when the business comes. These include dealers who are holding production to the minimum, unwilling to take a chance against the future until the business actually is at hand.

CHICAGO

CHICAGO, Dec. 31—No notable increase of sales of automobiles is evident in connection with the holiday purchasing of commodities and dealers are not in an expectant mood for immediate improvement. The reported increase in price of Franklin cars is expected to stimulate buying, which has been quiet for months, through the effect it will create on the public mind that other cars may likewise have their price values moved upward.

It can be said that show week is looked forward to with keen anticipation by all dealers as the real beginning for the return to normal in the automobile trade in this city. With that in mind every effort is being made to line up prospects now and have them ready when the coliseum opens. For the present, however, conditions remain unaltered generally from what they have been for the past few months. While there have been sales made they have not been made in such volume as to make the horizon any too rosy for the dealers.

New Air-Cooled Car Designed by Horning

CLEVELAND, Dec. 31—The Washington Automobile Co. of this city plans to produce a new air-cooled car to be known as the Washington Six from designs of Walter R. Horning, who was formerly engaged in the electrical equipment business. It will be an assembled car comprising such components as Timken axles, Delco electrical equipment, Borg & Beck clutch, Grant-Lees gearset and Thermoid Hardy universals. The engine is a six cylinder $3\frac{1}{4}$ x $4\frac{1}{2}$ inch overhead valve design and the wheelbase will be 120 in. A rear axle ratio of 4.66 to 1 will be used. Oilless bushings will be extensively used, and a Harrison ventilator will be fitted to vary the cooling effect in accordance with atmospheric temperature.

MILWAUKEE

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January or February after the income tax period and are depending on the severity of the weather to sell for spring delivery on liberal deposit. Provided these plans get sufficient reaction, and it is expected they will develop formidably though intensive salesmanship, business will truly open up on sane basis.

At several private conferences the dealers expressed decidedly more confidence in the next three months. They do not expect a boom period but do expect a response exactly in proportion to hard sales work. They declare that practically all owners who trade in annually and for new cars are anxious to get action as soon as possible, showing there is plenty of money among the present owners. Lower-priced cars are not expecting anything like the rush of two or three years ago, of course, but they feel sure they have a sound and healthy business which will more than make up for the reduction in boom volume.

Trucks are selling slowly and the tractors are not expected to revive for several months more. The public is still talking about further price reduction in all automotive lines but is impressed by their failure to get cut prices now. The dealers are all standing pat.

DES MOINES

DES MOINES, IOWA, Dec. 31—Automobile conditions are practically stationary in Des Moines territory. One distributor had twelve salesmen in the field during the entire month of December and they failed to bring in a single order for immediate delivery. The prospects for spring business are good but little business is expected the next sixty days. To show the trend during the past sixty days, of 1000 registrations issued in 25 counties in Des Moines territory, more than 800 were for Fords. Relief from present conditions is dependent upon the credit situation. In the farm produce market there are signs that the movement of grain has started and this will tend to improve the situation, but it will be slow.

HENDEE BUILDS POLICE CARS

SPRINGFIELD, MASS., Dec. 30—The New York police department has bought of the Hendee Mfg. Co., eighty-eight motorcycles and side cars for use in the suppression of the crime wave in that city. The motorcycles will be equipped for patrol duty, to carry driver and passenger heavily armed. It is believed that the free use of motorcycles will be effective in dealing with automobile bandits. The same corporation has received large orders from Boston and Philadelphia, making a total of 221 motorcycles and 153 side cars ordered for these three cities.

Automobile Sales at Retail Spotty

Dependent Chiefly on Local Business—Little New Discussion on Prices

(*Continued from page* 36)

of the industry as a whole. Ford produced at top speed all of last year and probably has a considerable surplus on hand. A few other manufacturers are in the same position.

Except for the announcement that Franklin will raise his prices slightly, there has been little discussion of late of the price question as it relates to finished cars. In this respect there seems to have been more or less stabilization. It may be significant, nevertheless, that manufacturers of parts and accessories are announcing reductions. The expectation in some quarters is that companies which gave price guarantee in lieu of reductions may announce readjustments during the show. Much importance is being attached to the sales stimulation which will result from the New York and Chicago exhibitions, and everything possible will be done to extract from them every possible benefit to the industry.

Production to-day is at a low ebb, but the outlook is more hopeful than it has been in six months. Sales very largely depend upon the stabilization of retail prices in general at more normal levels and there are many indications that retailers in various lines are resigning themselves to the inevitable and are preparing to pass on to the ultimate consumer some of the substantial cuts which have been made in retail prices.

FORT WAYNE PLANTS CLOSE

FORT WAYNE, IND., Dec. 31—The Dudlo Mfg. Co. of this city has closed down all its departments which were engaged in the manufacture of products used by the Ford company. About 700 employees have been thrown out of employment indefinitely by this shutdown, this number including 75 employees in the New Haven branch and 30 employees in the Peru branch. The Dudlo company manufactures insulated wire. About 300 employees engaged in the manufacture of products which are not used by Ford still are at work.

The Harry Andrews Paper Co. of this city has also been affected by the Ford shutdown. The Andrews company supplies Ford with a paper composition used for the inside doors of Ford cars.

COMPLETE HIGHWAY LINK

MASON CITY, ILL., Jan. 3—The largest stretch of paved road which has yet been completed under the Federal Aid Act, has been formerly dedicated. It constitutes a link in the Chicago—St. Louis highway extending from Sparland to Chatham, a distance of 117 miles. The entire road is paved with concrete and it passes through Springfield and Peoria.

STUDEBAKER QUITS WAGON MANUFACTURE

SOUTH BEND, IND., Jan. 3—Manufacture of the famous old Studebaker line of wagons will be discontinued and the entire facilities of the Studebaker plant here will be devoted to the production of motor cars. Some time ago the carriage and harness ends of the business were closed out, but the manufacture of farm wagons and heavy vehicles for army purposes was continued until the present time.

Newark Factories Cut Down Operations

NEWARK, N. J., Dec. 31—A survey of important plants in this section of New Jersey indicates an almost complete stoppage of production in many cases, while other firms are simply holding together skeleton organizations.

Hyatt Roller Bearing Co. shut down on Dec. 24th and expects to resume production Jan. 3. An announcement to employees stated that all departments will resume at the same time, but with forces of a size proportionate to production necessities at that time.

Splitdorf Electrical Co. is holding together its office and shop organizations, but has reduced production very materially.

After a two-weeks shutdown, Gould & Eberhardt will start production again on Jan. 5. A force of 270 men will be put to work at that time, and gradually increased as necessity demands. The working force at this plant numbers about 900 under peak-load production conditions.

In contrast to the generally depressed situation in this district, the Rubber & Celluloid Products Co., which employs about 80 men, is maintaining its working force intact, although some decline in volume of business has been experienced.

TO USE NEW RAUSIE ENGINE

SPRINGFIELD, OHIO, Jan. 3—The Martin Aircraft Co. of Cleveland will equip one of its large commercial airplanes with a Rausie Big-Six engine of 250 hp. A new design of engine with four valves per cylinder and double camshafts will be submitted to the Government for the air mail service. This engine will be equipped with an electric starter.

A CORRECTION

Hanson & Tyler Co., Fort Dodge, Iowa, which has made an assignment to creditors, was not agent for Chandler and Cleveland cars as was stated at the time the assignment was announced. These accounts with the Hanson-Tyler company were closed April, 1919 and since that time have been in other hands.

Excise Tax Refund Sought in Canada

Deputation of Dealers Request Return of Money on Unsold Cars

OTTAWA, Dec. 31—A deputation of Motor car dealers, 400 strong, coming from all points in Canada, from Vancouver to Halifax, waited on Sir Henry Drayton, Minister of Finance, to urge that the excise tax paid on unsold cars in stock at the time of the recent repeal of the excise tax be refunded.

In the brief presented on their behalf by E. M. Trowern of Ottawa and supported by G. M. MacWilliam of Toronto, and J. H. Fortier of Montreal, it was pointed out that in collecting the excise tax on motor cars at their Canadian source (point of manufacture or port of entry of domestic manufactured and imported automobiles respectively), the motor car dealers were discriminated against, as this procedure not only aggravated the already difficult credit situation, but also militated against sales during the life of the excise or so-called luxury tax.

This adverse discrimination unfortunately, like the "evil men do," survives the tax in a much more grevious form, for while on clothing, shoes, jewelry, etc. (collected by retailers at the time of sale) the tax was automatically dropped at the time of the repeal, it remains on motor cars that were in dealers' stocks at that time, as a result of which the dealers must take it as a loss.

The tax, 15 per cent on cars under $3,000 and 20 per cent on cars at $3,000 and over, in many cases approximately equals the dealers' profit. It was further pointed out that owing to the buyers strike and credit stringency, the loss a large proportion of dealers would be compelled to face was beyond their power of absorption. Consequently many would be bankrupted and others would be paralyzed. Some dealers stand to lose as high as $60,000 on the tax alone unless it is refunded.

LABOR NEARS PRE-WAR BASIS

HARRISBURG, PA., Dec. 31—Reports to the central office of the Pennsylvania State Employment Bureau are said by the officials to indicate that labor of all kinds is rapidly returning to its pre-war status and the Pennsylvania labor turnover is decreasing. It is believed conditions will be back to normal in virtually all trades in January.

HAYES WHEEL STAYS DOWN

DETROIT, Jan. 3—Hayes Wheel Co. at Albion, which had been closed for about two months and which was reopened Monday, was closed again Wednesday following the announcement that Ford would not reopen. The company manufactures hubs for Fords almost exclusively.

Goodyear Passes January Dividend

Statement Declares Impairment of Capital Made Action Unavoidable—Add Directors

AKRON, Jan. 3—Explaining to stockholders that the present impairment of capital made its action unavoidable, the Goodyear Tire & Rubber Co. passed its quarterly preferred dividend which fell due Jan. 1, at the same time issuing an official statement to the effect that preferred dividends, being cumulative, would be paid before any further dividend is paid to common stockholders.

Announcement of the company's action was made following an adjourned meeting of stockholders at which several changes in the company's code of regulations were voted. Principal among these changes is the decision to increase the number of directors from seven to eleven. Stockholders also ratified change of the fiscal year to correspond with the calendar year instead of ending on Oct. 31; voted to hold the annual meeting in March instead of December, and empowered officials of the company to create finance and executive boards.

In announcing the company's inability to declare the usual preferred stock dividend, officials in formal letters to stockholders said:

"Your disappointment in not receiving the quarterly dividend on the preferred stock held by you, due on Jan. 1, 1921, is no greater than that of your board of directors in not being able to pay the same on that date. The plans for the refinancing of our company, which we expected to have fully completed at the time of the first adjournment of the special meeting of stockholders several days ago, are not yet fully consummated. Until these plans have been completed and the present impairment of the company's capital, as shown by the audit made as of Oct. 31, 1920, and which was presented to stockholders Dec. 29, has been restored, the company would have no legal right to pay this dividend even though it had at present funds to do so.

First Duty to Creditors

"The company's first duty is to make satisfactory arrangements with its creditors before any dividends are paid to the stockholders.

"These dividends are cumulative and when payments are resumed all dividends in arrears on preferred stock will have to be paid before any dividend is paid to the common stockholders. We hope to announce in the very near future the completion of the plans now under way for the company's permanent financing."

The annual audit showed a deficit of $15,647,653 in addition to anticipated losses of approximately $19,000,000 on contractural obligations for rubber and fabric.

Much to the surprise of stockholders attending the adjourned meeting on Dec. 29, officials of the company were unable to announce definite and satisfactory consummation of the refinancing negotiations, and asked a second adjournment for two weeks in order to permit more time for carrying on the negotiations. It is understood in Akron that an eleventh hour hitch in the tentative negotiations arose, due to terms of the Eastern banking group expected to negotiate the loan to the extent of $40,000,000 or $50,000,000, which were regarded as too exacting by Goodyear officials.

Tried Other Financial Groups

This unexpected development, it is reported, caused Goodyear representatives to turn to other financial groups in the hope of pushing through the refinancing upon terms more satisfactory and acceptable both to officials and stockholders of the company. The permanent refinancing must be consummated by Feb. 15 to replace the temporary loan of $28,000,000 advanced through the Goldman-Sachs Co. of New York, and which matures on that date. There is a possibility of extension of this loan, officials state, should the permanent refinancing plans be further delayed.

In casting about for new and more friendly financial interests to tide the Goodyear company over its present crisis, it is understood officials turned to J. Pierpont Morgan and the banking group represented by him. Latest available and tangible information received in Akron from Wall Street indicates that the company is experiencing considerable difficulty in interesting the Morgan interests in the refinancing venture.

Wall Street is known to be none too friendly to Goodyear, due to the fact that the company through the financial strategy, business ability and genius of its president, F. A. Seiberling, who in Akron is known as the "Little Napoleon," prior to this time has been able to carry on its previous refinancing without the aid of Wall Street, and therefore has declined proffers of aid from Eastern banking groups.

Called for Stock Control

The original terms, upon which the original banking group consulted, offered to absorb the Goodyear issue of $40,000,000 in first mortgage gold notes, are said to have included a stipulation that the financing group be assigned control of fifty-one per cent of the Goodyear participating stock during the tenure of the loan. This President Seiberling is endeavoring to avoid. The original terms also included a virtual mortgage on the Goodyear plant and a commission of 2½ per cent on net profits during the tenure of the loan, in addition to the interest charge agreed upon.

HARDMAN RECEIVER NAMED

NEWARK, N. J., Jan. 3—Vice Chancellor Foster has appointed Chester N. Farlie receiver of the Hardman Tire & Rubber Co. of Belleville. The application was made by the Rubber Importers & Dealers Co. of New York for a judgment claim of $3,336.

Franklin Completes Largest Sales Year

Production of 10,500 Represents 1500 Increase — December Output Totals 1000

SYRACUSE, Jan. 3—Franklin Automobile Co. has announced completion of its biggest year and the establishment of several new records. Despite the almost complete let-down in selling during the autumn months the Franklin company has sold and delivered ten thousand five hundred cars during the year. Of this number one thousand have been delivered to customers for immediate use during the month of December. This is the largest December in the history of the company and is considered indicative of the growing popularity of the air-cooled car for winter use.

Figures for the entire output in 1919 were 9173 cars, of which number 828 were sold during December. December, 1918, the Franklin company sold 234 cars. The production schedule of the preceding years never approached the figures of 1919 and 1920. The largest single day's delivery during the past month was Dec. 29 when seventy cars were shipped. They were sent to all parts of the country and not to any distributer who contemplated storage for future delivery.

Harvester to Deliver First Light Trucks

SPRINGFIELD, OHIO, Jan. 3—Preparations have been made by the Springfield works of the International Harvester Co. to usher in the new year by delivering the new high speed trucks to the trade. The first truck will be placed on exhibition in the lobby of Hotel Shawnee, permission having been granted by Manager Charles T. Gauvey. The new truck will be shown at the Columbus show in January and at the Springfield show in February.

Preparations are being made to increase the force at the Springfield works to 3000 before the end of 1921. About 1200 men are at work now getting out the new trucks and working on bodies for the Akron plant.

WINTHER BUYS TRUCK CONTRACT

SPRINGFIELD, MASS., Dec. 30—The United States contract held by the Sinclair Motors Corp. of this city was obtained by the Winther Motor Co. of Kenosha, Wis., for $10,000, the sale being authorized by Referee Charles W. Bosworth at the adjourned meeting of the Sinclair company creditors in bankruptcy court here. The deal was negotiated through the trustee in bankruptcy of the Sinclair Motors Corp. It was reported by Referee Bosworth that the contract carries with it all of the assets of the Sinclair company intended for use in constructing the trucks.

Factories Resume on Low Schedules

General Operation Still Month or More Away—Wages Cut 20 Per Cent

DETROIT, Jan. 4—Between 8000 and 10,000 men went back to work in automobile factories here yesterday and today. While it is the plan of the manufacturers to increase forces and production steadily it is admitted freely there will be no real resumption for a month at least.

Wage schedules in all plants which reopened yesterday have been cut around 20 per cent, but no complaint has been received and workmen, after weeks of idleness, are apparently eager to return at the reduced scale. The stopping of the Ford and Dodge plants simplified the wage problem and plenty of labor is now available at a reasonable wage. Best of all, manufacturers say, the returned workmen are full of pep and are apparently ready to give full return in service despite the wage reduction.

It was stated unofficially that the Dodge plant will be down indefinitely. General Manager F. J. Haynes declined to predict the date of resumption or the schedule likely to be in effect on reopening. Practically the entire force of 22,000 men are off, though a few hundred have been given work cleaning and overhauling the plant and parts department. Dodge continued to have a heavy output in October and November. Dealers are heavily overstocked and thousands of cars are stored.

Cadillac is still taking inventory and will not get back to production before next week, according to Lynn McNaughton, general sales manager. He declined to say how many men will go back next week or what the output would be.

Packard reopened yesterday with about 50 per cent of the regular force. Officials say they will increase the force as circumstances warrant. Production will be confined to closed jobs on the single six chiefly and only in keeping with demand.

Studebaker Starts 400 Men

Studebaker opened plant No. 5 yesterday with 400 men. They are getting the plant in shape for resumption of production next Monday in all the company's units as announced before the holidays. They will start on a schedule of 90 cars daily for all plants, increasing as conditions warrant.

Paige-Detroit began taking back married men yesterday and hope to get back into production as soon as the plant is in shape, probably by the end of the week. They will maintain a rate of 25 cars daily with about 1000 men working temporarily. The company has orders for January delivery totaling $2,000,000 and for February of $2,500,000. This, with the daily demand expected, will permit an increase to 35 cars daily by Feb. 1. A survey of Paige dealers on Dec. 1, according to H. C. Dart, advertising manager, shows fewer cars unsold in the country than the actual number of Paige dealers.

The Lincoln Motor Co. has about 200 men at work though not attempting to produce any cars. All its efforts are being centered in the parts departments. It expects to swing into production next week, though officials have not announced the schedule.

Chalmers to Start Monday

Officials of Maxwell-Chalmers say the Chalmers plant will open next Monday with about 300 men working on closed cars of both types.

About 75 men went to work at the Columbia Motor Co. yesterday in the parts department and they are getting the plant into shape for resumption of production. The date of starting has not been decided.

Other plants are still down so far as production of automobiles is concerned, though the parts departments in all factories are being operated except in the case of Hudson and Hupp which did not stop for inventory, continuing on the curtailed schedule in vogue the last two months.

The Essex plant is closed but both Hudson and Essex cars are being built in the Hudson plant at the rate of about 15 daily. Hupp is continuing its schedule of 35 maintained since Dec. 1.

Buick will get under way next Monday and will continue indefinitely the daily schedule of 250. Dort will not get started on its new model probably until the end of the month and Oakland and Olds expect to start next week with a short force and their output limited to the demand in sight, though a schedule of 100 for Oakland and 30 for Olds will be the starting figure. Reo has resumed production but is continuing on a short time schedule and building about 30 cars daily. Chevrolet will get under way by the end of the week on a production of 100 a day to be increased as demand justifies.

Finds Country Stocks Down to Low Point

NEW YORK, Jan. 4—David Ludlum of the Autocar Co. was here to-day to visit the truck show and incidentally to impart as much optimism as possible to all he met. Ludlum came to New York from a two weeks' vacation in upper New York State, where he visited many country merchants. He had with him the December sales reports of his company. His optimism was founded on these two incidents. He said:

"I firmly believe that we are beginning a very big year. During my trip I have visited many country merchants. I found that they were so down in stocks that they could not supply the wants of their trade and they all are realizing that they must order goods and order them quickly. They believe that present wholesale prices are as low as can be expected. I predict good merchant buying at once and that it will be widespread.

Akron Begins Work on New Schedules

Goodyear Cuts Factory Wages and Salaries—January Orders Substantial

AKRON, Jan. 4—The Akron rubber companies resumed operations on Jan. 3, after being closed for the Christmas Holiday week, with every indication pointing to considerably increased production. There is a gradual absorption of Akron's estimated army of 20,000 unemployed men and a steady return to conditions approaching normal in the tire industry. Goodyear wages will be cut 12½ per cent Jan. 10, and all salaries from 15 to 20 per cent.

It is stated authoritatively by Akron manufacturers that Akron rubber and tire concerns start the new year with fully $50,000,000 worth of new business on their books so far for the month of January. This estimate is conservatively made and is likely to be exceeded largely when all January orders are compiled.

This, according to business experts, is the most encouraging note in the tire industry that has been sounded since the period of retrenchment began last summer. It is not taken to mean, however, that the $50,000,000 worth of business will result in increased production at once, but is taken to augur well for an early resumption of operations.

Practically all companies have surplus finished product on hand sufficient to accommodate January orders, but with orders continuing to increase as they have since Dec. 15, it is stated that this surplus rapidly will be worked down and will demand greater production at least by Feb. 15 in order to keep production apace with demand. The Goodyear company on Dec. 15 had over $10,000,000 worth of business booked, with over $5,000,000 more in new January orders received. Since that time other companies show commensurate amounts of January business.

The B. F. Goodrich Co. on Monday increased factory operating time, and put on many former employees for the first time in eight months.

Firestone on Firm Basis

The Firestone company is understood to be more sound financially than any other concern in Akron and to be prepared to increase production just as soon as the present surplus is worked down by deliveries on early 1921 orders.

The Goodyear company's business is coming in to such extent as to indicate an early necessity for increased production, but under the present temporary financing program, there is no possibility of the present payroll being increased. Should the Goodyear permanent refinancing replace the temporary loan of $28,000,000 which matures Feb. 15 be consummated before the next adjourned meeting of stockholders, officials hope to be able to increase production.

Ford Organization Shaken by Strife

Three Officials Resign Positions —Plant Down Indefinitely, Officials Declare

(*Continued from page* 39)

the financial end, then took the position that resumption of operations would be unwise until the big surplus of cars had been unloaded.

A long conference last Wednesday resulted in orders to parts manufacturers who had resumed operations Monday again to stop production for Ford indefinitely, and some of them, notably the Hayes Wheel Co., at Albion, which makes Ford hubs exclusively, promptly closed down after three days' operation following a shut-down of six weeks. At the same time orders went forth that the factory would remain closed indefinitely —certainly until Feb. 1. Officials said to-day there would be no resumption before Feb. 15 in any event, and most likely the shut-down would continue some time after that date.

Just what action took place with regard to the resignations at the conference Wednesday is not known. It was followed, however, by an all-day session Thursday, and Friday morning Brownell announced his resignation. He later gave out the statement regarding Klingensmith and Turrell together with the facts which brought about the crisis.

Brownell has been with the Ford company since 1914, prior to which time he had handled Ford copy in the firm of J. Walter Thompson Co. When he joined the organization the company was building 38,000 cars a year. The output for 1920 was 1,023,552. Brownell had been contemplating a trip to California for the health of his wife, though his plans were simply to take her to Los Angeles, where he owns an estate upon which his daughter resides, and leave her there for a time, returning to his duties in Detroit. His resignation, however, he said to-day, would give him opportunity to spend three months in the West.

Turrell Regarded as Fixture

Turrell, formerly an expert accountant, has been with the Ford company nine years and, as the head of the accounting department, had actual charge of Ford finances, incoming and outgoing. He was regarded as one of the Ford fixtures. It is said Ford plans to abolish this position.

The resignation of Klingensmith, however, was the one big topic in banking circles and among automotive executives. Starting in as a bookkeeper with Ford about sixteen years ago, Klingensmith rose to the position where he was presumed to be head and shoulders above everyone else in the organization. He succeeded Mayor James Couzens as executive vice-president and general manager, and much of the success of the company is attributed to his efforts. The fact that he denies his resignation is regarded in the light of a technicality, because he insists on the request coming from Henry Ford rather than Liebold or Sorensen, and his official announcement of his resignation is expected later.

Willys to Maintain Present Car Models

TOLEDO, Dec. 31—C. B. Wilson, new vice-president of Willys-Overland Co., in a statement this week declared the automotive industry would be one of the first to right itself from the present depression. Local troubles, he said, threw the Willys-Overland plant out of balance and declared it would take some time to put the plant back on the basis desired by the owners, but assured Toledo that it would not be long until it would be in operation.

"There is no doubt of the well-laid plan of the Overland officials to operate on conservative lines on an economical basis. The product has been studied carefully and executives are laying plans for the future. There will be no new models brought out in 1921.

Resume on To-Order Basis

NEW YORK, Jan. 4—Production at the Willys-Overland and Willys-Knight factories will be continued strictly on a "to-order" basis. No cars will be made in anticipation of demand for the present. Relative to the company's policy, Vice-President Chrysler said:

"We have materially reduced our outstanding obligations and have followed the policy of liquidating finished product. As a result our stocks in the field are very low and the total number of finished cars that we have at our warehouse in Toledo is less than 2200. Two weeks of business throughout the country would completely absorb every finished car."

EMERSON PASSES DIVIDEND

ROCKFORD, ILL., Jan. 4—At the annual meeting of the Emerson-Brantingham Co., it was voted to defer action until the next meeting upon the resignation of J. W. McLachlan, secretary-treasurer. The quarterly dividend was passed, the following explanation being submitted: "Owing to the general trade and financial conditions, the directors of the Emerson-Brantingham Co. deem it advisable to maintain the company's finances in the strongest possible position, and, consequently, voted to omit the declaration of the regular quarterly dividend which would be payable Feb. 1, 1921, although the earnings of the company for the fiscal year, recently closed, were more than its dividend requirements for that period."

INDEX TO VOL. XLIII

Subscribers who desire a copy of the index to Vol. XLIII (second half 1920) can secure same by sending their name and address and a request for the index to this office.

South America Open for Continued Sales

Exchange Conditions Only Important Drawback to Big Opportunity—Roads Improve

NEW YORK, Jan. 3—A belief that American automotive manufacturers should not slacken their sales and service work in any of the countries of Latin-America was expressed here to-day by J. H. Wise, who has just returned from a business trip to Para, Pernambuco, Bahia, Rio de Janeiro, Sao Paulo, Santos and Rio Grande del Sur, Brazil; Montevideo, Uruguay, and Buenos Aires, Argentina. Wise, as a representative of Gaston, Williams & Wigmore, Inc., was placing agencies for the Peerless automobile and Selden trucks.

"Exchange conditions are the greatest hindrance to trade at the present time," he said. "But, due to the great natural wealth of these countries and the business betterment that may be expected in the coming months, this is no time to let up the slightest on foreign trade. Exchange with South America will return to normal much more rapidly than it will in Europe, and to one who has sufficient knowledge of the great territory of Brazil, Uruguay and the Argentine, there can be no doubt of the trade volume that we may expect in coming months.

"Service is a prime requisite for the exporter who expects to continue in the South American market. Now, when conditions are slackened here at home, is the time to undertake service and maintenance campaigns for the foreign field. Service literature is needed, education is required—all of which should be undertaken by the North American automotive manufacturer who would extend his business in the Spanish and Portuguese speaking countries."

Sao Paulo Market Promising

Wise sees the Brazilian state of Sao Paulo, the center of the coffee-growing district, as one of the most promising fields for automotive sales. The city of that name, which is the capital of the State, is the third largest in population in the South American continent and already boasts of some 4000 automobiles. An improved road is now being built to the city of Campinas, which has a population of 150,000 and is located 105 kilometers to the north. The completed highway to Santos stands as an example of fine highway construction, and Wise reports an active project for the construction of an improved highway to connect Sao Paulo with Rio de Janeiro.

The touring car predominates in Sao Paulo, there probably being more five-passenger machines than any other design. But, as Brazilian families are apt to be large, there is a steady demand for seven-passenger models. The sale of cars with limousine bodies is not large, but among those who can afford them, this type is popular. The demand for sedan or similar enclosed cars is small.

France Gets Bill to Quash Gas Tax

Would Help Lift Industry from Slump—New British Tax in Effect

PARIS, Jan. 3—(By cable to AUTOMOTIVE INDUSTRIES)—A bill has been brought before the French Parliament calling for the abolition of the state tax of 20 centimes a litre on gasoline on a caloric basis. This is equivalent to a tax of $35 a ton on coal and is responsible in large measure for the present slump in the automotive industry. In February Germany will begin delivery of 35,000 tons of benzol a year in accordance with the terms of the peace treaty. It originally was intended to use this mixed with alcohol as automobile fuel but no alcohol is available, owing to the decrease in production. The Government now proposes to sell most of this benzol at cost to the French chemical industry and the rest will be put on the market. The automotive industry would have preferred to have all of it go on the open market in order to force down the price of gasoline.

The price of gasoline in England dropped 7 pence a gallon Jan. 1 but the 1 pound sterling horsepower tax went into effect at the same time.

A French law which went into effect Jan. 1 provides that no person can pilot an aircraft without a government license delivered after a thorough medical examination.

Swiss banks have advanced the funds necessary to continue the operation of the Piccard-Pictet. Liquidators have been appointed and it is probable the affairs of the company will be wound up.

The French Dunlop Co. has purchased the government shell factory at Mont Lucon, covering 250 acres and will use the property as a tire factory, but will not get into production until the end of 1921.

Dates have been fixed for the London automobile shows to bring them after the Paris exhibition. Trucks will be shown from Oct. 14 to 22 and passenger cars from Nov. 4 to 12.

A new tire company is being formed in Turin with a capital of $5,000,000. It is believed the Fiat Co. is financially interested.

Entries for the French Grand Prix, which closed on the last day of the year, were disappointing. They included only four Ballots, three Fiats, three Darracqs, two Sunbeams, two Talbots and one Mathis. Unless late entries are received at double fees it is doubtful whether the race will be held. BRADLEY.

Kelly Tire Reported Sought as G.M.C. Unit

NEW YORK, Jan. 5—The Kelly-Springfield Tire Co. has declared the regular quarterly cash dividend of $1 a share and the usual quarterly 3 per cent stock dividend on the common stock as well as the quarterly dividend of $2 a share on the 8 per cent preferred. Stock of the company has risen rapidly on the stock exchange in the last few days on reports that several new directors soon will enter the board and that control of the company soon will be shifted to the Morgan interests. This is coupled with assertions that after these changes are made Kelly-Springfield will become a unit of General Motors, which now has no tire factory although it has close relations with the Dunlop Tire Co. It has been impossible to obtain confirmation of these reports.

ROCKFORD TO AID COTTA

ROCKFORD, ILL., Jan. 3—Business men of this city have launched a campaign to save the Cotta Transmission Co., manufacturer of motor vehicle accessories, now in bankruptcy. Since the company's difficulties reached an acute stage, there has been a desire upon the part of the leading citizens of Rockford to prevent a suspension. Several manufacturers in other lines have offered to assist in a financial way and some of the preferred stockholders have also volunteered their co-operation.

It is the impression that the trouble is only temporary and that a little aid at this juncture will tide the company over the present embarrassment. It is planned to sell enough stock to realize funds to take care of the pressing obligations. A committee of five leading merchants has been appointed.

Exports for November, 1920, and Eleven Months Ending November 30

	November				Eleven Months Ending Nov. 30			
	1919		1920		1919		1920	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Aeroplanes	1	$3,000	1	$2,000	36	$156,200	57	$548,174
Aeroplane parts	..	77,706	..	906	..	3,248,989	..	524,406
Passenger	7,743	8,227,828	11,486	14,511,756	59,932	65,686,554	133,274	153,610,700
Commercial	1,712	3,143,351	2,330	4,557,385	14,104	32,889,384	26,876	43,168,368
Parts, not including engines and tires	..	3,644,460	..	8,480,615	..	37,565,548	..	77,818,024
Total automobiles and parts of	..	15,015,639	..	27,549,756	..	136,141,486	..	274,597,092
Motorcycles	2,884	790,289	3,605	1,112,877	22,163	6,056,806	33,385	9,355,057

ENGINES

	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Automobile	2,921	$393,988	220	$63,743	28,853	$4,350,851	30,246	$4,968,282
Marine	572	209,924	746	231,513	10,095	4,187,630	8,875	2,895,169
Stationary	720	298,395	3,368	604,164	23,898	3,405,420	28,749	5,074,779
Traction	994	987,101	1,500	1,587,284	18,969	18,734,672	20,673	20,082,075
Total gasoline engines	7,207	$1,889,408	5,834	$2,486,704	81,815	$30,678,573	88,543	$33,020,305

Car Exports Reach $274,597,092 Total

Figures to November 30 Double Previous Year—Imports Grow to $1,236,256

WASHINGTON, Jan. 3—Both exports and imports of automobiles and accessories showed a remarkable increase in the statistics of foreign trade, compiled by the Bureau of Foreign and Domestic Commerce for November. The shipments of American cars for the first eleven months of this year were valued at $274,597,092, as compared with $136,141,486 for the corresponding period last year. These figures show that the foreign trade in automobiles has more than doubled.

Imports, too, have grown with the passing of the months, indicating the rehabilitation of European car manufacturers. There were 853 automobiles entered at American ports in the eleven months ended November. The declared value was $925,669. For the same period in 1919, 107 cars valued at $100,781 were placed on American markets. The automobile parts manufactured abroad and sold here increased tremendously for the total value of the shipments for the eleven months of 1919 was $251,491, as compared with $1,136,256 for the corresponding period this year. The imports of these products for November, 1919, were valued at $79,584, as against $107,264 for November, 1920. Nineteen cars, valued at $58,054, entered this country in November last year and sixty-six cars, with a valuation of $67,272, were imported for the same month this year.

The 4917 cars manufactured in this country and returned for various reasons were valued at $7,855,499. This eleven months' total is large, for in the same period last year 1497 cars valued at $3,199,675 were returned. Part of this increase is perhaps due to returned army cars.

Harbeck Resigns from American Can

Will Confine Activities to Automotive Interests—Maxwell-Chalmers Position Good

NEW YORK, Jan. 4—J. R. Harbeck has resigned as vice-president and director of the American Can Co. in order to devote all his time to his automobile interests. He felt that it was unfair to remain an officer of the can company when he was able to give it so little of his attention.

Harbeck for some months past has been devoting himself to the affairs of the various John N. Willys enterprises in which he is a director and to the reorganization of the Maxwell and Chalmers companies. He is vice-chairman of the reorganization committee which is headed by Walter C. Chrysler, executive vice-president of the Willys companies.

It is expected the Maxwell-Chalmers consolidation plan, which has been approved by a large majority of the stockholders and creditors, will be declared operative about the middle of this month. No announcement will be made about the appointment of a new active management until that time. Both companies are in much better financial position than they were a few months ago.

Harbeck is essentially a financial man and because of this ability he was drafted with Chrysler by bank interests to save the Maxwell-Chalmers combination. Besides being a director of other Willys companies he is president of the Duesenberg Motors Corp.

N. A. C. C. STATISTICS SHOW ACHIEVEMENTS OF INDUSTRY IN 1920

Automobile statistics for 1920 as prepared by Alfred Reeves, general manager of the National Automobile Chamber of Commerce, show a total car registration of about 8,500,000, of which 900,000 are trucks. Production for the year is shown as 2,241,000, of which 335,000 are trucks. The combined wholesale value of the product reached $2,136,183,676. Exports for the year totaled $338,000,000. The figures are shown in the following tables:

Automobile Use

Automobiles registered in U. S. (approx.)	8,500,000
Passenger cars registered in U. S.	7,600,000
Motor trucks registered in U. S.	900,000
Cars and trucks owned by farmers	2,500,000
Per cent of registration in towns of 5000 population or less	55%
Per cent of registration in towns of 1000 population or less	33%
Per cent of 1920 output bought by agricultural districts	60%

Automobile's Part in Nation's Business

Amount of special taxes paid annually by industry to Federal Government	$257,000,000
Registration fees paid by car users	$81,000,000
Amount paid by industry to railroads for freight shipments on finished motor vehicles	$100,000,000

Production in 1920

Cars and trucks produced	2,241,000
Passenger cars produced	1,906,000
Motor trucks produced	335,000
Wholesale value of cars and trucks produced	$2,136,183,676
Wholesale value of passenger cars produced	$1,703,437,213
Wholesale value of motor trucks produced	$432,746,463

Automobile Exports in 1920

Value of motor vehicles and parts exported, including engines and tires	$338,000,000
Number of passenger automobiles exported	153,000
Increase in number of passenger cars exported	120%
Value of passenger cars exported	$155,000,000
Number of motor trucks exported	27,000
Increase in number of trucks exported	60%
Value of motor trucks exported	$45,000,000
Number of countries to which automobiles were exported during year	114

Dealers and Garages in United States

Passenger car dealers	36,210
Motor truck dealers	20,596
Garages	38,538
Repair shops	47,556

Army Truck Dumping Burdens Coast Market

LOS ANGELES, CALIF., Jan. 5—Pacific Coast motor truck dealers are alarmed over the prospective effects on their business of the importation of war trucks from Europe and their sale in this country and the suggestion of Congressman Anthony that the War Department be compelled to release between 30,000 and 40,000 trucks. Seventy-five trucks imported from Europe were unloaded here a few days ago. Similar cargoes are destined for San Francisco, Portland and Seattle.

These trucks have been brought here by the Slough Trading Co. of England and their local representative says the trucks originally were sold abroad by agents of the American government. The shipment received here is made up of Packards and Rikers, all practically new. The representative of the Slough company claims they have 4000 similar trucks to be marketed in this country, including Whites, Pierces and Peerlesses in addition to the Packards and Rikers.

He is seeking to dispose of the local shipment intact, but if he is unable to do so, he probably will auction them. He also has on hand large quantities of tires and tubes from the same sources. In view of the present market conditions, the arrival of these trucks from Europe and Anthony's proposal, the truck dealers are appealing to national associations and Congressional representatives for protection. They say the country might absorb 4000 trucks from Europe, but never 40,000 from the army.

Wilson Body Declares Big Stock Dividend

DETROIT, Jan. 6—The C. R. Wilson Body Co. has declared a stock dividend of 300 per cent, payable to all stockholders of record. Notwithstanding financial depression the company has had the biggest year in its history. There now is a steady increase in the number of orders for bodies.

REO RESUMES ON HALF TIME

LANSING, MICH., Jan. 6—The Reo Motor Car Co. has resumed operations after inventory. Its entire force of 5,400 men is working on half time.

Templar Stockholders Ask Stock Accounting

COLUMBUS, Jan. 3—Alleging that the W. O. Cooper Co. of Cleveland had made unjust profits "in disposing of stock in the Templar Motor Co. of Cleveland," J. W. Wilson, owner of 200 shares of common stock in the automobile company, and B. Pittman, owner of fifty shares of common stock, filed suit in the local courts asking for an accounting from the W. O. Cooper Co., and also for the rescinding of the contract between the two concerns over the disposition of Templar stock. The Cooper company, it is claimed, was formed for the sole purpose of selling Templar stock.

M. F. Bramley and W. O. Cooper, stockholders in both corporations, are named defendants and are charged with collusion in obtaining advantageous terms for the sale of stock. It is alleged that the Cooper company has received 25 per cent on the sale of stock, and in addition a bonus of $500,000 in Templar stock. Stock in the Templar Motor Co. unsold totals $8,500,000.

900 Tickets Issued for S. A. E. Dinner

Speakers to Discuss Economic Situation and Transportation —Review Road Tests

NEW YORK, Jan. 5—The annual dinner of the Society of Automotive Engineers which will be held next Thursday evening, promises to be one of the most successful in the history of the organization. More than 900 tickets already have been sold and it is expected the attendance will exceed 1200. C. F. Kettering will act as toastmaster. The speakers will be G. E. Roberts, vice-president of the National City Bank, who will discuss the economic situation and R. E. W. Cowie, vice-president of the American Railway Express Co., whose subject will be "Transportation."

One of the innovations in the program for the convention this year will be the discussions which will mark each of the various sessions. It is intended to devote half the time to formal papers and the other half to an informal discussion of them. No papers at all will be read at the chassis session Wednesday afternoon. It is expected a dozen of the leading engineers in the industry will express their opinion on this subject.

At the highway session Thursday afternoon A. T. Goldbeck will tell in detail of the highway research work done at the Government experimental station at Arlington. Approximately 20,000 tests of the effects on highways of various kinds of tires have been made and this work will be reviewed by Goldbeck.

The engineers are displaying much interest in the annual carnival which will be held Wednesday evening. The committee has not disclosed the program but has promised many surprises.

Transportation to New York and return may be secured by members at the rate of a fare and a half upon application to ticket agents.

Rubber Divisions to Meet

The various divisions and committees of the Rubber Association of America will meet the first four days of next week. The annual meeting of the association will be held Monday afternoon in the Astor Gallery at the Waldorf. The traffic committee and the executive industrial relations committee will hold sessions at the Yale Club, Monday morning, and the bicycle tire manufacturers committee at the same place Tuesday morning. The organization meeting of the board of directors to elect officers will be held at 4 p. m. Monday. A session of the executive committee of the tire manufacturers division, which will be held at the headquarters of the association Thursday morning, will be followed by a general meeting of the tire manufacturers division at the Yale Club in the afternoon. Luncheon will be served in connection with all the meetings.

So much interesting material has been made available for the aeronautic session of the Society of Automotive Engineers that two meetings will be held during the winter convention next week. The first will be Tuesday evening and the second Wednesday afternoon. Glenn L. Martin will preside at both.

Price Drops Thought Likely During Show

NEW YORK, Jan. 5—Keen interest is being displayed throughout the industry on the possibility that numerous price changes will be announced during the New York show next week. The general belief is that prices will be scaled down. This is based on the fact that labor costs are becoming materially less and that numerous parts makers are announcing cuts. Steel and other raw materials also are down.

One report is that reductions will be announced on several of the General Motors lines. The utmost reticence is maintained at General Motors headquarters here on this subject, but it is known that President Du Pont has been in conference with several of the large distributers to learn whether they believe lower prices would stimulate business. Cadillac and Oakland are mentioned most frequently in this connection.

When other companies were following the lead of Henry Ford last fall, General Motors stood pat and guaranteed its prices until the first of this year. If its schedules are lowered it is confidently expected all other companies which have not reduced already soon will do so.

DAVIS PRICES REDUCED

RICHMOND, IND., Jan. 3—George W. Davis Motor Car Co. has reduced prices on all models. The reductions range from $200 to $400 and bring the enclosed models under the $3,000 mark. The touring car has been reduced from $2,185 to $1,895, the special sport car and special roadster from $2,350 to $2,150, and the coupe and sedan from $3,185 to $2,795. These reductions have been made possible by a decrease in the cost of materials.

REYNOLDS CUTS PRICES

NEW YORK, Jan. 3—The Reynolds Machine Co., Massillon, O., manufacturers of automatic screw driving machinery for machine screws or wood screws, has sent letters to its customers announcing a substantial reduction in the price of its products.

The Electric Storage Battery Co. of Philadelphia has made a cut of 28 per cent in the price of Exide batteries of all sizes and types, effective Jan. 1.

RIVETT REDUCES PRICES

BOSTON, Jan. 4—A trade bulletin issued by the Rivett Lathe & Grinder Co. says "You can buy now Rivett machines at prices comparing favorably with those in effect in 1914." In a tabulation of new prices, compared with "peak prices" it is found that the price reductions range from 20 to 43 per cent.

METAL MARKETS

ONCE again the eyes of the metal market are riveted on the automotive industries, for there is no doubt that they are playing the part of the bellwether in the miniature buying movement that cast its shadows before in the closing days of the old year and which is slowly gaining momentum in the first week of the new year. So far only a small portion of this business is beyond the stage of preliminary negotiation, but the all-important fact that automotive buyers are once more in the market imparts to it an undertone of reassurance that is in sharp contrast with the doleful sentiment that had full sway a few weeks ago. To be sure, producers recognize that orders which a year ago would have been handed to them on a silver platter with the buyer's most devout wishes for speedy delivery will now cause an intensive scrimmage between sellers. The latter appear to be perfectly willing, however, to compete for business, being mighty grateful that some is to be had. This is the all-important fact. With the Ford Motor Company in the market for upward of 30,000,000 bolts, nuts and rivets; the General Motors Corporation reported to have placed an order for $1,000,000 worth of Oldsmobile bodies, and several passenger car builders inquiring for relatively good-sized tonnages of sheets, the steel industry is convinced that the corner has been turned. The automotive purchasing agent was the first out of the market, wherefore the prodigal's return is interpreted as a doubly happy omen.

Highly interesting, from a market point of view, are the brickbats which the copper industry is hurling at the automotive industries. A committee, known as the Copper and Brass Research Committee, has investigated the causes for the decline in copper consumption, and among these it has discovered that "in no one industry has public ignorance of the merits of copper and brass been more costly than in automobiles." "Since the first year of the war," says this report, "there has been a steady tendency toward iron products until the total amount of copper and brass now used in the average automobile is about 36 pounds. To this substitution in structural and working parts is attributed the tremendous increase in the automobile repair business in the last few years." With copper selling to-day at one-third of what it cost during the 1916 and 1917 flurries, it is quite possible that the automotive industries' interest in the metal may be revived to some extent, but the committee's findings ignore altogether the tremendous forward strides of alloy steels and heat treatment methods achieved since the war's outbreak.

Pig Iron—One report has it that the Ford Motor Company is now asking $33 base furnace, or $2 more than stated a few weeks ago. The market seems destined to remain in abeyance until consumers are convinced that they can not buy at $30, or sellers that $33 will not attract sufficient business.

Steel—Supplies of full finished body sheets in automotive builders' warehouses are reported to have dwindled and, aside from an inquiry for 1500 tons a month by a Detroit passenger car manufacturer, smaller tonnages are being sought by other interests. Prices generally are resting at the Corporation's levels.

Aluminum—Bargain lots of sundry imported and resale metal are still offered at 50 per cent below the sole producer's nominal contract price. At the first sign of demand the market is likely to stiffen considerably.

FINANCIAL NOTES

Chandler Motor Car Co. has fixed its net profits at about $5,000,000, or equivalent to $18 a share on the 280,000 share capital. This is following all write-offs, including a severe inventory shrinkage. In 1919 Chandler earned $26.91 a share before taxes on 210,000 shares Total production for 1920 is expected to reach 26,000, an increase of 8,000 over the previous year.

Gray & Davis, under the new American Bosch management, has been able to develop a modest earning power, which holds out the promise of substantial profits whenever business revives. From August to October, inclusive, net earnings totalled $36,000, after allowance of $61,000 for depreciation.

Miller Tire & Rubber Co. has declared a dividend on common stock, but has reduced it from 8 per cent to 4 per cent a year, or at the rate of 1 per cent a quarter. The reduction is made because officials deemed it wise at this time not to disburse any more funds than necessary.

Auto Sales Corp., reports net income of $118,035 for ten months ending Oct. 31 after deducting charges and taxes. This is equal to $2.22 a share on the $2,656,100 preferred stock of 50 par value. The balance sheet shows total assets of $7,575,414 and surplus of $381,729.

Paige-Detroit Motor Car Co. notified the Detroit stock exchange yesterday that the monthly dividend of 1 per cent had been passed. The company reduced the dividend from 2 to 1 per cent several months ago when the slump came in the automobile industry.

Parish & Bingham Corp. has passed its quarterly dividend due at this time owing to business curtailment in December. The inventory position of the company also influenced directors in their determination to pass dividends at this time.

Clayton & Lambert Mfg. Co. has declared a dividend of 2½ per cent on all stock record Dec. 16. This is the fourth cash dividend paid during 1920, making a distribution of 10 per cent cash and 25 per cent stock during the year.

Ohio Body & Blower Co. has passed its quarterly dividend due at this time. Curtailment of operations in the automotive industry so reduced operations in the body division that the dividend was not earned in the last quarter.

Biddle Motor Car Co. creditors will meet Jan. 11 at 82 Beaver Street, New York, to prove claims, appoint a trustee, examine the bankrupt and transact such other business as may come before the meeting.

Cleveland Tractor Co. directors have declared the first quarterly dividend at the annual rate of 7 per cent, payable Jan. 1. Previous dividends were at the rate of 6 per cent per annum.

Westcott Motor Car Co., Springfield, Ohio, has declared the usual 2 per cent quarterly dividend on preferred stock. The company is making preparations to resume full operations Feb. 1.

Pierce-Arrow Motor Car Co. directors will meet in February, not Jan. 11, as reported, to vote on the regular quarterly preferred dividend payable April 1.

Republic Motor Truck Co., Inc., has declared a quarterly dividend of $1.75 a share on preferred stock payable Jan. 1 to stockholders of Dec. 20.

Hupp Motor Car Corp., has declared a quarterly dividend of 2½ per cent on common stock, payable Feb. 1 to stockholders Jan. 15.

Jones Motor Car Co., Wichita, Kans., has been thrown into bankruptcy and M. E. Garrison has been appointed trustee.

Continental Motors Corp. closed its books Jan. 4 in preparation for the annual meeting of stockholders, Jan. 19.

Singer Motor Co., Mt. Vernon, N. Y., will be sold at auction Jan. 11, by order of Sidney S. Meyers, trustee.

Jordan Motor Car Co. paid its regular quarterly dividend Dec. 31.

G. M. C. Directorate Increased to 31

NEW YORK, Jan. 3—Directors of the General Motors Corp. at a meeting late last week omitted the stock dividend of one-fortieth of a share of common stock which has been paid quarterly since March of last year. The elimination of this portion of the customary dividend was no surprise, since there had been rumors recently that this was to be done. The directors declared the quarterly cash dividend of 25 cents a share on the common. The quarterly dividends of $1.50 a share on the preferred, $1.50 a share on the 6 per cent debentures and $1.75 a share on the 7 per cent debentures were also declared. All of the dividends are payable Feb. 1 to stockholders of record Jan. 10.

The Board of Directors was increased to thirty-one members by the election of K. W. Zimmerschied, C. F. Kettering and F. D. Brown. Both Brown and Zimmerschied were elected vice-presidents of the company, the first named to have charge of finances under the Chairman of the Finance Committee. L. R. Beardsley was elected an assistant secretary.

The position of General Motors at this time is said to be strong. It has on hand at this time less than 3500 complete vehicles, which is a remarkable showing in view of the fact that the total production for the year will approximate 400,000. Inventories of raw materials have been substantially reduced. Plants are being kept in readiness, however, to speed up production.

REPUBLIC RUBBER RESUMES

YOUNGSTOWN, OHIO, Jan. 3—Republic Rubber Corp. will resume operations Jan. 10, after being closed down since Dec. 23 for inventory and repairs. Pneumatic tire, tube and solid tire departments will begin with three eight-hour shifts on the 10th while the mechanical goods departments will resume Jan. 17. Orders received since the plant closed down are expected to keep it in operation for some time.

KELLY GETS TRUCK ORDERS

NEW YORK, Jan. 3—Directors of the Kelly-Springfield Truck Co. met here today but transacted only routine business. No decision was reached in regard to opening the factory at Springfield, O. A steadily increasing number of orders is being received but no more vehicles will be produced until those on hand are sold. The directors believe the truck market is improving and that the outlook is brighter than it has been for some time.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Jan. 6—Withdrawal last week by the Government of $36,000,000 of its funds, and the announcement of a further withdrawal of $45,000,000 to take place early this week, had no outward effect on the money market last week. These Government operations, together with the maturity this week of some $155,000,000 Treasury Certificates, had evidently been sufficiently anticipated. Call money was quoted without change all week at 7 per cent. Time money was scarce, with few transactions, and with nominal rates unchanged.

A decline of $16,354,000 in Federal Reserve notes was responsible, in the main, for the slightly improved reserve position of the New York Federal Reserve Bank last week. Total gold reserves declined $7,350,000, and bills on hand increased $10,105,000. Net deposits increased $5,129,000, and holdings of U. S. certificates of indebtedness declined $18,974,000. Total earning assets declined $8,869,000. The reserve position of the bank was better, for the first time during the year, than for the corresponding week of 1919.

The week-end statement of the Federal Reserve banks as a whole reflected an improved reserve position. The ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against net deposits, equalled the figure of Dec. 17, when it was 50.5 per cent. This ratio had been equalled only once before in the year, and exceeded only on Jan. 23, 1920. The week before, the ratio had been 49.8 per cent.

This improvement was chiefly a result of a decline in Federal Reserve notes in circulation of $60,245,000, accompanied by an increase in total gold reserves of $3,531,000. The total cash reserves increased $12,409,000. Bills discounted, secured by Government war obligations, declined $36,227,000, and total earning assets declined $18,012,000. Total net deposits, however, increased $54,842,000.

KARDELL PETITION FILED

ST. LOUIS, Dec. 30—An involuntary petition in bankruptcy was filed in the United States court yesterday against the Kardell Tractor & Truck Co. whose plant has been closed for two weeks. The company has built tractors but has never produced any trucks. The petitioning creditors are the Machine Products Co. of Cleveland with a claim of $15,659.74; Ruebelman-Lucas Hardware Co., $286.90, and William J. Kennedy Stationery Co., $5. The acts of bankruptcy alleged are the payment on Nov. 20 of $87.93 to Johnson Automobile Co. and on Nov. 24 of $64 in Liberty Bonds to the Liberty Bank. W. H. Kardell is president, and J. C. Kardell, vice president, of the tractor company which was incorporated in 1917. They also are president and vice-president of the Kardell Motor Car Co., but the two have no connection.

MEN OF THE INDUSTRY

L. B. McEwing, manager of the wholesale department of the Reo Chicago branch organization, has been promoted to the position of general sales manager with jurisdiction over both retail and wholesale departments as successor to N. O. Gilbert, former retail sales manager who has resigned. P. A. Collins until recently identified with the Reo factory engineering department has been named service manager of the Chicago branch.

J. C. Culbertson, president and general manager of the Wichita Motors Co. has been appointed a member of the committee which will work out the organization of the Foreign Trade Financing Corp., which will be formed with a capital of $100,000,000 to conduct foreign trade. He is associated with some of the leading financiers of the country. Wichita Motors now is selling its products in 83 foreign countries.

H. P. Meredith, formerly manager of the Curtis Airplane and Motor Corp., Garden City, L. I., has joined the Maxwell-Chalmers organization in Detroit as general works engineer in charge of all building design, construction changes, plant maintenance and power plant operation. His duties will cover the company's plants in Detroit, Dayton, New Castle, Ind., and in Canada.

Earl E. Harrington has assumed his duties as general superintendent of the Dellon Tire & Rubber Co., Baltimore. For the last five years he has been with the Goodyear Tire & Rubber Co. and his last service with it was in the technical service division where he worked on tire production and construction engineering problems.

H. A. Oswald has been made general manager and secretary-treasurer of the Hamilton Motors Co., Grand Haven, Mich. F. A. Inman has been named assistant to the general manager. E. A. Grabman is factory manager and fiscal agent representing the interest of Adolph Pricken, New York, the company's president.

I. L. Walker, manager of the engineering department of S. F. Bowser & Co., Inc., Ft. Wayne, Ind. has been appointed executive engineer. He has been connected with the company about twelve years. In his new position, he will have supervision over the company's dealings with insurance companies.

W. L. Carver has been made general manager and chief engineer of the Antigo Tractor Co., Antigo, Wis. B. W. Keene will be his assistant, and D. S. Stewart, designer of the tractor to be built by the company, has been elected a director and named consulting engineer.

Alfred Weiland has been appointed assistant to the president of the Pierce-Arrow Motor Car Co., acting for the president in matters relating to engineering. Weiland was formerly production engineer for the Wright-Martin Co., and later was with the Goethals Company.

William Elliott Phelps has been appointed general sales manager of the Haynes Automobile Co. He was formerly sales manager in the Chicago district for the Haynes company and previous to that had been general sales manager of the All American Truck Co.

Max B. Loomis has been made advertising manager of the Sparks-Withington Co. at Jackson. Mr. Loomis formerly was with the Reo organization and succeeds Major H. L. Hunt who returns to his newspaper work on the Jackson Evening News.

C. A. Bishop has been appointed western sales manager of the Hart-Parr Co. His headquarters will be at the factory, Charles City, Iowa. John P. Gregg has been named northwestern sales manager for the company.

Dan B. Hurlbut has been named factory representative of the Kroyer Motors Co., Stockton, Cal., manufacturers of the Wizard tractor. He was formerly connected with the International Harvester Co.

A. O. Williams is now secretary of the Automotive Association of Cleveland. Dale Brown has been acting secretary for the past year or so and Williams will now take up the active work.

E. S. Partridge, formerly Owen Magnetic and Liberty distributer in New York, has become New York branch manager for the American Motors Corp., manufacturers of the American 6.

Allen C. Chambers for three years sales manager of the Russel Motor Axle Co., tendered his resignation Jan. 1. He has announced no future connection.

Dr. F. G. Cottrell has resigned as Director of the United States Bureau of Mines. It has been arranged that H. Foster Bain of California shall succeed him.

Millard S. Binney, formerly advertising manager of the Traffic Motor Truck Co., has joined the Ross-Gould Co., advertising agency, St. Louis.

W. E. Nutting has been made general manager of the Detroit Motor Parts Co., to succeed R. B. Merrill, resigned.

Frank B. Willis has been appointed sales manager of the Duplex Truck Co., Lansing, Mich.

Moline Executives Earn Promotions

MOLINE, ILL., Jan. 3—H. B. Dinneen, general trade manager of the Moline Plow Co., has been placed in charge of the manufacture of farm implements. He went with the company a year ago from the John Deere plow works, of which he then was manager, and the capacity he has displayed in that brief period has brought his promotion. His preliminary experience has given him a thorough knowledge of the field requirements for Moline goods. His place as general trade manager will be taken by F. W. Edlin, who has established a wide reputation among men engaged in the distribution of farm implements.

Louis W. Fuller has been transferred from the drill works at St. Louis to become manager of the plow works in this city.

Liberty Takes Over Cameron Engine Sale

BRIDGEPORT, CONN., Jan. 3—The Cameron air-cooled engine, heretofore marketed by the Cameron Motors Corp., will hereafter be marketed as well as manufactured by the Liberty Mfg. Co., this city. Cameron will continue his identification with the Cameron engine as engineer in charge and also as a director.

A new plant completely equipped for and entirely devoted to engine production has just been completed by Liberty at Stratford, a suburb of Bridgeport. This plant will have a capacity of 30 complete engines per eight hour shift.

INDUSTRIAL NOTES

American Bosch Magneto Corp. expects to ship some 12,000 magnetos in the first two months of 1921. This compares with 40,000 in a single month in 1920. Beginning March 1 the company expects a decided improvement in business. The financial position of the company is good, its total quick assets being four times its liabilities. It is borrowing about $1,000,000.

S. F. Bowser & Co., Inc., Fort Wayne, Ind., did a $9,000,000 business in 1920 and is looking forward to increasing this to $12,000,000 in 1921. One per cent of the 1920 business has been set aside for distribution as a bonus to employees in July.

Cutler-Hammer Mfg. Co. has opened district offices in St. Louis under the management of Harold Phillips, formerly of the engineering department, Chicago.

Dayton Engineering Laboratories Co. has deferred the erection of its new $1,000,000 plant, owing to the present falling off in demand for automotive products.

McKone Tire & Rubber Co. will move its plant from Carrollton to Millersburg, Ohio, where the plant of the Foster Tire & Rubber Co. has been purchased.

Erie Tire Officials Held on Indictments

CLEVELAND, Jan. 4—The Erie county grand jury at Sandusky last week returned indictments for embezzlement against P. F. Wills and C. H. Roth, of Cleveland, both prominent in the affairs of the Erie Tire & Rubber Co.

Wills, president of the company, is charged in the indictment with obtaining $41,886.20 of the funds of the company, and Roth, a former treasurer, is charged with taking $63,593.82 for his personal use. While neither Wills or Roth have made a statement on the matter, it was learned that the indictments were the result of differences between the stockholders, and that both men accused claim to have defences. A stockholders' investigation was started last summer. Prominent in that probe were R. J. Bender, assistant auditor; William H. Briggs, purchasing agent; and H. H. Forest, office executive.

The grand jury charges that Wills took company funds by illegal operations through seventeen banks, and that Roth manipulated stock and other securities owned by the company. The corporation was capitalized some time ago for $4,000,000 and recently the capital was increased to $10,000,000, and extensive plant additions were made. The plant recently was closed for inventory.

OBENBERGER COMMITTEE NAMED

MILWAUKEE, Jan. 4—Roland LeBarre of the Interstate Iron & Steel Co. of Chicago has been appointed chairman of the creditors committee which is in charge of the affairs of the Obenberger Forge Co. An effort will be made to work out a plan under which all creditors will be paid in full and the company can be kept in operation. The assets exceed $1,000,000 and the liabilities are approximately $800,000.

Calendar

SHOWS

Jan. 8-15—New York. National Passenger Car Show, Grand Central Palace. Auspices of N.A.C.C.

Jan. 10-17—Portland, Ore., Annual Automobile Show, Automobile Dealers' Ass'n. Municipal Auditorium, M. O. Wilkins, Mgr.

Jan. 15-22—Philadelphia, Annual Automobile Show, Philadelphia Automobile Trade Ass'n.

Jan. 17-23—Milwaukee. Annual Automobile Show, Milwaukee Automotive Dealers' Ass'n.

Jan. 22-27—San Francisco, Second Annual Pacific Coast Automotive Equipment Exposition, Auditorium.

Jan. 22-29—Baltimore, Annual Automobile Show, Baltimore, Automobile Dealers' Ass'n, 5th Regiment Armory, J. C. O'Brien, Mgr.

Jan. 22-29—Cleveland, Annual Passenger Car Show. Cleveland Mfr's & Dealers' Ass'n, Wigmore Coliseum.

Jan. 22-29—Montreal, Annual Automobile Show, Montreal Automobile Trade Ass'n, Motordrome Bldg.

Jan. 29-Feb. 4 — Chicago, National Passenger Car Show, Coliseum, Auspices of N.A.C.C.

Feb. 5-12—Minneapolis, Annual Automobile Show, Minneapolis Automobile Trade Ass'n.

Feb. 7-12—Columbus, National Tractor Show, Columbus Tractor & Implement Club, Ohio State Fair Grounds.

Feb. 12-19—Hartford, Conn., Annual Automobile Show, Hartford Automobile Dealers Ass'n. Armory, Arthur Fifoot, Mgr.

Feb. 13-19—Kansas City. Annual Automobile Show, Kansas City Motor Car Dealers' Ass'n.

Feb. 14-19—St. Louis, Annual Automobile Show, St. Louis Automobile M'f'rs & Dealers' Ass'n, Robt. E. Lee, Mgr.

Feb. 14-19—Winnipeg, Western Canada Automotive Equipment Show.

Feb. 18-28—San Bernardino, Cal., National Orange Show, Fred M. Renfro, Mgr.

Feb. 19-26—San Francisco, Fifth Annual Pacific Automobile Show, Exposition Auditorium, George Mahlgreen, Mgr.

Feb. 21-26—Louisville, Annual Automobile Show, Louisville Automobile Dealers Ass'n, First Regiment Armory, C. L. Alderson, sec'y.

Feb. 21-26—Salt Lake City, Annual Automobile Show. Intermountain Automotive Trades Ass'n, W. D. Rishal, Mgr.

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April— Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Jan. 22-29 — Colombo, Ceylon Motor Show.

Feb. 7—Delhi, India, Delhi Motor Show.

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

CONVENTIONS

Jan. 11-12—S. A. E. Annual Meeting, New York City.

Feb. 2-4—Chicago, First Annual Meeting, Automotive Electric Service Assn. Hotel La Salle.

May 4-7 — Cleveland, National Foreign Trade Council.

Oct. 12-14, 1921—Chicago, Twenty-Eighth Annual Convention National Implement & Vehicle Ass'n.

Van Sicklen to Sell New Newark Factory

NEWARK, N. J., Jan. 4—Due to the change in the industrial situation, the Van Sicklen Co., a Willys subsidiary, has determined to abandon its plan to build speedometers here in the new plant just completed at 76-84 Warren Street, and will instead continue the manufacture at the present plant at Elgin, Ill.

In keeping with this decision the Newark plant has been offered for sale and negotiations looking to this end are expected to be completed within a few days. The sales price has been fixed at $850,000. C. W. Curtiss, who resigned as general manager of the Splitdorf company to accept the general managership of the Van Sicklen company, will represent the latter in the sale of the building and will then sever his connections. His plans for the future are not announced.

The building is a modern eight-story structure, with a sprinkler system throughout, containing 186,000 sq. ft. of floor space. Much of the machinery for the new building had been contracted for and some of it had been set up. With the change in plans this machinery will be sold for the most part and some of it transferred to the Elgin plant where it will be employed.

N. A. C. C. SURVEYS FARM TRUCKS

NEW YORK, Jan. 4—The motor truck committee of the National Automobile Chamber of Commerce, with the co-operation of departments of agriculture in all States, will make a survey of the use of motor vehicles on farms throughout the country. A questionnaire similar to the one mailed in the recent New York State survey will be used. Seven questions are outlined which aim to discover the needs of individual communities and to ascertain the value of co-operative motor truck lines in specific localities.

Goethals to Advise on Ohio Highways

COLUMBUS, Jan. 3—Governor-elect Harry L. Davis announces that he has wired Major General George W. Goethals, builder of the Panama Canal, and former Quartermaster General of the Army, asking for a conference in Columbus immediately after his inauguration early in January for the purpose of getting advice on the reorganization of the Ohio Highway Department. The reorganization of the Ohio Highway Department has been given a great deal of attention by the incoming governor and which he promised to accomplish during his campaign speeches.

"I am looking for the biggest man I can find to aid me in the reorganization of the Ohio Highway Department, which spends millions of dollars each year on roads," said the Governor-elect. General Goethals will be asked to spend as much time as possible in Ohio while the reorganization is taking place.

NEW CASTLE RUBBER SUED

NEW CASTLE, PA., Jan. 3—An involuntary petition in bankruptcy has been filed by Chicago creditors against the New Castle Rubber Co. Assets are estimated at $1,500,000 and liabilities at $4,500,000.

Tilden to Direct Highway Education

NEW YORK, Jan. 3—C. T. Tilden, professor of engineering mechanics at Yale University, and one of the best known engineering educators in the United States, has been named director of the work of the Highway and Highway Transport Education Committee with headquarters at Washington. He will take up his duties at once and will formulate a comprehensive program for courses in highway and highway transport education.

Professor Tilden was called to Yale from Johns Hopkins a year ago to undertake the reorganization of the engineering courses at Yale. The importance of his present task may be gaged from the fact that the Yale authorities were ready to grant him a year's leave of absence in order to lay out the program of work for the new organization.

Professor Tilden is the author of a number of technical and historical papers on engineering, one of the most interesting, perhaps, being that on "Kinetic Effects of Crowds." He has also held positions as consulting engineer, being attached to the staff of the Bureau of Public Roads and the Emergency Fleet Corp. in that capacity.

The Highway and Highway Transport Education Committee is the outgrowth of a conference on these subjects held in Washington last May.

U. S. LIGHT CUTS BATTERY

NIAGARA FALLS, N. Y., Jan. 3—United States Light & Heat Corp. has reduced prices on its batteries from 20 to 25 per cent, effective at once.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

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Novelties Not Abundant at New York Show

Effect of recent depression not yet reflected in passenger car design. Most models shown are similar to those exhibited last year, but brighter colors add attractiveness. Some new chassis and engines have features and refinements which are described here.

ANY results that the motor car depression of the last seven months may eventually have on vehicle design has not yet become apparent in the exhibit of the eighty-nine makes of vehicles at the twenty-first national show of the National Automobile Chamber of Commerce now running for the week in Grand Central Palace. Engineering departments may be working overtime in factories on designs that admit of more economical manufacturing and that will give improved performance due to light weight, better use of fuel, etc., but these are not at the show, excepting in a few instances where changes in manufacturing programs were decided upon a year ago and the new products are not a direct result of the trend of events in the last few months.

As a show it parallels rather closely in character and quality that of a year ago, there being 307 exhibitors a year ago and the same number this week. It is not the biggest show in history as 1913 recorded 424 exhibitors. It was not to be expected that many new designs would be on hand as the unsatisfied demand that continued up to last June was not conducive to the production of new designs.

The show carries external evidences of many concerns adding merchandising features not so prominent in former years, particularly with models that are not in greatest demand. On touring cars and roadsters the show contains more specially painted jobs. Glass wings on windshields are added merchandising talks. On most of the fifty-six cars fitted with disk wheels the equipment is a sales argument rather than an indication of stock equipment. Disk wheels have not yet reached this status in stock equipment.

On the other hand the exhibit of but thirty-eight polished chassis falls behind the record of former years, yet the attention that these constantly receive must be accepted as an indication of the interest if not the sales value of such an exhibit. Relatively new chassis, such as LaFayette, Lincoln and Pierce-Arrow are magnetic centers. The sales value of a good chassis cannot be overlooked and it might be injected as a show criticism that manufacturers could to advantage continue the chassis exhibit and add to the merchandising value of the show space. The show should be used as one factor in bringing about the disintegration of a buyers' strike. Every merchandising feature needs to be used to the maximum. The Marmon exhibit of miniatures made to one-quarter size is one example of a good merchandising thought.

As indicating a trend of design the fact that the number of four-cylinder cars has been increased by fifteen, and six-cylinders reduced by ten, suggests the increasing utility aspect of the industry. There are no so-called engineering avalanches at the show, no

influx of fours, sixes, eights or twelves. There is no trend toward a greater use of multi-cylinder jobs, rather a stationary situation excepting for a slight movement toward fours. The question of cylinders is more an engineering one rather than a merchandising one. The time when a maker changed from a four to a six, or from a six to an eight to get into a certain market has little echo in the present show.

The criticism that reached America from the recent Olympia show in London to the effect that our touring cars were sorely criticized both from style and comfort viewpoints might be taken to heart to advantage. Too many cooks spoil the broth, and frequently factory heads quite ignorant of the fundamentals of body design have a major say in it. The fact that the body design does not make a good engine worse or a poor engine better permits of someone dictating a design who would not dare to interfere in the design of an engine, or transmission system. Fools step in where angels fear to tread. It is not surprising that there are body designs that are not a credit to the manufacturer. There is indication of a trend away from the present straight edge body style to the rounded edge. The straight edge job calls for more art in handling than the rounded edge. It is easier to work with curves than straight lines. The return to the curved lines is being forced on body engineers because the straight edge job has been so poorly done in too many cases. A good body engineer can accomplish a most satisfactory result with either, but the amateur cannot.

There can be no doubt but that the demands of production in the last five years carried a penalty of sombre colors. The present buyers' market is bringing out the nickeled radiator, which not only adds distinction but is certain to receive more attention. There are more of these in the show than there has been for many years. They are meeting with a favorable response.

The Combination Body

The combination summer and winter body is not a strong factor, the exhibit of eighty different models of sedans indicating the necessary demand for these and the exhibit of not more than half a dozen so-called all-year bodies indicating how unsettled is that design. The so-called California top with its permanent overhead portion and removable tops for the doors and removable sides is not in great numbers, the added cost of approximately $500 involving a fairly high sales resistance. There is an unmistakable feeling that there should be a lower price for an all-year car.

With roadsters a commendable advance is dropping the folding rear seat, which so often was more of a talking point than a feasible design, and making worth while baggage carrying compartments in the rear. There are a few roadsters with ample space for suit cases, coats, golf clubs and robes. There is a broader field for the roadster if it is made more complete in these regards.

A point to be guarded against in winter tops as well as closed designs is the blind spot at the end of the windshield. The glass windshield wings on a few cars have an extra amount of attaching parts which constitute a blind spot. One or two examples of winter tops have front side curtains that are bad offenders and their use certainly courts accidents in city driving in stormy weather.

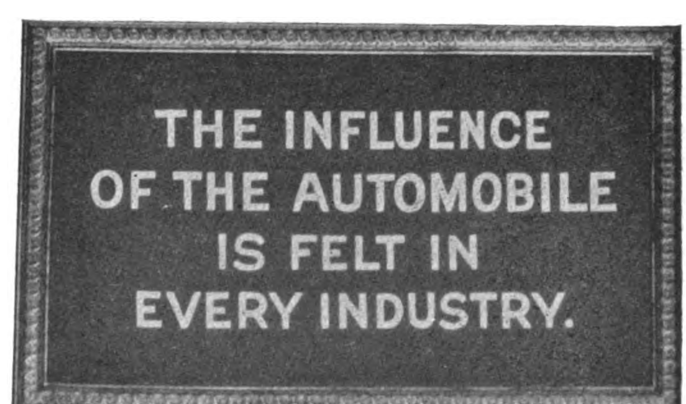
The road wheel is still an unsettled feature in the industry, not so much whether artillery, wire or disk types dominate, but rather the question of peripheral weight. Europe never has agreed with us in the heavy demountable rim and the handicap it places not only on the acceleration but deceleration. The demountable rim was a first essential until the cord tire has to such an extent eliminated tire changes. The demountable wheel has reduced peripheral weight, but it has largely been confined to wire and disk types. Not a few engineers are seriously considering whether or not the penalty of the demountable rim is a too heavy one to-day. In appearance the demountable rim never has been attractive and some of the wheels at the show are really eyesores. Disk wheels are still too expensive.

Leaving off the runningboard and using front and rear steps is more general than heretofore, but this again is to be interpreted as an easy step to a merchandising talk. Some of the steps are veritable wash basins and look the part, while others are fashioned more after carriage art, and unquestionably add a note of smartness. There is a possible danger factor where the steps are too large and have suspicious looking sharp edges that might injure a passing pedestrian.

The Salesmanship

Coming, as the show does, at a time when every sales inquiry should be made the best of, one criticism must be made, namely, the regrettable lack of full information on the part of the salesman in the exhibit booths. These salesmen should know the meritorious parts of the car, but too often they do not. Too often they cannot point out the good production features. Too often they are ignorant of the good maintenance points. Wheelbase, tire sizes, number of cylinders and number of speeds are not enough. The average show visitor who is looking over the cars with buying in mind should be given all the information desired.

The psychology of the salesman in the exhibit booth is too frequently almost negative. In a few stands the apparent rôle was to approach everybody before they reached the car or chassis and ask what point of the car they were interested in. That is not good psychology, as many were observed who wanted to shop around and it was quickly noted that too insistent attention of the salesman was resented. The analytical salesman does not thrust himself on the prospect but rather studies him, notes what part of the car or chassis he is interested in and then studies the exact moment when his assistance is needed and is ready at that second. The salesman should realize that the show visitor who pays his 75 cents for the privilege of attending the show to see the cars has a certain privilege in each exhibit space. The spaces are the display windows of the show. Give the visitor his free right to use them. The old question of "Are you interested in cars?" is not heard, but there is need for better show salesmanship, for studying the visitor and endeavoring to assist him and not interfering with him.



One of the slogans at the New York show

Engines Exhibited at New York Show

By P. M. Heldt

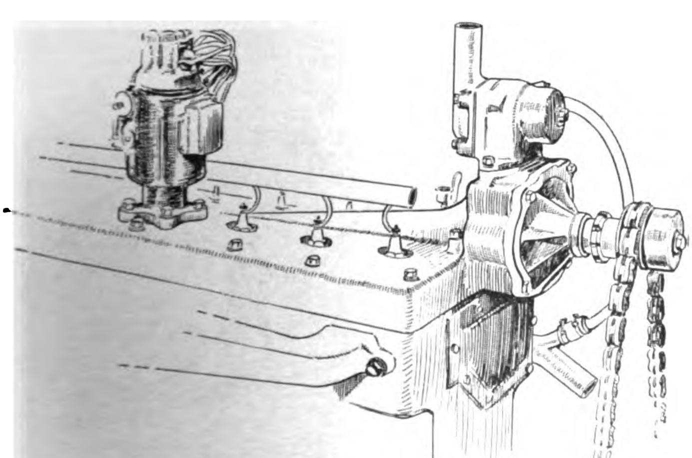
CONTRARY to expectation there are no surprises at the automobile show this year; that is, entirely new models of which announcement was withheld until the show opening. Of cars which are exhibited this year for the first time there is a fair number. There are first of all the Packard single six, already fully described in these columns, and the new Pierce-Arrow car which will be the only passenger chassis model of the Pierce-Arrow company the coming year. There are two newcomers in the eight-cylinder class, the Lafayette and Lincoln. The Fergus, while not an entirely new design, shows many changes as compared with last year's model. In the medium priced class there is, first of all, the new Lexington model equipped with the new Ansted engine, which was specially designed for operation at high speed and which embodies a new idea in valve actuating mechanism. There is also a new Oldsmobile, a four, but its engine presents such striking family resemblance to certain other products of the General Motors Corp. that to one in search of novelties in engine and accessories the design is somewhat disappointing.

Leaving the show proper for a few moments and visiting some of the nearby hotels whose lobbies have been converted into show rooms for the week, we find some of the most striking novelties. This is not at all surprising when it is considered that at the show members of the N. A. C. C. receive first consideration and applicants for space are accommodated in the order of their last year's production; hence the oldest and the largest manufacturers are represented at the Palace while the smaller and newer concerns have space at the hotels, and as conservatism generally grows with age and volume of production it is only natural that the most radical models are seen at the hotels. This applies to such cars as the Ace, the Parenti and the German Sauer. Then there is another class of new cars at the hotels, designed along conservative yet up-to-date lines, such as the Navarre and Ferris, which will probably be built on a moderate scale mainly for use as closed cars.

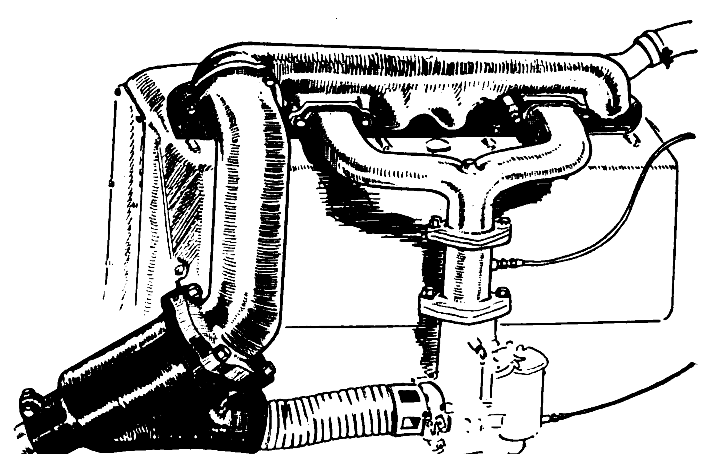
After this brief outline of the outstanding novelties, we may pass to a consideration of engineering features in connection with engines and engine appurtenances exhibited by cars at the show and especially those shown in chassis form. It may be mentioned that some of the leading firms, notably the Hudson and Marmon companies, do not exhibit a show chassis this year. Whether the reason is a desire to save the cost of a sectioned and highly polished show chassis—which is by no means small—or whether it is believed that the available space can be utilized to better advantage by exhibiting a full line of the models offered, is a question, but it is most likely that the last mentioned reason is the real one, for to judge by rumors of the cost of the models exhibited at the Marmon stand economy was not an important consideration in the preparation of that exhibit.

In its new single six the Packard Motor Car Co. has struck a new note with respect to location of engine accessories. With the constant increase in the number of these accessories their arrangement has become somewhat of a problem. When placed on the sides of the engine between the crankcase and the frame they not only interfere with access to the engine but often are hard to get at themselves. In the new Packard the ignition unit is placed centrally on top of the engine and the pump, which is of the water circulation type, together with the fan and thermostat form a unit also located high up in front, so that there are few auxiliaries on the sides of the engine. The control rods from the ignition unit and carbureter are, moreover, very neatly arranged, running substantially parallel with the engine axis, which makes them unobtrusive and gives a clean cut engine layout.

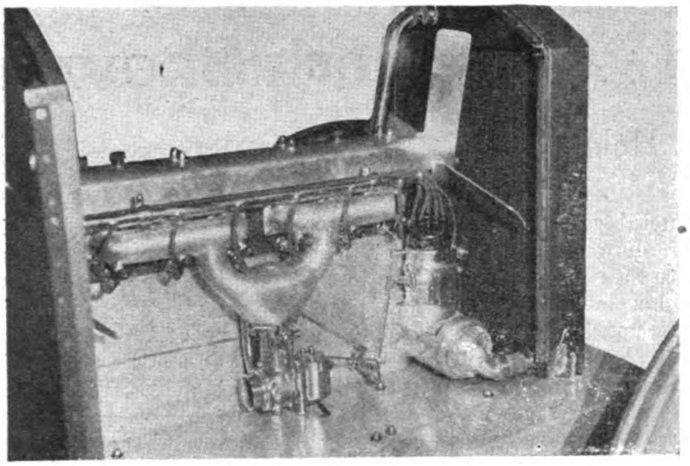
In respect to control rod connections many designers still have much to learn. In a great many cars either the carbureter or the ignition unit is located on the opposite side of the engine from the steering gear, and this requires running the control linkage around—or through—the engine. Now that an interconnection between the throttle valve and the pressure relief valve on the lubricating system is provided on many cars, this linkage has become even more complicated than formerly. On one car no less than eleven ball joints were counted, and as these were of the type in which the socket is spun over, which usually gets very loose after two or three years' service, such cars naturally age very rapidly. Of course, it is not a great expense for the owner to put in a complete new set of these ball and socket joints, but the average owner will not take the trouble, though the rattle will annoy him.



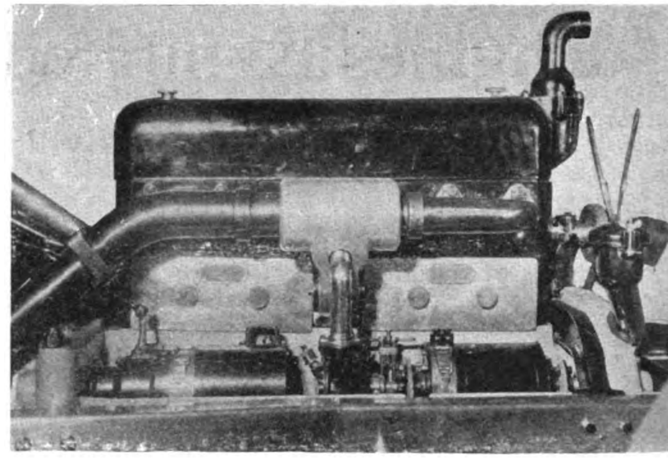
Packard places accessories above rather than at the sides of the engine



On the Roamer the exhaust pipe runs conveniently near the carbureter for a hot-air connection



Left-hand side of Fergus engine



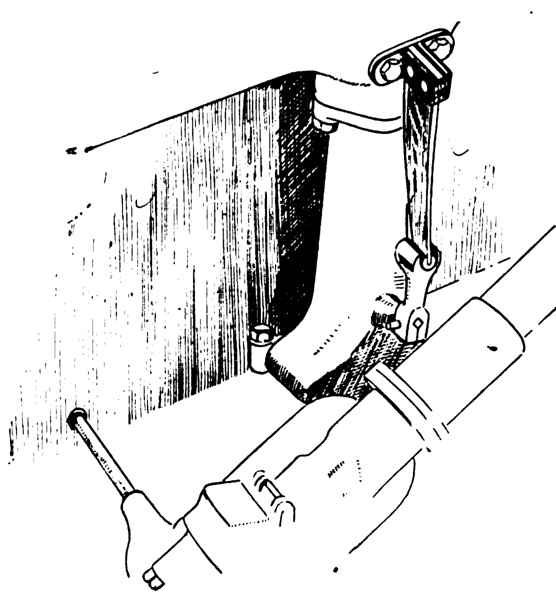
Exhaust side of Pierce-Arrow engine

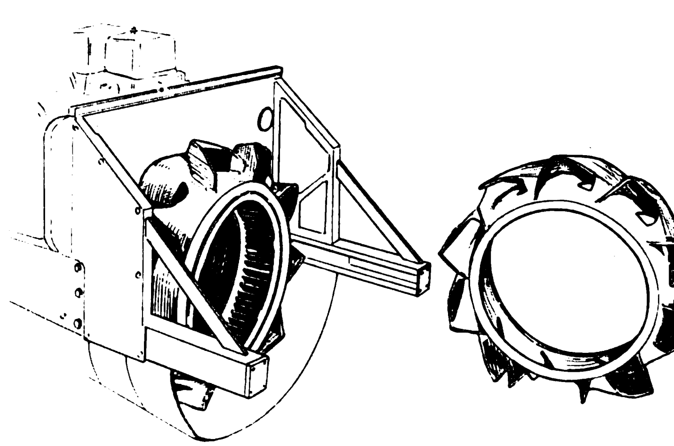
Where connections have to be made from the steering gear on one side to auxiliaries on the opposite side of the engine it is often a good plan to carry a control shaft right through the engine, either through the crankcase or the cylinder block. Such an arrangement is now found on quite a number of cars, notably the Templar. Whatever exposed linkages there are should be arranged in a neat manner, the individual links preferably in the three main planes. The Italians are pastmasters in the art of neat design, but Mr. Ferguson in the Fergus car has shown that the Latin race has no monopoly on the ability to produce simple looking and attractive layouts.

Whenever there appears some simple improvement whose advantages are obvious, it is remarkable how quickly it is taken up by designers generally. It is now hardly a year ago that attention was first called to the practice of providing oil cocks with extension handles so that they can be reached without getting down under the chassis, yet at the show these extension handles are found on many cars. There seems to be a tendency to discard the float type of oil gage. In the new Pierce-Arrow, for instance, the oil sump is provided with two try cocks whose stems extend up through the continuous web of the crankcase into a position where they can be easily reached. As there is no sod pan, the cocks can be easily seen, and as they extend straight out from the side of the oil pan they can be easily cleaned if they become clogged with dirt. No doubt this method of determining the oil level in the case, while ordinarily not as exact as the float indicator, is on the whole more reliable. It was noticed that the bayonet type of oil gage, which heretofore has been used almost exclusively on truck engines, is rapidly coming into use also on passenger car engines, particularly those of the less expensive type.

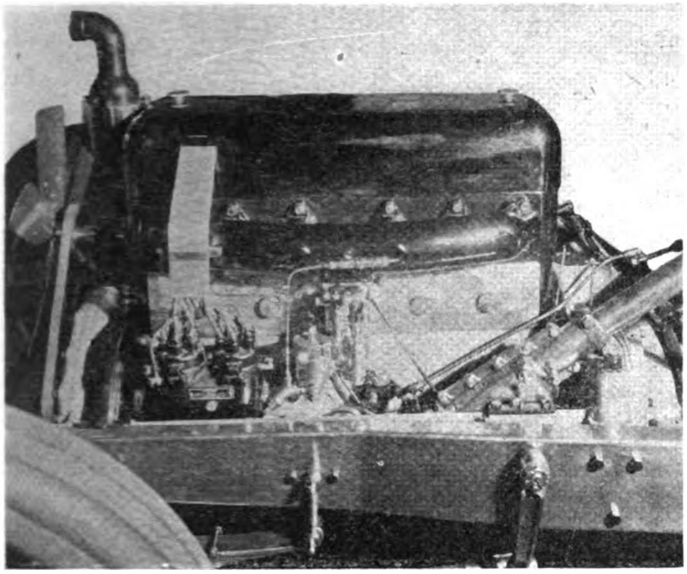
Valve enclosure came first in connection with L-head engines. Several years later makers of T-head engines found that in order to hold their own they also would have to enclose the valves, though, since valve chambers had to be provided on both sides of the engine, this involved a greater increase in weight than in the L-head type. The valve-in-head type with tappet rods extending up one side of the engine resisted longest the general tendency to enclose all working parts, but finally the hour of the exposed long tappet rod has struck too. In certain engines, such as the Weidely, the tappet rods extend up through a chamber whose walls are cast integral with the cylinder block which gives generally the neatest construction, but most designers cannot convince themselves that the very considerable increase in weight necessitated by this construction is warranted. In the Dorris the rods are enclosed individually in tubes extending between the crankcase and an overhanging portion of the head. This, of course, hides the moving parts, but it does not give that simplicity of outward form which is the aim of many designers. On the Buick and several other cars sheet metal covers are secured over the side of the engine on which the tappet rods are located. In the Buick the cylinder block is cast with offsets or steps along the vertical center line at both ends, against which the metal cover fits.

The bell housing construction is constantly coming into

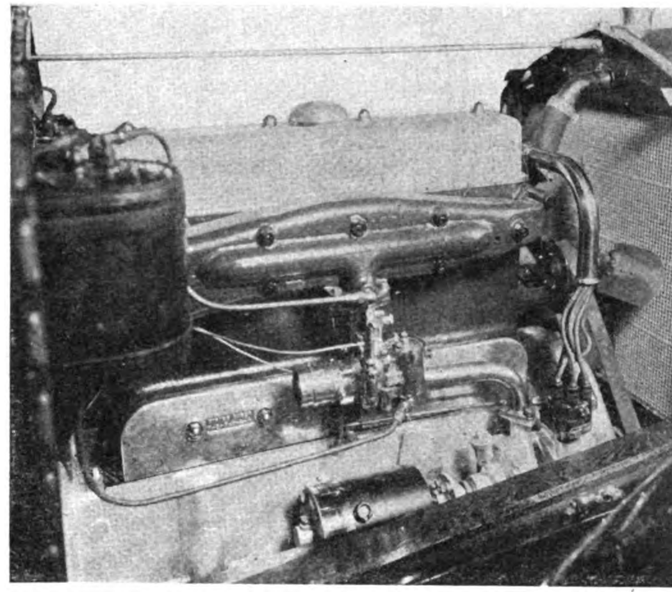




To the left—Thermostat on Fergus car for controlling exhaust heat. Above—Aeroduct casting over Sirocco fan on Holmes engine



Inlet side of Pierce-Arrow engine

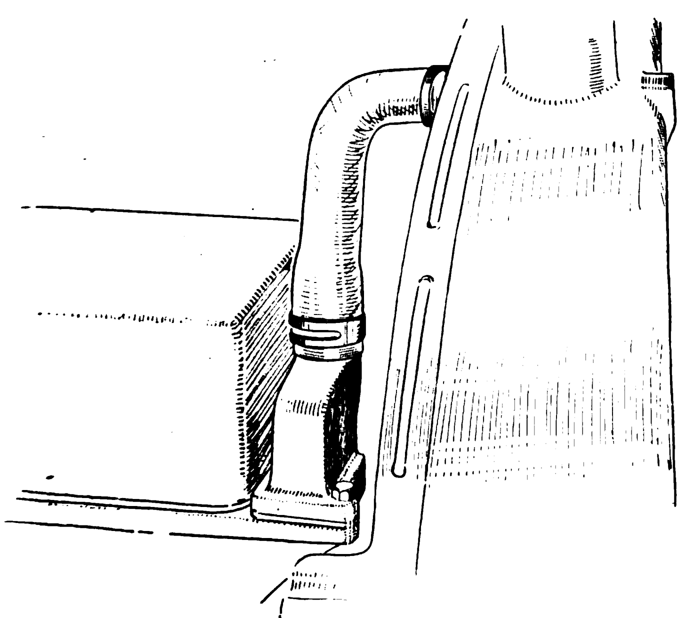


Valve side of Northway engine

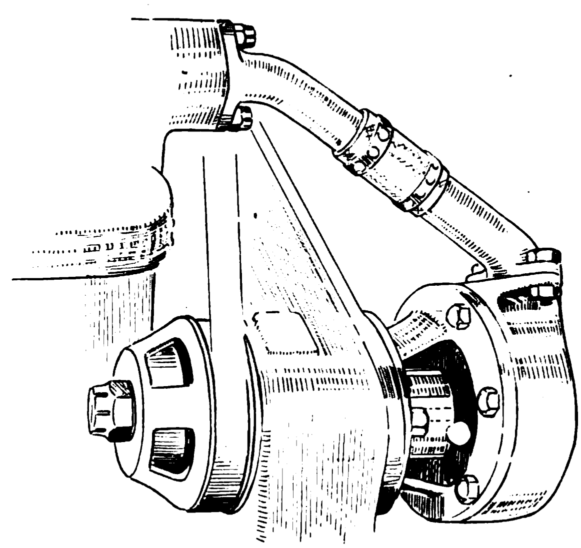
more general use, among those who have adopted it recently being the Pierce-Arrow Motor Car Co. Although the Pierce retains the separate transmission amidships, it now has an enclosed flywheel and clutch, and this has eliminated the characteristic Pierce engine suspension by means of two drop forged carriers. At the front the drop forged carrier is retained, but at the rear integral arms extend from the bell housing and rest upon lugs riveted to the frame, the holding down bolts passing through the arms and lugs being provided with coiled springs under their nuts to provide flexibility.

In reports of the European shows this year attention was called to the growing popularity of continuous webs between the engine crankcase and the chassis frame, and the same tendency is observable here. The sheet metal underpan is always more or less of a nuisance, because of the amount of dirt it will collect and because in some cases when parts or tools drop into it they are hard to get out again. Besides, it slightly reduces the road clearance and without it the engine can be set correspondingly lower, which makes for a lower center of gravity. Practically all of the new high grade cars with vertical engines have continuous webs, and where they are not cast integral with the crankcase, filler plates are sometimes bolted between the crankcase and the frame, as in the Fergus.

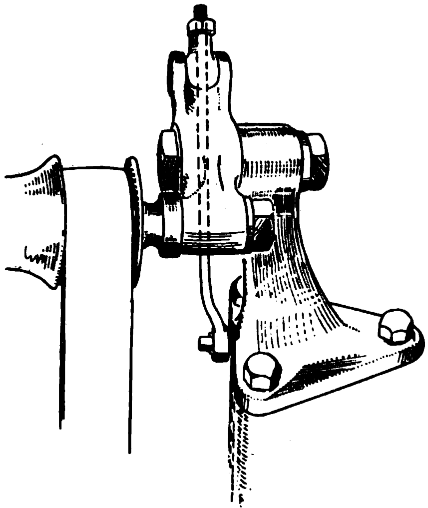
When an overhead valve engine has a cover over the valves, something of a problem is presented by the water outlet from the engine jacket. As such covers have been applied only during the last year or two the problem is a relatively new one, and this is reflected by the variety of solutions worked out. In the Stephens six-cylinder engine, which is related to the Moline tractor engine, the valve cover is jacketed and the outlet header or manifold is cast integral with the cover. One explanation of this design is undoubtedly that in a tractor engine, which works constantly very close to full capacity, the valves and their adjacent parts get very hot, and jacketing the cover undoubtedly tends to keep them cool. In the Buick there are two small indentations of the cover on one side where the water return manifold bolts to the cylinder head. In the



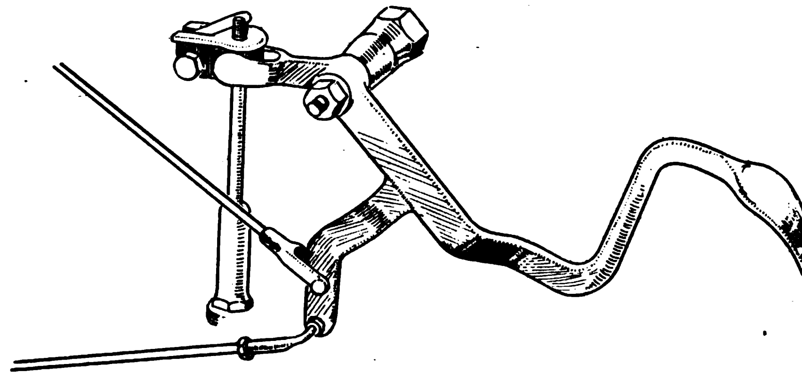
On the National overhead valve engine the water outlet from the head is through a forward extension of the head casting



On the Du Pont the fan pulley is behind the gear case and the water pump in front of the casing on the same shaft



Positive fan adjustment on Templar

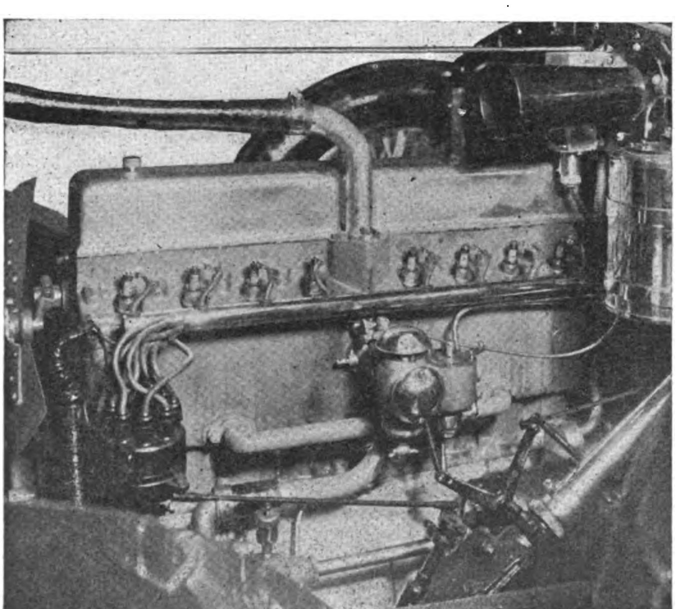


Stearns accelerator pedal has several crooks, but its connections are simple

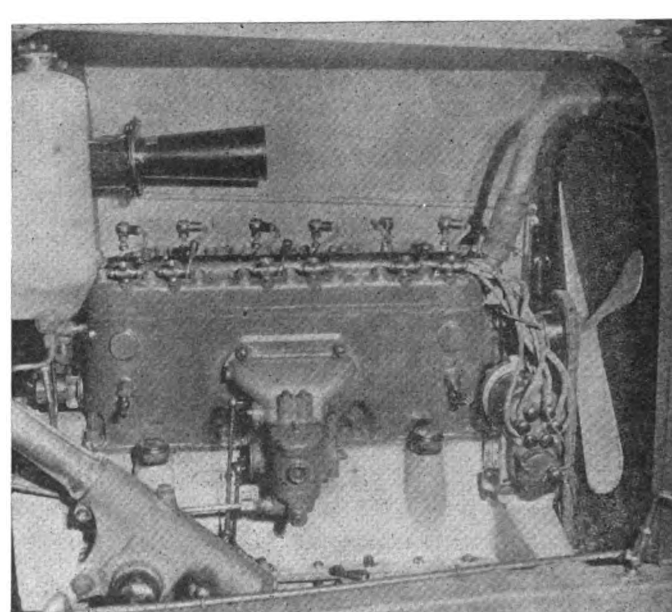
Scripps-Booth the outlet from the cylinder head is under the valve cover and the water is led through a pipe fitting secured into the side of the cover at the middle of its length. On the National and several other engines the head casting is slightly extended at the front, beyond the reach of the valve cover, and the water return pipe bolts to this extension. This latter solution is undoubtedly the simplest and neatest, and the only reason for some of the others probably is that the cylinder head castings were already in existence when the problem of covering the valves arose.

While on the subject of water connections mention may be made of some expedients resorted to in order to get uniform distribution of flow and consequently uniform cooling action. In most cases the pump is mounted near the front of the engine, which makes it most convenient to have the water inlet near the front, and the outlet from the cylinder jacket to the radiator also comes most naturally either at the middle of the head or some point forward thereof. Consequently there is danger of sluggish circulation in the rear jackets, and as it is the hottest cylinder that causes trouble from knocking and faulty lubrication, it is important to take precautions against this eventuality. In the Du Pont car, in which the pump is located in front of the engine and driven from a forward extension of the accessories shaft, the water inlet connection to the cylinder block is made at the front end but a pipe extends through the jacket to the rear, and as the outlet is also at the front the water is compelled to flow through the entire length of the jacket. The somewhat similar arrangement on the aluminum engine of the Premier car is well known and is shown to good advantage in a cut-away model at the Grand Central Palace. On the engine of the six-cylinder Kissel car, on the other hand, where the pump is located at the side of the engine forward, the inlet pipe is run along the side of the cylinder block and the water enters the jacket at the rear.

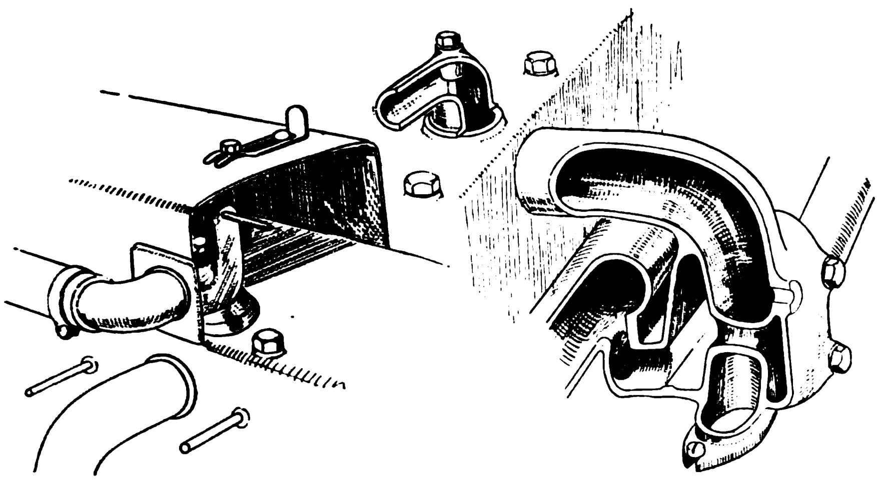
Where the inlet manifolds are jacketed it makes for simplicity and neatness if the inlet to and outlet from the jacket are through ports alongside of the main inlet ports of the manifold. In the new Pierce-Arrow, water from the engine cooling system enters the jacket in this way, and in the Lafayette, exhaust gas. In connection with manifolds it seems to be a good plan to hold them in place by means of studs whose nuts are outside the plane of the manifolds, as such nuts can be screwed in place and removed much



Carbureter side of engine on Kenworthy car



Carbureter side of engine on Fiat car



On the left is sketched the water outlet from the cylinder head of the Scripps-Booth and on the right the sectional inlet and exhaust manifolds of the Oakland

more conveniently than nuts passing through lugs or ears cast on the manifold and lying close up against the cylinder block. Moreover, if the nuts press on clamping pieces or bridges between sections of the inlet and exhaust manifolds, as in the Scripps-Booth (Northway engine), they will not get so hot and are not so apt to rust tight as if bearing directly against a part of the manifold. On the Fergus engine the exhaust manifold is held in place by five studs passing through cast-on bosses the whole depth of the manifold, thus bringing the nuts into accessible positions.

Although the hot spot and exhaust jacketed manifolds are constantly gaining in favor there are still many engines which merely preheat the air before it enters the carbureter and do not apply any exhaust heat to the mixture after it is formed. In some designs the flexible pipe connection between the hot air stove on one side and the carbureter on the other side is inordinately conspicuous. In the new Pierce the hot air is carried right through the cylinder block between cylinders Nos. 3 and 4, and in the Roamer, using the Duesenberg engine, the connection is short and direct, as shown by the sketch herewith, the exhaust and inlet being on the same side of the engine as the carbureter.

At each show in recent years—and the present one is no exception—there have been exhibitors who in the course of the year had changed from splash to force feed lubrication. With this change often goes the adoption of oil pressure control in proportion to throttle opening. This method of lubrication control is in use on the Chalmers and Liberty, the Kissel and Stearns among others. On the Stearns car the linkage from the accelerator-pedal and throttle lever rod to the throttle valve and oil pressure relief valve is particularly neat, and is sketched herewith.

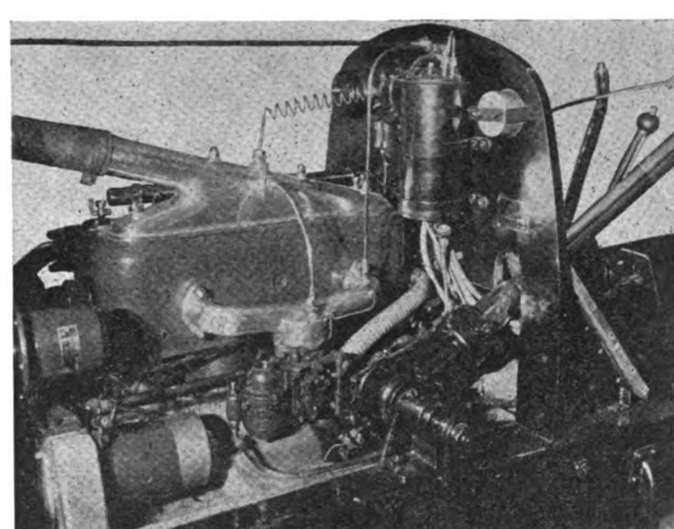
Restriction of the outlet passage from the engine space has long been a cause of poor cooling of engines, or, perhaps, it would be more correct to say that this was formerly a frequent cause of poor cooling, because the fault has often been pointed out and has been remedied on most water cooled cars. One of the improvements in the Holmes air cooled car aims at eliminating this fault. This car has a centrifugal type of fan, forming the flywheel, and as the outlet from this fan is in a radial direction and the space between it and the mud pan and other parts of the enclosure is restricted the circulation of the air has been greatly hampered. By installing what is called an aeroduct (see sketch) the rate of air circulation at any given engine speed is said to have been practically doubled. This device consists merely of an aluminum casting surrounding the fan flywheel on its circumference, in which are formed a series of air passages which gradually change the direction of the air from perpendicular to parallel the car axis. Holmes has also done away with the rather intricate valve mechanism formerly employed and now uses a plain tappet and rocker motion.

It was noticed that on the high grade cars the use of steel pressings for the oil pan, gear cover and such parts is scrupulously avoided. From a strictly practical standpoint pressed steel would seem to be as good as aluminum, as the constant pressure of oil will keep it from rusting, and if there is any difference in weight in favor of aluminum it must be very slight. Aluminum, however, looks better.

A feature of interest from a maintenance standpoint was observed on the Mitchell six-cylinder engine, in the form of an eye bolt in the cylinder head casting by which it can be easily removed when necessary. Although this feature is not new with the Mitchell, it does not seem to have been copied so far. The nearest approach to it in other engines noticed by the writer is in the form of overhanging lugs at the ends of the head casting which afford a grip when the head is to be removed.

The Oldsmobile eight has the generator mounted centrally in front and driven by belt, the fan being mounted on an extension of the armature shaft. This is similar to the construction used on the Nash. Belt drive of the generator was also noticed on one other car where the fan was not combined with the generator. While there is some objection to a non-positive drive of the generator it must be remembered that the power consumption of the latter is much less than that of the average fan. The average generator delivers not over 20 amperes at about 7 volts, which is equal to 140 watts, and at 50 per cent generator efficiency the power required to drive the generator is only slightly more than one-third of a horsepower.

Quite a few designers now place the driving pulley for the fan belt on the accessories drive shaft *behind* the gear housing. This has the advantage that it eliminates one shaft outlet from the gear housing and one chance for oil leakage. Thermostats are finding additional applications on automobile engines. Thus on the Fergus engine there are two serving novel purposes. One is in the form of an aluminum rod inside the hollow overhead camshaft, which,



Left-hand side of engine on new Du Pont car

as it expands from the growing heat of the engine, engages the friction clutch by which the fan is driven from the camshaft. When the engine is cold the fan does not rotate, or at least not at any speed. The other thermostat, which is of the compound metal strip type, extends down the side of the exhaust pipe and controls the opening of the exhaust bypass through the inlet manifold jacket.

In a class by itself is the small Fiat car which has an engine of probably not much over $2\frac{1}{2}$ in. bore. This, of course, is a car designed for economical operation, and as low first cost should go with low running expense, some of the features found in the larger Fiats have been eliminated. Thus the fuel, instead of being carried in a rear tank from which there is pressure feed to the carbureter, is contained in a flat tank on the forward side of the dash. With the low consumption of these small engined cars a sufficient supply can be carried in this way, especially since the dashboard and the radiator opposite it are very large as compared with the diminutive engine.

Fan tension adjusting means are sometimes a weak point. If the cranked support is used and adjustment made by swinging the crank around its stud and then clamping it on same, the tension often loosens quickly owing to irregularities, such as a heavy lap joint, in the belt. In the Templar, although the fan is supported by a crank, adjustment is made by a positive device in the form of a pullrod with nut, as shown by the accompanying sketch.

On the Navarre, which is a new car built in Springfield, Mass., an outside water inlet connection to the cylinder is eliminated by bolting the pump up against a water passage in the crankcase which communicates with a vertical passage through the cylinder block. This vertical water passage is at the middle of the length of the engine.

Refinements in Chassis Construction

By J. Edward Schipper

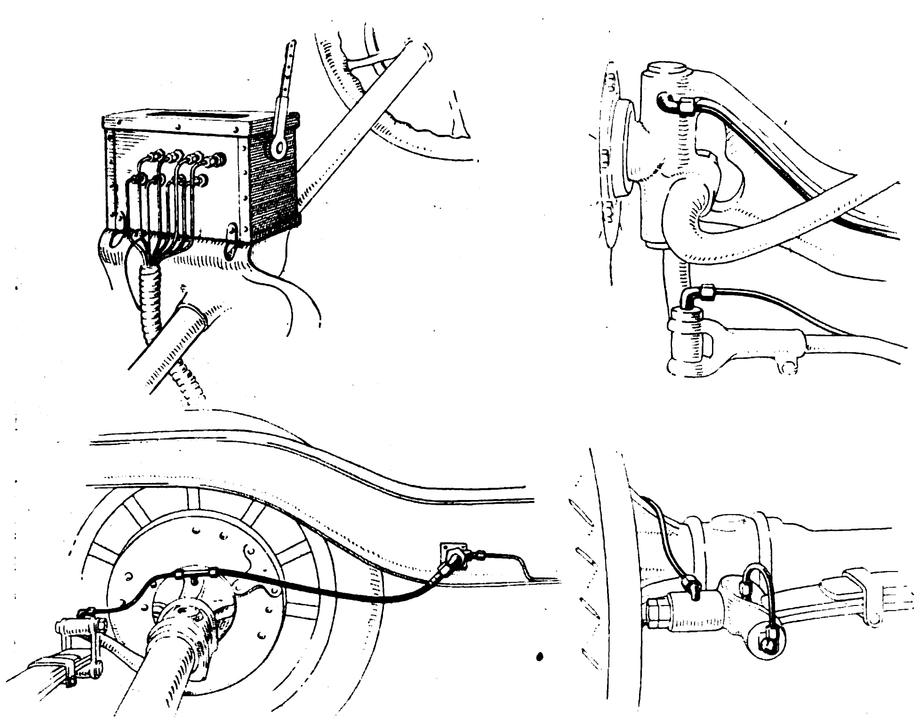
HIGH lights in the development of chassis design as indicated by the show exhibits are improved chassis lubrication, greater simplicity, rattle elimination, lightness, increased strength due to the better disposition of materials and greater accessibility of adjustment.

Taken generally, engineers visiting the show are impressed with the cleaner and neater appearance of chassis, particularly in the lower and medium priced field. It is noticeable that a few of the newer cars in the very high-priced field have almost the same simplicity as the lower priced cars, but being larger and heavier are not so prone to use the Hotchkiss drive and consequently employ torque members which serve to make the chassis seem of a little more complicated construction.

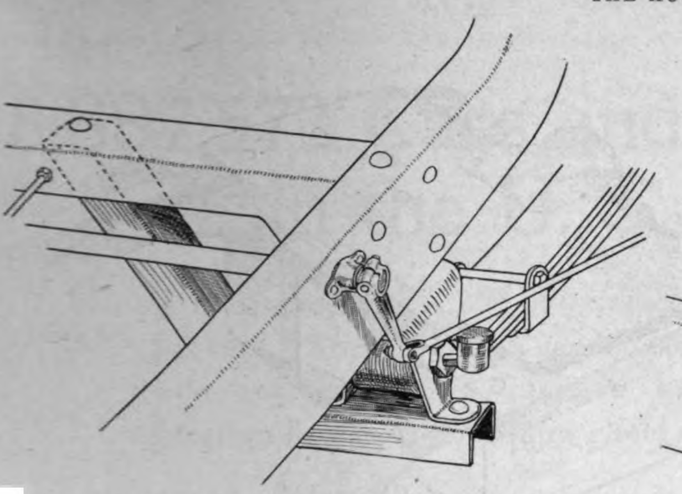
There is a very laudable effort throughout to clean up the details and lighten the chassis. This is being accomplished generally in one of two ways, either through the use of very neat drop forgings or by making a part which formerly served one purpose perform the work of two. In many instances these two ideas are combined and a drop forging is made which perhaps acts both to support the gasoline tank and the spare tire or perform some other dual service, thus saving weight.

The outstanding feature of chassis development, however, is the effort toward the simplification of chassis lubrication from the owner's standpoint. There is not a manufacturer who does not realize that vigorous steps are necessary on this part of chassis design to bring it up to a par with other parts of the car. The result is that on practically every chassis at the show some improvement in this respect is noticeable. There are probably fifty or more makes of cars shown with the Alemite system, a great many having adopted this oil-gun method during the year. The Saxon car is shown with the Romon automatic chassis lubricator as standard equipment.

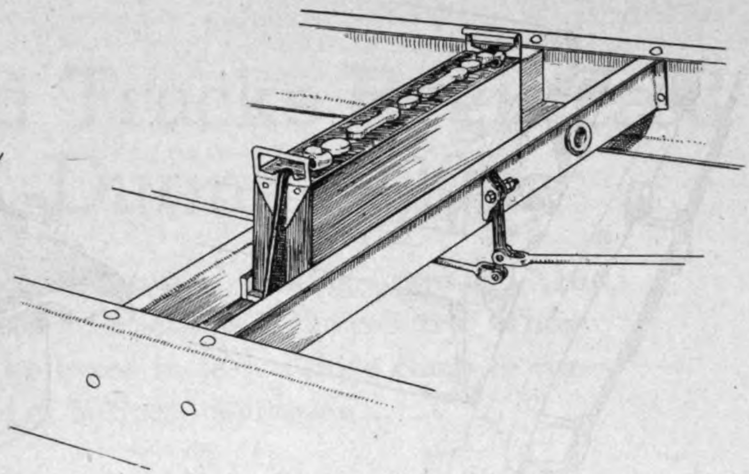
This system provides centralized lubrication for the entire chassis. In the Saxon installation the box-like reservoir is mounted on the steering column just behind the dash. The device is operated by periodically (about once every 500 miles) rocking a lever which works on a ratchet rotating the camshafts inside the reservoir. These in turn drive a series of pumps which are connected to the copper leads which run to all parts of the chassis. The pumps are plunger type and are depressed by the cams and return to normal position by means of springs. The oil is forced against a ball check in the intake and through a delivery passage into oil lines leading to the various points on the chassis which require lubrication. Ball checks are also located at these points so that the oil forced to these points remains there and also remains in the line between the reservoir and the bearings,



Romon chassis lubrication system on Saxon car and installation details



Unusual construction of spring bracket on Cleveland car



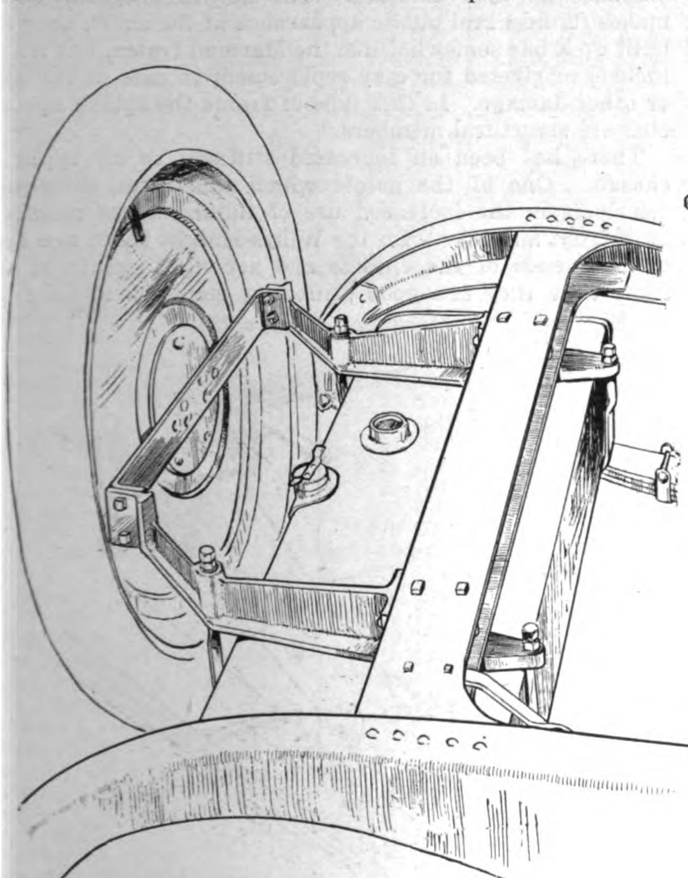
Cross member of frame serves as battery carrier on Briscoe

insuring immediate movement of the oil on operation of the pump.

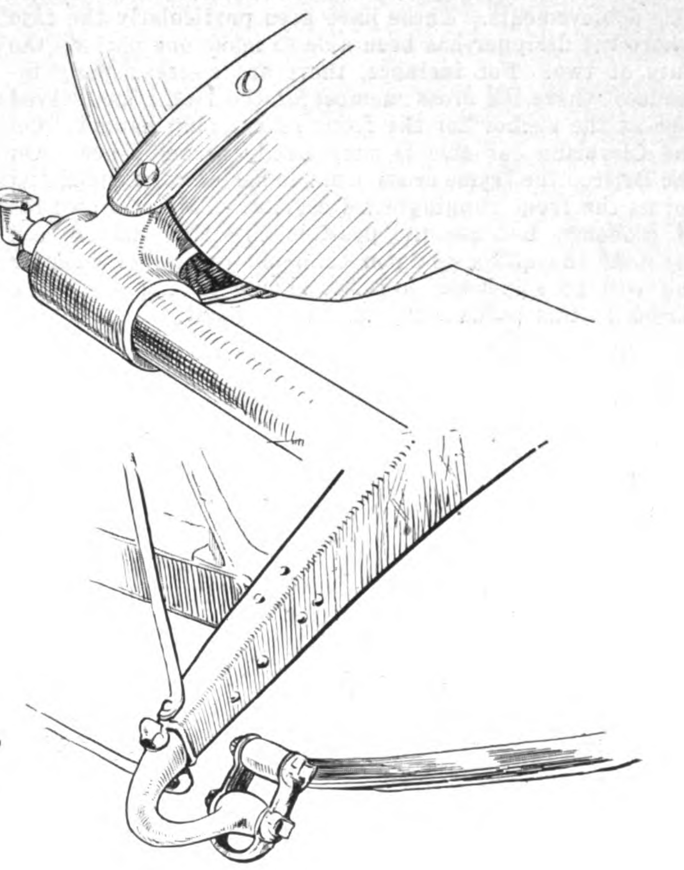
To take care of the various steering, spring and axle points a number of fittings of a standard character are employed. The system displaces all the grease and oil cups on the chassis, the oil being lead direct to these points by the copper tubing and by flexible tubing connections to parts which have motion relative to the chassis frame. There are also special swivel connections at necessary points so that none of the tubing is under stress due to the oscillation of the springs, movement of the steering gear, etc.

The Fergus cars, with the centralized lubrication scheme, familiar to readers of AUTOMOTIVE INDUSTRIES, was also on exhibit and furnished another example in which a manufacturer has made the effort to eliminate the troublesome and often neglected task of chassis lubrication. This centralized tank takes care of the system by gravity, the flow of oil being from a tank which the makers state requires filling but once in every six months. On this car the springs are covered with leather boots and are oiled from the central system.

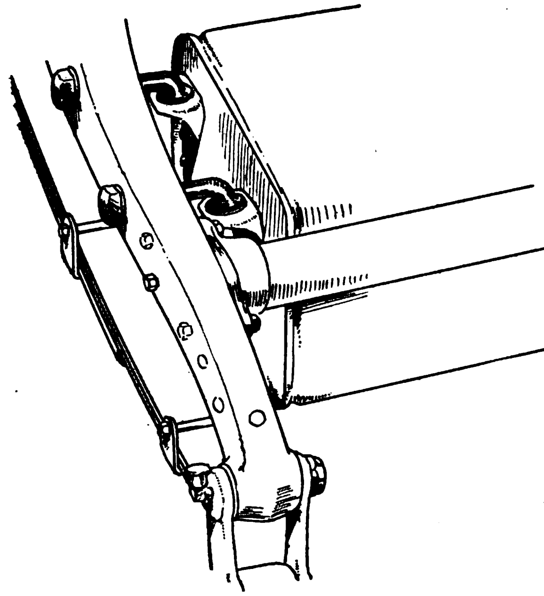
While the above mentioned cars offer some good examples of the solution of the chassis lubrication problem, there are some bad examples which may be justly criticized. There are some grease and oil cups still located at points where it is doubtful if even a vigilant owner would find them. After he had found them he would have to disregard the necessity of soiling his clothing and suffering great inconvenience in order to get the lubricant to the



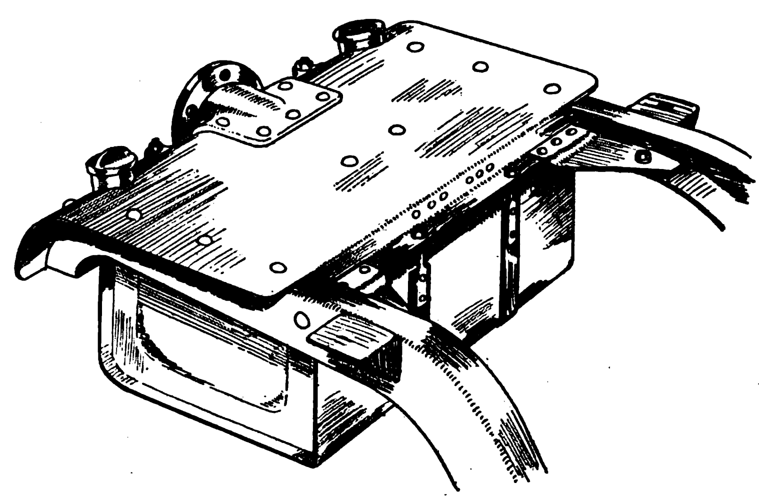
Combined tire carrier and tank support on Davis car



Tubular front cross member on Cole chassis. Below—Braced rear end of frame channel on Dorris



Tubular rear cross member and flexible tank support on Templar



Frame stiffening plate and tire carrier base on Stearns

points in question. Probably the location which is the greatest offender is inside the brake drum where some axle manufacturers still place the grease cup which takes care of the rear wheel bearing. Even on the stripped chassis it is hard to reach these cups, but when the body is mounted, the fenders put on, and road dirt has collected, it is a foregone conclusion that these points will be neglected. In fact the manufacturer might about as well save himself the price of the cups.

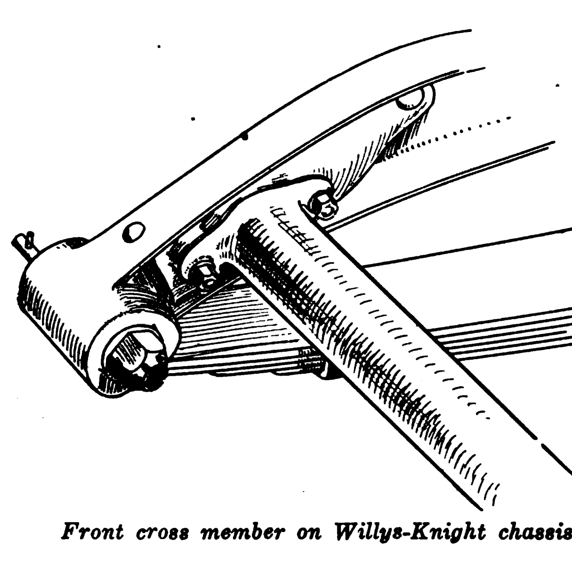
In simplifying the chassis, or in other words, cutting out the unnecessary parts, there have been some noticeable achievements. These have been particularly the case where the designer has been able to make one part do the duty of two. For instance, there are a great many instances where the cross member of the frame has served also as the anchor for the front rear spring hanger. On the Cleveland car this is very neatly accomplished. On the Briscoe the frame cross member has been extended and forms the front runningboard carrier. This is a nice bit of economy, but has the possible objection that in the event of the all-too-common collision, the owner's repair bill will be somewhat heavier, should he happen to be struck at this particularly vulnerable point.

Another clever bit of manufacturing economy on the Briscoe, which is noticeably good in this respect, is the use of the central U cross member as the battery retainer. This eliminates the customary cradle and certainly gives a firm support to the battery and at a very accessible point of the chassis.

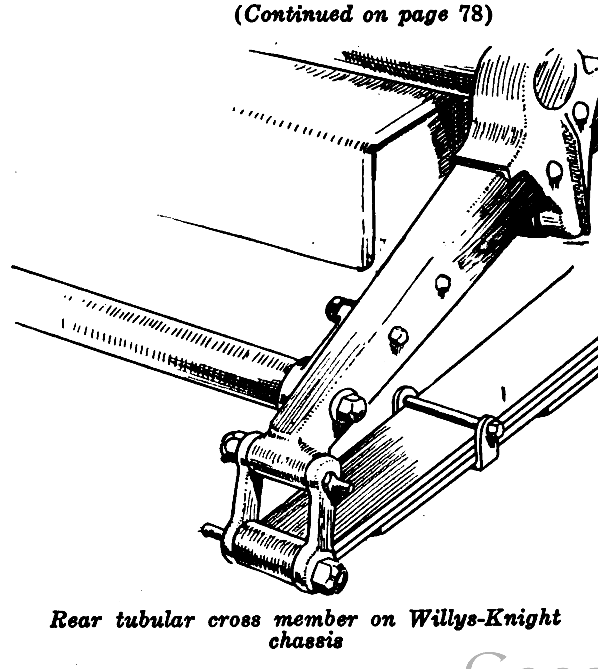
On the Davis car there is a combined tire carrier and tank support which is a good example of making one part suffice for two purposes. Others make the rear cross member act in this capacity, either supporting the tire carrier, the tank or both. The new Lexington, which makes its first real public appearance at the show, uses the built up Z bar somewhat like the Marmon frame, but bolted instead of riveted for easy replacement in case of collision or other damage. In this type of frame the splash aprons, etc., are structural members.

There has been an increased stiffness in all types of chassis. One of the points which illustrates this quite clearly is in the increased use of tubular cross members both front and rear. On the Willys-Knight these are used on both ends of the chassis and are light, while at the same time they are good stiffening members and in the

(*Continued on page* 78)



Front cross member on Willys-Knight chassis



Rear tubular cross member on Willys-Knight chassis

8,887,572 Cars and Trucks Registered in the U. S. During 1920

A net increase of 1,291,096 vehicles is recorded, making a gain of 17.16 per cent. There is now a car for every 12 persons in the country. There were approximately $75,000,000 collected in fees. Huge climb in registration figures fails to show effect of business depression.

THERE are now 8,887,572 automobiles and trucks registered in the United States. This figure surpasses by over 300,000 most of the estimates made at the beginning of the year. While it was freely predicted that the number of vehicles would go well over 8,000,000, it was not expected that the 9,000,000 mark would be threatened so closely as it has been.

The figures show a gain of 1,291,096 over 1919, a gain of 17.16 per cent. On the basis of these new registration figures and of the 1920 census statistics, it appears that there is one vehicle for every 12.21 persons in the country. Thus, utilizing the full capacity of all the trucks, as

Registration of Motor Vehicles

State	Total Net Registration	Non-Resident and Re-Registration	Passenger Cars	Commercial Cars	Motorcycles	Chauffeurs and Operators	Total Fees
Alabama	74,637	3,123	61,941	12,696	1,035	....	$832,980
Arizona	34,559	1,816	29,826	4,733	542	416	192,245
Arkansas	59,082		....	....	....	....	....
California	568,892	126,827	534,814	34,078	20,047	865,699	5,554,265
Colorado	128,951	10,881	121,223	7,728	3,364	9,814	818,938
Connecticut	119,134	....	95,123	24,011	6,543	....	1,561,191
Delaware	18,300	....	....	....	606	....	329,980
District of Columbia*	9,712	....	8,403	790	519	7,468	54,231
Florida†	57,000	....	....	....	....	....	....
Georgia	144,422	2,028	....	....	1,688	5,147	1,918,512
Idaho	50,750	....	....	....	....	....	....
Illinois	568,759	....	503,762	64,997	10,597	63,451	5,897,879
Indiana	332,707	....	300,226	32,481	8,823	9,758	2,029,103
Iowa	437,300	97,908	....	....	....	....	7,507,202
Kansas*	265,396	5,903	248,322	17,074	2,972	....	135,214
Kentucky	112,685	....	99,426	13,259	1,543	5,000	816,159
Louisiana	66,000	....	59,400	6,600	500	....	....
Maine	62,907	4,636	55,395	7,512	1,566	78,539	818,756
Maryland†	105,000	....	....	....	....	....	....
Massachusetts	304,631	35,346	253,245	51,386	15,143	361,579	3,860,232
Michigan	412,717	35,640	366,946	45,771	8,011	74,648	5,694,486
Minnesota*	64,312	2,717	....	....	1,158	3,277	151,382
Mississippi	64,000	....	....	....	....	....	....
Missouri‡	295,817	16,025	....	....	3,969	26,627	....
Montana	60,646	....	....	....	....	....	....
Nebraska	223,000	....	204,000	19,000	2,000	....	2,070,144
Nevada	10,464	....	....	....	76	....	....
New Hampshire	34,680	4,800	30,240	4,440	2,542	44,093	645,968
New Jersey‡	226,459	....	202,943	23,516	....	....	....
New Mexico	22,109	....	....	....	219	....	200,000
New York	651,796	....	543,808	108,988	29,342	358,022	8,511,597
North Carolina	140,860	....	127,415	13,455	1,418	....	1,785,000
North Dakota	90,840	10,100	89,385	1,455	898	....	691,500
Ohio	616,800	16,000	534,800	82,000	21,050	....	5,200,000
Oklahoma	204,300	....	....	....	1,320	....	2,393,788
Oregon	103,790	15,946	....	....	3,516	3,963	2,085,000
Pennsylvania	570,164	72,545	521,835	48,329	23,981	258,135	....
Rhode Island	50,375	5,772	40,800	9,575	2,225	58,710	531,000
South Carolina	92,818	1,933	....	....	908	....	527,868
South Dakota	122,000	....	113,000	9,000	560	....	768,000
Tennessee	101,852	....	90,214	11,638	1,151	....	1,215,776
Texas	427,634	....	....	....	4,293	....	....
Utah	42,604	....	37,042	5,502	....	....	....
Vermont	31,625	....	....	....	946	33,817	555,422
Virginia	134,000	10,000	101,800	13,670	2,233	5,520	1,825,000
Washington†	175,000	....	....	....	....	....	....
West Virginia	78,862	6,000	68,162	10,700	1,659	10,514	1,100,000
Wisconsin	293,298	....	277,093	16,205	8,002	....	3,127,073
Wyoming	23,926	....	....	....	327	....	267,179
TOTALS	8,887,572	485,946	5,720,589	700,589	197,292	2,284,197	$71,613,070

*Registration year ends July 1. Figures for Jan. 1 †Estimated. ‡Figures as of December 1.

Cars and Trucks in the United States, December 31, 1920

New York	651,796
Ohio	616,800
Pennsylvania	570,164
California	568,892
Illinois	568,759
Iowa	437,300
Texas	427,634
Michigan	412,717
Indiana	332,707
Massachusetts	304,631
Missouri	295,817
Wisconsin	293,298
Kansas	265,396
New Jersey	226,459
Nebraska	223,000
Oklahoma	204,300
Washington	175,000
Georgia	144,422
N. Carolina	140,860
Virginia	134,000
Colorado	128,951
S. Dakota	122,000
Connecticut	119,134
Kentucky	112,685
Maryland	105,000
Oregon	103,790
Tennessee	101,852
S. Carolina	92,818
N. Dakota	90,840
West Virginia	78,862
Alabama	74,637
Louisiana	66,000
Minnesota	64,312
Mississippi	64,000
Maine	62,907
Montana	60,646
Arkansas	59,082
Florida	57,000
Idaho	50,750
Rhode Island	50,375
Utah	42,604
New Hampshire	34,680
Arizona	34,559
Vermont	31,625
Wyoming	23,926
New Mexico	22,109
Delaware	18,300
Nevada	10,464
D. of C.	9,712
Total	8,887,572

well as the passenger cars, it would be perfectly possible at the present time for every individual in the United States to go for a motor vehicle ride at the same time.

Over $75,000,000 have probably been paid in fees during the last year, although figures from several states are not available at this time. With 14 states missing, however, an actual total of $71,613,070 is recorded as received by the various states from automobile fees. This incomplete sum alone exceeds the 1919 total by $10,000,000.

New York, as usual, took a spurt during the last six months and again leads in total registrations with 651,696, after trailing Ohio, Pennsylvania and Illinois at the mid-year mark. Ohio is second, while Pennsylvania pushes California out of the third place position, which it occupied last year.

Three facts are outstanding in an examination of the detailed statistics. West Virginia has jumped to the top of the list in percentage gain in registration, having the surprising advance of slightly over 57 per cent.

The large advance of Texas in the last year is another feature. Only one state, Ohio, showed a larger numerical gain. With its gain of 96,324, Texas stands second in the list of registration gains, while a year ago it stood only thirtieth in the same list. This state also advanced in the total registration list from tenth to seventh place.

The other distinct gain noted was made by South Dakota, which now has one vehicle for every 5.24 persons in the state. Last year, at this time, South Dakota stood fourth in this list with one car for every 7.20 persons. This year, however, it has passed Iowa, California and Nebraska and has taken its place at the top. California dropped back of Nebraska.

The accompanying tables tell the preliminary detailed story of the

Gain in Registration 1919—1920

Ohio	105,769
Texas	96,324
California	91,442
Illinois	90,321
Pennsylvania	88,047
Michigan	86,904
New York	80,134
Iowa	73,443
Oklahoma	59,800
Massachusetts	57,448
Wisconsin	56,317
Indiana	55,452
Missouri	51,454
Virginia	39,880
Kansas	37,644
New Jersey	35,586
N. Carolina	31,843
Nebraska	31,000
W. Virginia	28,659
Washington	26,225
Colorado	24,086
S. Carolina	22,675
Kentucky	22,044
Tennessee	21,430
Oregon	20,458
Mississippi	18,970
S. Dakota	17,372
Georgia	17,096
Alabama	15,739
Louisiana	15,000
Arkansas	9,632
Connecticut	9,483
Maine	9,482
Maryland	9,366
Idaho	8,530
N. Dakota	7,955
Utah	7,368
Arizona	5,580
Rhode Island	5,542
Vermont	4,818
New Mexico	4,032
New Hampshire	3,055
Wyoming	2,555
Delaware	2,148
Florida	1,600
Montana	1,321
Nevada	1,159
Dist. of Columbia	—25,688
Minnesota	—195,431
	1,291,096

Number of Persons Per Car, Dec. 31, 1920

State	Pop.	Cars and Trucks	Pop. per Car
So. Dakota	635,839	122,000	5.24
Iowa	2,403,630	437,300	5.49
Nebraska	1,295,502	223,000	5.74
California	3,426,536	568,892	6.04
Kansas	1,769,257	265,396	6.66
N. Dakota	645,730	90,840	7.14
Colorado	939,376	128,951	7.29
Nevada	77,407	10,464	7.39
Oregon	783,389	103,790	7.59
Washington	1,356,316	175,000	7.88
Wyoming	194,402	23,926	8.25
Idaho	431,826	50,750	8.52
Indiana	2,930,544	332,707	8.80
Michigan	3,667,222	412,717	8.91
Wisconsin	2,631,839	293,298	8.98
Montana	547,593	60,646	9.02
Ohio	5,759,368	616,800	9.34

State	Pop.	Cars and Trucks	Pop. per Car
Arizona	333,273	34,559	9.71
Oklahoma	2,027,564	204,300	9.72
Texas	4,661,027	427,634	9.79
Vermont	352,421	31,625	11.29
Illinois	6,485,098	568,759	11.41
Missouri	3,403,547	295,817	11.51
Connecticut	1,380,585	119,134	11.59
Rhode Island	604,397	50,375	11.99
Delaware	223,003	18,300	12.19
Maine	768,014	62,907	12.21
Mass.	3,852,356	304,631	12.61
N. Hamp.	443,083	34,760	12.78
Maryland	1,449,610	105,000	13.79
New Jersey	3,155,374	226,459	13.89
Utah	449,446	42,604	15.00
Penn.	8,720,159	570,164	15.45
New York	10,384,144	651,796	15.78

State	Pop.	Cars and Trucks	Pop. per Car
N. Mexico	360,247	22,109	16.51
Florida	966,296	57,000	16.93
Virginia	2,306,361	134,000	17.20
N. Carolina	2,556,486	140,860	18.15
S. Carolina	1,683,662	92,818	18.25
W. Virginia	1,463,610	78,862	18.59
Georgia	2,894,683	144,422	20.00
Kentucky	2,416,013	112,685	21.20
Tennessee	2,337,459	101,852	23.08
Mississippi	1,789,384	64,000	27.91
Arkansas	1,750,995	59,082	29.70
Louisiana	1,797,798	66,000	29.82
Alabama	2,347,295	74,637	31.49
Minnesota	2,386,271	64,312	37.20
Dist. of Col.	437,571	9,712	45.00
Totals	105,683,108	8,887,572	12.21

huge 1920 increase. In the Statistical Number of AUTOMOTIVE INDUSTRIES will appear the revised figures for December 31, which will comprise an exact and accurate record for every state. Only minor changes will be made, however, as the figures in the accompanying tables are essentially correct, in most cases being exact.

The difficulty of obtaining accurate registration figures has been commented upon in previous years. Not only does every state law differ from that of every other state, but many states make wholly inadequate provision for administering effectively the laws that they have. The only final remedy for the confusion which now exists, of course, is a uniform national registration law.

In the meantime, however, AUTOMOTIVE INDUSTRIES has conducted an extensive investigation with a view to rendering its registration statistics as accurate as is humanly possible under present conditions. The registration laws and the methods of administering those laws in every state have been investigated, in most cases by personal visit; this being the first survey of this kind for this purpose that has ever been attempted.

The results of this investigation have been filed and correlated, so that the exact meaning of the figures sent in by any state can be accurately interpreted in making the tabulations.

The terms "transfer" or "re-registration," for instance, have a different meaning in various cases. In some states it is necessary to subtract from the figure given as "total vehicles registered" the figures for "transfers" if the exact number of cars in use in the state is to be determined. In other cases, to make this subtraction would render the figures incorrect. AUTOMOTIVE INDUSTRIES is able, as a result of this investigation, to interpret the figures of each individual state in terms of the practice of that state, thus making the figures accurate in the final tables. Another difficulty is to learn the actual number of cars in use in the country on any single date, since the registration year of the various states does not coincide; that is, there is no single date upon which the registration figures of every state have reached their highest point. A majority of the state registration years end on Dec. 31, however, and consequently that offers the best time for the making of a compilation.

The figures for Minnesota and for the District of Columbia need to be explained. In Minnesota the registration year and the fiscal year ends July 1. Up to July 1, 1920, Minnesota had a three-year, instead of a one-year, registration period. The total of registration simply grew over a period of three years, so that the Minnesota total last year was the result of two and one-half years' growth. The figures given in these tables comprise the number of registrations as of Dec. 31, 1920, and have been growing only since July 1, 1920, a six months' period.

This explains the apparent drop in registrations suffered in Minnesota; it is merely an apparent or "statistical" drop, however, and does not in any sense indicate that the actual number of cars in that state has decreased. The Minnesota law has been changed, however, and the registrations for future years should indicate more truly the actual number of vehicles in that state.

The fiscal year for the District of Columbia ends July 1, as well, and the figures given are for a six months' period. Consequently they are naturally smaller than the mid-year figures. It is impossible, however, to explain exactly the difficulties in the District of Columbia statistics, since the whole registration matter is in an exceedingly confused state. It is sufficient to note, however, that no special significance should be attached to apparently radical jumps or falls in the registration figures for the District of Columbia.

A table showing the number of states which register tractors and trailers and the number of these vehicles in each state is being prepared, but complete data are not available immediately. A comparative table of motorcycle registrations for the last three years will also be presented in the Statistical Number.

A CORRESPONDENT of *Der Motorwagen*, who visited the recent automobile show in Copenhagen, noted the following prices for cars of different size, quality and nationality: A Ford car with electric light and starter, 5600 crowns (one crown has a nominal value of 27 cents); a small German Wanderer, 7000 crowns; a French Citroen four passenger car with electric equipment and a piston displacement of about 95 cu. in., 10,500 crowns; a British Calthorpe of the same size, 14,000 crowns; a German Opel of the same size, but without electrical equipment, 9000 crowns; an 8-25 Fiat with electrical equipment, 30,000 crowns, and a 10-30 Mercedes limousine, 32,000

The above prices are in part the result of the remittance embargo on all luxury articles which has been in force in Denmark for some time. No automobiles can be imported at present and the prices asked are controlled more by the pressure of the demand than by factory prices.

Motor Vehicle Registration 1912 to 1920

	1912	1913	1914	1915	1916	1917	1918	1919	1920
Alabama	3,385	5,435	8,078	11,925	21,636	32,873	46,171	58,898	74,637
Arizona	1,624	3,098	5,040	7,318	12,124	19,890	23,905	28,979	34,559
Arkansas	2,250	3,000	5,642	8,021	15,000	28,693	41,458	49,450	59,082
California	88,699	60,000	123,516	163,795	232,440	306,916	364,800	477,450	568,892
Colorado	8,950	13,135	17,756	27,568	43,296	66,850	83,630	104,865	128,951
Connecticut	24,101	27,189	33,009	43,965	61,855	85,724	92,605	109,651	119,134
Delaware	1,732	2,350	3,050	4,657	7,102	10,700	12,955	16,152	18,300
Dist. of Col.	1,732	2,373	4,833	8,009	13,118	15,493	30,490	35,400	9,712
Florida	1,749	2,372	3,368	10,850	20,718	27,000	54,186	55,400	*57,000
Georgia	19,120	18,500	20,916	25,671	47,579	70,357	99,800	127,326	144,422
Idaho	2,500	2,173	3,346	7,071	12,999	24,731	323,289	42,220	50,750
Illinois	68,073	94,656	131,140	180,832	248,429	340,292	389,620	478,438	568,755
Indiana	54,334	47,000	66,400	96,915	139,317	192,192	227,160	277,255	332,707
Iowa	47,188	75,088	112,134	152,134	198,602	254,317	278,313	363,857	437,300
Kansas	22,000	34,366	49,374	72,520	112,122	159,343	189,163	227,752	265,396
Kentucky	5,147	7,210	11,746	19,500	31,700	47,416	65,870	90,641	112,685
Louisiana	7,000	7,200	12,000	11,380	17,000	28,394	40,000	51,000	66,006
Maine	7,743	10,570	15,700	21,545	30,972	41,499	40,372	53,425	62,907
Maryland	10,487	14,254	20,213	31,047	44,245	60,943	74,666	95,634	*105,000
Massachusetts	50,132	62,660	77,246	102,633	136,809	174,274	193,497	247,183	304,631
Michigan	39,579	54,366	76,389	114,845	160,052	247,006	262,125	325,813	412,717
Minnesota	29,000	37,800	67,862	93,269	46,000	54,009	204,458	259,743	64,312
Mississippi	2,895	3,000	5,694	9,669	25,000	36,600	48,400	45,030	64,000
Missouri	24,379	38,140	54,468	76,462	103,587	147,528	188,040	244,363	295,817
Montana	2,000	5,686	10,172	14,499	24,440	42,696	51,037	59,325	60,646
Nebraska	33,861	25,617	40,929	59,140	100,534	148,101	175,409	192,000	223,000
Nevada	900	1,131	1,487	2,009	4,919	7,160	8,159	9,305	10,464
New Hampshire	5,764	7,420	9,571	13,449	17,508	22,267	24,817	31,625	34,680
New Jersey	43,056	48,892	60,247	78,232	104,341	134,964	155,519	190,873	226,459
New Mexico	911	1,721	2,945	5,100	8,228	8,457	15,000	18,077	22,109
New York	107,262	134,405	169,966	234,032	317,866	411,567	463,758	571,662	651,796
North Carolina	6,178	10,000	14,677	21,000	33,904	55,950	72,313	109,017	140,860
North Dakota	8,997	13,075	15,701	24,908	40,446	62,993	71,627	82,885	90,840
Ohio	63,066	86,054	122,504	181,332	252,431	346,772	412,775	511,031	616,800
Oklahoma	6,524	7,934	13,500	25,032	52,718	100,199	121,500	144,500	204,309
Oregon	10,165	13,957	16,447	23,585	33,917	48,632	63,324	83,332	103,790
Pennsylvania	59,357	76,178	112,854	160,137	230,578	325,153	394,186	482,117	570,164
Rhode Island	8,565	10,294	12,331	16,362	21,406	37,046	36,218	44,833	50,375
South Carolina	10,000	11,500	14,500	15,000	19,000	39,527	55,492	70,143	92,818
South Dakota	14,481	14,578	20,929	28,784	44,271	67,158	90,521	104,628	122,000
Tennessee	35,187	54,362	19,769	7,618	30,000	48,000	63,000	80,422	101,852
Texas	35,187	54,362	64,732	90,000	197,687	213,334	251,118	331,310	427,634
Utah	2,576	4,021	2,253	9,177	13,507	24,076	32,273	35,236	42,604
Vermont	4,283	5,918	8,256	11,499	15,671	20,369	22,655	26,807	31,625
Virginia	5,760	9,022	14,002	21,357	35,426	55,000	72,228	94,120	134,000
Washington	13,990	24,178	30,253	38,823	60,734	91,337	117,278	148,775	*175,000
W. Virginia	5,349	5,088	6,159	13,279	20,571	31,300	38,750	50,203	78,862
Wisconsin	24,578	34,646	53,161	79,791	115,637	164,531	196,844	236,981	293,298
Wyoming	1,300	1,584	2,428	3,976	7,125	12,523	16,200	21,371	23,926
Totals	1,033,096	1,287,558	1,768,720	2,479,742	3,584,567	4,992,152	6,105,974	7,596,503	8,887,572

*Estimated.

Belgian Show Includes New Cars With Many Previously Exhibited

Newer chassis are mostly equipped with eight or four cylinder engines having overhead camshafts, separate heads and block castings which serve to enclose the vertical shaft drive. Aluminum webs and dash form separate engine compartment on some expensive chassis. Many novelties and refinements in spring suspensions, braking systems and steering gears.

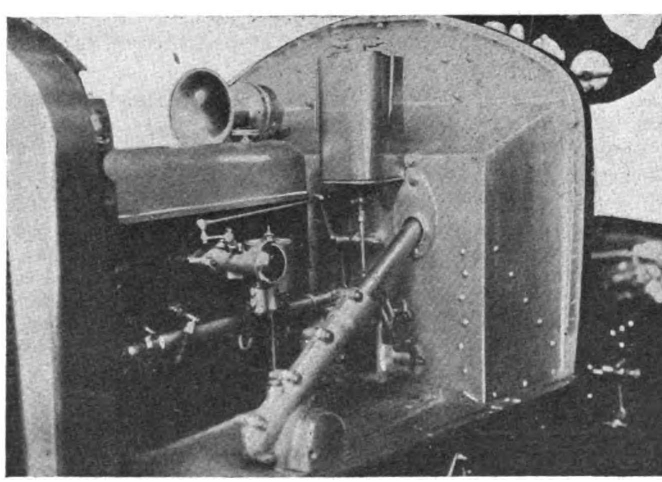
By W. F. Bradley

BELGIUM possesses less than a dozen automobile factories employing about 8,000 men (with another 7,000 in body and accessory works and forges), hence an invitation had to be sent to foreign manufacturers in order to fill her first post-war automobile show. The exhibition was held in the Palais du Cinquantenaire from Dec. 10 to 19, and was officially visited by the King. It was supported by every Belgian manufacturer, but these were outnumbered by foreign makers. France had the biggest share in the show, with 75 exhibitors of passenger cars; America had 14 car makers, Belgium 10, Italy 6, Great Britain 4, and Holland and Switzerland one each. In addition to passenger cars, the show comprised truck, tractor, body and accessory sections, with a total of 309 exhibitors. This constituted a record, for at the last show, held just before the war, there were not more than 200 exhibitors.

Since the French show of a year ago there have not been many changes in design, and inasmuch as most of the leading continental manufacturers were represented at the recent Olympic show, it was not to be expected that very much in the way of novelties and new refinements would be found on other than Belgian exhibits.

The spirit of enterprise and determination shown by the Belgian people in getting back to work is remarkable in view of the fact that no special protection has been afforded. Unlike any other country in Europe, Belgium has the same import duties as before the war, with the result that foreign competitors have been able to step in and secure an important place in her market. The greatest change since pre-war days is in the importation of American cars. Before the war these were practically unknown in Belgium, whereas at the present time at least 20 makes are selling in this market. America has created this position for herself despite very adverse rates of exchange. She had in her favor, however, the ability to make deliveries at a time when other nations were not producing.

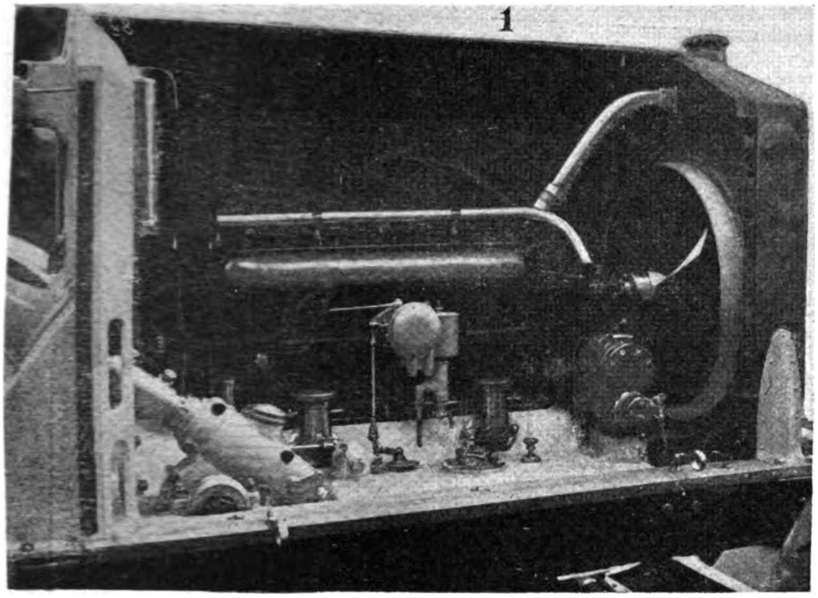
The position of France on the Belgian market has not undergone any appreciable change. Exchange is slightly in favor of the French manufacturer, but it is only during the last six months—or since the depression set in—that he has been in a position to export. England has not changed her position in this market, and does not do a great volume of business. Her motor bicycles and motor accessories seem to be more appreciated than her cars.

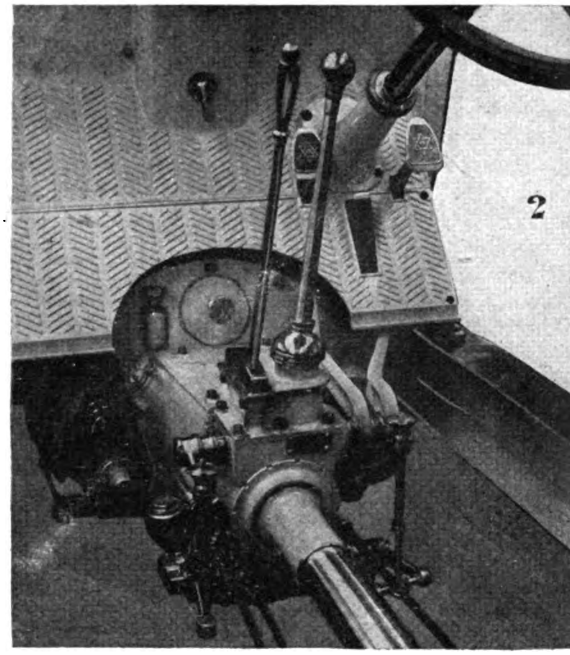


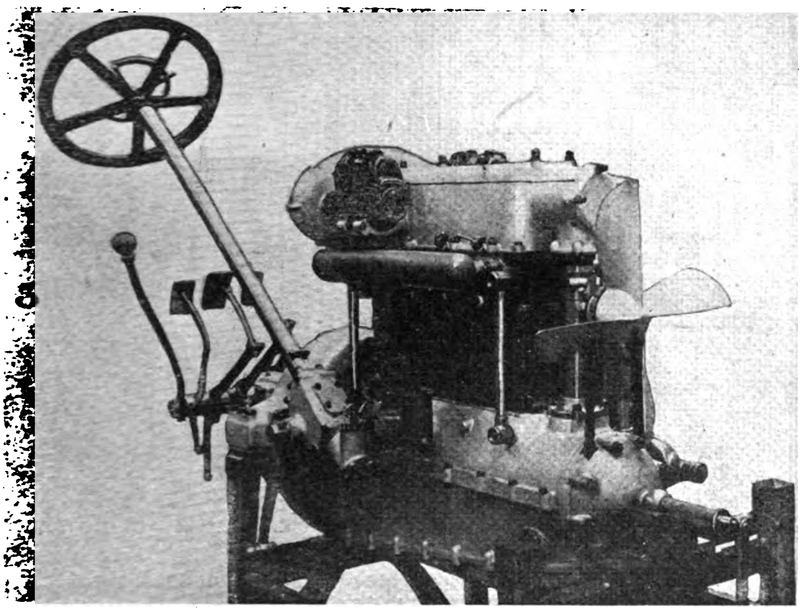
Beck overhead valve engine

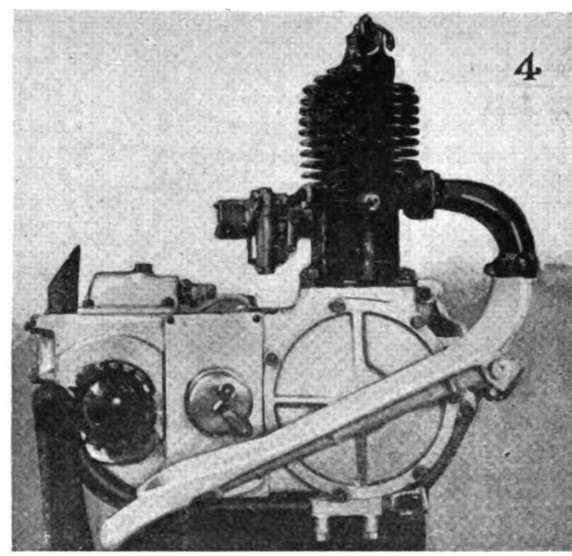
Outside the Belgian exhibits the only entirely new cars at the Brussels show were the Italian Ansaldo; the French Fonck and the Beck. Lorraine-Dietrich showed the latest type of light six cylinder. Renault has made some changes on his six cylinder. Instead of underslung semi-elliptic springs, this car now has cantilevers, placed diagonally in the frame and, instead of being shackled, having their ends carried in rollers. Another change in this model is in the radiator, which instead of going right across the frame, behind the engine, now has its vertical tubes only to left and right of the last cylinder.

The Fonck is an entirely new production, established by the well-known French aviator, with the assistance of a former Hispano-Suiza engineer and the backing of the Jacob Holtzer Steel Company. Two cars are to be produced, a four and an eight-in-line, of the same general design but with the difference that the eight will have brakes on all four wheels and the four the usual brakes on transmission and rear wheels. Only the complete chassis of the four found a place in the Brussels show, the eight being limited to the engine and gearbox. This job is very high-class throughout, and is laid out as a well finished, lively, sporting model. Although the cylinders are only 3.1 by 5.1 in., it is claimed that the four cylinder model will attain a speed upward of 60 m.p.h. with a four passenger touring body. Modern design tends to keep weight down, but the frame members are heavy and very much deeper than would be considered necessary by an American designer. Evidently the engineer has sought, by adopting this deep section, to avoid the troubles of sagging frames and misalignment which have developed in some sporting cars when driven hard over French roads.







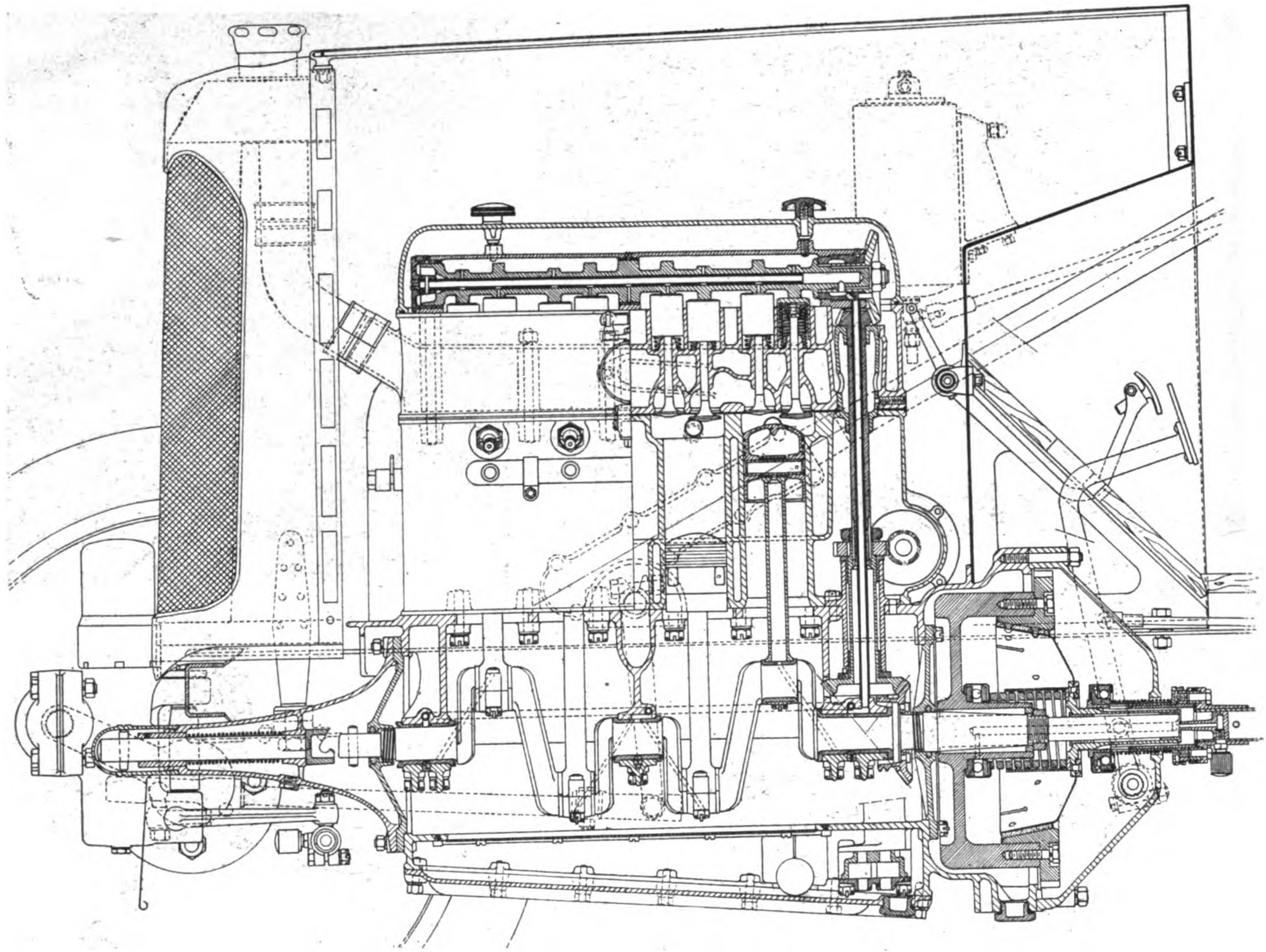


1—*Carbureter side Metallurgique engine.* 2—*Metallurgique gearbox with left-hand control.* 3—*D'Aoust three-litre semi-racing type engine.* 4—*Ballot two-stroke motorcycle engine and transmission*

The cylinder block is so compact that it does not give the impression of having five main bearings for the crankshaft. A detachable head is used. It carries the eight vertical valves and the overhead camshaft. A central drive is employed for the camshaft, by the use of helical gears, the vertical shaft being inside the cylinder casting. There is a double housing for the camshaft; the inner one carrying the camshaft and being perfectly oiltight. The outer one which covers the whole of the valve operating mechanism, really serves only to add to the finished appearance of the engine as a whole. At the base of the vertical shaft driving the camshaft, there is a cross shaft which on one side drives the magneto and the generator and on the other side operates the water pump. The magneto and generator are placed parallel to the cylinders. A double distributer, delivering current to eight plugs placed horizontally on opposite sides of the engine is used. For the eight cylinder model the arrangement is not quite the same, for instead of the water pump being driven directly off the end of the cross shaft it is placed with axis parallel to the cylinders and in tandem with a second magneto. Aluminum alloy pistons are used and connecting rods are I-section forgings.

The unit powerplant of the Fonck models has three point suspension. Left hand steering and right hand control are employed, the change speed and brake levers being directly on top of the gear-box. The whole of the space between the engine and the frame members is covered in with cast aluminum plates. The aluminum dash comes right down to the engine base chamber and is bolted to it. All the air has to escape through the louvres in the side of the hood or through the wire gauze in the lower portion of the aluminum dash, and the only opening under the hood is for the fan belt, which is driven off the crankshaft. The steering gear passes through the dash, but without leaving any gap. The shaft carrying carbureter and ignition control levers is covered by an aluminum housing. The radiator is cowled, and the whole of the aluminum work is polished so as to make it as easy as possible to keep the engine clean. The aluminum instrument board has two tubular supports which slide into sockets cast with the aluminum dash, thus making it possible to adjust the instrument board to any desired position to suit the bodywork.

One of the features of the Fonck is the use of semi-elliptic springs which have their greatest width, 4.7 in., at



Longitudinal section, Beck overhead valve motor at Brussels show

the axle and gradually decrease to a width of 2.3 in. at the extremities. The springs are underslung, have no clips, and take the drive and the torque. With this arrangement, two universal joints are required. The propeller shaft is tubular and of large diameter. The wheelbase of this chassis is 122 in., but with the compact engine the available length for the body is 103 in. The eight cylinder has a wheelbase of 142 in.

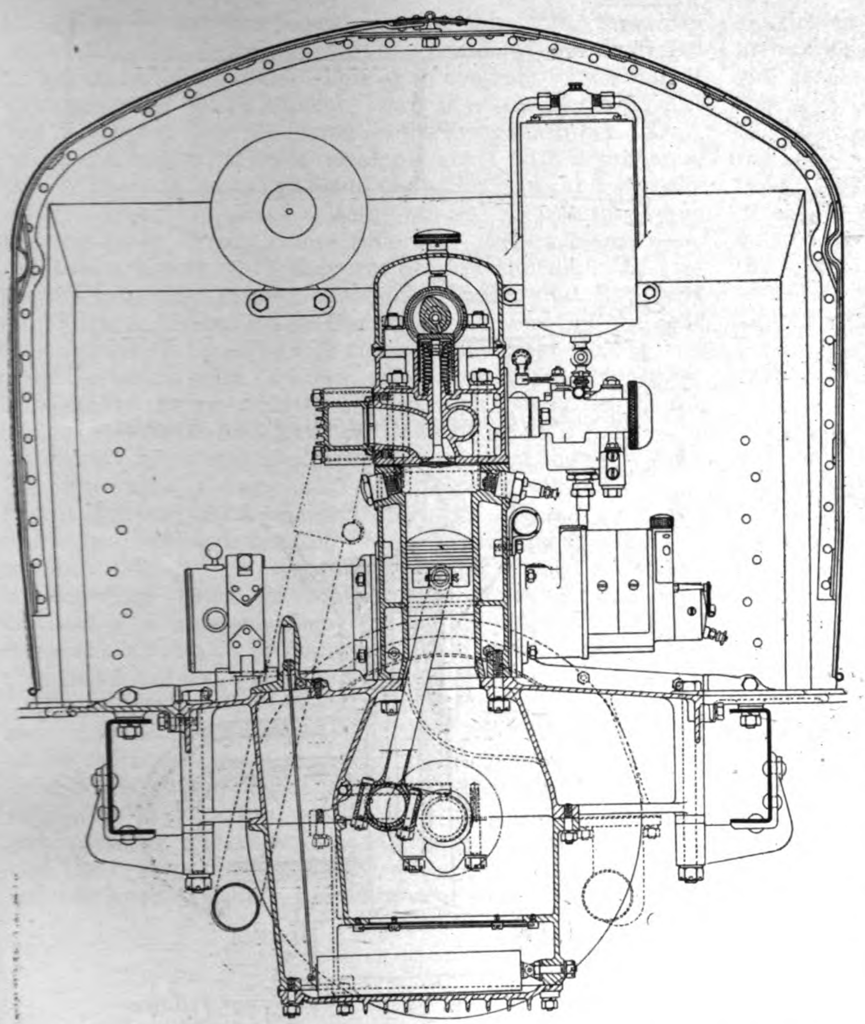
The Italian Ansaldo Car

Ansaldo, the largest general engineering firm in Italy, has entered the automobile field with what is considered in Europe a medium, general service, economical automobile. This is a class of car which has no counterpart in America, for it is smaller and better finished than the Dodge type. The four cylinders of the Ansaldo measure 2.7 by 4.7 in., are a single casting with the upper portion of the basechamber and have a detachable head with overhead camshaft. The vertical drive shaft is within the cylinder casting. The water pump housing is cast with the cylinders, and is driven by the cross shaft which also operates the magneto. The engine has three point attachment to the frame and is a unit with the clutch and gearbox, the latter having only three speeds, instead of the four commonly employed on a car of this type in Europe. It is rather unusual, from the Italian standpoint, to find that Hotchkiss drive is employed. Detachable wood wheels are also an unusual feature, for Italian makers show a strong preference for metal.

It is understood that this car was designed to be produced at 7,000 lires, but the price in Italy is now more than 30,000 lires.

There is a lot of original work in the Beck light car, a small four cylinder (2.5 by 4.4 in.). It has block cast cylinders with detachable head and overhead camshaft driven by a vertical shaft and bevel gearing from the rear. By this arrangement the electric generator and the magneto are placed at the rear, but there is no loss of accessibility, for the distributer end of the magneto is outwards, directly under the steering column. Valve operation is direct, without the use of followers. A piston type head is screwed into the extremity of the valve stem to give adjustment. It is guided in the camshaft housing so as to provide for the thrust occasioned by the directly operating cam. Beck has adopted the plan, which up to the present has been confined to makers of costly cars, of extending the crankcase webs up to the frame members and bringing the cast aluminum dash down to the engine, so as to make a completely enclosed compartment. By this arrangement all the hot air from the engine has to escape through the sides of the hood.

Another peculiarity of this car is the method of uniting gearbox and differential housing, carrying the load on a tubular axle, and driving by transverse shafts with universal joints. Coil springs are used all around for suspension, in place of laminated springs. All four are enclosed in dust-proof and oil-tight housings, and the coils are of variable thickness, increasing in section as the center is reached. This gives a suspension which in a certain degree automatically adjusts itself to the load. One



Transverse section, Beck four-cylinder overhead valve motor at Brussels show

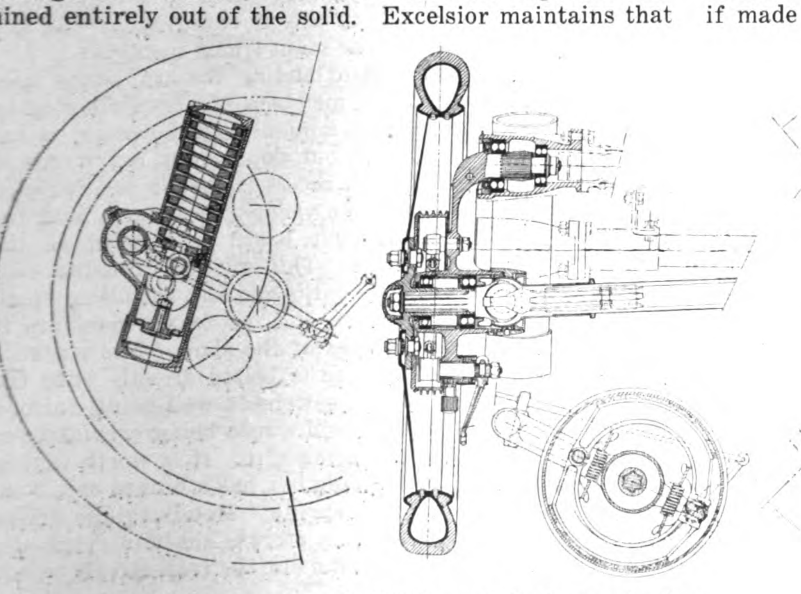
for a high class job the results justify the extra cost compared with a forged shaft. There is a flexible connection between engine flywheel and a clutch member. Heavy rubber rings, about six in number, are recessed in the rear face of the flywheel, and these receive studs on the forward face of the clutch member. The rubber rings are set up with graphite and, it is declared, there is no tendency for them to harden under this service. The dominating feature of this chassis, however, is the system of braking on all wheels, together with the cantilever suspension and attachment of the rear axle to the frame. The four wheel brakes are the design of Engineer De Coninck and were worked out during the four years the Germans had forcible possession of his factory. Excelsior brakes diagonally by means of cables; one cable being brought from the right front wheel over a double lever on the brake pedal shaft and thence to the left rear wheel. In this way the effort applied to opposite wheels is always equal, and even if one cable should break, two wheels on opposite sides would hold and the car would not deviate from its straight course. Merely for holding the car when in a stationary position, there is a second control to the rear wheels by lever.

At the front the brake camshaft is received in the lower portion of the axle and passes direct into the brake drum, so that there are no universal joints on this braking system. The four main brake levers with yoked ends are telescopic, so that when dismounting it is not necessary to touch the yokes but merely knock out a pin and pull the two telescopic parts apart. Another unusual feature, which it is declared has given excellent results, is the use of alternating sections of cast iron and fabric for brake lining. It is found that this stops the screaming common with metal to metal

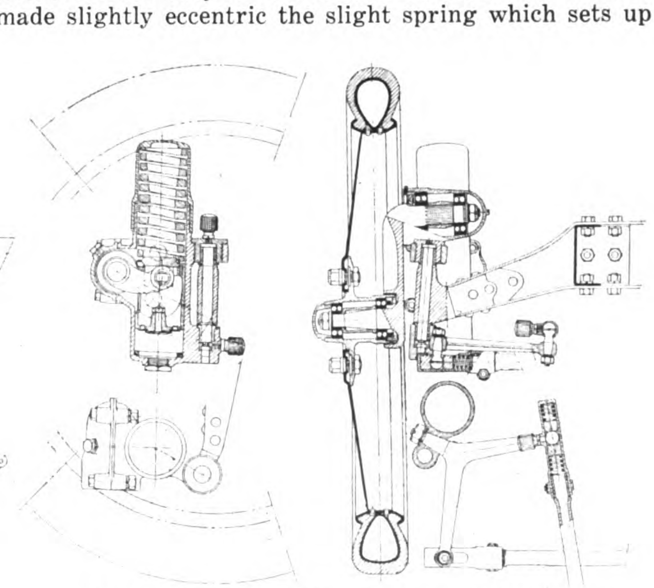
of the mechanical features of the car is the entire absence of keys and keyways, all shaft fittings being tapered and splined.

Among the Belgian makes one of the most distinctive cars is the new Excelsior, a high-class six 3.3 by 5.5. in. The engine is an L-head type in one casting, with a counterweighted crankshaft carried in four bearings and machined entirely out of the solid. Excelsior maintains that

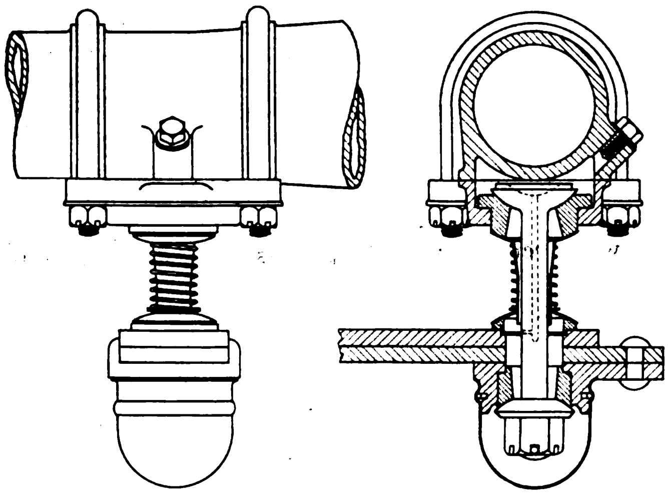
shoes, and that the fabric is rendered more efficient as it becomes impregnated with iron dust. The hardened steel face plates on the brake shoes, which come in contact with the brake cam, are double wedges with notches giving one millimeter adjustments. Finally, the brake shoes are slightly eccentric. It is claimed that with perfectly concentric shoes only a line contact is obtained, whereas if made slightly eccentric the slight spring which sets up



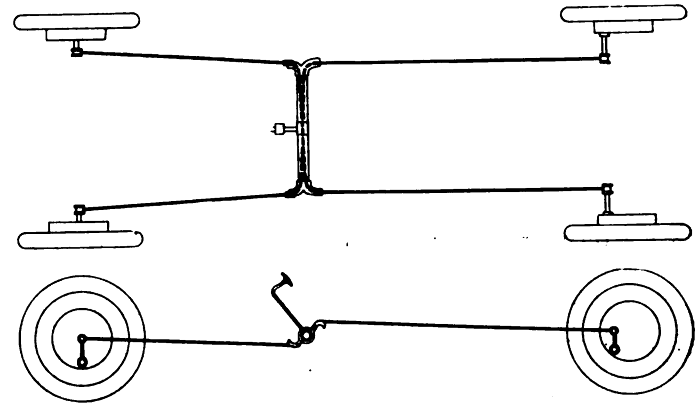
Beck coil spring suspension, final drive and brake mechanism



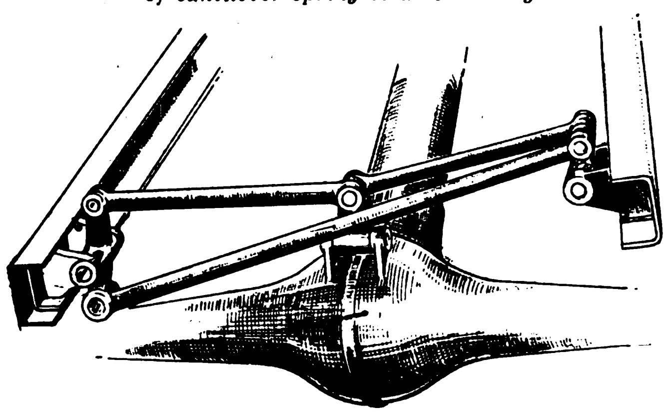
Beck coil spring suspension and steering pivot



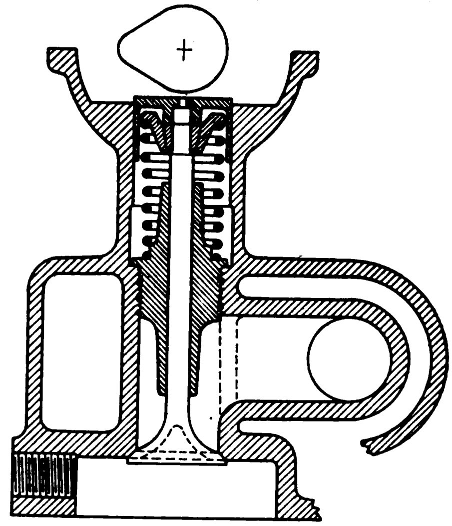
Excelsior car, showing ball and socket attachment of cantilever spring to axle housing



Four-wheel braking system on Belgian Excelsior



Compensator on Belgian Excelsior



Miesse overhead valve with guide for follower

in the shoes assures the entire surface being made use of for braking.

The cantilever springs on the Excelsior are not rigidly fastened to the axle housing, but are secured by a short connecting rod with ball and socket at each end, the whole of the mechanism being enclosed and fed with oil from a reservoir containing a six months' supply. By this attachment the axle is free in relation to the main frame members, but in conjunction with this flexible attachment, use is made of a compensating stabilizer consisting of two connecting rods from the upper portion of the differential housing to links on the inside of the main frame members, the whole forming a parallelogram, as shown in the illustrations. This device leaves the axle free to move in a vertical plane, but eliminates all lateral movement, the practical result being that all the advantages of cantilever springing are obtained without any tendency for the rear end of the car to roll when running fast. Tests show that when taking turns at high speed the rear wheels track perfectly and show none of the tendency to skid so common with the usual attachment of cantilevers.

It has been necessary, with this device, to stiffen up the rear end of the frame and to obtain a very substantial attachment, but the results obtained are remarkably satisfactory. All the bolts used with the stabilizer, as well as every spring shackle bolt on the car, are adjustable for lateral play. In the case of a shackle, instead of the bolt being passed directly in the cheeks of the shackle, it is carried in two hardened and ground sleeves, one of which is fixed and the other adjustable laterally. This allows a spring to be mounted with plenty of lateral play, all of which can be taken up in the adjustment, and any subsequent wear can be taken up in the same manner.

Metallurgique, while maintaining two smaller types, has produced an entirely new chassis with a four cylinder 3.9 by 6.29 in. engine. It is understood that this engine will be replaced, at a later date, by a six-cylinder of the same bore and stroke, mounted in the same chassis. Features of this new product, which is a really high class job, are unit construction of engine and gearbox, with centre control; brakes on all four wheels; cast aluminum dash and floor boards; a new forged full floating rear axle; and underslung semi-elliptic springs of exceptional length. Probably these are the longest springs ever fitted to a car—70 in. long and 2.7 in. wide. They are mounted under the axle and placed directly under the main frame members.

The growing practice of extending the crankcase webs right up to the main frame members has been adopted by Metallurgique. The cast aluminum dash, however, is not extended down to the engine but slopes away rearwards so as to form the toeboards. A recess is cast in the forward face of the dash to carry the vacuum feed tank, and the polished aluminum instrument board is secured to the dash by tubular steel arms. This method of using cast aluminum for dash and toe boards and also for filling in all the space between the engine and the frame members is one of the refinement features of the show. The steering gear box of the Metallurgique is bolted directly onto the top of the extended crankcase webs, a well being formed here to receive the housing, and a hole being provided for the passage of the main steering arm. It is worth noting that the oil filler on the steering box has a hinged cap, 3 in. in diameter, held down by a spring. Metallurgique drives water pump and magneto from a cross shaft in front and places the electric generator and starter respectively to left and right of the gear box.

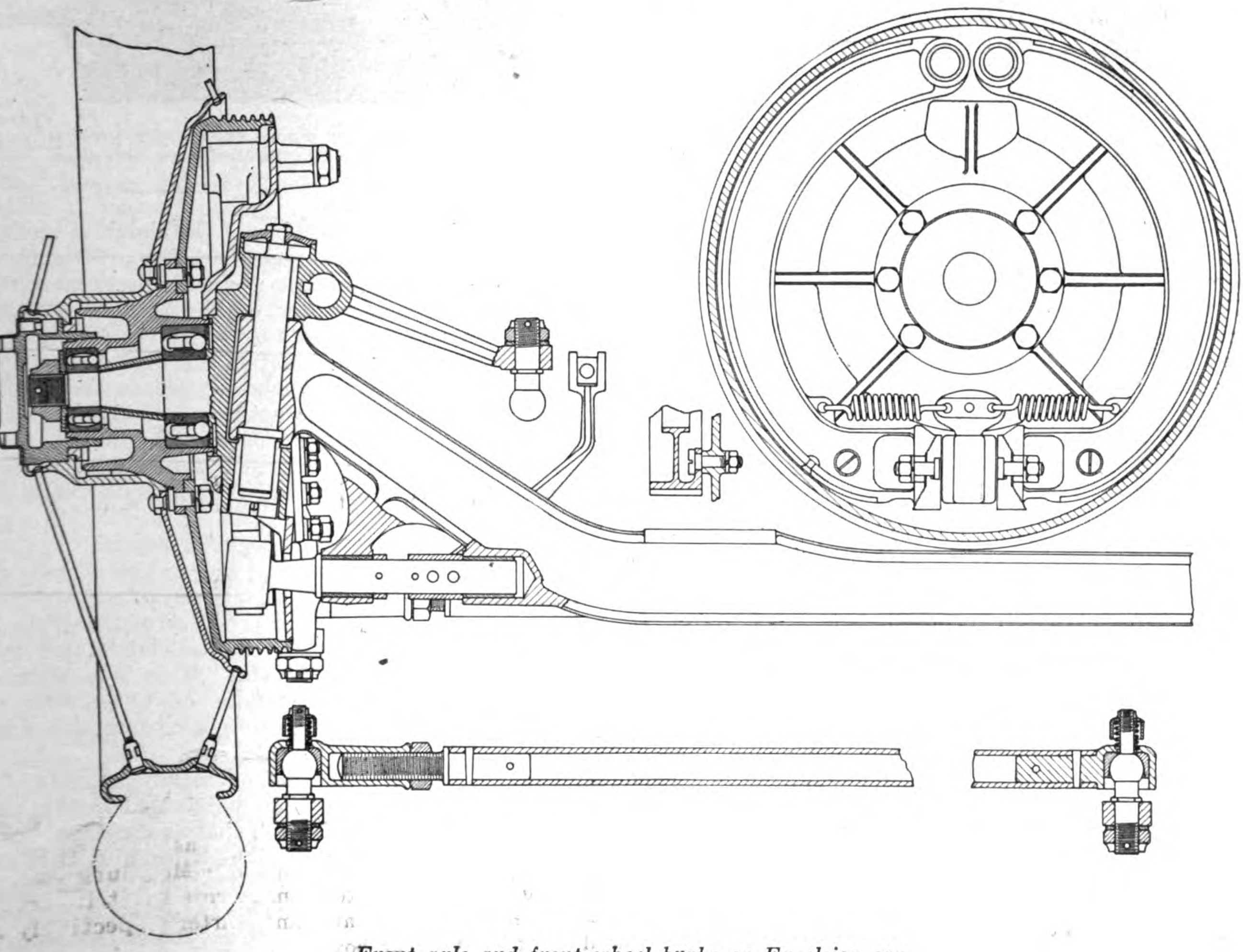
Brakes on all four wheels are of the Isotta-Fraschini type, with the brake camshaft for the front wheel carried in bushings in the axle. This is in contrast to the Perrot system, under which the cam shaft is at the highest point and is supported in a bearing on the frame member. This, of course, necessitates a telescopic shaft with a universal joint. Steel ribbons are made use of on this car for brake control, but instead of placing these horizontally, and passing them through fibre rollers or other support, as is usual to prevent whip, they are placed vertically. In connection with the brakes, it should be noted that front and rear ribbed drums are of the same diameter, but the rear ones are twice the width of those on the front wheels, and carry an extra pair of shoes, which are operated by lever. This makes it possible to comply with the necessity for locking the brake when the car is standing on a hill.

Other front wheel braking systems seen at the show were Hispano-Suiza, Delage and Talbot-Darracq, all built on the Perrot license; the Bellanger, which has its steering pivots inside the brake drums, the Isotta-Fraschini, and the Excelsior. Other firms announcing front wheel brakes but not showing them on their chassis were Fonck, Spa, D'Aoust and Miesse. Some half dozen other Continental firms are known to be negotiating for Perrot licenses, but they have not yet made public announcements.

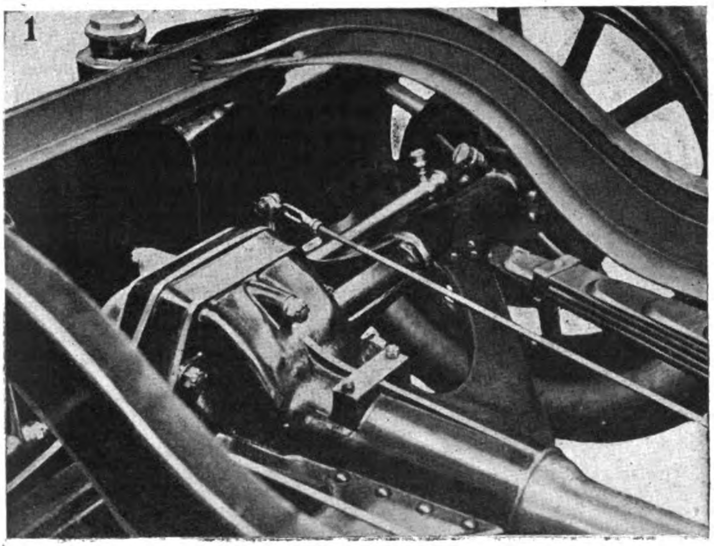
Miesse, one of the oldest of the Belgian firms, has two new engines, with respectively four and eight cylinders, of the same general design and the same bore and stroke. It is a growing practice, when adopting an eight-in-line engine, to make a four at the same time and of the same size. Miesse dimensions are 2.7 by 5.1 in., and for each type the cylinders are a block casting with detachable head and overhead camshaft, driven by a vertical shaft and bevel gearing inside the cylinder casting. The show models have aluminum cylinders with liners, but it is declared that these will be abandoned for cast iron. In common with several others at the Brussels show, Miesse does not use a pivoted follower between cam and valve, but has a nut screwed on the end of the valve stem, and mounted on this a piston-type hardened and ground cap, which is well guided in the detachable head. This eliminates the thrust and consequent wear occuring when the plate is screwed directly into the valve stem.

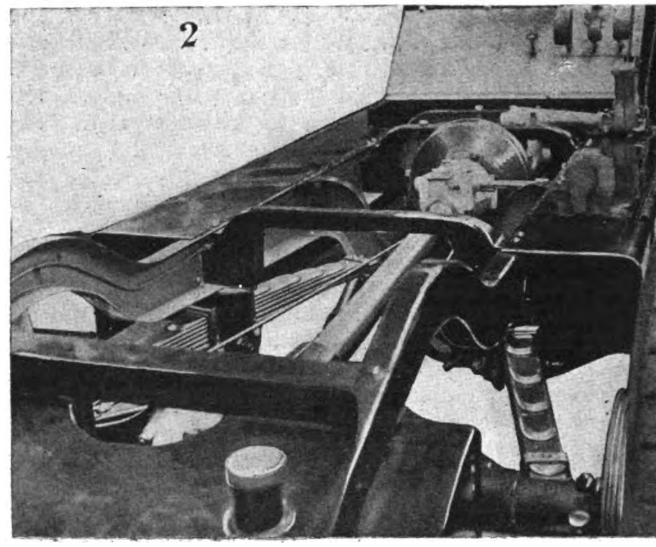
Miesse drives the two blade fan from the vertical shaft, with a friction clutch interposed. A rather unusual feature is that the steering gear housing is cast with the engine base chamber, being placed on the right hand forward arm, just below the magneto driven from the cross shaft. The complete chassis of this new type was not ready for the show, but according to information obtained its chief feature will be front wheel brakes with hydraulic operation.

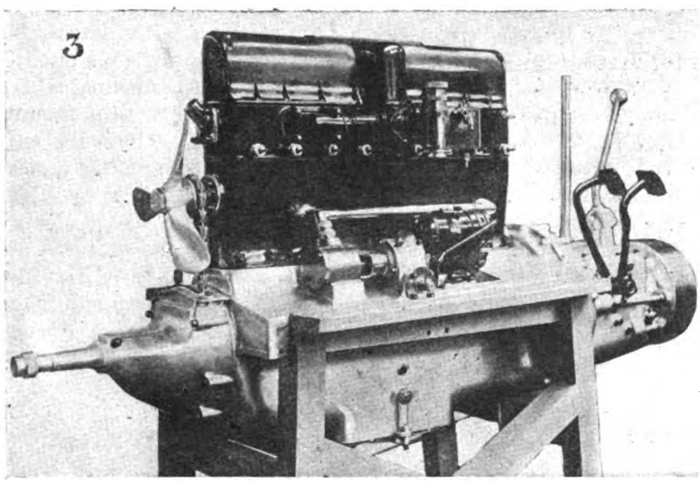
A semi-racing type 3-litre engine is the feature of the D'Aoust production. This car was not shown complete, only the engine, clutch and gearbox unit being on exhibition. Cylinders are a block iron casting with detachable head, and an overhead camshaft in an aluminum housing. A vertical shaft at the front drives the camshaft which operates three valves per cylinder. The method of mounting the two magnetos is rather unusual. They are carried on a platform cast with the camshaft housing and to the left and right of it, each magneto being driven by silent chain from the rear end of the camshaft. This design brings the magnetos to the highest part of the engine and has probably been adopted for the accessibility it provides and the possibility of quick change and adjustment when racing. This engine is built to the designs of a French

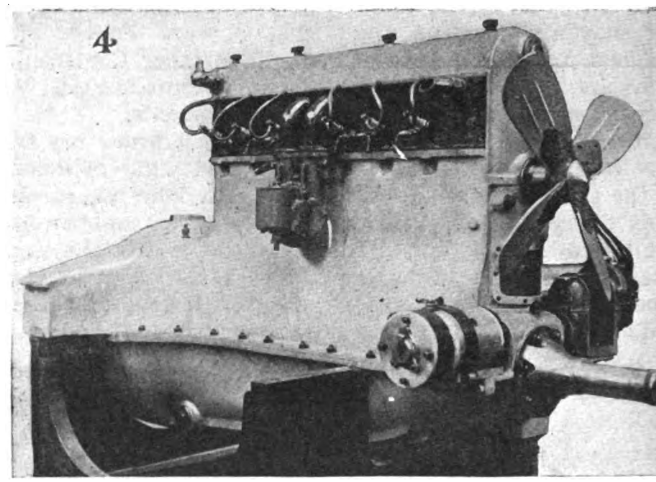


Front axle and front wheel brake on Excelsior car









1—Renault reinforced rear axle and cantilever springs. 2—Renault diagonally placed cantilever springs. 3—Fonck eight-cylinder engine. 4—Spa new six-cylinder engine which is all aluminum with the exception of detachable head

specialist, and will, it is declared, be entered in the leading 183 cubic inch races of the year. In addition to this special sporting type D'Aoust has a medium size car on quite standard lines.

Minerva, the biggest producer in Belgium, shows nothing new, for this firm had its post-war models out for the Paris show of a year ago, and exhibited the same at the recent London show. There are two models, with Knight engines of four and six cylinders, respectively.

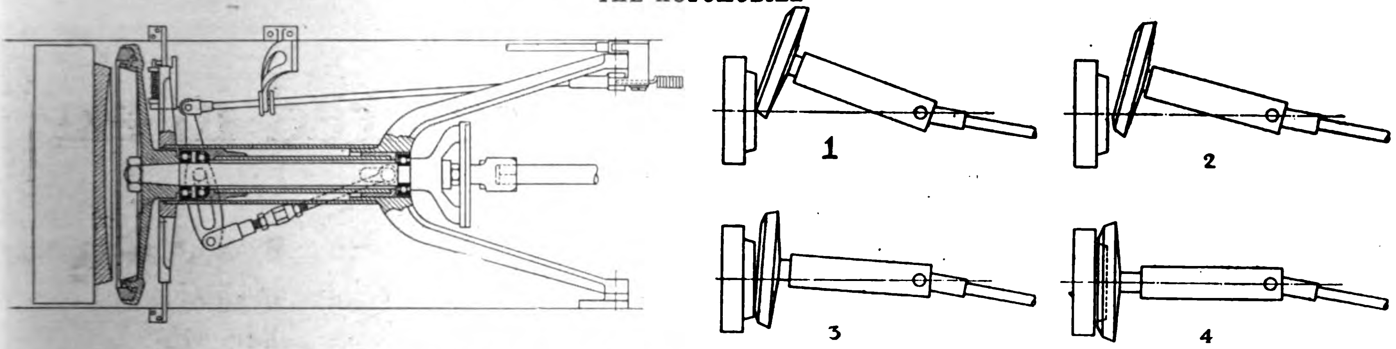
The F. N. Company exhibited a new model which also was uncovered at the recent London show.

Belgian makers generally are paying more attention to high class, almost luxury types, than to popular models. There is no firm with a program similar to that of Citroen in France or Bean in England. Somua has a popular type, but the firm does not have big production means. Practically the only other firm attempting to get into the popular class is Belga, a concern established since the war and marketing a light car with an unusual and interesting type of friction transmission.

The engine is a Ballot of 2.5 by 4.7 in. bore and stroke, carried on a subframe, and the rear axle is a standard type, with Hotchkiss drive. In place of the usual gearbox there is a friction transmission. When driving on top a cone clutch is in engagement and the drive is straight through to the rear axle. The driven member of the cone clutch has two friction surfaces; the cone used for normal driving on top gear, and a ring of canvas and rubber mounted on the forward face of this disc. When the cone has been disengaged, the driven member of the clutch is inclined so as to bring the ring in contact with the driving member, and the lower the gear ratio required the greater the inclination, until dead center of the driving member is reached. Reverse is obtained by taking the plate past dead center. The necessary inclination is provided for by carrying the clutch shaft in a yoke pivoted to the subframe. The clutch is used in the usual way, and changes of ratio are obtained by a straight movement of the lever. It is claimed that this device has been on the road for a year and has given perfect satisfaction. The direct drive is no departure from standard practice, and if the friction gear has stood up to tests, the Belga ought to become popular, for it is cheap to build and gives a wide range of gear ratios.

Ballot, the French specialist, took advantage of the Brussels show to come forth as a producer of complete power plants. His unit comprises engine, clutch and gearbox ready for fitting to a sub-frame. This firm is now also specializing on motorcycle units of two-stroke engine, clutch and gears in one. House lighting sets also are being produced.

Belgium had a high reputation before the war, for customs bodies, and this has been maintained in the post-war products. Numbers of English chassis are sent across the Channel to be fitted with Belgian bodies, and this accounts for a greater predominance of English types that is seen elsewhere on the Continent. This is particularly noticeable in all weather bodies, which are not much favored by Continental motorists, but are in great demand by English



Friction transmission used on Belga light car

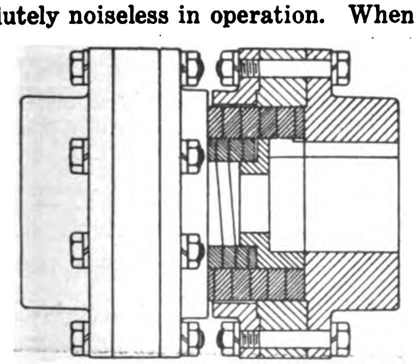
motorists. There is only a mild tendency towards the concealed top, and, speaking generally, it is adopted only for sporting type two and three seaters. The Etablissements Generaux showed some very fine examples of running boards and tool boxes in a single stamping, thus avoiding the sharp angles which are unavoidable when the tool box is a separate construction placed on the running board. This firm showed runningboard, tool box, two fenders and valance in one piece without any visible bolts and screws, giving a very good effect on cars with rounded lines.

The Bosch magneto was seen on two cars, one Belgian, the other Dutch. Bosch, however, did not have a stand. Switzerland came into the field as a magneto producer with the Scintilla. On this instrument the permanent magnet rotates, while the contact breaker, the windings and the condenser are fixed. The distributer is at the driving end of the magneto, thus allowing shorter wires to be used than when placed at the opposite, and outer, end. A feature of the Scintilla is the ease with which it can be dismounted and assembled.

An All-Metal Flexible Universal

A NOVEL type of universal coupling has recently been placed on the market by the Karge-Baker Corporation. The flexible portion of this coupling consists of two coil springs wound in opposite directions, placed concentrically. The ends of each spring is welded to a header attached to the driving and driven flanges or sleeves respectively in the manner shown in the accompanying cut. It is claimed that the drive is carried through the continuous coil, but when under torsional load the coils of the outer spring expand or contract depending upon the direction of turning and grip either the outer casing or the inner spring, thus transmitting torque to the driven member. The particular advantages attributed to the coupling are the cushioning effect of the springs in picking up the load, the fact that no lubrication is required and that the efficiency is high. The design is such that perfect balance is obtained and the permanency and reliability in operation are said to be unquestioned.

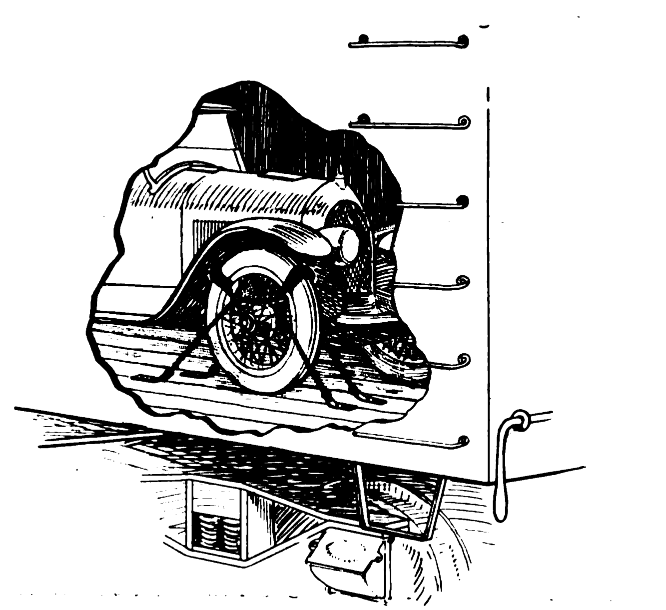
The driving coil is constructed of heat-treated alloy steel, accurately ground to size. The flexible arbor or smaller coil is ground to assemble with accuracy inside the driving coil. The driving coil is so constructed that the thrust caused by forward and backward shaft movements is taken up by the spring. The couplings are designed to allow a maximum driving angle of about 10 deg. or a 1/8 in. offset, and are said to be absolutely noiseless in operation. When picking up the load the driving end of the joint moves about one-tenth of a revolution before the driven end moves. A certificate of tests made by the French Government laboratories show that a Karge coupling having a coil of 52 mm. dia. and 9 turns transmitted without appreciable power loss from 8 to 24 hp. at speeds of 925 to 1560 r.p.m. respectively when running at an angle of 11 deg.



Sectional drawing of flexible universal coupling

New Device in Use for Shipping Automobiles

A NEW device for fastening an automobile in a railroad freight car consists of a chain tie gripping the wheel and bolted to the floor of the car. This device has recently been placed on the market by the Carbo Steel Products Co. This chain is applied to each wheel of the car, the illustration herewith showing the manner of application. A rope winding around the tire gripping section of the chain protects the tire from abrasion.



Device for fastening automobiles in freight cars

Cylinder Blocks Manufactured in an Efficient Manner

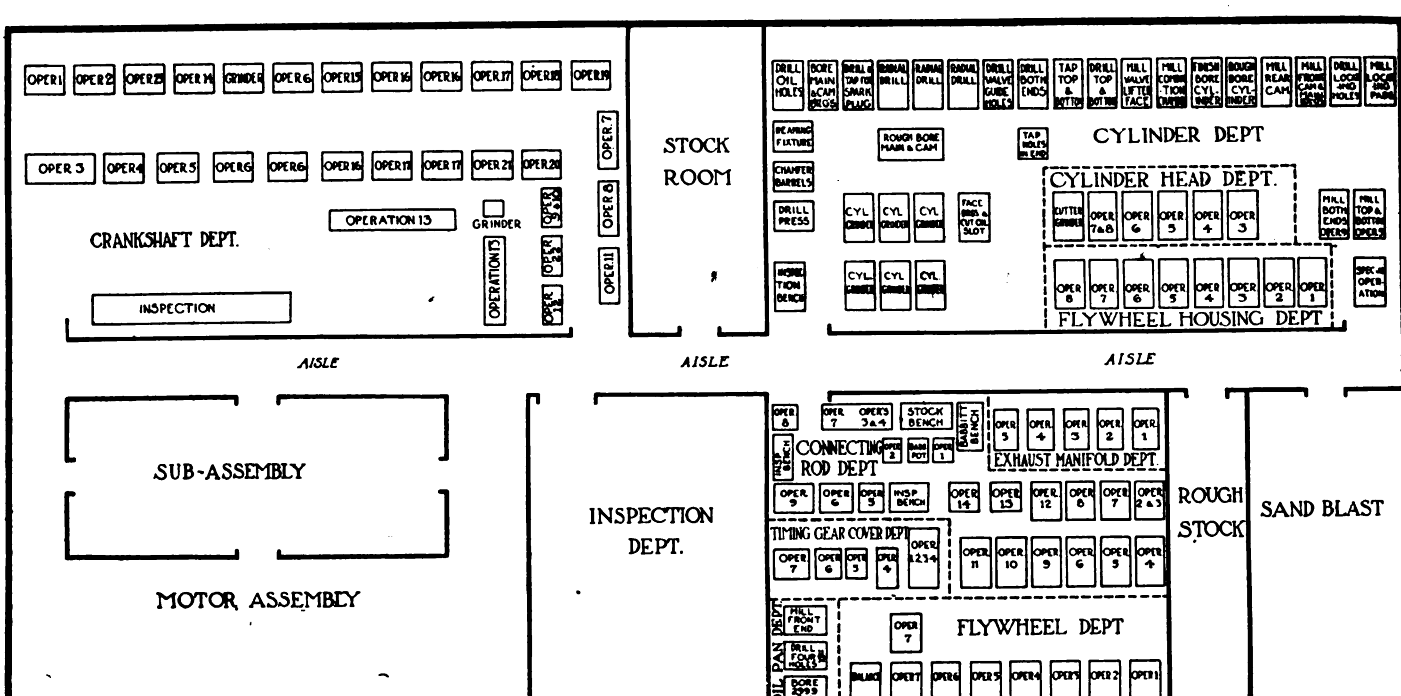
Engines for the Lexington car are being produced in a specially designed factory, which embodies many interesting production features. The following article describes in detail the manufacturing processes used in machining the cylinder block castings for this engine.

By J. Edward Schipper

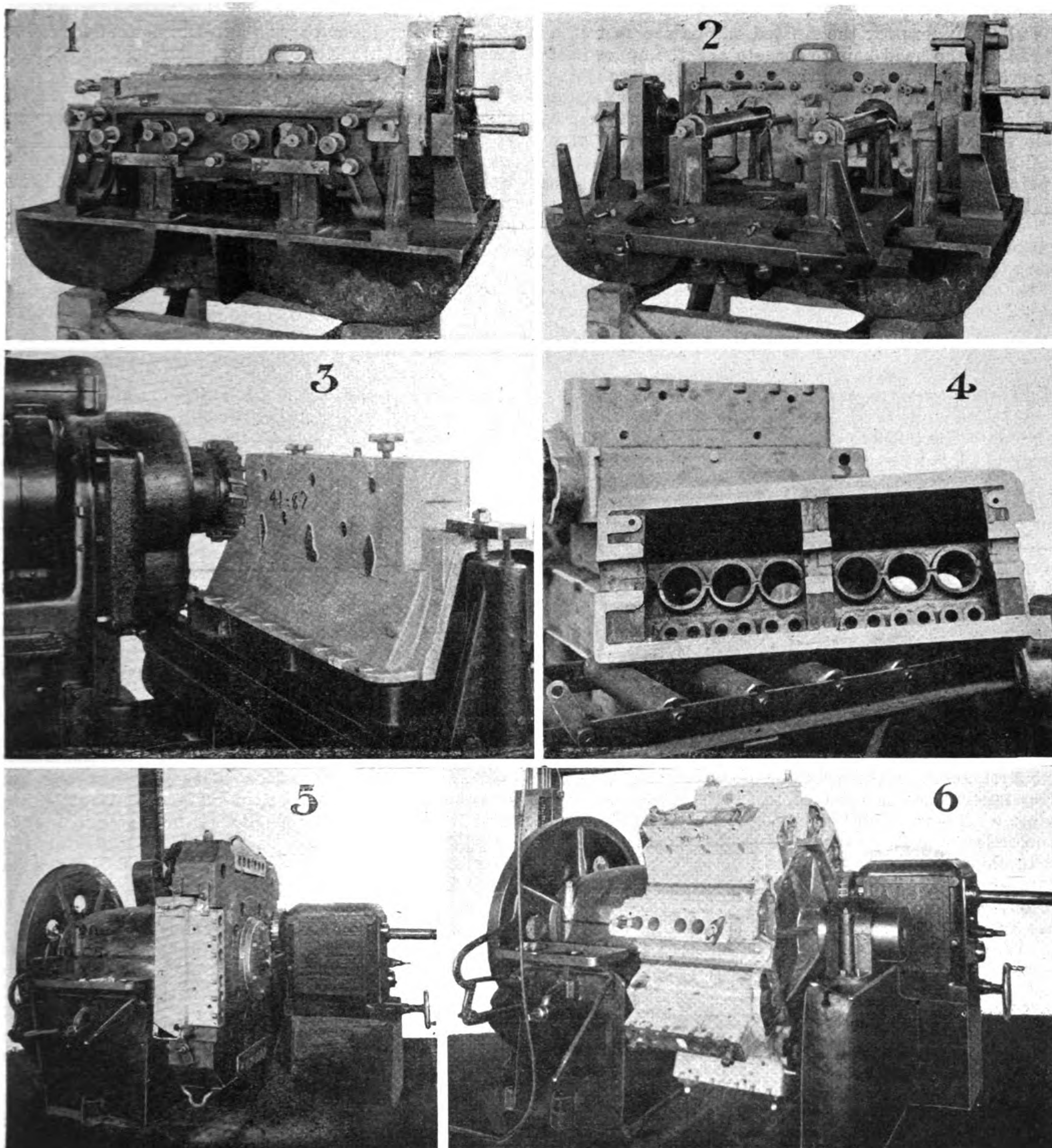
THE production of engines for the new Lexington car is taken care of in a specially designed factory with an output capacity of from 40 to 50 engines per day. The concern producing the engines is the Ansted Engineering Co., which has buildings adjacent to the Lexington factory and, in fact, is very closely allied with it. Inasmuch as this factory has been designed particularly for the production of the Ansted engine, and with an eye toward smooth production up to capacity, it incorporates some very interesting production features which have tended to make it a very efficient plant.

In the general layout the plant is divided into two parts, which may be called production and assembly. These two main parts occupy, roughly speaking, the two ends of the plant, while at the center is the finished stock store-room which acts as a clearing house for all of the material entering the assembly department. The parts which are manufactured in the factory enter this clearing house, as do also the parts which are received from outside sources. The plan of the factory shown herewith indicates this central stock-room and the inspection department from which the parts pass into the stock-room. Both the finished parts received from outside and those manufactured in the plant itself go through the inspection department into the finished stock-room, from which they are drawn for assembly. As there is a railroad siding along the side of the plant, the receiving department gets the material directly from the freight car from which it is passed to the inspection department and into the stock-room with a minimum of movement, as the unloading platform is at the entrance to the inspection department.

This general scheme gives an efficient layout which is backed up by some interesting installations of special machinery for the manufacture of the different parts. It is beyond the scope of this article to take up in detail the manufacture of all the parts which enter into the manufacture of the engine, but it will be of interest to select one and follow it through, to show how space has been conserved and efficiency promoted by the use of machinery particularly adapted to the needs of the product and incorporating the latest devices for rapid handling of the parts. To carry out this purpose the cylinder block operation has been chosen as perhaps presenting the greatest manufacturing difficulty and, at the same



Layout of Ansted engine plant



1—A cylinder block in the rough casting inspection jig. When the cylinders are received they are given a quick going over at the finish points with white cold water paint. This inspection jig in a very few minutes will go over each casting thoroughly and scribe the finish line of each important finished surface. This tells conclusively whether the cylinder block will machine. 2—The rough casting inspection jig without any casting in it, giving a good idea of its construction. 3—The first machine operation on the cylinder block. On the rough casting inspection jig and on the fixture for the first machine operation the location is from the cored holes of the cylinder barrels. This is contrary to usual practice and might be regarded as unnecessary, but is done to secure uniform cylinder walls and the balance of the machining on the cylinder block is brought to the barrels so there is no question of squareness on the entire job. This operation mills off the locating bosses on the side of the cylinder block. 4—In addition to the locating bosses there must be other locating points to fix the cylinder block for drilling and boring operations. This locating is done by means of two ½-in. reamed holes in the bottom of the cylinder block. These holes are shown in this print. The operation of drilling them is done by a standard machine and fixture. 5—Milling top and bottom faces on a Davis rapid miller with a rotating table capable of carrying four blocks at a time. 6—End milling a block on a Davis rapid milling machine capable of handling 240 blocks a day because of its continuously rotating table carrying nine blocks

time, involving the necessity for particular machine installations.

The six cylinders for the Ansted engine are cast in a single block, the head being separate and the upper half of the crankcase a unit with the block. Up-to-date methods are utilized from the very start in the handling of this block. As soon as the block is received from the foundry it is submitted to an inspection by means of a special gage which checks the amount of metal at all of the points at which machining is to take place. This special gage locates from the inside of the No. 2 and No. 5 cylinder barrels, and by stops against the valve tappet bosses. Fixed in the gage are a number of scribes to check the amount of metal at the points to be machined and also stops which must come against the various surfaces of the casting to show that there is sufficient metal at all points. Some castings, when they come to the plant, contain irregularities which render them unfit for use. This inspection gage catches such irregularities. Consequently, the cost of the block is not increased by machine work being followed by a rejection which could have been determined beforehand. This cylinder block ranges around 220 lb. in the rough. The finished block ranges around 180 lb. An average of 40 lb. of metal is removed from each cylinder block.

The blocks are allowed to age before being passed on to the manufacturing floor. They are kept in a special receiving room adjacent to the railroad siding, and after they have aged are sand blasted and passed out to the manufacturing floor on Standard roller conveyors. They are then given a coat of special dirt-proof paint. This is a Rogers product specially designed to keep the inside of the block clean. It differs from the usual paint in that alcohol is used for the vehicle in place of turpentine.

Machine Operations

The first actual manufacturing operation on the Ansted cylinder block is interesting because, while it has nothing whatever to do with the actual finish of the engine, it lays the foundation for manufacture which results in sharp jig economy and, at the same time; is the beginning of a system of location which materially cuts down any chance of error. The operation is the milling of the locating bosses on the right side of the block. These bosses are put on the cylinder block for no other purpose than to form a basis of location, and in milling these bosses, the block is located from the No. 2 and 5 bores in the same way that it was on the inspection jig. The work is done on a Chesterlein No. 34 heavy type of plain miller. The bosses are milled off and give a surface which is square to the centerline of the No. 2 and 5 bores.

The block is then placed on the conveyor and taken to another milling machine, where the top and bottom faces are milled. The particular milling machine which does this work is an interesting type, owing to the rapidity with which it operates. It is a Davis rapid miller with a rotating table capable of holding four blocks at the same time, giving continuous milling. That is, while manufacture is going on the table can be loaded from the outside so that there is no necessity for stopping the machine for reloading. In this work the block is located from the locating bosses previously milled and from the No. 2 and 5 bores. The machine is capable of producing 12½ per hr., or 125 per 10-hr. day.

The Davis rapid miller takes two cuts, the first being the roughing and the second the finish cut, so that after the block leaves this machine it is capable of location from the top and bottom faces as well as the locating bosses. The faces of the crankshaft and camshaft bearing holes are next milled, the location for this work being from the center line of the casting between the No. 3 and 4 cylinder barrels and the bottom face. This work is done on a No. 34 Ohio miller capable of 62 per 10-hr. day.

The next operation is a foundation operation which establishes the location for all of the rest of the work on the cylinder blocks, and since it is utilized in this way, it does away with the shifting of location, which is apt to lead to trouble and which makes it difficult to trace down errors. The operation in question is the drilling of locating holes which are used only for this purpose. There are two holes ½ in. in diameter which are drilled and reamed on a Wickes Bros. drill. These two locating holes, together with the top and bottom faces, are used for practically all of the subsequent operations and give a very simple system of location, which has greatly helped in simplifying the jig and fixture requirements for manufacturing this block.

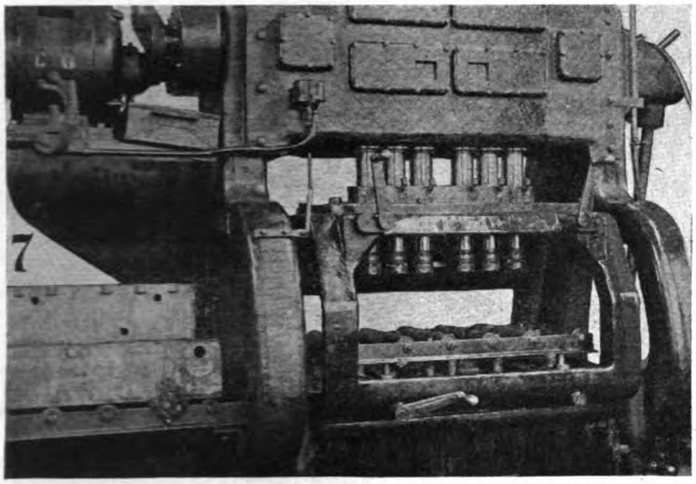
The block is end milled on both ends on a Davis No. 3 rapid miller. This milling machine holds nine blocks at the same time and has a continuously revolving table. The machine is capable of 240 blocks per 10-hr. day, taking both rough and finish cuts on both ends at the same time. For final finish, the blocks are passed to an Ingersoll miller which takes off .020 in. of the finish cut from the top and bottom of the casting. This machine is so arranged that an auxiliary cutter comes in after the timing flange has passed by and mills off the pump pad boss and the control lever bosses. The casting is put through the machine, standing on its side, so that the top and bottom milling are side cuts and the cutter for the pump pad and control lever bosses comes down from the top, after the timing flange has passed by. The limits on the top and bottom finish milling cuts are plus or minus .005 in.

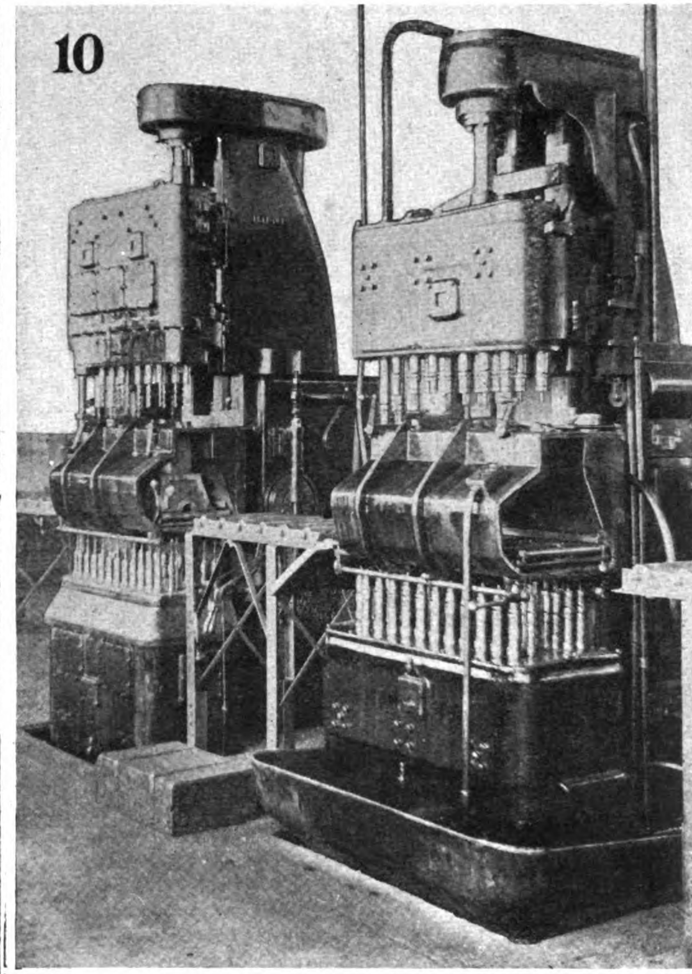
A LeBlond miller is used for milling the camshaft rear bearing pad. This operation is located from the locating holes and from the bottom surface. About ⅛ in. of metal is removed, the capacity of the machine being 62 per 10-hr. day. The block is then placed on a conveyor and starts through a battery of two No. 8 Defiance machines for cylinder boring. The first machine is a rough bore and the second a finish bore. The capacity of the outfit is 20 per hour, all six cylinders being bored at the same time. The location on this work, as on practically all of the following work, is from the locating holes and from the bottom face. On the rough bore the diameter of the cylinder is increased from 2 15/16 in. up to 3⅛ in., and on the finish cut the bore is increased from 3⅛ in. to 3 5/32 in. An interesting feature of the work on this battery of machines is that the conveyor extends over the table, allowing the block to be rolled directly into the machine. When a lever is pulled the conveyor drops below the supporting table level and the jig is clamped in place.

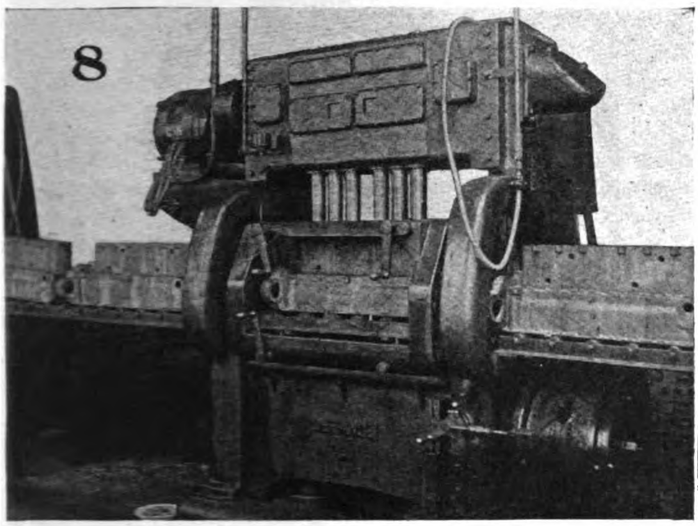
Chambered Cylinders

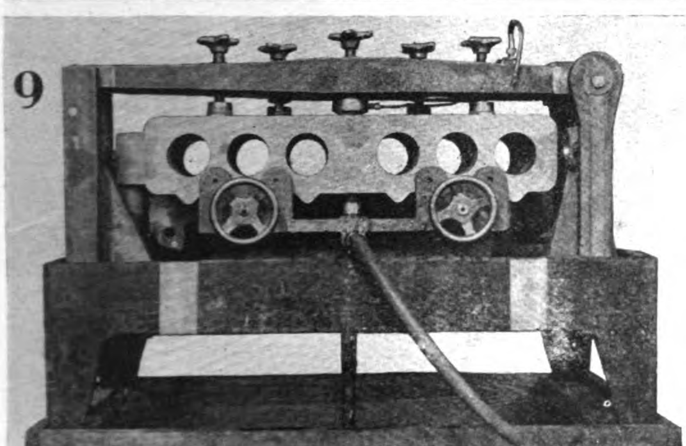
As the combined diameter of the two valves in the cylinders is larger than the cylinder bore, it is necessary to chamfer the cylinders for valve clearance at the top. This is done on a six-spindle Defiance machine, which takes this cut from the top of the cylinder. When this operation is complete the block is moved to a water testing jig for jacket leaks. The jig contains covers for the core holes and is so arranged that 45 lb. pressure can be put on the casting to check leakage.

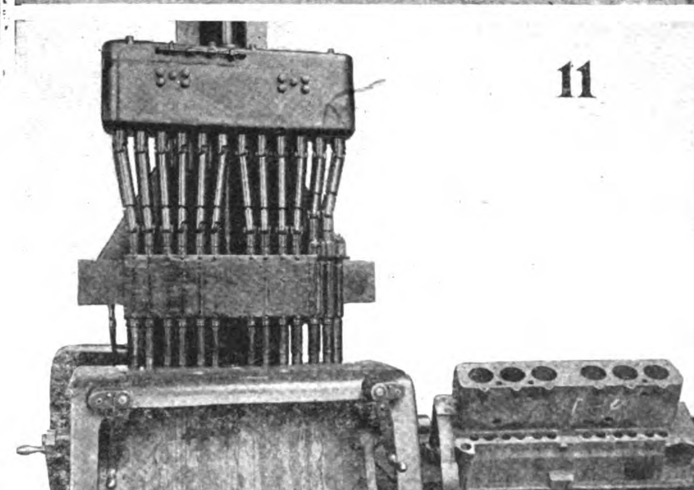
The next manufacturing operation is to mill the tappet boss, which is done on a Becker miller having a capacity of 45 per day. The location in this case is by the locating pads and the bottom face.



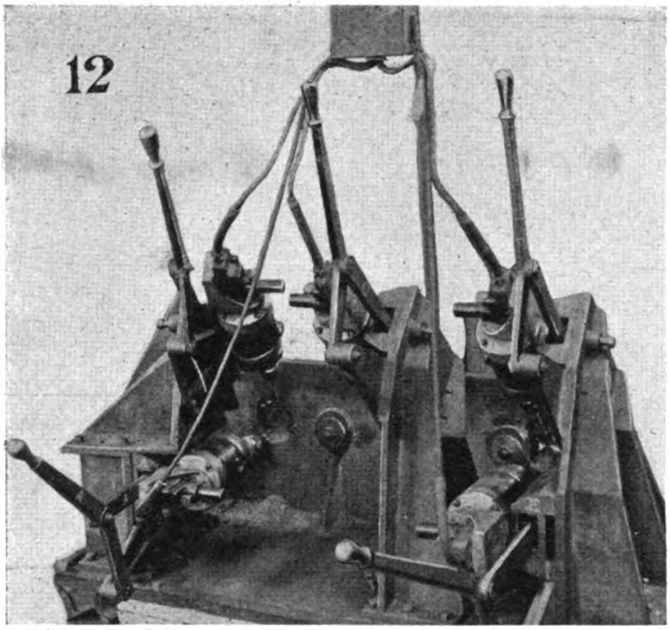


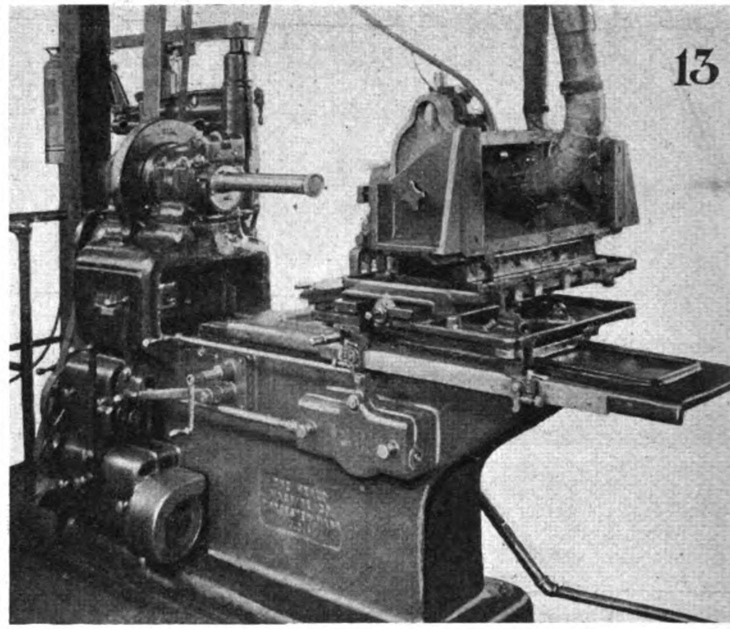


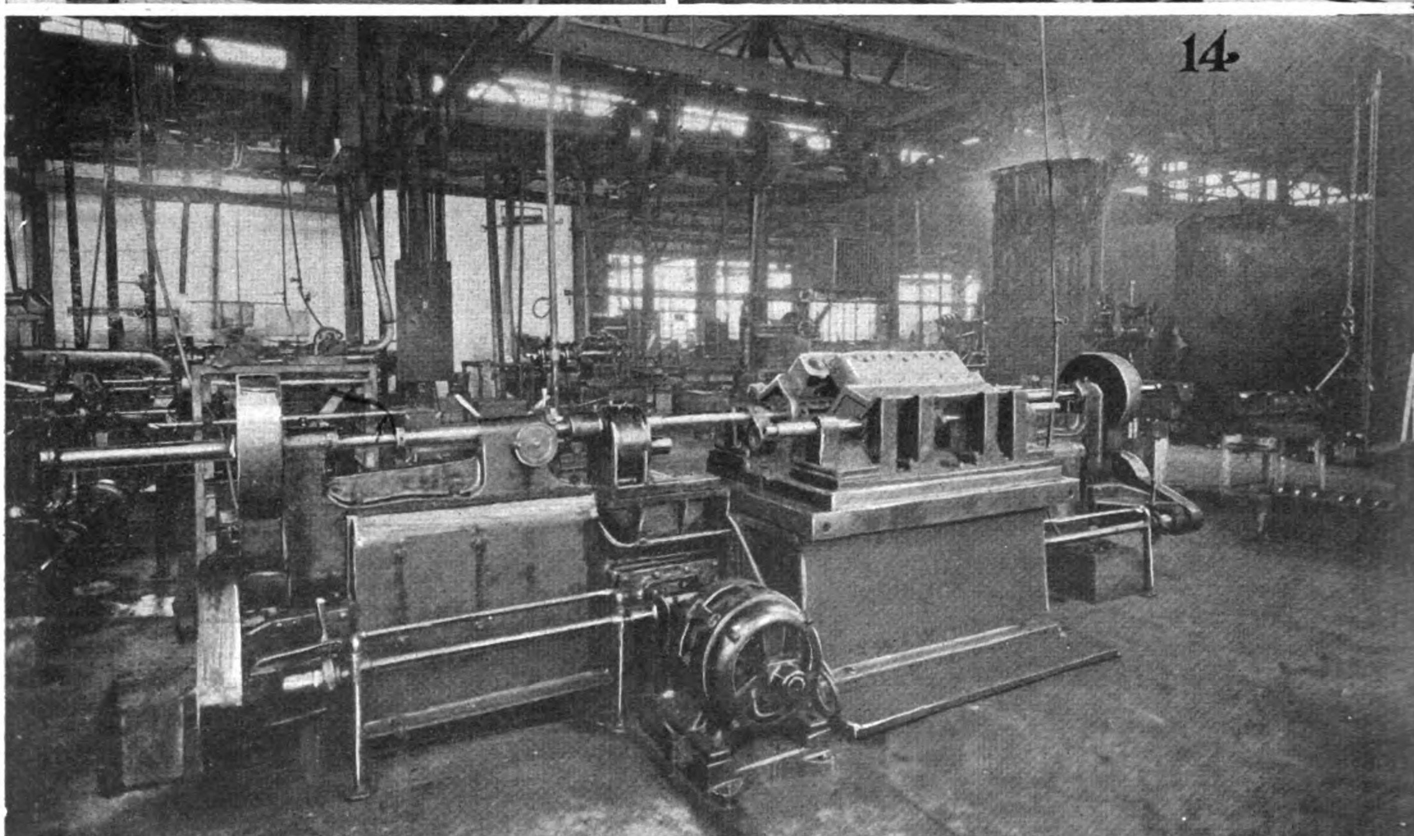




7—Rough cylinder boring machine operation. No block is shown in this machine so the jig construction may be illustrated. It will be noted that it is a tunnel jig with the roller conveyor in the jig so that the roller conveyor is continuous through the machine. The conveyor drops out of the way when the machine is in operation. 8—The finish boring machine. Only two boring operations are performed on this job. These two operations bring the barrels to grinding size. On this machine as well as on the rough boring machine will be seen an electric safety stop. The machines are directly driven and if the regular stop on the machine did not work the current to the motor would be shut off before damage could be done to the machine. 9—The water testing fixture. This operation comes after the finish bore and the fixture is clever, the arm across the top swinging upward, leaving the entire fixture open for the setting of the cylinder block. City pressure, which is about 54 lb., is used for this test and the block is left in the fixture for about 5 min. Two of these fixtures are used so that a man is setting a block in one while the pressure is on the other. Arrangements are being made to have this test made with hot water. 10—Defiance drilling and tapping machines which take care of the top and bottom holes at the same time. Another pair takes care of the horizontal holes in the same way. 11—Machine and fixture which drill the valve lifter guide holes in the side of the cylinder block. It will be noted that this drill carries 13 spindles, one of which is offset, being the extra spindle that drills the hole for the distributor. This is driven from the front end of the camshaft by means of a worm gear. Combination tools which ream as well as drill these holes are used on this machine







12—This shows a machine which is partially machine and partially fixture, designed and built in the Ansted shops. The oiling of the Ansted engine is accomplished under pressure and oil leads from the main bearings to the camshaft bearings are drilled in bosses, cast for that purpose. Five holes are required and all of them are at different angles. This fixture provides an electric drill for every hole set at its proper angle and a slide is provided. This entire tool cost $1,500, whereas to do this job on standard machines would have cost in the neighborhood of $12,000. 13—Grinding the cylinder. Note the exhaust suction pipe which removes grit directly from bore which is being ground. 14—Boring the main bearing and camshaft bearing holes. Rough caps are fitted to the main bearings during this operation so that the cutters get a full bearing. The fixture on this machine swivels so that one block is being set up and bars inserted while the other one is being machined. The camshaft bearings step down in size from the front. The main bearings step down in size from the rear. It is apparent, therefore, that in boring both of these lines at once they must be bored from opposite ends and the machine is therefore a double-end machine. The extra spindle shown in the left side of the machine is for a stud tool which bores and sizes a hole in the front gear housing, which is provided for magneto installation when necessary

One of the most interesting series of operations is that which now takes place. A group of four Defiance drilling and tapping machines is employed for this work. The first machine drills all of the top and bottom holes at the same time and is capable of easily taking care of 20 per hr., the capacity of the machine never having been reached in this plant. This would mean an excess of 200 per day, if desired. The second machine taps these same holes. The first two machines have 68 spindles each. The block is then moved to a second pair of machines which drills and taps the horizontal holes, taking care of both ends at the same time. These machines are equipped with electric stops which automatically kick off the motor should a spindle break or any other accident happen. The machines are operated by push buttons and stop automatically after the work is completed. The location of the work in these machines is by the locating holes and the bottom face of the casting.

The valve tappet guide holes are drilled and reamed, twelve at a time, on a Defiance machine, which also has a thirteenth spindle for drilling and reaming the igniter driveshaft hole. The location for this work is the bottom face of the casting and by dowel pins in the two locating holes. The machine is capable of taking care of 135 pieces per 10-hr. day, the diameter of the holes being 1¼ in.

A number of minor drilling operations follow this work, these including the cleaning up of the water circulating and oil regulation holes, drilling and tapping the ignition drive flange holes, the valve guide dowel screw holes, oil feed holes, etc. American radials are used for this work. The control rod holes are drilled on a gang radial drill, the holes being drilled in from both sides. This machine also bores the oil pump retainer flange hole and the retaining screw holes. A box jig is used for this work, the location being from the two locating holes and the bottom surface of the casting.

The next operation is to counterbore the core holes for Welch plugs, after which the spark plug holes are drilled, counterbored and tapped. This work is done on an Avey drill, the work being carried along on a jig which travels on a track below the three spindle drill, the three spindles, of course, being for drilling, counterboring and tapping.

The main bearings are bored on a Rockford horizontal drill with two bars operating at the same time. These roughbore the camshaft and crankshaft bearings simultaneously, the bearings being stepped for tool clearance. This operation is a roughing cut, the machine being capable of 40 per day. The finish cut is also made on a Rockford machine, this being a double ended unit which flycuts the crankshaft and camshaft bearings simultaneously. This machine is capable of 4 per hr., or 40 per 10-hr. day. The camshaft and crankshaft bearings are cut in from opposite directions, which allows the largest crankshaft bearings to be at the flywheel and the largest camshaft bearing to be at the timing gear end, as required by best engineering practice.

An ingenious layout is used for drilling the oil holes. These run in various directions, not square to either face of the casting, and are handled by independent electric drills. These are of Van Dorn manufacture and are arranged in a battery of five on a single jig.

The finish cut on the bearing for both crankshaft and the camshaft is taken care of by hand reaming at the present time. Eventually, air-driven Kelly reamers are to be installed. This operation takes a very light cut from the metal, the bearing being practically finished by the flycutting operation on the Rockford drill previously mentioned. Following this, the bottom of the cylinders are chamfered on a Baker Bros. milling machine, the oil gage and suction line holes are drilled and tapped on a Barnes drill and the magneto opening cover plate holes are drilled and tapped on an American radial. The magneto installation, of course, is only used on the export cars.

On a Binsse Machine Co. horizontal miller adapted particularly to this work, the rear crankshaft oil thrower ring groove is cut and the bearings are milled off to proper length. This machine operates with a cross feed, the blocks being fed up to the cutter.

The cylinder blocks are then washed in a Blakeslee washing machine, being washed with Oakite solution. They are air dried in an oven and sprayed with a primer, baked and then enameled and baked again. The cylinders are then ready for grinding, the grinding being the final operation, so that the heat of the drying oven for baking the enamel will not distort the castings after grinding. The grinding is done on No. 60 Heald grinders with Norton 303S wheels. From .010 to .015 in. of metal is taken off, the limitations on the work being plus or minus .00025 in. Exhaust fans are placed over the open end of the cylinder upon which grinding is taking place to exhaust the grinding dust immediately.

Sequence of Operations in the Manufacture of the Ansted Cylinder Block

Chip snags
Snag grind
Sand blast
Chip, remove wires, blow out with air and paint
Inspect sand holes, etc.
Mill locating pad in water manifold
Mill face front, main and camshaft bearing
Rough mill top and bottom (Davis)
Mill top, bottom and oil pump pad (Ingersoll)
Drill and ream two ½ in. locating holes
Mill rear camshaft bearing
Mill both ends
Rough bore cylinder barrels
Finish bore cylinder barrels
Inspect all preceding operations
Water test
Mill valve lifter guide flange and mill oil regulator pad
Drill and holes top and bottom
Tap all holes top and bottom
Drill all holes, both ends
Tap all holes, both ends
Drill and ream valve guide and timer holes
Drill 12 water circulation holes
Drill ½ in. oil relief holes
Drill one 23/64 in. hole
Drill two 17/64 in. holes
Tap two 5/16-4 in. holes
Tap two ⅜-24 in. holes
Countersink all tapped holes
Ream .375 holes
Drill, ream and tap all holes on both sides of block except core hole
Countersink and tap six 5/16 by 24 holes, bore and counterbore for plugs
Drill, counterbore and tap for spark plugs
Assemble rough cap for main bearing
Inspect all operations up to and including water test
Bore and ream crankshaft and camshaft brgs. and spot face magneto locating bearing
Dis-assemble
Drive five oil holes in main bearing
Drill one 7/16 in. and one 21/64 in. hole and counterdrill 9/16 in. hole
Tap ½-20 in. and tap one ⅝-18 in. hole
Drill and tap guide lock screw holes
Drill and tap timer bracket holes
Drill and tap oil lead holes over rear brg.
Drill three magneto pad holes
Tap two ⅜-24 holes and ream one 11/32 in. hole
Hand ream push rod guide holes
Chamfer bottom of barrels
Countersink all tapped holes and retap
Drill and tap ⅛ in. compression test cup holes
Mill combustion chambers
Straddle face main brgs. and cut oil slinger slot
Wash and put in Hubbard plugs
Grind barrels

Refinements in Chassis Construction

(Continued from page 60)

case of the front end of the chassis they furnish additional protection against collision, particularly protecting the radiator against the minor collisions which are constantly occurring in the congested parking centers. Cole uses a heavy tube at the front end of the chassis and Templar at both ends. An interesting chassis stiffener is the large flat plate at the rear end of the Stearns. This extends across the entire rear end of the chassis and beside providing a stiffening member acts as a foundation for the rear tire carrier.

One of the greatest lines of improvement in the chassis is the incorporation of anti-rattle features in the brake mechanism and in the shackles. In the brake linkage there has been a noticeable growth in the use of tension springs which keeps the linkage continually taut so that there is no chance of rattle. On the Oakland cars these little coil springs are very ingeniously mounted under the cross member which supports the brake equalizer shaft. The springs are smaller and more compact than usually employed for this work and are hung upon retainers which are free to rock in the cross member.

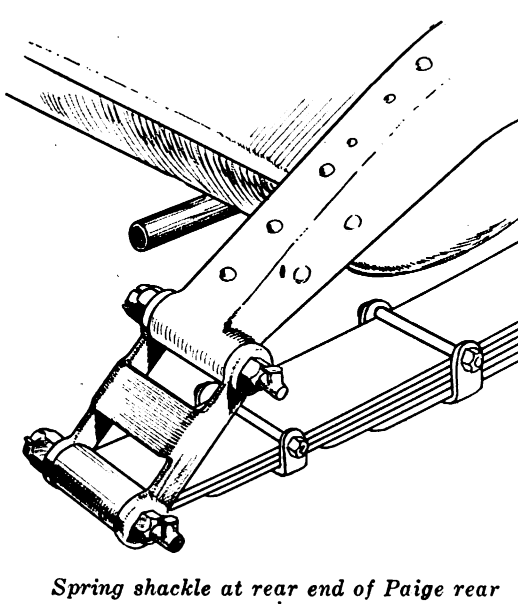
In preventing rattle in the shackles, which are notably the worst offenders in this respect, the use of the adjustable shackle on the Locomobile and on the new Navarre, designed by A. C. Schulz, formerly of Locomobile, are of interest. These have a take up secured by a clamp, which permits of compensation for wear. On the Navarre the spring is allowed to center itself on the bolt and then the bolt retainer is brought against a washer which is forced against the spring. Since the spring is allowed to center itself before the bushing is screwed against it, it is not necessary to hold the spring width to close limits in manufacture. The adjustment is held tight by a clamp bolt, the end of the frame horn being split.

From the standpoint of spring suspension the only radical developments apparent are the Roamer double cantilever, which is already familiar to most of our readers, and in the only German product shown. This is the Sauer on exhibit at the Commodore. It has a cantilever pivoted at the center with a rocking seat on the rear axle very similar to the Rolls-Royce suspension. In the Roamer installation the noteworthy point is that the cantilever arrangement is used in conjunction with Hotchkiss drive. The springs are super-imposed, one member being supported at the bottom of the brake drum, pivoted and anchored on the chassis by a forging and the other member being similarly mounted by a pivot point at the top of the brake drum and anchored at a point on the chassis ahead of the center on the lower member. The bottom unit is intended to check shocks and the top to check rebound.

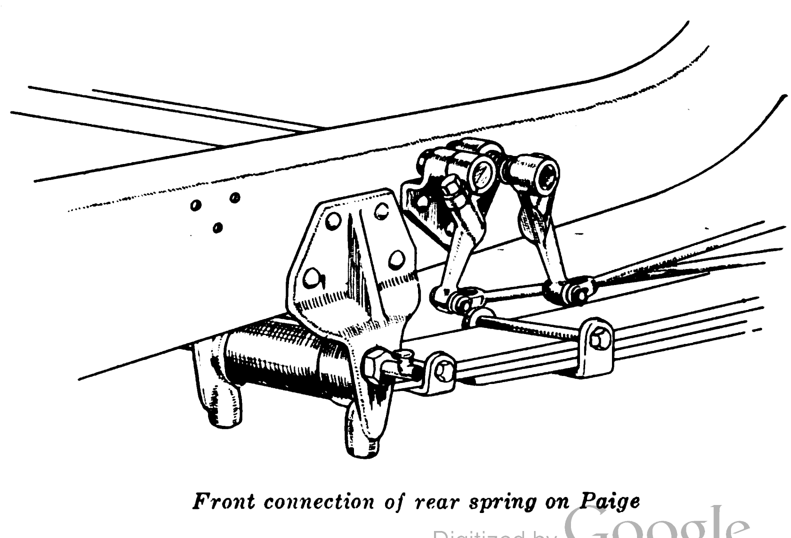
There are a number of variations in practice in the supporting of the rear end of the rear semi-elliptic spring. Where the frame has tapering side members, many designers are making an effort to take the twist out of the spring by keeping the spring itself parallel to the center line of the car. The use of a prominent drop in the rear end of the frame to coincide with the flatter spring suspension is quite a prominent feature and a few makers are sweeping the horn down for the purpose of dropping the side rails slightly, making the rear shackles tension instead of compression members.

Throughout the entire line of exhibits there has been a notable effort to increase the stiffness of the frame through the use of deeper side rails, by a greater number of cross members and by more thorough gusseting. There are a great many frames which taper materially in depth. For instance, the Scripps Booth, which is very noticeable in this respect, the depth of the frame being constant for only a short portion of the length. The Maxwell is another example in which the frame tapers considerably in depth. The majority of frames, however, have only slight taper and this takes place at the extremities. The bottleneck type has about disappeared and in its place the tapered frame is used to get the narrow front end necessary to give narrow turning radius and a sightly front end.

There are not any noticeable steering developments except perhaps in the lubrication of the parts where practice has been improved in line with what has already been said under the head of chassis lubrication. There is, however, a tendency on the part of a great many to use heavier oversize parts. The Hupp has been materially strengthened in this respect, the steering gear having been entirely revised and a larger unit installed.



Spring shackle at rear end of Paige rear spring



Front connection of rear spring on Paige

Clutches, Transmissions and Universal Joints

By Herbert Chase

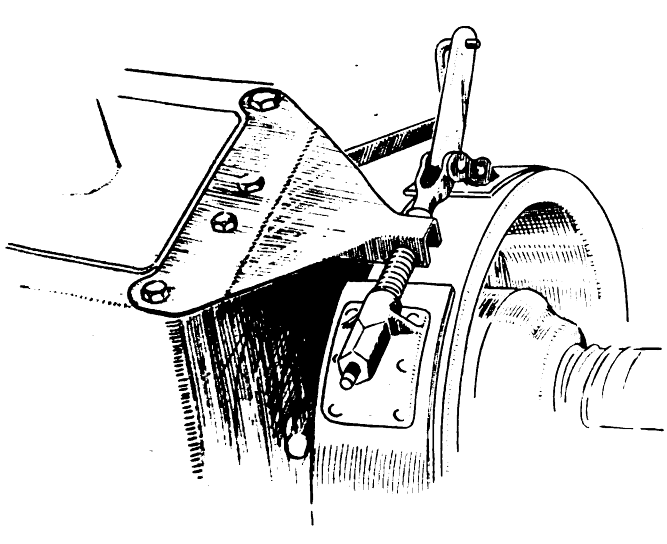
THERE is little that is really new in the way of clutches, although some makers have changed the type employed. Substantially all of the higher price cars use the multiple disk type running dry and faced with molded or woven asbestos composition. The new Pierce-Arrow chassis is fitted with this type, having finally abandoned the cone type, which was standard on chassis built by this company for many years. There are to-day in this country but few makers who continue to use the cone clutch and the tendency both here and abroad is toward the multiple or the single disk type which, as a rule, is smoother in engagement and less apt to cause clashing of gears when changing, because it does not continue to spin so long after disengagement. The plate or single disk type is very widely used in this country as it is also in Europe. It requires, however, the application of considerable pressure on the friction surfaces to prevent slipping, and this in turn means relatively rapid wear and a heavy pedal pressure unless a considerable multiplication by levers is employed, and even then the pedal pressures frequently used are excessive. This, indeed, is a point in which there is much room for improvement. In the case of cars driven by women, in particular, it is a serious mistake to use high pedal pressure, and it certainly does not add to the pleasure or comfort of any driver to be required to use unnecessary exertion to declutch the engine when changing gears.

There are several ways of overcoming this drawback. One is to use multiplying levers somewhere between clutch pedal and the disengaging member, as is done in several European and some American designs, Lincoln, Packard and Dorris being cases in point. Another is to use a larger number of disks with lighter springs, as is done on the LaFayette, or to employ some of the more recently developed materials which have a higher friction coefficient. A larger diameter of friction surface can also be used, but in this case means to stop spinning on disengagement are doubly important.

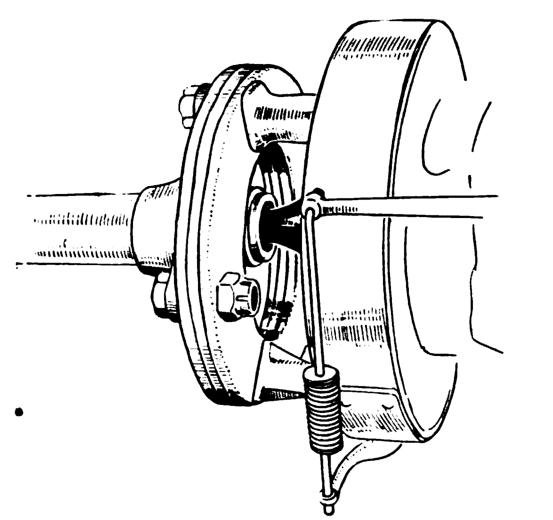
It is possible to design clutches that require no adjustment throughout the life of the facings, but most types in common use require occasional adjustment or other attention, hence it is desirable to make them as accessible as possible. This has been done on many cars exhibited, the Briscoe, Nash and Dort, for example, but many others are not easily accessible and in most cases it is necessary to remove the transmission when it becomes necessary to dismantle the clutch for refacing or major repairs. In some very recent designs it is not only necessary to remove the entire transmission in order to dismantle the clutch, but before this can be done the spring bolts must be removed and the entire rear axle be moved back! Inaccessibility is partly due in most cases to the use of a closed bellhousing. In other cases the bellhousing is open at the bottom, sometimes having a removable cover top and bottom as in the Cleveland. While the need for ready access to the clutch is not so important a factor as it used to be with the earlier cars, it should not be forgotten, even though the use of the unit powerplant has introduced a factor that has not simplified the problem of securing accessibility.

The clutch thrust bearing has in the past been a source of much trouble, hence it is pleasing to note a tendency to improve the design in this particular. Better and larger bearings are provided and the practice of using a forked throwout lever engaging with pins on the casing for the thrust bearing is being abandoned in many designs. When levers or cams with contact only on the forward face of the bearing casing are used the latter is free to rotate with the clutch, so that the bearing runs only when the clutch is disengaged, and not continuously as in the other type. Obviously the bearing will require less lubrication if it runs only when the clutch is disengaged. It can in this case be packed with enough grease to last for many thousand of miles, while in the other case it requires frequent lubrication, and a grease cup is often provided, this cup being placed above the floor boards in some cases, so that it will not be forgotten. In the Kissel car an oil lead was carried to a point near the rear engine cylinder where an oil cup was fitted, the idea apparently being to make it easy to oil the clutch bearing whenever valves or other parts under the hood are oiled.

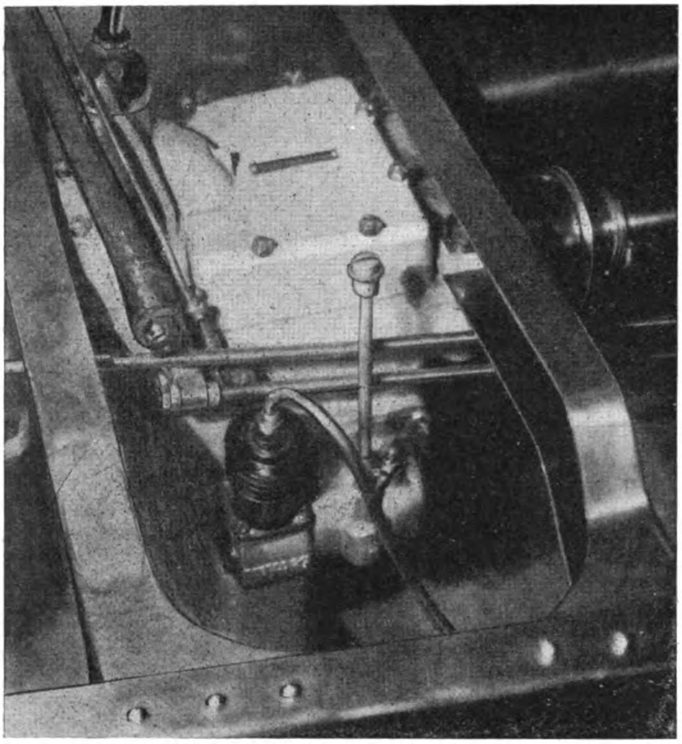
Apparently chassis designers are mostly men with medium length legs, otherwise more frequent arrangement would be made for adjusting the pedals to accommodate



Transmission brake support on Nash



Central guide for fabric universal joint on Briscoe



Air pump mounting on Pierce-Arrow transmission

the short or long legged driver. This is a very simple thing to do and is done on many cars. The practice might well be followed by all. A detail which most makers overlook is provided in a few cars, that is the fitting or rubber covers on the pedals, as on Pierce, National and LaFayette, among others. Serious accidents have been known to occur as a result of an operator's foot slipping off the clutch or brake pedals in a tight place or when instant action was required. This possibility is minimized by the use of rubber covers. Pedals so covered are also easier on the feet and help to prevent the feet from becoming chilled in cold weather. They should be more generally used.

Transmission

Novelties in transmissions are very few indeed. It is getting to be well nigh universal practice to rigidly connect engine and transmission, forming a unit powerplant by the use of a bellhousing, which encloses flywheel and clutch. This construction renders the use of flexible connection between clutch and transmission unnecessary, and departures from it involve expense which make the practice of fitting the transmission amidships almost prohibitive except in the higher priced cars, and even the newer higher priced jobs, such as Lincoln and LaFayette and Fergus, make use of the unit construction. Thus the transmission is usually supported from the engine, its weight being carried by the rear engine arms or a cross member of the frame bolted to the crankcase just forward or just aft of the flywheel. The overhang is frequently considerable, but the conical bellhousing and boxlike section of the transmission case provide the necessary rigidity, especially when the double universal joint construction is employed, as it so frequently is.

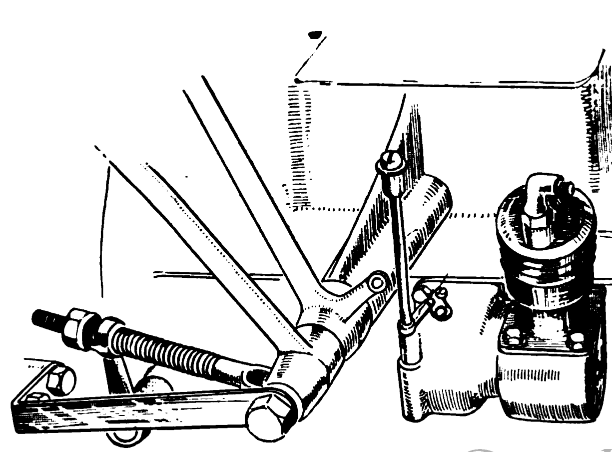
The use of three-speed gear boxes is more nearly universal than the unit powerplant. Three speeds are used in the new Pierce-Arrow, Packard, LaFayette and Lincoln chassis, but the Mercer uses a four-speed box. No one has attempted to emulate the British and Continental manufacturers in producing a light chassis with small size highly efficient engine and four-speed gearset, though such a procedure would seem to be called for if the fuel stringency so long promised becomes a reality.

The Fiat has a novel gear shifting mechanism. The shifter forks are carried on a cross shaft which is moved axially by side motion of the shifter lever. The change of gear is then made by rocking the cross shaft through motion of the hand lever forward or back in the gate. A single pair of links, one with ball and the other elongated socket ends imparts both lateral and rocking motion to the shifter shaft. Aside from this the changes noted in the design of the gearbox lie chiefly in the addition of appendages in the form of air pumps and propeller shaft brakes. Many of the latter are fitted, among them being Nash, Cleveland, Briscoe, Mercer and Citroen, and these for the most part are emergency brakes, a departure from the practice formerly employed of fitting the foot brake on the propeller shaft. Most of the transmission brakes are of the contracting type, the band being anchored to lugs fastened in sockets cast on the transmission case or to integrally cast extensions of the case. In the case of the Nash six, however, the brake anchorages are made from stampings bolted to the transmission case. In a few of the more expensive chassis, such as the Mercer, the transmission brake is of the expanding type, the drum having cooling ribs and the shoes being placed between the drum and the transmission. This makes it possible to use a camshaft running through or beside the gearbox parallel to the gear shafts and a neat linkage with a short pullrod connecting direct to the brake pedal, the brake in this case being the service instead of the emergency brake.

A considerable number, especially of the higher priced cars, among them Packard, Locomobile, LaFayette, Pierce and Dorris, are fitted with gear driven air pumps. These are nearly always mounted on the left side of the gear box and have but one cylinder. They are usually thrown into and out of engagement by turning a short vertical shaft which extends upward through the floor boards, or horizontally through the side member of the frame. Many makes of gear box are provided with S. A. E. standard opening to which the air pump can easily be connected by the purchaser if the manufacturer does not fit it as regular equipment.

It is almost universal practice to mount the gear shifting lever on a pedestal directly over the gear case. This makes a compact and neat arrangement which is sightly and provides a convenient means of bringing the control through the floor boards. The gate formerly used is no longer required and is used on only a few cars, Fiat and Stutz among the latter.

Holes through the floor boards are frequently made larger than necessary for the controls, thus admitting to the space above them noise, grease and cold air, which



Air pump mounting on Packard transmission

would be largely excluded if the space were closed by a flexible material or other means. A refinement in this direction would be especially appropriate when closed body is fitted.

On the whole, controls are more conveniently arranged than heretofore. Room for egress is usually provided, yet the gear shifting lever is so placed that it is easily reached by the operator. An offset lever is employed in many instances.

Speedometer drives are mostly from the transmission. Spur gears are frequently used for this purpose, but the neatest and best drive is the spiral gear, employed on Lincoln and some other chassis, for it is noiseless and can be made compact.

A commendable practice is that of fitting transmission locks as is done by Lincoln among others.

No marked advance in universal joint construction is noted, but improvements in detail, especially in lubrication means, are occasionally in evidence. In the LaFayette and Fiat chassis, for example, the single universal is lubricated by oil from the gearcase. One parts manufacturer (Merchant & Evans) is exhibiting a system of lubrication in which oil is forced through the universal joints and hollow propeller shaft to the rear axle, from which the lubricant is returned to a tank on the dash and again fed to the transmission. More hollow propeller shafts are being used, the solid ends being welded in place.

The metal joint predominates and is manufactured in a large variety of patterns, most of these being enclosed in metal or leather covers, but some are not enclosed and no adequate provision for lubrication made. Many makers employ flexible disk joints of fabric with rubber impregnation. Those used on the Briscoe chassis are held from radial displacement by the use of a centrally placed ball and socket. When a separate gearset is used the universal connection with the engine is generally of fabric, but Sauer, the only German chassis shown, uses a laminated metal disk for this connection.

The disk wheel is in great prominence among the special show cars. On the Franklin are the new Parker aluminum disk wheels which have been lately introduced and which, of course, have the quality of lightness to a marked degree, being about 15 lb. per set lighter than wood on this particular installation. Growing numbers of manufacturers are offering these wheels as optional equipment, the retail prices for this equipment averaging around $125 per set.

Passenger Car Bodies at the Show

By George J. Mercer

THE body display at the show this year is very interesting especially in the brighter color combinations, clean cut trimming designs (particularly in the finish on the edges) and the uniformly good looking tops on the open cars. There are an unusually large number of sport type touring cars and runabouts with cycle mudguards and steps in place of the runboards. These are generally fitted with disk or wire wheels and an increased number of cars have side wings on the windshield, and cowl lamps, in most cases attached to the base of the windshield itself. Nickel plating of radiators is more general and there is, altogether, a brightening up that cannot help but please the prospective buyer.

The keynote of the body display is the general refinement in detail. The models displayed include the conventional runabout, touring body, coupe and sedan, while the exhibitors of the more expensive cars show the two compartment closed body and a few town car types. Most exhibitors, however, seemed to have concentrated attention on the open cars in an effort to change the appearance or add new features.

The runabouts shown appear more substantial looking than in former years. There is no increase in the seating space, but the carrying space at the rear is larger. The runabout is essentially a two-passenger car and all attempts to take it out of this class have been abortive. These bodies have generous seating space, comfortable cushions and backs, and good height to the body side. The use of steps in place of runboards works out well on this type of car, as it gives the driver a near ground view when driving fast. The illustration of the top, Fig. 1, shows that even on this body type the tendency is to use the car with the top up. The use of the wings to the windshield are necessary when this top is used, as they help to prevent the wind pocketing under the top.

Two views of windshields are shown in Figs. 2 and 3, one portraying the side wings and the other a type used for protecting the tonneau. This latter is not commonly

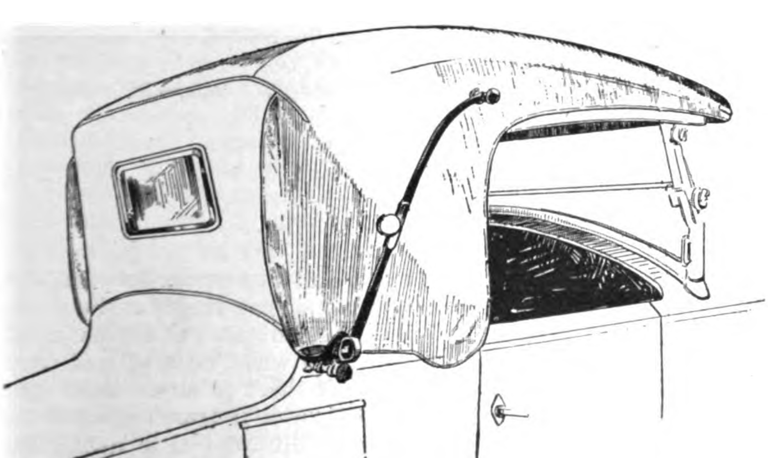


Fig. 1—Cole runabout with top raised

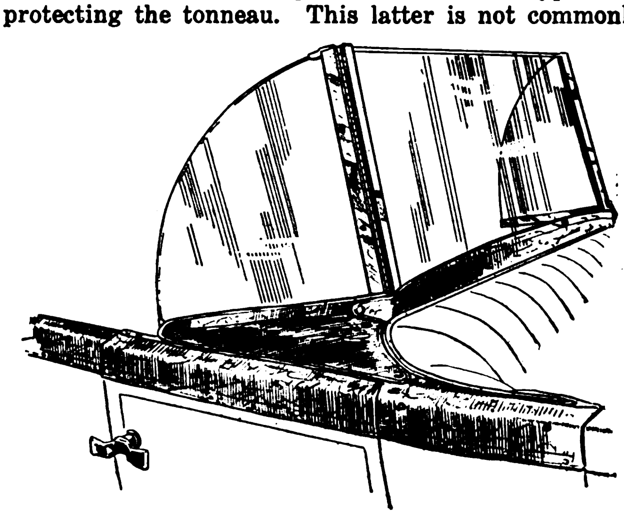


Fig. 2—Tonneau windshield of Roamer car

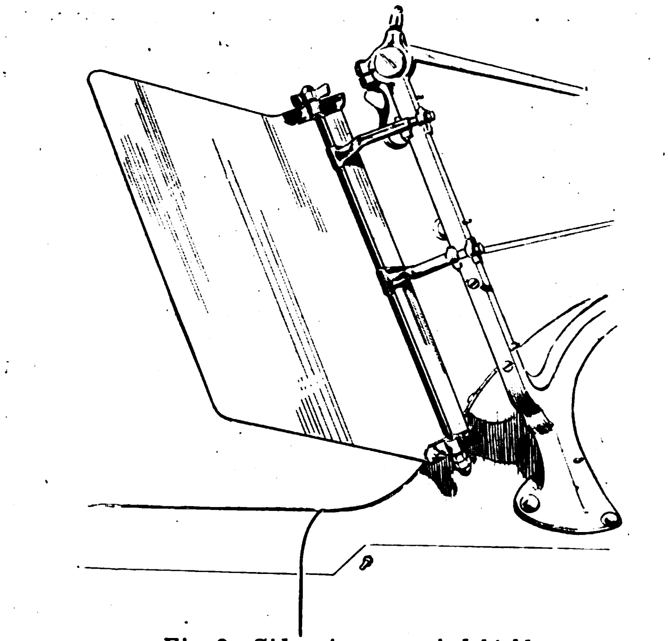


Fig. 3—Side wings on windshield

used. In this case the top of the body is protected by a leather skirt.

Windshield frames, like some of the other parts of the car, are being nickel plated. On some of the smart types of touring cars and runabouts, the nickel work included the radiators, windshield frames, lamps and door handles. The steps which often replace the runboards are cast in white metal and polished.

Fig. 4 shows a novel method of fastening the windshield to the body. It exemplifies the refinement in detail already referred to. Another part of the car that benefited by a change is the radiator. Addition of shutters has unquestionably improved the appearance of the front end of the car. The shutters are sometimes placed in a vertical position, but they are usually horizontal.

Refinement in open cars has been of a character that will be permanent. The brighter color combinations with striping will be more in evidence during the coming season than for many years past.

The buyer is attracted by the opportunity for individualism. He is often satisfied if this can be gained in the color scheme. There are no color combinations but there are more cars painted in colors and they are uniformly good. Workmanship and finish average better than usual. In general, the best colors were the blues, that is, the Rolls Royce or Belgian blue. The striping was usually white. Some of the wide stripes had hair lines at each side. When this is used in moderation the results are pleasing. There were cases in which the striping did not logically carry out any design pattern, but was continued from the flat over rounded surfaces. The tendency for some years past has been to eliminate striping on all except very high grade work, hence the art has, to some extent, been forgotten.

The disk wheel does not allow much latitude in the matter of colors. The very best results are obtained when the color used on the disk is lighter than the body color.

Some of the closed cars use bright color combinations with the upper part black, lake maroon, blue and gray being used to good effect in some cases.

Colored trimmings are less in use on open cars this year. There were isolated cases, but the majority used the conventional black leather for cushions, and imitation leather for the flat parts and on doors. On closed cars the trimming colors were modest and of inconspicuous pattern with very modest appointments.

Real comfort in the seating has made progress, but there is still room for improvement on many cars. The runabouts usually have comfortable seats, the height of the cushion in relation to the sides being generally low. The slope of the cushion and back are sufficient. Too many touring bodies lack this, and with the majority of five-passenger bodies there is an opportunity to give more room forward of the driver's seat. Seven-passenger body practice sometimes involving a cramped front section has in some instances been followed in the five-passenger model without logical reason. The cushion and back, when of the right angle or slope and height, together with correct height of body side as a retainer, will hold the passenger in without effort on his part when rough places in the road are encountered.

The tendency in design is toward more rounded surfaces, in contrast to the angular lines which have been the prevailing tendency for some time past. Production methods require as many units as possible to be interchangeable on several models, hence rounded radiators and hoods which blend readily with other rounded surfaces are in favor.

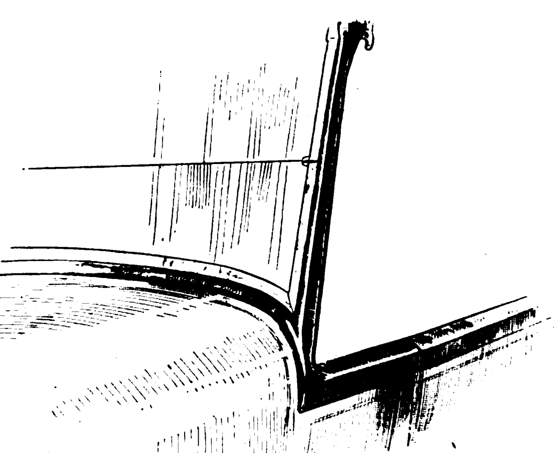


Fig. 4—Novel method of fastening windshield frame to body

New British Light Car

A SMALL air cooled car with friction drive has been placed on the British market and was exhibited at the recent London show. The engine is a two cylinder opposed, 3⅜ x 3 7-16 in., with steel, flanged cylinders and cast iron heads. The main feature is that the engine, rear axle and all of the transmission gear are carried on a sub-frame and are really built up as one unit. This unit is pivoted on a cross member of the frame at the front and attached by the springs at the rear. No universal joints are therefore required, nor is there any relative motion between the sprocket wheels of the chain, which can therefore be short.

The friction disk is mounted on an extension of the engine shaft, and the friction wheel on a splined cross shaft. At the end of this shaft there is an enclosed spur reduction gear, and thence the power is transmitted to the rear axle by a short chain. No differential is used. The wheelbase is 102 in., the tread 42 in. and the weight is approximately 900 lb.

Service Advertising Is the Need of Day

Largest meeting of Advertising Managers' Council of M. A. M. A. hears notable speakers who urge practical advice in all of their publicity. Start movement for revision of rules governing shows and exhibits.

By Clyde Jennings

AT no period of the well filled program that made for a busy day did the members of the Advertising Managers' Council of the Motor and Accessory Manufacturers' Association escape from the outspoken fact that advertising must be directed more and more toward the service work and that managers must examine more closely the objective and mediums of their advertising campaign. And let it be said, to the credit of the 150 or more men and two women present, that they showed no disposition to escape this service talk. Indeed, their heartiest applause was for the men who talked service most emphatically.

The service talk began at the very beginning. S. E. Baldwin, who called the meeting to order in the place of Chairman E. C. Tibbitts, spoke of the service of the Council to those who attended. Then E. W. Clark read a paper on "Selling the Automotive Industry to America." The speaker went into his subject exhaustively and traced the story of transportation from the beginning, showing how wealth had increased as transportation costs decreased. At this period, he said, we were at another turning point when railway building in this country was almost at a standstill, and that highway building is just beginning. The truck and the passenger car were coming into their own as utility vehicles. The excess of expectation and the purely pleasure use of these vehicles are undergoing adjustment. He advocated that when the spokesmen for the automotive vehicles appear before the Congressional Committee to seek the proper adjustment of taxes, that they openly advocate that automotive vehicles be taxed in proportion to their carrying capacity on par with railroad locomotives and cars. Clark expressed a belief in the need for a greater automotive organization than yet existed, to co-ordinate the work of the present organizations and that on this organization should fall much of the promotion work.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, reviewed briefly the organization work within the industry and expressed the belief that co-ordination was rapidly being effected. He said that he believed that if any fault was to be found with the advertising of the past it was that the automobile had been over advertised. His thought was that the needs of the past justified the means used, but that now a turning point had come and that more utility advertising was needed. Service was the great need of the day and a part of the advertising of service was to provide the 120,000 mechanics needed for this branch of the industry. He suggested that each advertiser of any automotive product inject into his display space some bit of information regarding the advances of automotive transportation.

C. C. Parlin of the Curtis Publishing Co. reviewed the business situation with an especial reference to what he termed the "retarded sales." His view was that while this country was not now buying as freely as it might, that the greatest stagnation of business was due to the lack of willingness of retail merchants, especially the smaller merchants, to lose some money themselves. Merchants, he said, like every other human being, were entirely willing to see some other person lose money. As a consequence they had been permitting their shelf stocks to dwindle, awaiting the necessity of buying. That period was here, he said.

He viewed the automotive prospects as entirely hopeful. He predicted early sales, but not an avalanche of sales. He reviewed the ownership in homes of several high priced articles—in the community canvassed pianos were in 44 per cent of the homes, autos in 42 per cent and talking machines in 32 per cent. Since that survey was made in 1918, the purchases had been 24 per cent of autos, 22 per cent of talking machines and 4 per cent of pianos. The speaker made the point that pianos were not "advertised." His definition of advertising apparently was space in thirty leading magazines. But he made this point only as to purchases since 1918, ignoring the fact that pianos are well advertised locally and in business papers and had in the canvass a higher percentage of ownership than the nationally advertised articles he referred to.

In a humorously cynical address A. R. Kroh, who introduced himself as a farmer, advised that it was a necessity for every automotive man to advertise his vehicle or part of a vehicle to the farmers in the plainest possible service terms so that the farmer might improve his position and be able to continue raising enough food to keep on feeding the great percentage of people who are non-productive from a food viewpoint. His address was well received and carried home its lesson of the responsibility of advertisers to sell their goods definitely and truthfully.

In his paper on "Cashing In On This Year's Automobile Shows" W. E. Brewster took the position that the show put before the public the spirit of the industry and as long as the public will pay to see the annual exhibition it is the duty of all concerned to participate. He advised a closer check of the visitors, etc. In his discussion of this paper, A. H. Bartsch brought up the subject of revised exhibition rules and was offered much encouragement. As a result, a resolution was passed that the executive committee name a committee to take up with General Manager Heminway the subject of revising the rules for shows, a work that Heminway reported to be already under way, and he welcomed the assistance.

"My Best Advertising Bet for 1921" was a forum participated in by Ralph Leavenworth, Eben Griffiths, Joseph Jacobs and R. E. Mackenzie. Their suggestions were for closer co-operation with the salesmen, better co-ordination of business paper, magazine and mail advertising, better follow-ups and generally for injection of efficiency into the advertising business.

The time and place for holding the quarterly meeting in March was left to the executive committee. The January meeting was held in the college room of the Astor Hotel. The attendance was the largest since the council was formed. Chairman Tibbitts's absence was due to the very serious illness of Mrs. Tibbitts.

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The New York Show

THE opening three days of the New York Automobile Show have given unmistakable evidences of a potential buying market and also indications of a disintegration of the buyers' strike. While attendance may not quite equal that of a year ago, it is highly encouraging and the percentage of visitors displaying a particular interest is perhaps higher than a year ago. It has been conspicuous that there has been a great amount of interest in high priced jobs and that the percentage of attendance of visitors in exhibit spaces of such cars is greater when compared with the visitors in the exhibits of low-priced cars than formerly. In other words, it might be inferred that the drop in attendance is more with that class looking for low priced jobs than in that class looking for high priced jobs. A natural inference is that the last few months have not taken the buyer of high priced cars out of the market due to any lack of money but that he has been awaiting the developments of the market and, perhaps like many others, has been holding off from buying as long as possible.

The growing conviction that the merchandise shelves of the retail industry of the country are very empty and that they must come into the market is having an echo in the indications of real buying that the show has already given. The great arrival of buyers of textiles from all parts of the country in New York during this week, is a further indication that the buying strike is gradually breaking down. These buyers were in New York City last July and they refused to buy. Some of them came during later months in the fall and they refused to buy. The heavy reductions in many lines of textile prices made on Dec. 31, 1920, are having their effect. There has to be heavy buying in the textile field. This is going to play its part in breaking up the buyers' strike in other lines. It is the entering of the thin edge of the wedge.

The New York Automobile Show has never been a strong retail show. Coming as it does in January, it is too far in advance of the spring season to warrant hasty deductions as to the effect on later buying. There is a greater tendency this year than in former years to conclude that business is not picking up due to few retail sales. In other years when we did not approach the show through a supercharged atmosphere of depression nobody expected much retail business and consequently were not disappointed if it did not come. The results of this year's shows should be interpreted rather through the spectacles of a year ago than through the spectacles of this year.

There is no question as to the interest in the engineering features by those who know motor cars best. The engineers present were quite anxious to see what was on display and the parts manufacturers were free to say that their engineering departments are busier than ever before. All of this indicates that the present design of cars is not to be regarded as by any means fixed. Fortunately, the cessation in production is not permitted to check development. It has in fact given an opportunity for improvements which could not have been made during a period of intensive production. Many improvements known to be in process are not yet exhibited. Next year's show will, for this reason, be apt to contain more that is really new than is to be seen at the current exhibit.

A Change in Brake Practice

IN the past when a transmission brake has been used on American cars it has generally been the pedal operated service brake, while the wheel brakes were the rarely used emergency brakes. The chief object in making the transmission brake the service brake obviously was to render brake operation less onerous to the driver, as the transmission brake requires much less effort to apply than does the ordinary rear wheel brake.

Recently, there has been a complete change in this practice, and the transmission brake is now generally made the emergency brake. This change can be justified on several grounds. The emergency brake is undoubtedly the one which should be used for making emergency stops, that is, quick stops required to avoid collisions or other accidents. Now, the transmission brake is always far more powerful than the

rear wheel brake and therefore far better adapted for making quick stops.

Under ordinary conditions it is not good for a car to be stopped very quickly, and with the rear wheel brakes, which require much more effort to apply, the careless driver is not so apt to misuse his brakes. Moreover, the transmission mechanism is not subjected to the braking strains when the brakes act directly on the rear wheels. Unnecessary strain on the driving members has been the chief argument against the transmission brake in the past, and if the brake is used only for rare emergency stops the objection loses much of its weight. On the other hand it seems to be the reasonable thing to ordinarily use the mild brake and only in case a quick stop is absolutely necessary to resort to the more powerful one. The wear of tires will certainly be much reduced if this plan is followed, as compared with the case when the transmission brake is constantly used.

Stock rear axles usually carry two sets of brakes, and this tends to prevent the adoption of transmission brakes on new cars. However, where the axles are specially designed for a new job there seems to be a decided tendency to adopt the transmission brake, as this obviates the need for the exposed contracting brake on the rear wheels which is hardly in keeping with the modern practice in motor car engineering of enclosing all working parts so they are fully protected from dust and dirt.

Aircraft Development in U. S. During 1920

A SURVEY of aircraft development during the past year does not show startling advances in this country, viewed from a civil or commercial angle. American built and designed aircraft have maintained a high standard of efficiency, however, according to a statement of the Manufacturers' Aircraft Association.

Production of airplanes has greatly decreased and a general contraction of the entire aeronautical industry has been evident during the latter part of 1920.

Several very definite reasons can be noted as cause for the lack of civil and commercial development in this country. Among the chief of these are:

1. Lack of aerial laws.
2. Lack of a sufficient number of properly equipped landing fields.
3. Need for a definitely outlined policy of Federal jurisdiction.

The most important of these lacking provisions is considered by the industry to be the last. It is believed that because no definite Federal policy has been pursued in regard to the advance of civil aviation, we are in our present position, inferior to England and several other nations in this particular respect.

The matter is gaining attention from legislators, however. This is indicated by the fact that the New York State Legislature considered State aircraft legislation, but finally adopted a resolution asking Congress to enact a Federal law before the various States passed conflicting legislation.

American pilots flying American machines, however, have achieved excellent individual performances both in the way of speed, consistency, endurance, and altitude.

The Engineer as a Partner in Business

IT is often said that the engineer is not a good business man. Some executives hold the view that engineers in general are narrow-minded specialists who are either incapable of or unwilling to be guided by factors which must dictate business policy. Certain it is that some engineers are so absorbed in abstract theory and its application, or in making changes in design to improve or bring up to date the product they have in hand, that the effect upon cost and time of production with consequent effect upon marketing, profits, etc., is overlooked.

This tendency is one of which we should not lose sight in this day of specialization. It has often reduced the engineer to a mere employee when, if he had taken a broader view, he would have become a partner in the business, as he properly should. The truly successful engineer is the one who fits himself into his environment—who serves wherever and in whatever way opportunity offers—not the one who rides his own particular hobby or follows the narrow gage single track of a specialty to the exclusion of broader activity.

The engineer must strive to put himself in the position of the executive who must make a business success of the venture. When he takes this broader view, and secures the confidence of the executive he should, and we believe will as a rule, be recognized as a true partner in business. This is but one reason for the plea that engineers who have not already seen the light to cut loose from old fashioned precedent and widen their horizon for their own benefit. We do not advocate departure from engineering ideals worthy of the name, but we do urge upon the engineer the necessity of appreciating the viewpoint of the man who must make the venture pay, lest the whole structure fall, realizing, of course, that no structure can prove permanently effective which is not built on sound engineering principles.

On the other hand, it should not be forgotten that modern business is itself carried forward on engineering principles and that many of the most successful engineers are holding prominent executive positions in which their engineering ability is being utilized to the best possible advantage. Such men as C. F. Kettering, W. H. Van Dervoort, H. E. Coffin, H. M. Leland, H. W. Alden, A. L. Riker, Howard Marmon, K. W. Zimmerschied, J. G. Vincent and many others of like standing have reached positions which indicate that the engineer is not lacking in business ability. Similar success will attend many more engineers in the future if a broader conception of the function of the engineer becomes more prevalent.

Show Illustrates Trade Conditions

Public Not Deterred by Price Situation

No Likelihood of General Revisions—Production Schedules in Formation Stage

PRICE REVISIONS AND PRICES ON NEW MODELS IN EFFECT AT NEW YORK SHOW

REDUCTIONS

Peerless	4-pass. $3230 to $2990; roadsters $3200 to $2990.
Jackson	$200 on all models except new 4-pass.
Auburn	$200 on all models.
Davis	$200 to $290 on open cars; $390 on enclosed.

INCREASES

Franklin	$100 on open cars, Jan. 1; $100 on enclosed cars, Jan. 15.
Dort	$130 on new touring and roadster models.
Velie	$325 on new model 48 Sedan at once; $100 on new model 34 Touring, Feb. 15.
Moon	$200, Model 6-68, $2685; 6-48, $2185; enclosed, $3185. (Moon previously cut $400)

NEW MODELS

Saxon-Duplex	$1675 on open models; $2475 on enclosed. This represents a reduction of $220 on former open models, and $320 on former enclosed.
Columbia	5-pass. Touring, $1995; coupe, $2895.
Haynes	5-pass. Touring, $1985.
Mitchell	5-pass. Touring, $1995.
Malbohm	Coupe, $2395.
Detroit-Electric	Brougham, $4000.
Pilot	5-pass. touring $2285.

An increase of $200 was practically effected by Dorris through elimination of extra equipment, though refinements were added in construction.

NEW YORK, Jan. 10—Prospective purchasers of motor cars apparently are less interested in the subject of prices than they are in quality, workmanship and satisfactory service. Salesmen at the show are not often called upon to undergo heckling about how much their cars cost or what the prospects are for reductions. It is becoming apparent that with the general downward trend of prices for the commodities which make up the everyday budget, persons who own motor cars and who hope to own them will not be deterred from purchasing the car they want by a few dollars more or less.

As a matter of fact, factory representatives and dealers appear to be more interested in prices than do the public. The expectation had become more or less general in the trade that drastic changes downward would be announced at the opening of the show. This belief was not well founded. Quite a number of price changes were announced but there were fully as many which moved up as there were down. In cases where price schedules were raised, they generally were accompanied by new models or by refinements in the old models which made them more attractive and which justify the additional cost to the purchaser. Companies which guaranteed their prices are standing pat and in several cases the belief is expressed that the guarantees will be extended. In a few instances however, it is expected reductions will be announced when the guarantees expire.

Production 25 Per Cent

Except in a few instances, officers of manufacturing companies who are here for the show, make no attempt to gloss over the situation. They admit frankly that production at this time is virtually nil and that they are not being overwhelmed with orders. There are heard only a few glowing accounts of factories running in full blast and purchasers falling over each other to get cars. The average production in the industry at this time does not exceed 25 per cent and the chances are it is less than that. Fully a quarter of a million workers in passenger car plants are out of work. Most factories however, have resumed production on a much reduced scale or contemplate doing so in the near future.

In spite of the absence of actual orders, there is manifest everywhere a feeling of confidence in the future. This is not expressed in extravagant claims, but it shines through all the statements of present conditions. The sales manager of nearly every well known company is here, and they say frankly that business is slow at present but they are unanimous in the assertion that a greater willingness on the part of the public to purchase is reported by their dealers in nearly every section of the country. They are agreed that the buyers' strike is being broken gradually.

There is no expectation that there will be a big boom in business the first quarter of the year. As a matter of fact, most manufacturers will be well satisfied if they do as much business in the first half of 1921 as they did in the last six months of 1920. It is the general expectation that something like normal will be restored by April 1. All efforts to obtain tentative production schedules for the year are futile. Factories expect to be guided by the results of the New York show.

Production Matter of Sales

Production schedules in factories, large or small, whether located in the Detroit zone or out in the "sticks" depend entirely upon developments in the next few weeks, and to a considerable extent, on buying tendencies evinced at the show here. Not a factory representative at the New York exhibit could proclaim anything definite in the line of a schedule as the show opened.

Sales managers were a unit in the opinion that production for some time would be entirely on a sales basis. This was emphasized particularly in the higher priced cars.

Considerable apprehension was expressed of a too sudden development of business which would catch the factories unprepared to go into capacity production and which might cause another ascent in prices. With the results of the show here analyzed, however, the factory executives hope to be able to prepare themselves for early spring developments and meet business without undue delays in deliveries.

No Stocks in Salesrooms

Few dealers are stocked to any extent to meet a sudden spring onset of business, the factory men declared, this condition being particularly acute in the Middle West and agricultural districts of the country where credits required to carry winter stocks had been withdrawn with the agricultural and transportation crisis of the past summer.

This condition, sales heads were agreed, is likely to bring upon the factories the necessity of getting six months normal production rushed through in three months. To forestall this, the developments of the show and the general attitude of the public will be scrutinized

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Enthusiasm Kills Sales Resistance

Distributers Place Contracts for Cars

Evidences of Good Retail Business Also Seen to Keep Production Even

NEW YORK, Jan. 12—Assuming for the sake of argument that all factory sales managers are prevaricators and discounting their statements by half, the tide has turned in the passenger car field and the sales resistance offered by the public is slowly but surely crumbling.

The New York show is bringing business not only at retail but from dealers and distributers. There is substantial e idence that dealers are placing orders without strings on them and fixing shipping dates. One surprising feature of the exposition is the large number of dealers and distributers who are sticking close to the exhibits of their chosen line and thereby feeling the public pulse.

As the show has progressed, uncertainty has given way to hope and hope to confidence. The faces of men in all branches of the industry who have gathered here in large numbers from all parts of the country are wreathed in smiles. When they started to New York they seemed more or less dubious as to what the actual results of the show would be but when they saw the crowd on the opening day, they became hopeful and as the throngs around the exhibits have steadily increased in size, they have become confident.

Confidence Becomes General

The feeling of confidence is shared not only by passenger car manufacturers, but by parts makers, tire manufacturers, distributers, dealers and salesmen. The people attending the show are not idle curiosity seekers, but a large proportion of them actually intend to buy cars. This is evidenced by the careful way in which they do their shopping and by the intelligent questions they ask. It is apparent that the manufacturers of expensive and medium priced cars will do fully as good a business in proportion to their normal production as those who make the lower priced vehicles.

Factory sales managers and their assistants are not sitting in easy chairs in hotel rooms waiting for dealers to call upon them, unless it is to keep appointments, but are working with the salesmen at the exposition. The statements they make are not roseate and they do not appear to be exaggerated. There is no attempt to give the impression that factories will be running full blast in a few weeks, but it is plain the men who sell the factory output are greatly encouraged over the outlook.

They are unanimous in the assertion that the business which the show is bringing is much better than they anticipated. They refuse to make predictions as to production schedules for 1921 and they do not expect the business for the year to equal that of 1920, but they are confident the year will bring a normal trade.

No More Overproduction

It is safe to say that from now on there will be no over-production of passenger cars. Factory heads are determined to produce only enough to meet the actual needs of dealers and there is no intention of renting warehouses to store cars for which there is no immediate demand. One company reports that it already has on hand orders for approximately 15 per cent of the cars it expects to make this year.

All the sales managers say the majority of their dealers have ceased to shake their heads in discouragement and that they are vastly more hopeful about a satisfactory spring business than they were even a fortnight ago. The New York show has proved its value and it probably is doing more to aid the industry than any exposition previously held.

MILES SMILES

S. A. Miles, veteran manager of the N. A. C. C. shows, is chuckling over the success which is attending the New York exposition this year. He was confident that there would be a satisfactory attendance but the interest on the part of the public has exceeded his expectations and he believes a substantial number of actual sales will result from the show.

Southern Reserve Sees Improvements in Outlook

ATLANTA, Jan. 10—Reports received by the Federal Reserve Bank of Atlanta from various parts of the sixth district, which comprises nearly all of the Southeastern area, indicate an improved outlook for the beginning of the new year, and portend a return to normalcy, in the opinion of M. B. Wellborn, governor of the bank. Business and industry in general throughout the Southeast is beginning to resume activity, Wellborn stated.

He further stated that he believed business was becoming gradually more stable and that the outlook for the future indicated a return to normal during the next few months.

Factory Executives Assume Active Roles

Many in Attendance at Opening of Show to Push Business—Service Men Active

NEW YORK, Jan. 10—Seldom have there been so many factory representatives at a show as are here this year, especially for the opening. It is significant of the trend in the industry that several service managers have stationed themselves at the exhibits of their companies to answer questions and see that nothing goes wrong with the cars displayed. Engineering departments also are well represented. The salesmen on duty are in most instances under the watchful eyes of factory sales managers. This is a business show and the men from the factories are sticking on the job. They have come for work and not for amusement. Here are some of the factory representatives who arrived for the opening of the show:

Hupmobile—Charles D. Hastings, president; O. C. Hutchinson, general sales manager; Frederick Dickinson, advertising manager; C. E. Salisbury, service manager.

Cole—President J. J. Cole; H. R. Hyman, advertising manager.

Nordyke-Marmon—President W. C. Marmon; H. C. Marmon, vice-president; F. E. Moskovics, vice-president; H. H. Brooks, assistant sales manager, A. J. Rogers, advertising manager.

Jordan—President E. S. Jordan; R. S. Begg, chief engineer; Paul Zens, secretary; W. B. Riley, sales manager; S. R. Thomas, assistant chief engineer; J. H. Kelley, factory manager; R. A. O'Reilly, foreign sales manager.

Packard—President Alvan Macauley; J. G. Vincent, vice-president; R. E. Chamberlain, assistant general manager; H. T. Gardner, carriage sales manager.

Franklin—President H. H. Franklin; G. R. Taxada, engineering department.

Oldsmobile—President Edward Ver Linden; Leon R. German, vice-president; Charles A. Tucker, general sales manager; Guy A. Peasley, assistant sales manager; Thomas O'Brien, manager sales promotion; R. K. Jack, chief engineer.

Dort—President J. D. Dort; D. M. Averill, vice-president; John D. Mansfield, general sales manager; H. S. Daniels, advertising manager; F. A. Petrie, assistant sales manager.

Velie—F. E. Bradfield, vice-president and manager; H. T. Wheelock, advertising manager; L. E. McKie, sales representative.

Columbia—President J. G. Bayerline; A. T. O'Connor, secretary-treasurer; W. L. Daly, sales manager; Charles E. Pelton, supervisor of agencies; George C. Gurney, service manager; William C. Hunt, advertising manager.

Auburn—President M. Eckhart; A. P. Kemp, vice-president; J. I. Farley, sales manager; A. M. Graffis, chief engineer; A. R. Johnson, assistant sales manager.

Haynes—Gilbert U. Radoye, director of advertising and sales promotion.

Peerless—R. J. Schmunck, general sales manager; W. W. Lewis, assistant sales manager; C. Sterling Bailey, advertising manager; W. W. Mitchell, Southern representative.

Dorris—President G. P. Dorris.

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LIVE NOTES OF INTEREST AT NEW YORK SHOW

TWO avenues of progress are open before the industry according to a merchandising expert who has studied it. First, he stated, there is need of greater capitalization. Too many factories, he declared are under-capitalized.

The second need, he asserted, is for real, active, studious, working sales managers who can do something besides write contracts and ship cars. He said we must revise the industry in this important point. He said a company which he represents is now looking for a $25,000 sales manager—and hasn't found him yet. And he added that men like Normal A. Hawkins and other eminent sales executives would be found back in key positions in big organizations inside of a few months.

The Holmes Automobile Co., Canton, Ohio, is producing five of its aircooled cars daily. It has cut the wages of its employees from 5 to 10 per cent. Prices are guaranteed until July 1.

The Kline Car Corp., Richmond, is at 60 per cent production. No reduction in wages has been made. Prices are guaranteed until June 1.

The Saxon company expects to announce its production schedules for the year by February 1. It is now making five cars a day. When the factory really gets into operation, it is probable a wage cut of 20 per cent will be made.

The plant of the Kentucky Wagon Mfg. Co. which makes the Dixie Flyer is practically closed and no wage cuts have been made as yet. Prices have been guaranteed to May 1.

The LaFayette factory at Indianapolis is said to be producing cars at the usual rate and no wage reductions have been made. The company has not guaranteed prices but expects to make no changes in the near future.

General Sales Manager J. W. Connor of Pilot said contracts had been signed by him for half of the anticipated output of 2500 cars for the year. The company is making a higher priced model than ever before, a five-passenger touring car, and is finding sales generally satisfactory. Slight wage cuts have been made and inefficient workmen weeded out. H. E. Walker has been added to the personnel as assistant sales manager.

MAKERS of the Stanley steam car expect to increase prices in the next few months unless reductions in parts prices and materials are made. These were contemplated when reductions were made recently in prices but as yet they have not been realized. Wages at the factory are to be reduced and the full force of employees kept working unless the employees decide upon a short work week at present wages.

Apperson factory representatives sensed a continuance of sales resistance until possibly April 1, and in the interval until then thought several manufacturers might be compelled to go out of business. Production at Apperson factory was strictly on a to-order basis and would not be increased until it was evident that sales resistance had been overcome. Wages were lower, they said.

General Sales Manager T. L. Marshall of Stutz said his company would be in a position to outline production after the New York show. The show should be a big factor, he said, in showing just how much sales resistance had lessened. Wages at the Stutz factory, and in fact in all Indianapolis factories, was practically on the same level as formerly, the companies having found it impossible to maintain efficiency of workmen at lessened wage.

Cadillac swung into production Monday, but no information could be secured as to the production schedule or the number of men employed. Prior to the shutdown for the holidays, Cadillac was building on a schedule of around 2000 cars a month with a force of more than 2000. It is known, however, that Cadillac had a large surplus, and unofficially it is stated production will be held down to about 25 cars a day for the time being.

Packard still is operating about 50 per cent of its force with a production schedule around 25 daily, chiefly the new single Six.

MANUFACTURERS of enclosed bodies, say their business has suffered because of the open winter. In one cold week one company sold 50 bodies and the next week when the weather was mild again, practically none was sold. As a result of this condition, dealers are cutting prices to unload their stock.

Locomobile and Mercer, the Hare's Motors cars, are being produced only on a sales basis. Wages are at the same level but factory efficiency has been increased. No price revisions are under consideration.

Sayers & Scoville Co., maker of the Sayers car, finds its production fairly stable owing to its specialization in cars for commercial purposes, such as motorized funeral equipment, ambulances and work requiring special bodies. Demand for this work is setting in very strong in New England and the East generally. Wages are on practically the same level as previously to maintain efficiency. No hesitancy would be exhibited by the company in increasing prices, General Manager Hess said, if it were thought necessary to maintain standards.

The Oakland distributers in New York report the best pre-show week business in their history. Prior to that time, sales were practically dead.

The Cole company expects its business for the first half of 1921 to equal the last half of 1920 and that the second six months of this year will be still better. Shipments are being made only to fill actual orders. Prices have been guaranteed to April 1. No action has been taken as yet on wage reduction.

The Nordyke-Marmon Co. is operating on a 25 per cent production basis. No price changes have been made and nothing has been done in cutting wages. H. H. Rice, sales manager, will return this week from a six weeks tour of Europe where he has been establishing agencies.

ORDERS in the past ten days have brightened appreciably, representatives of most factories declared, many coming in the nature of surprises. A new dealer signed by the American in the Minneapolis district has ordered a car-load shipment for immediate delivery when no orders had been expected from him before spring.

The Jordan company is producing at the rate of 35 per cent of normal. Business in December was better than either in November or October and a further increase is expected this month. Slight wage reductions have been made in the factory.

A reduction of 10 per cent has been made in wages paid employees in the Maxwell service stations in the Metropolitan district.

The Dorris Co. expects this year to equal its 1920 production. No wage reduction has been made in the factory because it is the purpose of the company to use only the highest class workmen in producing its cars The price of the car has been guaranteed and there has been an increase of practically $200 in the price to the consumer by the elimination of spare parts in the standard equipment although this has been invested by the company in superior materials.

The McFarlan Motor Co. is said to be in full production. Prices have been guaranteed to May 1. There has been no readjustment as yet in factory wage scale.

The estimated production of the Hatfield car for 1921 is from 500 to 600. The factory now is closed.

Production of the Pan-American car at present is at low ebb, but more orders are being received. Wages have been reduced from 10 to 20 per cent. Prices have been guaranteed to July 1.

The price guarantee on Noma cars probably will be extended from March 1 to July 1. Production this year is expected to reach 300. An average reduction of 10 cents an hour in wages has been made in the factory.

CHARLES A. VERLIN, eastern representative of the Hanson company, said its record of price maintenance without change for six years will not be sullied now. Sufficient material is on hand to make 1500 cars, he said. Though production is now only at the rate of four or five a day to meet sales, this could be increased immediately to capacity.

Maxwell-Chalmers dealers have been greatly cheered by an announcement that the reorganization plan which provides for a consolidation of the two companies has been declared effective and that details of the proposed new management probably will be announced in a few days.

PUBLIC INTEREST BRIGHTENS BUSINESS PROSPECT

W. E. Metzger, vice-president of Columbia Motors and a director of the National Automobile Chamber of Commerce, reports there has been a very marked improvement in the feeling of Detroit manufacturers in the past fortnight. They expect a steady increase in business from now on, but they have no idea that the upward trend will be rapid. In Metzger's opinion, the used car problem is one of the most serious which confronts the industry at this time, and he believes that all dealers would do well to follow the example of those in Detroit and clean out their used cars regardless of their losses, so that the decks can be cleared for new business.

The Oldsmobile plant is producing 35 cars a day. A reduced factory force is working at a nine hour schedule. Wages were reduced two weeks ago.

H. G. Wilson, Detroit distributer for the Auburn line, last week drove 25 cars away from the factory.

The new Navarre six cylinder model is on display at the show. Prices for it have not been announced yet.

WILLIAM SMALL CO., manufacturer of the Monroe, received orders for 18 cars last week from Indianapolis purchasers. The parts department of the company has been kept in continuous operation. The outlook for the future is so encouraging it is hoped that it will be possible to lift the receivership in the near future.

The Dort factory is practically dead in production at present because it is changing over from its old to its new models which are being shown here for the first time. It already has received a substantial number of orders for these cars and they will be placed on the market Jan. 20. When the factory gets into operation. wage readjustment will be made.

R. E. Olds, president of the Reo Motor Car Co.. is a sane optimist regarding the future. He feels that his company is producing cars at a rate as nearly normal as any passenger car concern, and he expects a steady improvement in business, although he does not look for any sudden jump. As a matter of fact, he believes a normal spring business will develop after the show, but he has no expectation that it will be abnormal as it was last spring, nor does he think the 1921 sales will be as large as those in 1920. His expectations regarding the future are based upon his own observations and the views of his distributers.

Pat Emerson, assistant sales manager of Reo. who is in charge of sales of the "speed wagon," says the world looks a lot better than it did two or three weeks ago. As proof of his assertion he tells of Henry Adams, his dealer at Fostoria, Ohio, who is driving 150 vehicles away from the factory this week. December, in his opinion, marked the darkest hours for the industry. The commercial vehicle end of the Reo business has been good all through the period of depression, however, and the factory is running full blast, giving employment to 5000 men. Emerson has sold cars right along but he says the secret of his success has been hard work and constant plugging with not enough hours in the day to do all he has wanted to accomplish.

HUPP Motor Car Corp., which has been on a schedule of 35 cars a day since Dec. 1, now is building 50 cars with a slight increase in the working force, and will continue that schedule throughout this month. Good reports on prospects are being received from Hupp dealers, justifying the 15 per day increase in the present production schedule. Hupp has about 800 men working.

The plant of the Elgin Motor Car Co. is running at about 65% of capacity, thanks to a very large export order given by Gaston, Williams & Wigmore. Its own export business is holding up remarkably well and representatives of the company at the show say that they have had many inquiries from exporters who ship cars to Sweden, Denmark, England and India.

The drill department of the Clark Equipment Co. is working full time, while every department is operating to some extent on a four-day a week basis. Taken altogether, the entire plant is working about one-half normal capacity, according to E. W. Clark, advertising manager of the concern.

Wages are controlled by the workmen and have not been reduced. Questioned as to whether a cut was likely, Clark said that future conditions would naturally govern, but expressed confidence that having raised wages in the plant, employees would reduce them again when conditions and necessity warranted a cut.

Continental Motors officials are meeting this afternoon to discuss production plans, and from the meeting information was given out that 2500 men would be put to work tomorrow in the Detroit plant.

Paige, which began taking on men last week preparatory to getting into production, had between 800 and 1000 men working, with a production schedule of 25 cars a day. Orders on the books and reports from dealers, according to production officials, justify announcement of a schedule increase of 10 cars a day next week, with a complete increase in working force, and two weeks from today the schedule will be increased to 45 a day.

DU PONT is making two and three cars a day at the new Moore, Pa., plant and is ready to go ahead at full speed as soon as conditions require. E. P. du Pont, president of the company, has taken the general managership of the company under his direction for the time being, A. M. Marris, former general manager, having resigned. Wages are lower than formerly and labor efficiency is at a high point.

Liberty Motor Car Co. will resume next Monday with several hundred on a schedule that will approximate around 375 cars a month. Liberty reports splendid information from the dealers' field in the last two weeks, and officials at the plant feel confident that the production schedule will be increased steadily until late spring, when it is believed the factory will be on a basis of pre-war normal conditions. Liberty, while the plant has not been down completely, practically has been producing no cars for some time, and the plant's resumption next Monday will permit of increased operations by the Motor Products Corp., Timken-Detroit Axle Co., the Michigan Stamping & Tool Co. and other parts makers affected by the Liberty recession.

Scripps-Booth is operating with about 250 men building closed cars, chiefly on a schedule of a bout 20 per cent of the normal conditions, or approximately 250 cars a month. This schedule will be increased to 25 per cent later this month, and by Feb. 1 it is hoped to have the factory running on a 50 per cent basis, with a full production schedule March 1. Scripps dealers, according to Pres. Sarver, feel that the bottom has been reached, and they are now moving upward with prospects for gradual steady improvement in demand. The actual orders on hand and the reports on prospects from dealers are the basis on which the present production schedules have been outlined, and orders to parts makers in line with the schedules fixed have been sent out.

Both Maxwell and Chalmers plants began building cars today on a schedule of 25 of each type of car in each plant daily. About 375 men are at work in the Maxwell-Chalmers plants. It is the plan of the officials to increase this schedule beginning Feb. 1.

STUDEBAKER opened its second unit in Detroit Monday simultaneously with the opening of the factory at South Bend. With full resumption today, Studebaker starts a schedule of 90 cars in South Bend and Detroit, about 1100 men returning to work at the Studebaker Detroit plants today, which added to the 400 who returned to work in plant 5 last Monday gives a force of 1500.

Oakland Motor Car Co., which had planned to reach a production of 100 cars a day, still is behind that schedule, according to W. H. Maston, assistant general manager, who declined to say exactly what the daily output is. He intimated, however, it was around 75 cars a day, and said the factory was employing about 33⅓ per cent of the regular working force. The present output, Maston said, would be maintained until the demand justified an increase.

Buick resumed production today and will build about 250 cars daily until the demand justifies an increase in the schedule.

Chevrolet, which resumed production last week, now is operating on a schedule of 100 a day.

Public Not Deterred by Price Situation

Absence of Stock Cars May Cause Heavy Spring Demand—Parts Reduced

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closely in an attempt to meet the demand at all times with instant deliveries.

Manufacturers of essential parts here for the exposition, are somewhat perturbed over their inability to get estimates of car production schedules. They say that thus far manufacturers of complete vehicles have been unable to give them any idea of the number of cars they will purchase. For that reason the parts men have been unable to make contracts for supplies of raw materials. But they are hopeful of getting some figures which will be helpful within the next two or three weeks. They are agreed however, that the general tone of the market is better and say that some orders are being placed. Most of the parts factories which have been down have reopened on a much reduced schedule or are preparing to do so.

The downward trend of prices in the parts field is more marked than in the passenger car end and numerous reductions have been announced.

Of fifty-two representative accessory exhibitors, thirty-seven, including some of the larger companies, stated that they had not made any reduction in their prices. Of the remaining fifteen, twelve exhibitors announced reduction in prices as follows:

C. Cowles	10-40	percent
Light Mfg. & Foundry Co.	20	"
Prestolite Co.	20-22	"
Wm. Cramp & Sons	20	"
U. S. E. Corp.	40	"
Luthy Storage Battery Co.	20	"
Consolidated Utilities Corp.	20-25	"
Breeze Metal Hose & Mfg. Co.	25-33-1/3	"
Willard Storage Battery Co.	20	"
Doehler Die Casting Co.	15	"
Superior Lamp Mfg. Co.	15	"
Gemco Mfg. Co.	15	"

The remaining three exhibitors had nothing to say about prices.

These figures show that a reduction in prices has begun. This is particularly true in the case of concerns manufacturing castings, etc., rather than assembled jobs, but the twelve price reductions out of fifty-two is probably not representative of general conditions, a much larger percentage of reduction being probable in the near future.

As regards present factory production the greater number of exhibitors stated their production to be anywhere from ten per cent up to fifty per cent of capacity; 33-1/3 per cent would be a fair average figure for all the exhibitors questioned.

Out of fifty-two representative exhibitors only three the Giant Grip Co., the Sun Co., and the Biflex Products Co. announced their factories as working at full capacity production. But the number of companies whose present production is down to thirty, forty or fifty per cent stated the probability and in some cases the certainty that their factories would be working to full capacity by March of the present year.

Wages on Lower Basis

The question of wages is uppermost in the minds of nearly all the manufacturers. Factories which are operated on a production basis of even 20 or 25 per cent, already have reduced the pay of their workers from 5 to 20 per cent. In nearly every case, these cuts have been accepted willingly and the men at work have shown much greater efficiency than they did at higher wages.

It is apparent that the factory hands realize that their pay must be scaled down along with the cost of living to them. Most operators of factories which have not yet resumed production say that when their plants reopen, there will be wage cuts. There are a few notable exceptions to this rule, notably Franklin and Columbia which say they will not cut factory wage schedules until they are forced to do so.

The same stand is taken by a few other car makers whose plants are located in small towns or who produce high quality cars which they say they cannot afford to entrust to any but the most skilled workmen.

While wage cuts have not been so general in garages and service stations, the downward tendency is apparent also in this field and several instances have been reported of reductions. Here also there are reports of greater efficiency and as much work is being turned out by a reduced force.

Credit Situation Remains

Both manufacturers and dealers report little actual change as yet in the credit situation. They are hopeful however of easier money conditions in the near future and appear little concerned over the possibility of financing the business they expect to get. Manufacturers whose plants are located in the south do not expect any great improvement in the industrial conditions there until the next crop is harvested. They say that there is no real shortage of money, but that cotton, rice and sugar growers who have suffered from the slump in the value of their products feel poor whether they actually are or not. The same conditions prevail in the other great agricultural districts of the country.

Taken all in all, the keynote of the New York show is optimism. Manufacturers and dealers came here hopeful that the public would display an increased and serious interest in motor cars and they have not been disappointed. The attendance is fully as large as was expected and there is apparent an actual determination to buy cars either in the near future or as soon as spring weather comes.

Trailer Association Makes Year's Plans

J. H. Fertig Again Chosen President—Initiation Fees and Dues Doubled—Favor Show

NEW YORK, Jan. 10—Two new officers and members of the executive committee were elected by the Trailer Manufacturers' Association of America, at the annual meeting, Jan. 6 in the offices of the Association, Grand Central Palace.

J. H. Fertig, of Newark, N. Y., president, and H. C. Fruehauf, of Detroit, first vice-president, were re-elected. Max Herrmann, of Beloit, Wis., was elected second vice-president to succeed C. H. Martin, of Springfield, Mass., and Henry M. Wood, of Cincinnati, was elected secretary-treasurer to succeed J. C. Endebrock, of Cincinnati. Herrmann and Wood were also elected to serve on the executive committee.

An amendment to the by-laws was adopted doubling the initiation fee and annual dues. A code of ethics in trade practices was also adopted as an amendment, as a preventive against the creeping into the industry of any objectionable methods that might lead to lack of harmony within the organization.

The patents committee was enlarged by appointment of W. E. Ferris, of Cleveland, and I. S. Byrum, of Troy, O., to serve with C. H. Martin, of Springfield; J. W. Menhall, of Edgerton, Wis., and Max Herrmann, of Beloit, Wis. The committee was instructed to make a study of the patent situation and strive to find some plan whereby litigation between members may be avoided, thereby promoting harmony and conserving energies and resources of members which can better be expended in developing the manufacture and sale of trailers.

The standardization committee was continued, with instructions to pursue its investigations and make recommendations to the next members' meeting for standardization of trailer axles and trailer hitches.

A number of members expressed a desire to participate in a national outdoor exhibition and demonstration of motor trucks, trailers, and material handling machinery in event that plans for the promotion of such an event begin to take shape in the motor vehicle industry.

FRANKLIN STOCKS CLEARED

SYRACUSE, Jan. 10—A letter sent to stockholders by the H. H. Franklin Mfg. Co. states that 1041 cars were sold and shipped last month as compared with 826 in December, 1919. Finished cars on hand at the factory on Sept. 1 numbered 544 but none were on hand Jan. 1. The production in December was at the rate of 33 cars a day while the average for the ten months ending Aug. 1 was 39. Reports to the factory show that dealers are not stocking cars but are selling them as fast as they are received.

Rubber Association to Widen Activities

Directors to Act on Proposed Export Department—Dunn New President

NEW YORK, Jan. 11—Harry T. Dunn, president of the Fisk Rubber Co., was elected president of the Rubber Association of America at the annual meeting of the directors here. He succeeds Homer E. Sawyer of the U. S. Rubber Co., who has served two terms. The other officers chosen were: First Vice-President, F. A. Seiberling, president of the Goodyear Tire & Rubber Co.; second vice-president, Horace DeLisser, chairman of the board of the Ajax Rubber Co.; secretary and general manager, A. L. Viles; treasurer, William C. Cox. Prior to the meeting of the directors the organization elected five directors who were: Seiberling, Dunn, DeLisser, William O'Neill, vice-president of the General Tire & Rubber Co., and F. R. Henderson, president of F. R. Henderson Rubber Co., dealers in crude rubber.

The association referred to the directors the power to act on the recommendation of the general manager that an export department and a publicity department should be added to the activities of the association. This question will be considered by the directors at the meeting on Jan. 18, but it is not probable final action will be taken at that time. In his report Viles said:

"We believe that sufficient experience has been had with the potential advantage in Association work to prove the wisdom of attempting to cover the field more comprehensively and efficiently, and that our organization and activities should be extended to a degree which will make the Association a more efficient and competent piece of commercial machinery.

Educational Work Important

"If the export department is established, as it undoubtedly will be, it will help to solve problems in connection with the tire industry in foreign markets, notable among which will be educational work in the interest of the straight side type of tire equipment as contrasted with the clincher type which is being vigorously promoted by the manufacturers in Europe. The publicity or educational department will devote its efforts to the preparation and dissemination of the right kind of publicity concerning the rubber industry in general."

Another proposal made by Viles was that the subject of cost accounting be turned over to an accounting committee and a department organized in charge of an assistant experienced in stock accounting work for industrial groups. It is believed this will be of great value.

The general manager paid tribute to the work of the industrial relations executive committee and proposed that it be made a department of the association in charge of an assistant who would devote most of his attention to the preparation of accurate and timely information concerning employment conditions in various parts of the country. He also urged that additional help be provided to promote broader work along research and statistical lines.

The annual dinner of the association was held last night in the grand ballroom of the Waldorf Astoria and approximately 875 representatives of all branches of the industry were present. The attendance was considered remarkable in view of the industrial conditions which now prevail. Homer E. Sawyer, the retiring president, presided as toastmaster, and the speakers were P. E. Blondin, Postmaster General of Canada; Representative Simeon D. Fess of Ohio and Rev. Nehemiah Boynton. The dinner committee was composed of Horace DeLisser, A. W. Warren and C. W. McLaughlin.

A. B. Jones Resigns Goodrich Committee

AKRON, Jan. 10—Alfred B. Jones, vice-president and director of plant administration of the B. F. Goodrich Co. has resigned from the executive committee, the governing body of the company composed of acting vice-presidents. The resignation became effective Jan. 8. Jones' only comment upon the report current among Goodrich officials that his resignation as vice-president would be acted upon at the next meeting of directors, was to the effect that he still was an officer of the Goodrich company.

Jones returned Monday, Jan. 3, from a six months' European tour during which he made an exhaustive survey of business conditions in many foreign countries. During his absence several changes in personnel in the engineering and administration departments of the Goodrich company were made, George W. Perks resigning as director of engineering, to be succeeded by S. B. Robertson.

Jones formerly was connected with the Diamond Rubber Co. and joined Goodrich upon consolidation of the two companies in 1902. He was elected vice-president two years ago. During the war Jones gained a leave of absence and served abroad for nearly a year as American Red Cross commissioner in France.

BIDDLE ASSETS $172,063

NEW YORK, Jan. 11—Schedules in bankruptcy filed by the Biddle Motor Car Co., Inc., show assets of $172,063 and liabilities of $333,563. Among the creditors are the United States, sales tax on automobiles and parts, $4,672; Forbes-Perkins Co., Boston, $22,000, and W. H. Lippincott, $12,338. Main items among the assets are stock, $149,719; accounts, $21,312, and notes, $750.

ROLLS STARTS PRODUCTION

SPRINGFIELD, MASS., Jan. 7—The American works of the Rolls-Royce company has reopened here on a full production schedule. About 600 workers are employed and more will be added.

Truck Sales Heads Confer on Problems

Gradual Improvement in Business Continues—Used Trucks Prove Stumbling Block

NEW YORK, Jan. 12—Directors of the National Motor Truck Sales Managers' Association met here to-day to consider some of the more important problems confronting their branch of the industry. The session was a continuation of an earlier one held last Friday. The sales managers think there has been some stimulation in sales and they expect a gradual improvement in business. Some of them assert that the gain will be more pronounced than in the passenger car field. Among the companies which report somewhat better trade are Federal, Sterling, Selden, Packard and Republic.

The accumulation of used vehicles on the market is one of the greatest stumbling blocks in the way of renewed activity in the truck market. One of the main subjects considered by the sales managers at the meetings here has been the perfection of some practical plan for meeting this situation. They are approaching the subject cautiously, however, and are not disposed to make any announcement of what they propose to do until they are convinced the proposal will be workable and will result in clearing dealers floors of used trucks. It can be said that conferences have been held here with representatives of the larger finance companies whose co-operation has been marked.

The sales managers also are perfecting plans for bringing about a closer relationship between the manufacturers and the distributers. It is felt they have been working in the past at cross purposes and that this evil should be eliminated. The manufacturers are eager to do everything in their power to aid their dealers. They are striving to eradicate so far as possible the ills resulting from the sale of trucks to anyone who can be dragged in to the sales room regardless of whether he is in a position to pay for the vehicle or whether he has any real need for it.

Would Organize Dealers

Secretary Babney of the Association, is co-operating with the National Automobile Dealers' Association in an attempt to enlist a much larger representation of truck dealers in the latter organization. He believes that if there were a truck division in the N. A. D. A. an opportunity would be presented for the discussion and solution of problems common to all truck distributers.

The sales managers are considerably perturbed over the announcement that the Slough Trading Co. of London proposed to sell in this country 4000 motor trucks made by American companies but left in England by the American Expeditionary Forces.

Fuel Exports Ban Favored in Senate

Members From Agricultural States Fear Shortage for Farms —Want Lower Prices

WASHINGTON, Jan. 7 — Senators from agricultural States, particularly where motorized equipment is used extensively, have announced their intention to support the McKellar bill, which would prohibit exports of petroleum to countries declining to permit American oil producers to own or acquire oil lands. Senator Gronna of North Dakota advised the Senate that restrictions must be placed on exports of gasoline because it is impossible for farmers to operate tractors and other essential automotive farm equipment because of the high prices of fuel.

In advocating the McKellar measure, Senator Gronna declared that "the cost of gasoline affects not only the farmer but it affects the manufacturer of tractors." He pointed out that unless gasoline prices drop, farmers in North Dakota and other neighboring States would be compelled to use horses or mules to operate their farms. Senator McKellar stated that Great Britain is getting more than 50 per cent of the oil supply from this country and at the same time acquiring vast oil fields.

The bill, Senator McKellar told AUTOMOTIVE INDUSTRIES, was not inspired by the resolutions of the American Petroleum Institute which convened here in November. The Senator claimed that it was based on his personal studies and was not sponsored by American producers. He favors reciprocal agreements on oil. It was his inquiry into England's failure to pay past-due interest on loans that led to this legislation, he said. The drastic measure was provoked by payment of vast sums for oil fields and neglect to retire the debt to America. The bill is now in committee.

British Dealers Hit By Higher Plate Tax

LONDON, Dec. 14 (Special Correspondence)—One of the most objectionable terms in the Ministry of Transport's Bill now before the Lower House of the legislature is the raising of the trade license tax from about $16 to $50 a number plate. At first the rate was to be $75 per plate but this has been reduced to $50 as a sort of compromise with the trade. Even at the amended rate the tax will press heavily on dealers as well as manufacturers, because it is not a case of one plate being required, but as many plates at the same rate as the dealer or maker finds necessary for his business.

Ford dealers are expected to be worse hit by this revised tax, because all Fords are invoiced ex-factory at Manchester, where the dealers largely receive them and deliver them by road.

CONGRESS ESTABLISHES CARS AS NECESSITIES

WASHINGTON, Jan. 10—Essentiality of the passenger car is again established. Congressman James Mann of Illinois, leader of the majority of the House of Representatives testified to this fact so convincingly that opposition to appropriations for automobiles for departmental use, faded. "The automobile," says the Congressional chief, "is as much a necessity today for convenience and transaction of business as the street car is in a big city."

Congressman Mann called attention of the House to the existence of a law which was enacted at a time when farmers were disposed to fight Government encouragement of automobiles because of the effect on horses. No money can be expended for automobiles without the express authorization of Congress. The Illinois legislator believes that the law should be revoked since the farmers own more automobiles than any other class.

Appropriation Limits Aeronautic Research

WASHINGTON, Jan. 10—Aeronautical research will be restricted this year because of reduced appropriations passed by the House for the maintainance and operation of the National Advisory Committee for Aeronautics. A total of $405,266 was asked specifically for development of aeronautic power plant materials and aero dynamical research. The House appropriations committee and subsequently the whole House allowed only $260,000 for scientific inquiry and administrative expenses.

It is understood here that engineers and manufacturers interested in the promotion of the science of aeronautics intend to bring pressure to bear on the Senate in order to restore the original estimate for the advisory committee.

The estimate of $131,600 for power plant research prepared by the advisory committee was to be devoted to current problems with a view of reducing costs of engines, fuel and other maintenance charges which hinder the development of commercial aviation. The program also contained a provision for continuing the performance tests of new and improved aircraft engines and accessories.

MOBILE LOSES STOCK LICENSE

ATLANTA, Jan. 10—Alleging that the Mobile Tractor Co., of Mobile, Ala., has been proven guilty of fraudulent transactions, the Georgia Securities Commission has revoked the company's license to sell stock in Georgia. The Mobile concern is one of the largest tractor manufacturing companies in the South.

N. A. C. C. to Consider Foreign Financing

Believe New Corporation Will Have Important Part in Developing Trade

NEW YORK, Jan. 8—The part that the automotive industries will play in the formation of the Foreign Financing Corp., the export financing institution which is being organized by the American Bankers Association, will be taken up at a forthcoming meeting of the foreign trade section of the National Automobile Chamber of Commerce. In making this announcement, George F. Bauer, the N. A. C. C. foreign trade secretary, said it was hoped to have the industry well represented in the organization of the proposed banking company.

The Foreign Financing Corp. is to have a capitalization of $100,000,000, which will give it a loaning power of ten times that amount. At the recent meeting in Chicago when it was considered by bankers and business men from all parts of the country, it was decided that its capitalization would be undertaken by districts and industries. Exports from these industries and districts would be financed by the company in proportion to the amount of capital stock thus underwritten.

The meeting of the N. A. C. C. committee will take up this angle from the standpoint of the automotive industries, as it is recognized that such a financing corporation may play a big part in the future foreign trade of the United States. The committee of thirty which is organizing the bank has two automotive representatives—Roy D. Chapin, of the Hudson Motors Car Co., and John S. Raskob, of the General Motors and Du-Pont interests. In addition, J. Walter Drake, of the Hupmobile company, was instrumental in perfecting the company's plans.

A meeting of the foreign trade committee of the Chamber will be held on Tuesday, Jan. 11. This will be closed to the seven members of the committee. The next open meeting will be that at which the Foreign Financing Corp. will be considered.

ANTIGO DOUBLES CAPITAL

ANTIGO, WIS., Jan. 10—In increasing its capitalization from the original amount of $500,000 to $1,000,000 upon starting active quantity output, the Antigo Tractor Co. of Antigo, Wis., has reincorporated as the Antigo Tractor Corp. It recently purchased the foundry, machine shop and equipment of the Murray-Mylrea Co. at Antigo and began production to-day under the direction of W. L. Carver, general manager, formerly of the Mid-West Engine Co., Indianapolis. F. H. Houck, formerly with the same concern, and C. R. Parrott, until now with the Universal tractor division of the Moline Plow Co., will be Carver's chief aides.

Confidence Features 21st N.A.C.C. Dinner

Enthusiasm Manifested at Show Kills Fears of Continued Depression in Industry

NEW YORK, Jan. 12—Nearly 700 representatives of the automotive industry, most of them passenger car makers and officers of their companies, attended the 21st annual dinner of the National Automobile Chamber of Commerce at the Commodore last night. There was no atmosphere of gloom but rather the reverse. The diners seemed to feel that the worst is over.

"I believe the tide has turned," was the smiling declaration of Edward R. Tinker, vice-president of the Chase National Bank and one of the leading automobile bankers of the country. He was one of the dominating factors in the reorganization of the Maxwell and Chalmers companies and has complete faith in the future of the industry.

"Things aren't so ——— bad as they have seemed," declared Col. Charles Clifton, president of the N. A. C. C. and one of the "grand old men" of the industry in his opening remarks as toastmaster.

The note of confidence which has permeated the show dominated the dinner. The men who attended were a bit more serious than they have been some other years but the seriousness was born of determination to succeed rather than discouragement. It was significant that a score of the most prominent automobile bankers in the city were interested guests.

Francis H. Sisson, vice-president of the Guaranty Trust Co., who discussed the economic situation from the viewpoint of a banker, declared the most critical of the post-war readjustments have been passed, although many more must yet be made. The most important of these, he said, is the adjustment of retail prices to declining wholesale prices and the costs of production to present purchasing power.

Wage Adjustment to Cut Cost

"The adjustment of production costs will consist chiefly of wage readjustments," he said. "although increased efficiency and decreased margins of profit will play their part. The laborers who profited most from the ever-soaring wages during the war and for some time after will feel the curtailment first and most, but they should be in a better position to bear it than their less fortunate fellow-workers.

"We are not in the throes of overproduction, but merely temporary underconsumption. And it is significant, in this connection, to note that when goods are offered for sale at retail prices which the public believes to be fairly commensurate with prevailing wholesale prices and costs of production they are eagerly bought. Despite the materially lessened purchasing power in agricultural sections, occasioned by the precipitate decline in the price of farm products. and in certain industrial sections, because of closed plants or the part-time operation of factories and reductions in wages. there is still a tremendous buying power and always will be.

"Wages cannot be sustained on an uneconomic basis any more than can farm products or any other commodities. All necessary liquidations must run their course, and the sooner and franker we face that fact and discount its inescapable consequences the better off we shall be. The producers and merchants who persist in holding their goods for prices that the public will not pay are courting disaster and preparing to swell the number of commercial failures. They have not learned the elemental rule of successful merchandising that profits come from turning over capital. They are endeavoring to ignore the inexorable law of supply and demand.

"American business men must recognize the vital fact that one of the most important factors in our prosperity henceforth will be our foreign trade. The extent to which our overseas trade is sustained and increased will depend to a large degree upon the methods devised for financing it.

World Looks to United States

"The world to-day looks to the United States as the one solidly fortified nation in the realm of finance and trade. No other country has to a like extent the great power needed to meet the present emergencies.

"As on a memorable occasion when Marshal Joffre decided that France would not yield another foot of ground and determined that the enemy should not pass at the Marne, the American people have reached the point in their post-war economic readjustments where they are called upon to stand firm to stop retreating and go forward. The present hour calls not so much for better conditions as it does for stronger courage; the existing situation requires less confusion, and more confidence."

The annual awards of medals evoked howls of mirth. The victims were Walter P. Chrysler, Henry M. and W. C. Leland, Windsor T. White, Emlen S. Hare and A. I. Brousseau, president of the International Motor Co.

Chrysler was told he was decorated because he had been so successful in standing around where he could be "discovered" by C. W. Nash and John Willys. His medal was given for his success in ironing out complications in the industry and it was remarked he found time to get behind the scenes in the Maxwell-Chalmers two ring circus.

The diners rose to greet Henry M. Leland and his son when they were called to the platform. They were told they had been summoned to find out when they would get into production and they were advised that if they had made mistakes not to admit them now but to wait until their car gets into the hands of the people.

White "Blazed" Industry's Way

White was complimented because he had "blazed" the way for the industry "in an inflammatory sense." It was remarked that he had "removed some of the surplus weight" from his passenger car "and labelled the invention a truck."

Hare was hailed as a man who was brave enough to tackle anything and one who, in the goodness of his heart, had rescued "several grand old museums of by-gone days."

Brousseau, it was asserted, was most revered by the road building machinery dealers because he was the maker of "graceful rolling warehouses" which were invaluable as road destroyers.

Maxwell-Chalmers Assets $41,000,000

Consolidated Companies on Sound Basis for Operation—Inventories Written Low

NEW YORK, Jan. 12—After weary months of conference and compromise the reorganization plan which will bring about a formal consolidation of the Maxwell Motor Car Co. and the Chalmers Motor Corp. was declared operative yesterday by the managing and reorganization committee headed by Walter P. Chrysler and J. R. Harbeck. More than 87 per cent of the outstanding stock of the two companies has been deposited under the plan, but the committee is extending until Feb. 1 the time under which deposits of stock and unsecured claims can be made without penalty. The following statement on the financial status of the new organization was made by Harbeck:

"The new company is now placed in an extremely fortunate position to face the conditions confronting the automobile industry. The net outstanding obligations of the Maxwell and Chalmers companies have been reduced, through liquidation, by approximately $11,000,000. This liquidation has been largely through the sale of cars in dealers' hands, resulting in a reduction of the companies' obligations arising from the discounting of dealers' notes, paper, etc. The merchandise and bank creditors are to be amply protected through substantial cash payments and the funding of the balance of the obligations upon a one, two and three year serial note basis.

"The new company's balance sheet shows net current assets of about $41,000,000 after depreciation, and net current liabilities of about $6,000,000, the ratio of current assets to current liabilities being approximately seven to one. Inventories have been substantially written down, so that the reorganized company will not be handicapped by having to take into 1921 operations losses chargeable to previous years.

"The reorganized company may be regarded as being upon a sound basis for profitable operation on the basis of reduced sale prices. During the reorganization period points of contact with the public have been more than doubled through establishment of additional selling agencies and branches.

"An analysis of the balance sheet, after excluding good-will and allowing $100 per share for the A shares, which are preference shares, shows a book value for the B stock of approximately $30."

SURPLUS WAR PLANES SOLD

NEW YORK, Jan. 10—The Aeromarine Plane & Motor Co. has taken over $4,000,000 worth of surplus naval aircraft and engines. This marks the first step in the retirement of the Government's surplus aeronautic stocks.

Wall Street Sees Good Normal Year

Tendency Probable Toward Consolidation of Weak Sisters—Stocks Show Gains

By JACQUES COHEN
of J. S. Bache & Co.

NEW YORK, Jan. 13—The recent recovery in the prices of industrial stocks has been fully reflected in automobile stocks as well. Wall Street was extremely bearish on motor stocks during the last two months of 1920 with the result that there was built up in this group what is commonly termed an "overcrowded short interest;" in other words, people speculatively inclined believed motor stocks were definitely on the downward grade and would have no chance of recovery for a long time to come. These people sold stock in anticipation of buying back cheaper. Consequently there was established a potential buying power which, once it got under way, generated sufficient momentum to make those people who were "short" run to cover.

The general consensus in Wall Street seems to be, however, that this recovery in motor stocks is temporary and that, after the recovery has run its course, security prices will again lapse toward a lower level, but not so low as the low prices of December. Then Studebaker sold at 37¾, General Motors at 12⅞, Willys-Overland at 5⅛, Pierce-Arrow at 15 and White at 30½. At present, prices recoveries have been anywhere from 3½ points in General Motors to 18 points in Studebaker.

The stocks of finished cars on hand are considerably below the high point a few months ago and are gradually being reduced to a point where production on a conservative basis will meet the demand and prevent a recurrence of a period of saturation such as we had three or four months ago.

Credit Burden on Banks Easier

There has been some speculative enthusiasm because of the automobile show and the presence here of important automobile officials for that event. The bright spot on the horizon, however, is the fact that curtailment of production and the gradual reduction of inventories will increase working capital to a point where the banks will be substantially relieved of their carrying loads and the industry as a whole will rapidly recover in health.

Prominent bankers seem to agree that the outlook for this year is not so bright as it was for 1919 and 1920 but that, on the whole, business will be fairly good and that there will be a tendency toward consolidation of "weak sisters" for the purpose of bolstering up the industry as a whole. Consequently, an era of consolidation may be looked forward to with eventual improvement in security prices, since Wall Street always views consolidations and mergers of companies in a favorable light.

Report Ford to Offer $100,000,000 in Stock

NEW YORK, Jan. 12—Financial circles in this city have been deeply interested this week in circumstantial reports that Henry Ford proposes to offer to the public in the near future an issue of $100,000,000 participating 8 per cent preferred stock of the Ford Motor Co. The stock would participate in the earnings of the company up to 12 per cent, it is stated, but would have no voting power.

Ford does not intend to offer any part of the stock to the banks, it is said, but intends to sell all of it to the public. He is reported to be confident that he would have no difficulty in disposing of it to the public and that the offering would be over-subscribed quickly.

Although official confirmation of the report is lacking, bankers here are inclined to believe it is true.

Remy Reduces Wages; Other Units Not Bound

ANDERSON, IND., Jan. 10—A general wage reduction of 20 per cent has been made by the Remy electric division of the General Motors Corp. The plant has been shut down practically since early in December, but in the past few days almost 100 men have been put back to work at the new wage scale in the service department. It is believed that other departments will resume within the next month. At the time the Remy plant shut down in December it was employing 1000 persons as against 3000 two years ago.

No Simultaneous Cuts

NEW YORK, Jan. 10—It was said at the headquarters of the General Motors Corp. that the action of the Remy Electric Division does not mean simultaneous wage cuts in all the parts plants of the corporation. Advisability of wage reductions will be determined by the managers of the individual units and will depend largely upon local conditions.

FORD LAND INCORPORATED

HOUGHTON, MICH., Jan. 10—Articles of incorporation for the Michigan Iron, Land & Lumber Co., capitalized at $2,000,000, have been filed by Henry Ford, Edsel Ford and Clara Ford. The company was formed to take over the assets of the Michigan Iron & Land Co., which was purchased by the Fords several months ago. It will do a general manufacturing lumbering and mercantile business. The main business will be the working up into automobile parts of lumber cut from the company's holdings. This will be done at the new Iron Mountain plant. The property comprises 68,000 acres, rich in iron ore and it is expected the Fords ultimately will engage in mining operations.

Truck Census Seen as Aid to Selling

N. A. C. C. Committee Authorizes Complete Survey of Country—Endorse Uniform Law

NEW YORK, Jan. 12—A census of the motor trucks in the United States was authorized by the Motor Truck Committee of the National Automobile Chamber of Commerce at its meeting here yesterday. It will extend to all communities in the country and will determine the conditions of the trucks, for what they are being used and their tonnage. The information would inform manufacturers on the extent to which motor trucks have been sold and would give valuable information regarding potential markets. This census will be supplemental to the survey now being made of the use of motor trucks on farms and when both are complete it is expected that practically every truck in the country will be listed.

The committee endorsed the provisions and alterations in the proposed uniform motor vehicle law as recommended by the Motor Vehicle Conference Committee.

Serious consideration also was given to the subject of highway impact tests which are being made by the Federal Bureau of Roads. The committee is ready to co-operate in every way in its power in the development of the nation's highway system.

Information has reached the committee disclosing that state highway departments are renting trucks given them by the government to county highway supervisors at the rate of $25 a year.

Sale of Used Trucks Is Started on Coast

LOS ANGELES, Jan. 10—Colonel Pierce is here with seventy-five Packard and Riker trucks brought from abroad and starts the sale of them Wednesday through a local dealer. The truck industry here is greatly disturbed and has appealed to the National Automobile Chamber of Commerce and the National Automobile Dealers' Association. The sale of these trucks, it is feared, will demoralize the used truck market and have a bad effect on the new truck business.

Colonel Pierce, the American representative of the Slough Trading Corp., has declared that if the trucks meet satisfactory demand hundreds more will be brought into the country from abroad. They are all of American manufacture which were turned over to the British.

DECEMBER PRODUCTION DROPS

NEW YORK, Jan. 13—December shipping figures gathered by the National Automobile Chamber of Commerce show that 11,814 carloads of passenger cars were shipped last month and that there were 6500 driveaways.

Team-work Wanted, Parts Men Are Told

M. A. M. A. Hears Inspirational Talk by G. M. Graham—Dinner Big Success

NEW YORK, Jan. 13—Nearly 400 members of the Motor and Accessory Manufacturers' Association attended the annual meeting of the organization at the Biltmore yesterday afternoon. The attendance came close to establishing a record and demonstrated that a large number of representatives of this branch of the industry are attending the show. The feeling among the members was optimistic and confidence was expressed that there will be a slow but steady improvement in business from now on.

The annual meeting this year offered an innovation. The usual lengthy reports covering the activities of the organization were eliminated and an inspirational address by George M. Graham, sales manager of the Pierce-Arrow Co., substituted. Graham pointed out the community of interest which exists between the parts and vehicle manufacturers. He told why there need be no fear about the future of the industry and asserted that conditions would improve from now on although the problem is to get away slowly and gather momentum as the year advances. He declared the men in the industry are courageous and for that reason are hanging on so gamely that there need be no fear of disaster.

The meeting was a fitting preliminary to the annual dinner last night. The feast and fun festival was fully up to the high standard already set and there were no dull moments for the 500 diners. Sidney S. Meyers, general counsel of the association, acting as impressario, transported Florenz Ziegfeld and the "Midnight Frolic" bodily from the New Amsterdam Roof.

The banqueters liked the show and showed their approval by generous applause. The performance ran as smoothly as it would if the performers had been at home. The music was by the "Midnight Frolic" orchestra. An ample stage had been built for the occasion at one end of the grand ballroom of the Commodore, where the dinner was served. Meyers and the other officers of the association were showered with congratulations upon the success of their efforts. According to the custom of the M. A. M. A., there were no speeches at the dinner.

Austin Makes Plans for Large Production

NEW YORK, Jan. 12—Manufacturing plans of the Austin Motor Co., Ltd., Birmingham, England, call for a production in 1921 of 10,000 automobiles, 10,000 farm tractors, 5000 trucks, 7500 farm light plants and 1500 airplanes, according to Major H. J. Cupper, American representative of the company, who is showing the Austin car and chassis at the Waldorf-Astoria during show week here.

The company is planning to export 1000 cars to the United States in 1921, the Major declared, and hoped to increase this number to 3000 in 1922. Sales offices and parts stations will be established in New York, Philadelphia, Washington, Chicago, Detroit, Boston, Atlanta, Los Angeles, San Francisco and Seattle. Wholesale branches will be maintained in New York and Montreal.

The Austin company passed the dividend on its preference shares early in January to conserve finances.

Haynes Is Elected to Dodge Presidency

NEW YORK, Jan. 12—The election of F. J. Haynes to the presidency of Dodge Brothers, at a directors' meeting in Detroit yesterday, was greeted with great enthusiasm by Dodge dealers attending a show luncheon at the Waldorf-Astoria here. Announcement of the election was made by Charles W. Matheson, general sales manager, who was presiding at the dealers' meeting. Howard B. Bloomer, personal friend and attorney to John and Horace Dodge, was elected chairman of the board of directors.

Haynes has been with Dodge since 1912, beginning as factory manager and working his way to the vice-presidency and general managership. He was with Franklin from 1901 to 1912 and prior to that had been with the E. C. Stearns Co., Toronto, and the National Cycle & Automobile Co. Haynes was superintendent of the Hamilton plant of the National company and there first became associated with John Dodge, then general manager there.

INDUSTRY URGES AIR MAIL

WASHINGTON, Jan. 12—Manufacturers of aircraft and industry in general are making a determined fight here this week to induce the Senate to restore the appropriation for the Air Mail Service which the House eliminated in passing the Post Office bill last week. The entire item was stricken from the House bill. The House Committee on Post Offices and Post Roads had recommended the appropriation of $1,250,000 or $2,250,000 less than the departmental estimates.

TAKE OVER AMERICAN BUS

CHICAGO, Jan. 12—The reorganization report on the American Motor Bus Corp., and the Chicago Motor Bus Co., submitted by Harold Almert, consulting engineer, has been adopted by the bankers, and the business of the two concerns taken over by the Lake Shore Motor Bus Corp., a holding company.

The American Motor Bus Corp., the manufacturing concern, has resumed the manufacture of front wheel drive, stepless type, motor buses and is bringing out a new double deck bus with a seating capacity of sixty passengers, with both upper and lower decks fully enclosed. The initial order will keep the factory operating at full capacity for the year 1921.

Retail Sales Show Business Returning

Placing of Dealers' Orders Indicates Good Spring Trade for Manufacturers

NEW YORK, Jan. 13—Retail sales in as great a volume as have been made at any New York show except that of 1919 are recorded as the week ends. The 1919 show, staged by the New York dealers and presenting automobiles publicly for the first time after the armistice, was phenomenal as a selling agency. But sales this year are fully up to those of the 1920 exposition in practically all lines of cars. Attendance to date is 10 per cent ahead of last year. Some remarkable prospect lists have been made up.

Attendance of dealers, particularly from the Eastern territory, is better than the average at a New York show. Dealers appear to have come in for two purposes, to feel the buying pulse and to obtain merchandising ideas. The crowds and the buying at the show have induced placing of orders for resumption of shipments of cars under allotments, not in many cases up to 100 per cent but in sufficient degree to encourage many manufacturers to proceed in anticipation of a good spring business.

A meeting of the Eastern Automotive Equipment Association early in the week and patronage of the equipment exhibits at the Palace reveals a gradual, yet steady, return of buying. in this field.

Higher Car Tariff Opposed by N. A. C. C.

NEW YORK, Jan. 13—Directors of the National Automobile Chamber of Commerce decided at a meeting yesterday to join with the National Founders Association in opposing an increase in tariff duties on aluminum. It is contended that the aluminum industry is virtually a monopoly now and that it needs no protection. A higher tariff would not result in increased revenue, it is held, because it would curtail imports.

Representatives of the N. A. C. C. will appear before the House Ways and Means Committee at Washington tomorrow to protest against the imposition of higher duties on automobiles and urge that all automobiles, regardless of value, come under the 30 per cent rate. An increase in tariff imposts would result in penalties being applied to American cars by other countries, the industry believes, and cause a reduction in the volume of exports.

A. J. Brousseau, president of the International Motor Co., was designated to represent the N. A. C. C. on the National Research Council.

The directors adopted a resolution expressing deep regret at the death of Horace E. Dodge. They elected Frederick J. Haynes, the new president of Dodge Bros., a director to succeed Dodge.

Goodyear Financing Matter of Selection

Choice of Several Plans Rests With Backers — Propose Organization Changes

NEW YORK, Jan. 12—Considerable progress is being made in the difficult tasks of readjusting the financial affairs of the Goodyear Tire & Rubber Co. Several plans have been taken up by the bankers interested as well as by unsecured creditors. One of these calls for an issue of junior securities to protect the claims of the unsecured creditors and a first mortgage to cover the bank borrowing.

Whatever plan is worked out, it is proposed to make important changes in the management of the corporation, and it can be said upon authority that a strong corporation executive will be placed in a position of authority so that he can readjust the affairs of the company on a sound operating basis.

The main difficulty now is getting the various interests to agree upon some basis of adjustment. There is every reason to believe that this ultimately will be done. The great tire company is entirely solvent and its difficulties are the result of the general financial and industrial depression. It is expected that the details of refinancing will be announced at the next meeting of the stockholders.

The merchandise creditors have declined to accept a proposal to take 75 per cent of their claims in cash and the balance in 5-year bonds. They have made a counter proposal that they be paid 60 per cent in cash and be given 1-year notes for 20 per cent and 2-year notes for the remainder. Their theory in this plan is that the notes would be virtually negotiable.

The preferred stockholders of the Goodyear Tire & Rubber Co. adjourned until Jan. 21 at a meeting held this morning. No announcement regarding the refinancing was made.

Cobleigh and Reeves Talk to Service Men

NEW YORK, Jan. 12—Over one hundred service executives attended the second annual convention of Automotive Service Associations held at the Hotel Commodore all day Monday. A number of prominent speakers addressed the delegates and plans were made to co-ordinate the efforts of the various associations, of which there are eleven at the present time. The morning session was devoted to reports from the delegates and the address of welcome by H. R. Cobleigh, secretary of the Service Committee of the National Automobile Chamber of Commerce.

Cobleigh briefly told of the early struggles of some of the associations; of the interest of the manufacturers in the movement, and of the formation of the Service Committee which, among other things, was formed to get a point of contact between factory service managers and local service managers. He predicted great strides during the coming year. Activity reports were read by delegates of the Brooklyn, New York, Newark, Baltimore, Western Massachusetts and Syracuse Automotive Service Associations and the Automotive Electric Service Association.

Army Not Contracting for Additional Trucks

WASHINGTON, Jan. 11—Reports current in the industry that the War Department refused to release truck manufacturers from contracts while Congress was proposing to dump the army surplus trucks on the market were officially denied at the War Department to-day. It was stated that the army is not buying trucks at present because it has adequate equipment on hand.

The announcement that truck manufacturers at Kenosha, Wis., were resuming production of War Department contracts is true, it was said. The Winther Motor Co., the Marwin Truck Co., and the Kenosha Wheel & Axle Co. took over the completion of a contract awarded the Sinclair Motors Co. in December, 1919. This contract called for the delivery of 75 militor tractors in May, 1920.

According to the War Department it was owing to financial difficulties that the Sinclair Co. transferrred the contract. The tractors represent a special experimental type designed by the Westerfelt Board for use with artillery. The total value of the contract is estimated at $600,000.

Winther Starts Contract

KENOSHA, WIS., Jan. 10—The Winther Motor Co., the Marwin Truck Corp., and the Kenosha Wheel & Axle Co, are preparing to resume production on a maximum capacity schedule by the end of this month in order to handle a large Government contract amounting to more than $3,000,000 and calling for 300 1½-ton and 75 3-ton trucks. The contract was issued by Charles Margerum, of the motor vehicles branch at Washington. All of the trucks will be of the quadruple drive type.

KENDAL RECEIVER ASKED

CANTON, OHIO, Jan. 10—Suit has been filed here asking for the appointment of a receiver for the Kendal Tire & Rubber Co., Massillon, by Charles Russ, a stockholder. The petition declares that the company has never manufactured any tires except a few samples. It is further declared that the plant has been sold to the Ariston Tire & Rubber Co., Chicago, by the promoters and officers who control a major part of the common stock. Russ alleges in his petition that the rights of the original stockholders were not safeguarded and asks that the sale be set aside and a receiver appointed.

Government Settles Templar War Claim

Payment of $650,000 Eases Financial Burden—To Proceed With Production

CLEVELAND, Jan. 10—The financial condition of the Templar Motor Co. has been improved materially by the settlement of the company's claim for war work against the United States Government. The claim was settled for approximately $650,000 under the Dent act and about all of the money has been paid.

The original claim was for $1,000,000 and the settlement is regarded as an equitable one. While it does not mean the full amount of the claim, deduction having been made for interest on delayed settlement and profit which would have been realized had the contract been fully completed, it nevertheless reimburses the Templar for all the money spent in changing over the plant for war purposes, materials bought, etc., and allows them a profit on the work actually completed.

The settlement puts considerable cash into the company's treasury which will be of assistance in carrying the present inventory and in manufacturing cars during the winter months for spring production.

Bramley Heads Safety Council

CLEVELAND, Jan. 10—M. F. Bramley, president of Templar Motors, has been elected president of the Cleveland Safety Council, an organization that is waging a fight to cut down automobile accidents. J. V. Whitebeck, of the Cleveland Automobile Co., is a vice-president of the council.

DODGE ESTATE TO WIDOW

DETROIT, Jan. 2—The will of Horace E. Dodge, filed for probate to-day, leaves practically the entire estate, estimated at $50,000,000, to Mrs. Dodge and Howard B. Bloomer, chairman of the board of the Dodge Bros. Motor Car Co., as trustees. The widow will receive the income until her death, when the estate will be divided equally between the two children, Horace E. Dodge and Mrs. Delphine Dodge Cromwell, provided they are 30 years old. If they have not reached that age the property will be held in trust until they are 30.

DUNLOP SUSPENDS OPERATIONS

BUFFALO, Jan. 13—Directors of the Dunlop Tire & Rubber Co. have issued a statement announcing that "general conditions in the automobile industry are such" that they are justified in practically suspending operations. April 1 has been set as the date for resumption, although it may be earlier. The British Dunlop Co. has stated that negotiations were pending in this country for a large loan to the American company by American capitalists.

Military Necessity May Retain Trucks

General Staff Likely to Win Point in Controversy Over Anthony Proposal

WASHINGTON, Jan. 11—Investigation here discloses that there is little probability that Representative Anthony of Kansas will be successful in his attempt to have dumped on the public some 20,000 motor trucks owned by the War Department. He has made this proposal as a measure of economy and it has been given serious consideration but it has met with the strenuous opposition of the General Staff and military considerations are likely to win the day.

Anthony has asserted that the army has many more trucks than it needs except in case of war and it is his idea that if a military emergency arose the trucks needed could be commandeered. The answer of the General Staff to this suggestion is that if trucks were commandeered it would be impossible to service them and that the question of replacing essential parts would offer an insurmountable obstacle to the success of the plan.

Since the beginning of the war the army has purchased approximately 64,000 motor vehicles, trucks and passenger cars. It has disposed of 34,393, most of which went to state highway departments and departments of the government. The trucks on hand Jan. 1 numbered 29,881. It is contended there is no surplus now but it is expected that in the near future the army will dispose of 6,850 trucks and 680 passenger cars. This would leave only 22,785 motor vehicles on hand. Of this number the National Guard of the various states will be supplied with 2,479 trucks and 166 passenger cars.

Under the law the vehicles which the army does not need must be turned over to other branches of the government. New legislation would be required before they could be sold to the public and it is not believed probable that there will be any amendments to the law at this session.

TO SELL CANTON COMPANY

CANTON, OHIO, Jan. 10—A court order has been issued calling for the sale on Jan. 22 of the assets of the Canton Automobile Parts Mfg. Co. which went into receivership several weeks ago. The court ordered that the property must not be sold for less than $50,000. It was organized to manufacture a new kind of piston ring.

EVINRUDE IN NEW PLANT

MILWAUKEE, Jan. 10—The Evinrude Motor Co. of Milwaukee, pioneer manufacturer of detachable gas engines to propel rowboats, canoes, etc., has moved into its new plant, occupying a tract of six acres. It will put into production a new type of oil engine for farm and similar purposes, in addition to greatly increasing its output of rowboat motors. The main shop is 200 x 300 ft.; the foundry, 75 x 100 ft., and the boat shop and warehouse, 100 x 150 ft. The company was founded in 1912 by Ole Evinrude, inventor of the detachable boat engine. It has outgrown three plants in eight years. The present capitalization is $500,000, and the principal officers are C. J. Meyer, president, and Hugo Biersach, secretary and treasurer.

C. G. Spring Acquires United States Bumper

KALAMAZOO, MICH., Jan. 10—The C. G. Spring Co., has purchased the assets and business of the U. S. Automobile Bumper Co., Chicago, and will move the industry intact to this city, doing all manufacturing here. The addition of this line to the present product of the plant will not require any extended layout for buildings or equipment, at least not for the time being.

Another step in the expansion of the C. G. Spring Co. is the announcement that the concern has opened branch service and repair stations in Detroit and Chicago. The Detroit station is on Woodward avenue, near the Cadillac plant, while the Chicago branch is at 3021 Michigan avenue. They will specialize in repairs to springs and replacements, also in the installation of the new type bumpers. These stations will be under the supervision of D. M. Short, who was associated with Girl, during the latter's connection with the Perfection Spring company.

At a special meeting of the directors, held Friday afternoon, Fred R. Eaton, cashier of the Kalamazoo National bank was elected to membership on the board. Eaton's acceptance of membership on the board adds to the conservative strength of the institution and meets with general favor in local financial and manufacturing circles.

SUBMIT TRUCK UTILITY BILL

DETROIT, Jan. 7—The bill extending the powers of the State Utilities Commission to cover the operation of the motor truck lines was introduced in the Michigan Legislature by Representative L. G. DeFoe. The bill stated that the motor truck lines have become an important part of the transportation system in competing with railroads and interurbans, and is at present without State control as to rates and service. This measure will provide supervision.

TO MOVE TRACTOR EXHIBITS

COLUMBUS, OHIO, Jan. 10—The management of the National Tractor Show has arranged with the Columbus Transfer Co. to take care of all freight shipments to the show in the event the exhibitor has no Columbus connection. The rate from the freight houses to the fair grounds will be $3.50 a ton and from the switch at the fair grounds to the show buildings, $3.50 a ton.

METAL MARKETS

PRICE movements during the next few weeks are almost certain to be devoid of the spectacular. In the pig iron market the trend is still declivous, what little activity being noticed consisting of resales of odd lots of foundry iron at prices much closer to a $30 base than the quotations of producers. In a condition emphasized by an excess of supply over demand this denotes the direction in which the market is headed and, taking the past relationship of pig iron values to those for semi-finished and finished steel into account, readjustment of the former can hardly be considered completed until after $30, valley, quotations represent the maximum, ranging down to a minimum of at least $1 to $2 below that figure. This, at least, seems to be the attitude of quite a number of buyers who are holding off until sufficient time has passed to show whether their judgment is correct or not. Numerically, there is a gratifying amount of inquiries from the automotive industries for finished steel, albeit nearly all of these inquiries are of a tentative character and the tonnages involved, compared with those customary last summer, light. In other words, a large number of small orders are hanging fire. The tardiness which characterizes these negotiations is to be ascribed to two causes. In the first place, a number of automotive buyers are endeavoring to hold off committing themselves until they have gained a somewhat better idea of the 1921 prospects for the sale of their own products. The second reason for procrastination is that there are still those who do not think that the declines in the steel market will stop at adoption by the independents of the Corporation's price levels, but that a waiting attitude on the part of buyers will force the independents' prices still further downward. The steel market's best judgment is that, if such recessions ensue, they will be general, with the Corporation taking the lead and, furthermore, that it will be two to three months before such a contingency will have to be reckoned with. By that time readjustment of wage scales will have been completed and, if a latent demand which can be forced on to order books through price reductions, is visible, say, by March 15, those who are shaping the steel industry's price policy will not be slow in resorting to such a step. Price reductions in the steel industry are, in fact, invariably made on the eve of a transparent buying movement and never when the demand would be light in spite of lower prices. By this is not meant that there may not be some slight readjustments long before the Ides of March. In fact, here and there rumors are heard even now of this or that independent being disposed to cut under the Corporation's price for some specialty. So far, these instances are exceptions, however, proving the general price uniformity rather than the opposite.

Pig Iron—Malleable is still offered for resale in limited tonnages by a Detroit automotive interest at $31. There is no question that much iron is available on a $30 basis, not only in the valley, where that level has come to be the Basic quotation, but also at Buffalo and other furnace and distributing points.

Steel—Automobile sheets rule quiet and steady. Some contracts are pending. Prices on cold rolled strip and most other grades of steel are being maintained largely because producers recognize slashing would not serve to stimulate buying.

Tin—This metal moves in harmony with pound sterling exchange.

FINANCIAL NOTES

Black & Decker Mfg. Co., Baltimore, has declared a dividend of 2 per cent on the common stock, payable to stockholders of record Dec. 30. This makes a total of 7 per cent paid during the year on the common stock of the company. Regular payments also have been made on the preferred. This showing is regarded as somewhat remarkable, in view of the general depression and the passing of dividends by many companies.

Kahlenberg Bros. Co., of Two Rivers, Wis., a large builder of oil engines for marine uses, has increased its capital stock from $75,000 to $300,000 to accommodate the expansion of its plant and business. It is filling large domestic and export orders and making shipments to China, Alaska, Cuba and other countries steadily. William Kahlenberg is president.

Parenti Motors Corp., Buffalo, at a shareholders' meeting Jan. 3, increased its capitalization from $2,500,000 to $11,000,000, to provide for expansion. The original capitalization was $1,000,000 preferred and $1,500,000 common and the increase consists of $10,000,000 common of $10 par value. The original issue is all subscribed.

Pierce-Arrow Motor Car Co. financial position is shown to be exceptionally strong with current assets in the ratio of nearly 4 to 1. Inventory is about 20 per cent larger than a year ago because of preparations for production of the new model. Sales for the year were 20 per cent lower than in 1919.

Fisher Body Corp. will pay a dividend of 1¾ per cent on the preferred stock of the company on Feb. 1. A dividend of $2.50 a share will be paid on the same date on the no-par common stock of the company.

Kelly-Springfield Tire Co. has declared dividends of $1 and 3 per cent in stock on the common stock payable Feb. 1, and a quarterly dividend of $2 on preferred stock payable Feb. 15.

United States Rubber Co. will pay a regular quarterly dividend of $2 a share on its first preferred and $2 a share on common stock on Jan. 31.

Mullins Body Corp. declared the regular quarterly dividends of $1 a share on common and $2 a share on preferred stock payable Feb. 12.

India Tire & Rubber Co. paid a dividend of 1¾ per cent on its preferred stock and 2 per cent on common stock on Jan. 10.

Standard Motor Construction Co. has declared a dividend of 2½ per cent payable February 1 to stockholders January 3.

Pawling & Harnischfeger Co., Milwaukee, has increased its capitalization from $1,000,000 to $3,000,000.

Briscoe Motor Corp. has deferred payment of the usual quarterly dividend on preferred stock.

Vulcan Automotive Parts Co., has increased its capital stock from $2,000,000 to $10,000,000.

Wilson Tire & Rubber Co. will not pay any dividends on its capital stock for the year 1921.

Steel Products Company on Three-day Basis

LANCASTER, PA., Jan. 11—Conditions as reflected by two big local plants engaged closely with the automobile trade are in direct contradiction to each other. Officials of the Rowe Motor Truck Co. announce that $1,000,000 of the company's 8 per cent preferred stock has been underwritten and will be expended to carry out a general broadening policy.

Officials of the Steel Products Co., one of many plants operated by the General Motors Co., has announced that, starting immediately, the plant will work but three days each week until further notice. This order follows the laying off of several hundred workmen and a big reduction in salaries.

Precision Castings in Receiver's Hands

SYRACUSE, Jan. 12—C. Hamilton Sanford is named receiver of the Precision Castings Co., Inc., of Fayetteville, in an order signed by United States Judge George W. Ray, which enjoins creditors from bringing action, or taking other proceedings against the company. Pressure brought to bear by a number of creditors is responsible for an equity action instituted to conserve the company's assets during the period while collection of accounts due from large automobile corporations is at low ebb. The suit was started by the Greenwich Trust Co., of Greenwich, Conn.

Federal Rubber Starts 40 Per Cent Capacity

MILWAUKEE, Jan. 10—After a curtailment of production for about a month, the Federal Rubber Co. of Cudahy, suburb of Milwaukee, resumed operations to-day with a force of about 900 men, or about 40 per cent of capacity. According to Arthur A. Frank, factory manager, business has improved substantially while a proper readjustment of stock and materials has been effected. He looks for continued increase in operations from this time forward. The Federal was one of the last of the larger tire manufacturers to curtail when over-production set in.

FACTORY EXECUTIVES ASSUME ACTIVE ROLES

(*Continued from page* 87)

Dixie Flyer—Stephen Miller, vice-president and sales manager; E. Palmer, manager of export department.

Lincoln—R. C. Getsinger, sales manager; A. H. Schiappacasse, service manager; F. G. Eastman, advertising manager; E. E. Sweet, consulting engineer; T. H. Mueller, chief engineer; W. W. Robertson, service engineer.

Lafayette—Leo N. Burnett, advertising manager.

Studebaker—William A. Morrow, general sales manager.

Monroe—President William Small; George Seibert, sales manager; Glen Todd, secretary-treasurer.

Paige—G. B. Gaunt, sales manager; John Germontrez, engineering department.

Stutz—T. L. Marshall, sales manager.

Pilot—Joseph W. Connor, sales manager.

Hanson—Charles A. Verlin, eastern factory representative.

Kline—L. H. Travers, sales manager.

Reo—R. E. Olds, president.

Nash—C. W. Nash, president.

Bank Credits

Written exclusively for* AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.

NEW YORK, Jan. 13—The new year began with sharp upturns on both the stock and bond markets. Practically the whole list of bonds moved upward, with especially noticeable improvement in the Liberty issues. There were indications that investors, as distinct from professional traders, were coming into the market. There was also a marked upturn in foreign exchange markets last week. Sterling advanced over 10c last week, and on Monday of this week it reached $3.73½, the highest since early in August of last year. This rate is 30½ cents above the minimum of last December, and 55½ cents over the low record made in February of last year. Exchange on most of the continental countries moved up sympathetically with the pound sterling.

While price recessions continue, with indications that retailers in some lines are taking their losses, there has been some resumption of industrial operations following wage adjustments, particularly in the textile field. Slackening of activity, on the other hand, continues in the steel industry, with the closing of mills more than offsetting the reopenings. For the month of December there was a net loss of 51 mills in operation. The U. S. Steel Corporation is still operating at a little more than 90 per cent of capacity, in spite of the fact that the Corporation's last monthly statement of unfilled orders indicated further curtailment in the industry.

Business failures are still on the increase, as evidenced by the December returns. The number of failures at 1,525 compares with 1,050 in November, and the liabilities involved in the December failures made a new high record at $58,871,545. This compares with $30,758,136 in November and $8,300,342 in December, 1919. For the full year 1920, the preliminary returns placed the total number of failures at 8,831, as against 6,451 in 1919. The liabilities involved were $287,772,471, and $113,291,237 for 1920 and 1919 respectively. A great increase in both the number of failures and in liabilities occurred in each of the last two quarters for 1920.

The money market continued unchanged last week with call money at 7 per cent. Large sums were returned to the banks daily as unlendable. A slight easing occurred on Monday of this week, however, and call money loaned at 6 per cent for the first time since Dec. 21. Time money continued at the same rates quoted for the two previous weeks.

REVERE DENIES CHARGES

INDIANAPOLIS, Jan. 11—The Revere Motor Co. of Logansport to-day entered a general denial in Federal court in answer to bankruptcy proceedings instituted against it two weeks ago by Chicago creditors. Judge Anderson set the case for trial Jan. 18.

MEN OF THE INDUSTRY

Major Victor W. Page has resigned as managing editor of *Everyday Engineering Magazine* and technical editor of the Norman W. Henley Publishing Co., and has moved his consulting engineering offices from 2 W. 45th Street to 309 Lafayette Street, New York. He is now president and chief engineer of the Victor Page Motors Corp., which has been formed to manufacture and market a new lightweight car, equipped with a four cylinder air-cooled engine of his design.

W. G. Jarman, general manager and secretary-treasurer of the Hamilton Motors Co., manufacturers of the Panhard motor truck, Grand Haven, Mich., has resigned, taking effect immediately. Jarman prior to the Panhard connection was sales manager of the Jackson Automobile Co., prior to that Canadian manager for Briscoe, and earlier was connected with Maxwell-Briscoe and Ford.

A. Schroeder, Cleveland, was elected president of the Ohio State Rubber Tire Co. of Port Clinton, near here, Jan. 5. The other officers chosen are J. F. Langenau, Cleveland, vice-president; Harmon Hankammer, Port Clinton, secretary. The following constitute the board of directors: A. Schroeder, J. F. Langenau, W. S. Lee, Bellevue; E. P. Reichert and S. E. Gernerm, Port Clinton.

Daniel G. Thorne, formerly district manager for the Diamond T Truck Co., has joined the Republic Truck Co. and will have charge of sales to national buyers, such as oil companies and other organizations doing business in all parts of the country. This announcement was made by A. J. Whipple, general sales manager, who is here for the automobile show.

Thomas H. Bingham has been appointed production manager of the Matthews Engineering Co., Sandusky, Ohio, which is prepared to go into larger manufacturing schedules with the completion of its new factory additions. Bingham for the past five years has been general superintendent of the Akron works of the International Harvester Co.

R. Jackson Jones, European representative of the Traffic Motor Truck Corp., has returned to this country after a trip through all the countries of Europe. He reports that traffic dealers are optimistic over the future. The widespread use of trucks during the war has educated the public to their value.

Ludwig T. Kuehl, of Racine, Wis., has been elected a director and vice-president of the Northeastern Rubber Co., New York, succeeding George G. Bryant of Milwaukee. Richard G. Bryant of Racine is president and treasurer. Charles E. Davies has been elected a director and secretary.

J. H. Desmond for the past three years, district manager for the Hart-Parr Co., over their Canadian territory with headquarters at Regina has been called in to the factory at Charles City and placed in charge of salesmen in the field.

Lynn Harvey has been appointed manager of the new export department of the India Tire & Rubber Co. He was formerly assistant export manager for the Miller Rubber Co., and had also been connected with the H. K. Porter Co.

Dorsey W. Hyde, Jr., has left the transportation engineering division of the Packard Motor Car Co. to become assistant manager of the Civic Development Department of the Chamber of Commerce of the United States.

Forest H. Akers has been appointed assistant general sales manager of the Republic Truck Corp. For the past seven years he has been connected with the Reo Motor Car Co., latterly as general sales manager.

F. W. Potts, for several years northwestern district manager of the Republic Rubber Co., with headquarters at Minneapolis, has resigned, effective Jan. 15. No announcement has been made of his future plans.

Barney Oldfield, famous race driver who is now in the tire business, is one of the most interested visitors at the New York show.

H. L. Van Wyck, advertising manager for the Mitchell company, has resigned.

Pollak Makes Changes in Staff Organization

CHICAGO, Jan. 10—At a recent meeting of the Board of Directors of the Pollak Steel Co., D. E. Sawyer was again elected general sales manager for the year of 1921 and is located, as in the past, at the New York office of the company. S. K. Morrow, formerly manager of operations, is now manager of sales for the three plants, with the offices at Cincinnati works. C. G. Talbott, formerly assistant manager of operations is now manager of rolled products for the Marion plant.

A. C. Weihl, for several years superintendent of the Cincinnati plant, is now general works manager in charge of operations and production of the Cincinnati, Chicago and Marion plants. V. W. Prather, formerly cost auditor for the Cincinnati plant, is now general cost auditor of the three plants. R. A. Mitchell takes the position vacated by Weihl. J. H. Deickman becomes manager of materials and inspection of the three plants. W. P. Woods becomes auditor and G. H. Tallaksen, superintendent of the Chicago plant.

Sorenson Promotion Now Believed Certain

DETROIT, Jan. 11—Though no official announcement has been made of the appointment of Charles Sorensen to succeed F. L. Klingensmith as executive vice-president and general manager of the Ford Motor Co., there is no doubt here of the certainty of the move. The appointment is expected to be made this week, together with other changes to fill important positions vacated either through resignations or promotions.

Edsel Ford to-day said there was no truth in the rumor that W. G. McAdoo or W. C. Durant were to join the Ford organization.

HAVANA OFFICERS CHOSEN

HAVANA, Jan. 10—Samuel T. Tolon has been re-elected president of the Havana Automobile Dealers' Association, according to information reaching New York. With Tolon were named Francisco Pla as vice-president, E. W. Miles as treasurer, M. T. Vallin, assistant treasurer; Enrique Hemel, secretary, and J. E. Diaz, assistant secretary. The directors are Jose G. Lopez, J. M. Martinez, Gabriel Miguez, Octavia Longa, Ramon Fernandez, and Alejandro Rodriguez.

INDUSTRIAL NOTES

L. H. Gilmer Co., manufacturers of belting and woven products whose main plant is located in Tacony, Pa., has disposed of their Allentown plant; moving the machinery and equipment to their factory at North Wales, Pa., which plant has been expanded for additional equipment.

Dodge Brothers this week will pay a bonus to employees amounting to about $2,000,000 on a basis of 10 to 15 per cent of the wages earned during the year. Both office and shop employees will share the bonus, the practice of distributing which originated last year.

Gehl Mfg. Co., West Bend, Wis., maker of gas engines and ensilage cutters, resumed production during the week after being partly closed down to facilitate extensive improvements. A new gray iron furnace has been installed.

Speedograph Corp., Newark, N. J., has purchased a two-acre tract and four concrete buildings at Morris Plains, N. J., and by Feb. 1 expect to be in production of 100 instruments a day.

Latex Tire & Rubber Co. Fond du Lac, Wis., has broken ground for a 2-story factory addition, 60 x 80 ft., which will cost about $45,000 equipped.

Badger Mfg. Corp., Milwaukee, has leased a factory building in anticipation of a greatly increased demand for its product in the near future.

Martin Tire Corp., this city, which has up to this time been specializing on passenger car tires is planning to get into production on truck tire sizes.

Advance Rubber Co. has moved into its new plant in Brooklyn and is looking forward to greatly increased production in the spring.

Western Felt Works has completed its new factory buildings in Chicago and is preparing to go into production at once.

Hyatt Roller Bearing Co. will remain closed until Feb. 1 or later, according to business developments.

Ladish Drop Forge Co., Milwaukee, expects to get back to normal production by Feb. 1.

Duplex Truck Surplus $249,276 for Year

DETROIT, Jan. 10—Duplex Truck Co. at Lansing, Mich., reports current assets totalling $1,137,851.86; current liabilities of $538,436.29, and surplus of $249,276.25 for the year ending Oct. 31. The management also has charged off $200,000 depreciation.

In a letter to stockholders, Pres. H. M. Lee said the credit stringency hit the truck business worse than any other due to the fact that it essentially is a credit business, practically 95 per cent of all truck sales being on a time basis. "With banks refusing to discount paper taken by dealers, sales stopped automatically," he said, "because few dealers were sufficiently financed to be able to carry the customer's paper."

Duplex earnings during the first of the year, Lee said, were very satisfactory and demonstrated the force of the company's costs and selling prices and indicated that with ten or twelve consecutive months of normal business, the company could show satisfactory earnings.

Calendar

SHOWS

Jan. 15-22—Philadelphia, Annual Automobile Show, Philadelphia Automobile Trade Ass'n.

Jan. 17-23—Milwaukee, Annual Automobile Show, Milwaukee Automotive Dealers' Ass'n.

Jan. 22-27—San Francisco, Second Annual Pacific Coast Automotive Equipment Exposition, Auditorium.

Jan. 22-29—Baltimore, Annual Automobile Show, Baltimore, Automobile Dealers' Ass'n, 5th Regiment Armory, J. C. O'Brien, Mgr.

Jan. 22-29—Cleveland, Annual Passenger Car Show, Cleveland Mfr's & Dealers' Ass'n, Wigmore Coliseum.

Jan. 22-29—Montreal, Annual Automobile Show, Montreal Automobile Trade Ass'n, Motordrome Bldg.

Jan. 29-Feb. 4 — Chicago, National Passenger Car Show, Coliseum, Auspices of N.A.C.C.

Jan. 31-Feb. 5—London, Ont., National Automobile Show of Western Canada, London Chamber of Commerce, Armouries, T. C. Kirby, Mgr.

Feb. 5-12—Minneapolis, Annual Automobile Show, Minneapolis Automobile Trade Ass'n.

Feb. 7-12—Columbus, National Tractor Show, Columbus Tractor & Implement Club, Ohio State Fair Grounds.

Feb. 12-19—Hartford, Conn., Annual Automobile Show, Hartford Automobile Dealers Ass'n, Armory, Arthur Fifoot, Mgr.

Feb. 12-19—Kansas City, Annual Automobile Show, Kansas City Motor Car Dealers' Ass'n.

Feb. 14-19—St. Louis, Annual Automobile Show, St. Louis Automobile M'f'rs & Dealers' Ass'n, Robt. E. Lee, Mgr.

Feb. 14-19—Winnipeg, Western Canada Automotive Equipment Show.

Feb. 18-28—San Bernardino, Cal., National Orange Show, Fred M. Renfro, Mgr.

Feb. 19-26—San Francisco, Fifth Annual Pacific Automobile Show, Exposition Auditorium, George Mahlgreen, Mgr.

Feb. 21-26—Louisville, Annual Automobile Show, Louisville Automobile Dealers Ass'n, First Regiment Armory, C. L. Alderson, sec'y.

Feb. 21-26—Salt Lake City, Annual Automobile Show, Intermountain Automotive Trades Ass'n, W. D. Rishal, Mgr.

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April— Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Jan. 22-29 — Colombo, Ceylon Motor Show.

Feb. 7—Delhi, India, Delhi Motor Show.

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

CONVENTIONS

Feb. 2-4—Chicago, First Annual Meeting, Automotive Electric Service Assn. Hotel La Salle.

May 4-7 — Cleveland, National Foreign Trade Council.

Oct. 12-14, 1921—Chicago, Twenty-Eighth Annual Convention National Implement & Vehicle Ass'n.

30 Organizations Back Uniform Vehicle Act

WASHINGTON, Jan. 12—Principles of a uniform vehicle act were adopted here to-day by the National Conference on Highway Traffic Regulations, and there was practically no variation from the proposed uniform vehicle law adopted last year by a committee representing the National Automobile Chamber of Commerce, American Automobile Association, American Association of State Highway Officials and the Highway Industries Association. The acceptance of these principles virtually means that instead of six national organizations, there will be more than 30 organizations pledged to support the underlying principles in an effort to have them placed on the statutes of all states.

At the suggestion of Harry Meixell, representing the National Automobile Chamber of Commerce, National Automobile Dealers Association, Motor & Accessory Manufacturers Association and Rubber Association of America, the conference did not specify any weight limitation.

On the objection of Meixell in behalf of the automotive organizations, the conference reconsidered its vote on mandatory stops at crossings and refused to include it in the declaration of principles.

Bureau of Mines Drops Gravity Specifications

WASHINGTON, Jan. 12—Specifications for petroleum products have been completed by the Bureau of Mines. The report, made public to-day, shows more definite standards of testing for automobile fuels and oils. Most of the suggestions of the Society of Automotive Engineers were incorporated.

The old gravity specifications for fuel oil have been completely eliminated. The viscosity requirement has been set for each grade of fuel oil and the Saybolt "Furol" viscosimeter adopted for testing all fuel oils was purchased by the Federal Government.

Lubricating oils specifications are practically unchanged, but several new grades have been added.

"Old Timers" to Hold Chicago Show Dinner

NEW YORK, Jan. 12—At a meeting of the Advertising Managers Council of the M. A. M. A., Ralph Leavenworth speaking for the Standard Parts Co., said that the Old Timers Club had enrolled more than 6,000 members. He said that the idea of this club was originated by Jim Braden, former advertising manager of that company, and no one had expected the distribution of badges to be taken so seriously. His plan was that this idea should become so widespread that it could be taken over by those he had enrolled.

Acting on this suggestion, several of those enrolled met yesterday at the Vanderbilt Hotel and formally decided to announce a dinner to take place during the Chicago show. All "Old Timers" will be welcomed at this dinner. At that time, Richard Kinnerdall, chairman of the nomination committee will announce the following nominations for office:—president, Albert Champion; secretary, F. Ed. Spooner; treasurer, Harvey Firestone.

Big British Companies Overcome Difficulties

LONDON, Jan. 10—No acute financial distress is anticipated for any of the important British automotive companies despite the general money tightness and vehicles awaiting sale. Creditors realize that a bigger loss would follow forced closures and they have confidence in the inherent stability of the trade.

Dunlop Rubber Co. has declared that negotiations concerning the company's American affairs may last another week. Its report for the financial year is expected this month. Stockholders have been cautioned by the company not to pay attention to adverse reports on Dunlop.

Briton Motor Co., Wolverhamton, one of the oldest British car manufacturers, has shown itself to be suffering from the financial stringency, but declared it to be only temporary. Orders are reported for $1,500,000 worth of cars on which deposits have been paid. Trade liabilities are given as $150,000 to Nov. 30, and bankers hold debenture securities for $200,000. It is proposed to liquidate the indebtedness by monthly installments beginning in March.

If this proposal fails the alternative will be a forced realization by the debenture holders.

VOL. XLIII INDEX

The index to Automotive Industries, Vol. XLIII, which comprises issues for the second six months of 1920, will shortly be off the press. It will be mailed without charge to subscribers who make a request for it.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLIV NEW YORK—THURSDAY, JANUARY 20, 1921 No. 3

Progress in Fuel Matters Features Annual S. A. E. Meeting

Much interest attaches to developments in fuel research of past year. Chassis session also brings out much discussion. Aeronautic sessions are well attended, while those devoted to body engineering and highways also prove highly successful.

By Herbert Chase

THE annual meeting of the Society of Automotive Engineers, just completed in New York, is regarded by many members of the organization as the best in the history of the Society. All of the sessions were well attended and the plan of holding simultaneous sessions on subjects not closely related proved very successful.

The fuel session, being as usual the most important, was the best attended, and those who were present could not have failed to carry away much useful information or avoid the conclusion that the persistent consideration of matters relating to fuel and its proper utilization is beginning to show results at least in the improvement of many of the automotive vehicles now being designed and produced.

There is, of course, a long distance still to be covered before it can be said that the average automotive vehicle is using fuel in a thoroughly efficient manner, and there still remains the stupendous problem of getting higher average efficiency in the operation of the nearly nine million automotive vehicles in use to-day. This, indeed, is a problem worthy of the best efforts of the most capable engineers, yet receiving scant consideration. As pointed out by speakers at the meeting, the average automotive engine now in use not only runs throttled a large percentage of the time—a condition under which high economy is impossible—but less than 75 per cent of the fuel entering the cylinder is burned in the average case, as definitely proved in one paper covering tests of a full hundred passenger cars and trucks. This waste of fuel is just as real as if 25 out of each hundred gallons of gasoline put into the car or truck tank was allowed to leak out, and is far more harmful than if so lost, for it results in many engine troubles, yet little or nothing is done to check the loss though it might be well nigh eliminated if car manufacturers were sufficiently interested to supply modern manifolds and carbureters and see that the service station and user are acquainted with the facts and educated to the importance and feasibility of bettering the fuel utilization of the car now in service.

The most discussed and perhaps the most valuable paper presented was that entitled the Fuel Problem in Relation to Engineering Viewpoint, by A. L. Nelson, chief engineer of the Premier Motor Corporation. The stated object of the paper was to get the engineer to take a broader viewpoint of the fuel situation and not to take the position that things which heretofore have not been commercially successful or feasible are by no means impossible of attainment. The paper, which will appear in an early issue of AUTOMOTIVE INDUSTRIES, should be instrumental in attaining this commendable object, but it goes much further than its title indicates in a most original and instructive presentation of data which no engineer who wishes

to be conversant with promising methods of improving car performance should fail to acquaint himself with. The author shows in the first place how small a proportion of the available power of the engine is required to propel a car at moderate speed on the level road, and points out how low a power factor with consequent low fuel economy results. It is then shown how economy and performance can be greatly increased by increased compression ratio, made feasible by a very late closing of the inlet valve. The effect of gear ratio on economy is also set forth and some new designs of piston and inlet manifold are described.

In discussing this paper C. P. Grimes laid stress upon the need for bettering the load factor as a means of securing better economy and briefly outlined tests he had recently made which showed that greater economy results from carrying a greater spark advance than is commonly employed under part throttle conditions. He suggested the need for some interconnection between throttle and spark advance mechanism when the latter is automatic as it then must be set to properly function at full loads when at the same speed and part load a greater advance can be used to advantage. H. L. Horning, among others, commended Nelson for the valuable paper he presented. He suggested that less valve lift than was employed by Nelson would have resulted in greater turbulence in the charge with good effect.

Fuel Waste in Present Cars

An item not on the program which proved of considerable interest was a report of tests conducted by the Bureau of Mines for the purpose of determining the percentage of unburned products in the exhaust of a large number of cars selected at random and tested under normal operating conditions in precisely the same state of adjustment (or lack of adjustment) in which they run in normal use. This report showed that in the average case the exhaust contained only 9 per cent of carbon dioxide, completely burned carbon, while the average percentage of carbon monoxide (partly burned carbon) was seven, and the unburned hydrogen and hydrocarbons was over 3 per cent. Not a car was found in which more than 95 per cent of the fuel was burned, and as previously stated the average percentage burned was under 75. This means that the average car is using an effective air to gas ratio of only 12 to 1, a ratio of 14 to 1 is the theoretical ratio for complete combustion, and 16 or more to one is usually required for maximum efficiency. In other words, the average user employs a much richer mixture than is necessary, though in so doing his fuel bill is about one-third higher than necessary and troubles from carbon deposits and crankcase polution, to mention only two evil effects, are encouraged. Until steps are taken to remedy this condition service problems will continue to multiply and the fuel problem will continue to grow more menacing.

In discussing this Bureau of Mines report Elmer Sperry drew attention to the fact that not even a trace of carbon monoxide was found in the exhaust gas of several Diesel engines in tests he had directed, although the fuel commonly employed is far less volatile than that used in conventional automotive engines. He spoke also of the apparent dread which the average engineer has of attempting to use high compression in engines, in spite of the fact that this involves little more than the addition of about three piston rings. A piston so fitted will, he said, fall of its own weight through the cylinder, and have little more friction than ordinary pistons.

C. F. Kettering's talk was similar in many respects to those he has given at past meetings of the Society, although he freely admitted that theories he had formerly evolved had been modified in many cases as new information had been accumulated. He feels that the fuel problem is beginning to be appreciated both by the automotive and fuel industries. He drew attention to the general misconceptions which a lack of understanding of terminology have brought about and said that it aids greatly in the understanding of combustion phenomena to remember that changes in temperature due to addition or subtraction of heat are simply interpreted as meaning increase or decrease in the velocity of the molecules of the substance heated.

Frank A. Howard, development manager of the Standard Oil Co. of New Jersey, in his paper on the Volatility of Internal Combustion Engine Gasoline first defined the term "gasoline" as "the cheapest petroleum product acceptable for universal use as a fuel in the prevailing type of internal combustion engine." He then showed the physical meaning of the term volatility, the vapor tension method of measuring it, laid stress on the fact that inherent volatility is dependent upon time, surface and heat. He commended the use of so-called hot-spot devices for adding heat to the fuel entering an engine and made it clear that heating the air only is not effective for the reason that air is a poor conductor of heat and therefore will not bring about vaporization of the fuel in the limited time available. The hot-spot will do this if so arranged that the fuel particles are thrown out of the insulating air stream against it and manifold "condensation" is impossible under the average manifold temperature prevailing because it is physically impossible for any vapor to condense when its partial pressure is lower than the vapor pressure of the liquid itself at that temperature.

Howard believes that the hot-spot, when properly designed, is an effective and simple solution of the problem, that it should be incorporated in new designs, and that it will lend itself to attachment in existing engines.

Howard, who was the only speaker who could be said to represent the point of view of the fuel industry, expressed himself as being pleased with the indications of progress in solving the fuel problem which were brought to light during the meeting.

Flame Movement in Closed Cylinders

The paper on Flame Movement in a Closed Cylinder by C. A. Woodbury was read in the absence of the author by his assistant, Mr. Lewis, and developed much useful information which supplements, and in part corroborates the work done by Prof. H. B. Dixon in England. Dr. Woodbury plans to continue this work and report upon it further at later meetings of the Society. To date the fuel used has been a fixed gas, acetylene, but it is the plan to later experiment with more complex fuels, such as are used in internal combustion engines. Results thus far appear to indicate that true detonations do not take place in cylinders of the size employed in automotive apparatus, but final conclusions in this regard are reserved pending the completion of further tests.

In a paper entitled Air Temperature Regulation Effects on Fuel Economy, R. E. Fielder of the Fifth Avenue Coach Company, the thermostatic device designed for use on buses operated by his company for controlling the temperature of air entering the carbureter. With this device it has proved possible to make an average saving of about 8 per cent, which means much when it is considered that the company uses several million gallons of gasoline each year, the fuel bill constituting the second greatest item of expense. The temperature control device is reported to afford the greatest possibility of saving in fuel of any of the numerous fuel devices tested.

The only other paper read at the fuel session was that

by Dr. H. C. Dickinson of the Bureau of Standards in which he gave a résumé of certain research work relating to fuel which the Bureau has been conducting. This work included some studies of conditions known to aggravate the tendency of an engine to knock. In order to prove that the knock is due after all to an aggravated piston slap, a piston with excessive clearance was tried, and it was found possible to readily distinguish between knock due to combustion phenomena and piston slap.

Other tests involving the use of one or two spark plugs used separately or together were conducted, and it was found possible to bring about conditions in which firing from one plug would cause a knock when firing from two plugs would not do so and vice versa. The reason for this is not yet apparent, but it is thought probable that the knock can be controlled by accurate timing of the center of the explosion. It has been noted that pressures in excess of 1000 lb. per square inch may result from the knock phenomenon, and that the latter is invariably accompanied by a sudden rise in temperature of the jacket water.

Thomas Midgley, Jr., stated that some believe that the temperature occurring at the time of the knock may be sufficient to convert carbon into the gaseous state. In any case quartz cylinder windows have enabled observation of the fact that an extremely brilliant light accompanies the knock. Spectrum analysis of this light reveals a green line thought, but not definitely known, to indicate carbon gas. Mr. Weinberg questioned this, stating that the highest temperatures attainable in a carbon arc in vacuum are not accompanied by gasification of carbon. He cited experiments that he has conducted on a 5⅞ by 6-in. air-cooled engine developing 35 hp. at 900 r.p.m. This engine cools very well, he said, when the spark plug is placed near the inlet valve, but when placed opposite the exhaust valve it is impossible to keep the engine cool.

H. L. Horning, in closing the discussion on fuel, cited the need for tests that would enable a measure of carbureter efficiency independent of engine performance, and outlined a test that he believes will give the desired result. He spoke of the plan for co-operation between the S. A. E., the American Petroleum Institute, the Bureau of Standards and the Bureau of Mines, and indicated that plans for financing research work bearing on the fuel problem at the laboratories of the two organizations last mentioned are being formulated and will shortly be announced.

The Chassis Session

By P. M. Heldt

H. M. CRANE presided at the chassis session, which was held in the Auditorium of the Engineering Societies Building, and was well attended. In opening the meeting Mr. Crane said the principal object was to discuss various questions which had come up from time to time in connection with the work of the Fuel Committee. Questions were constantly being asked as to why we burned so much fuel per passenger mile or per ton-mile. The petroleum industry had taken a certain view regarding the small car which called for comment. Comfort and speed were factors which could not be neglected in passenger-car design, even if somewhat more fuel had to be burned in order to provide them. We could not rationally ask the public to ride in open cars without top or windshield to save fuel.

We were often asked why we were using low-geared cars. The answer was that the public wants them. Possibly the public wanted low-geared cars because of the difficulty of gear changing. Unfortunately, the design of the present type of engine was such that if we cut down its power we also reduced its economy. The speaker said he had been told that on a flat stretch the most economical way to drive a car was to accelerate to full speed as rapidly as possible and then let the car coast with the engine cut off.

One reason for poor fuel efficiency was defective brake rigging, with the result that the brakes were constantly dragging, there being no means for rapidly adjusting them. Defective gearbox and axle design were other causes of low fuel efficiency. The housings of these parts were often of such design that the parts could not be lubricated by oil, and grease was generally a poor lubricant. In cold weather the grease becomes very stiff, so that a large amount of power was required to turn the gears, and everyone was familiar with the fact that occasionally it was impossible to shift the gears at all on a cold morning.

A paper on a Suggested Rating Rule for Racing Cars was presented by Mr. Crane, of which he gave a brief abstract only. Reference was made to the present racing rule, limiting the piston displacement of the engine to 183 cu. in. and it was pointed out that the piston displacement limit had led to such developments as enormous valve areas, huge inlet pipes and carbureters, extreme valve timing, and very light reciprocating parts. However desirable these features might be for racing purposes, they were undesirable in commercial engines. Those first mentioned made good performance at moderate and low engine speeds impossible with the present type of fuel, while the very light pistons used could not be expected to give either reasonable wear or proper control of lubrication in commercial service.

Mr. Crane's suggestion was to use a rule whereby cars would be rated in accordance with the piston displacement per mile actually used by them. Such a rule would involve rear wheel diameter and gear ratio, as well as the piston displacement of the engine. He pointed out that racing is very expensive, and expressed the opinion that such a rule would be of greater help in developing commercial design of passenger cars and trucks by enabling engineers to get some really valuable lessons from racing.

The second speaker was J. G. Vincent, who spoke briefly on Economy and Performance Demands. Mr. Vincent said that the average user, when thinking of economy, thought only of gasoline economy. However, the gasoline bill was not the chief item of expense, as a rule. Engine design was limited by the demand for performance. An acceleration of from 5 to 30 m.p.h. in anywhere from 12 to 14 seconds was generally desired. The engineer then had three choices: He might select a high speed engine with a gear ratio of about 5½ to 1, a medium speed engine with a gear ratio of about 4 to 1, or a low speed engine with a gear ratio of 2½ to 3. The speaker did not believe that so far as the engine was concerned, there was any great difference in respect to thermal efficiency because the larger engine would

have to be operated at a lower compression pressure.

Mr. Vincent expressed the view that entirely too much importance had been attached to the effect of the throttle on economy, and not enough to the friction of the engine. Probably everyone had tried the experiment of gradually reducing the amount of lubricant supplied to the engine, and he for one had been surprised at the small amount of oil to the cylinder that he "could get away with," but in thus cutting down the lubrication he had experienced other troubles which he had not looked for, such as increased crankcase dilution. In the matter of tires, he believed there was such a thing as oversizing, as well as undersizing, and the happy mean was the best. It was not possible to lay down rules as to how big a car to build, because different people demanded different sizes. Service costs were in proportion to simplicity, reliability and accessibility, which features he did not pretend to have given in the order of their relative importance. The automobile designer would do well to take out a sample car and test it on the road for a few months, taking care of the car himself, before turning it over to the factory. He would often be surprised what a number of parts had to be taken off before he was able to get at any particular part that needed attention. If there should come about a great change in the matter of performance requirements, the four-speed gearbox would get more consideration again.

Chassis Design for Fuel Economy

A. L. Putnam presented a paper on Chassis Design for Fuel Economy. Mr. Putnam stated that engines are now so reliable that they require very little attention, hours being usually spent on other parts where only minutes are spent on the engine. He wished to call attention to some of the losses in other parts of the chassis. Following are extracts covering the main points made in the paper:

The anti-friction bearings give very little chance for any considerable improvement. But the practice of using in the transmission and rear axle a very heavy grease which solidifies at even a cool temperature is far from economical from the standpoint of fuel economy and efficient lubrication. This is particularly the case when the car is frequently stopped and started and used intermittently in very cold weather. It is now perfectly possible to make and install gears which will pass as to sound even if not smothered by "dope." It is also possible to construct properly vented transmission cases and differential housings which will hold thin oil with even less leakage than we have at present with heavy oil.

The great congestion of traffic in cities has brought about a very common custom of insistence on a brake adjustment which gives instant action with a very small pedal movement. The external-band brake is a very poor instrument to fulfil this condition. It is virtually impossible as a matter of common practice to adjust it closely enough to suit and still not drag some. As the quick brake must be had at any cost, the larger number are dragging. A dragging brake which does not heat enough to call attention to itself by developing excessive heat at a moderate speed still has a marked effect on the position of the throttle and is the cause of wasting much fuel. Brakes are pulling from a mere fraction to several horsepower per pair out of the majority of cars equipped with them. The internal-expanding type of brake is much better adapted to extremely close adjustment without dragging and the heat it generates expands and contracts the drum in the right direction with relation to the shoes instead of the wrong direction as in the case of the external-band brake.

The excessive amount of motion between the engine and the axle, of course, causes a loss of power and fuel in a minor degree due to joint angularity which produces wear; it takes power to produce wear. I think that this excessive amount of movement, no matter how smoothly accomplished, is not, strictly speaking, a comfortable one for the passengers, and know that it is very fatiguing for the driver, increasing greatly the strain of guiding the vehicle.

Unsprung Weight

As the weight of the axle and springs is on the average about one-quarter of the total weight, these parts are able to cause considerable disturbance in the smooth operation of the vehicle. This fact is, of course, so generally appreciated that many serious endeavors are made to reduce appreciably the weight of these unsprung parts and by so doing decrease the effect of their action and reaction. These efforts undoubtedly have good effect when they are carried far enough to make an appreciable change in the proportion of sprung and unsprung weight.

The pneumatic tire is one of the main factors in the success of the passenger automobile. If this tire is such a good thing, why not have a little more of it? Why not give it a larger opportunity to show its worth and itself absorb a larger proportion of the shocks, and give better traction?

In fact it is perfectly possible to carry this idea far enough to eliminate the springs entirely and simply provide for the horizontal displacement of the front wheels with relation to the rear pair. When this is done the unsprung weight factor will have disappeared, as all the weight is sprung weight and completely tied together without movement. The wheels move with the body and the body with the wheels.

At present we seem to be accepting as gospel the statement that the present tire sizes as put forward are the last word as regards pneumatic-tire equipment, when a little thought and even less science can prove them as only the beginning of the real use of pneumatic tires.

Mr. Crane said he was glad Mr. Putnam had put so much emphasis on the tire problem. The fabric tire was inherently a shock absorber, and that was the reason of its shortness of life; it absorbed the energy of the shocks and that destroyed it. The tire companies in their literature had not taken full advantage of the possibilities of the cord tire.

Mechanical Losses

Next was read a paper entitled: "Mechanical Losses an Economy Factor," by Prof. Wm. T. Magruder of Ohio State University. Prof. Magruder said that tests of engines and materials had become common, and that greater attention must now be given to the smaller parts of the motor car. We could hardly expect private laboratories to make public the results which they had obtained at great effort and expense, and the general public must look for such informaton to the Bureau of Standards and to the several engineering laboratories conducted in connection with state universities and other institutions. Figures were given for the friction horsepower of the Ford engine at normal speed, and this was said to be approximately equal to the power required to drive an automobile at moderate speeds. How to reduce this friction horsepower was a problem that called for experimental investigation. The temperature of the jacket water had an important influence on the operation and economy of an engine. Intense cooling increased the power and reduced the specific fuel consumption, both with gasoline and kerosene. Prof. Magruder described the testing facilities at Ohio State University, and some of the methods followed in making power and

efficiency tests of engines, transmissions and complete chassis.

W. P. Kennedy presented a brief note descriptive of three light German cars, on behalf of Col. A. J. Slade, who was a member of the U. S. Armistice Commission and who, upon his return to the United States, brought along samples of the cars referred to, a Benz, a Wanderer and a Mathis. Recently experiments had been conducted with these cars to see whether a car of the Wanderer type, for instance, would not be more economical to maintain than heavy motorcycles in the mail service. Mr. Kennedy said that in case the design should be found suitable, it would have to be somewhat Americanized by increasing the tread from 48 to 56 in. and by making various parts more accessible so as to facilitate repairs.

C. W. Spicer presented a paper on Torsional Strength of Multiple Splined Shafts. Tests were run on 15 carefully machined shafts, of the dimensions shown in Fig. 1, there being not more than 0.0005 in variation from the diameters shown. The shafts were carefully heat treated, each specimen being checked by Brinell tests at the ends and by scleroscope tests throughout its length, the Brinell hardness lying between 220 and 235 and the scleroscope hardness between 38 and 43.

It will be noticed that the small diameter of shafts Nos. 11 to 15 lies between the large and the small diameters of shafts Nos. 6 to 10. This diameter represents a shaft which, according to one authority, is hypothetically equivalent to the splined shaft in torsional strength. Mr. Spicer's tests disproved this assertion.

The results of individual tests of the five specimens of each group were very uniform. The curves shown in Fig. 2 represent the average of the five shafts in each group, and are self-explanatory. Curve A is the plotted average of shafts Nos. 1 to 5. Curve B is curve A corrected for a diameter equal to the small diameter of shafts Nos. 6 to 10. Curve C is the average of shafts Nos. 6 to 10, and curve D is the average of shafts Nos. 11 to 15.

The position of the letters a, c, d also indicates the location of the so-called Johnson elastic limit; that is, the point at which the unit increment of deflection per unit of load increase is 50 per cent greater than at the beginning.

Comparing curves B and C it will be readily seen that a splined shaft of the dimensions given has a torsional

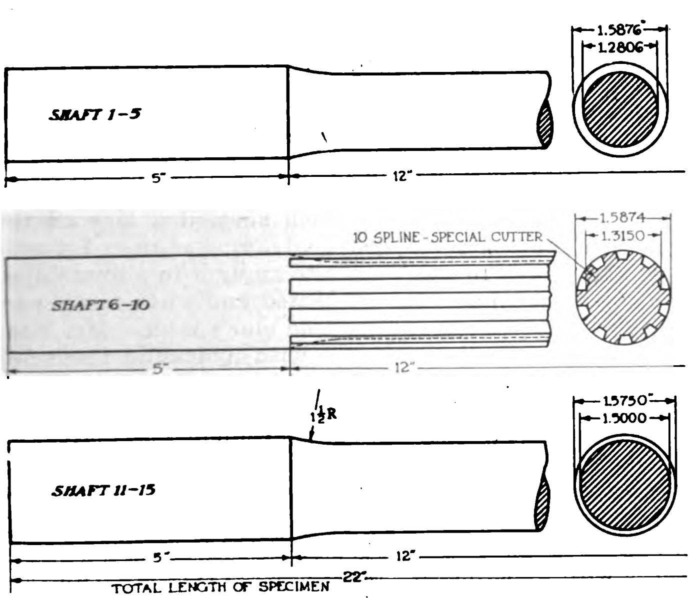


Fig. 1—Dimensions of test pieces used in splined shaft torsion tests

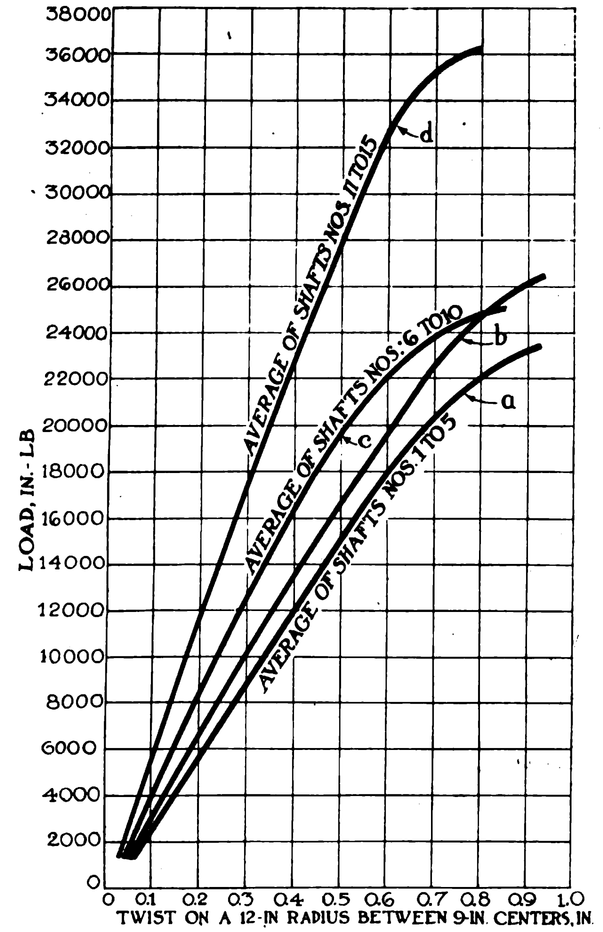


Fig. 2—Curves showing results of splined shaft tests

elastic limit of approximately 18 per cent less than a full round shaft of a diameter equal to the small diameter of the splined shaft. The elastic limit of the hypothetically equivalent shaft is very much higher.

A paper on a New Principle of Engine Suspension was presented by S. E. Slocum, Professor of Applied Mechanics at the University of Cincinnati. The method referred to consists in mounting the engine or powerplant upon a sub-frame or cradle, which is rigidly supported upon a trunnion at the middle of a cross member of the frame at one end, and resiliently supported on the main frame on both sides at the opposite end. Prof. Slocum said that most of the vibration in a motor car was due to synchronism between the natural period of vibration of the complete chassis and the operating speed of the engine. By mounting the engine as described, it would not only have a three point support, but within certain limits it would have freedom of motion about a fixed point. The engine had three degrees of freedom and it was possible to absolutely control the period of vibration. By properly designing or adjusting the resilient supports, which were shown in the form of coiled springs, it was possible to change the period of vibration so as to prevent any possibility of its synchronizing with the natural period of the chassis.

J. G. Perrin, who had been abroad recently, attending the London show, spoke briefly on light cars in Europe. He voiced the opinion that we did not have very much to learn from European engineers in the matter of securing economy. Abroad they obtained economy by using very small cars, which would not be practical here, at least not so long as we failed to get over our mania of doing everything on the high gear. They secured light weight by making their cars small. They used smaller

gear ratios, and we all knew that that made for fuel economy. The only example of advanced design that he saw was the Ricardo engine, which he described briefly. All the small cars being brought out in England had engines of only 11 to 12 h.p., and one reason for this low power was that the British Government had recently imposed a tax of one pound sterling per horsepower. In judging European fuel economy figures, it must be kept in mind that they are based on a somewhat better grade of gasoline than we were using, and, of course, it must also not be lost sight of that the Imperial gallon is considerably bigger than the U. S. gallon.

One speaker said that he had had experience in France with both the Wanderer and the Baby Peugeot. Both of these cars were equipped with 4-cylinder, 60 x 90 mm. (2.36 x 3.54) engines. The one original feature on the Wanderer was a transmission case of pressed steel. On the whole the Baby Peugeot showed much the better performance. On one occasion he drove it at an average speed of 28 m.p.h. continuously for over 2 hrs., with a fuel consumption of 7 liters per 100 kilometers, which is equivalent to nearly 34 miles per gal. Both the Wanderer and the Baby Peugeot were magneto-equipped. The Wanderer had a silent camshaft drive, while the Peugeot had a direct drive on both the second and third speeds, the second speed reduction being 7 to 1 and the third speed, 3½ to 1. Both of these cars weighed in the neighborhood of 1300 lb.

Efficiency of Pneumatic Tires

Mr. Manly asked Mr. Vincent what was the actual efficiency of the pneumatic tire. When the A. C. A. erected its clubhouse it installed a chassis testing dynamometer in its laboratory, and tests made on this dynamometer showed that a great amount of power was lost in the tires. In the case of one particular car, this loss amounted to from 36 to 45 h.p., and the results were very disappointing to the manufacturer. Mr. Manly said his reason for bringing up this matter was because in 1896 he had made some tests on the efficiency of bicycle tires in collaboration with Prof. Carpenter at Cornell University, and these tests indicated very low efficiency, the efficiency, moreover, being in inverse proportion to the wall thickness. Mr. Clayden said that the testing apparatus formerly installed in the A. C. A. laboratory had been transferred to Yale University, New Haven, Conn., and was now in charge of Prof. Lockwood, who had given some figures regarding the losses in pneumatic tires in a paper presented before the Philadelphia Section of the Society.

Mr. Manly said one thing he wanted to bring out was that a tire was very much more efficient when highly inflated, to which Mr. Crane replied that the efficiency also depended upon the flexibility of the casing. The power loss in cord tires varied between 20 and 30 per cent, while that in fabric tires amounted to considerably more.

Mr. Williams said it would appear, now that cord tires had come into extensive use, that it ought to be possible to make tires very much larger in width and with thinner walls, and at the same time use lower inflation pressures. Mr. Anglada said that if springs were to be dispensed with, it would be necessary to use pneumatic tires about 12 in. in width. In Buffalo recently he had seen a 12-in. tire on a motor truck burst, and the truck turn over as a result, and the same would undoubtedly happen if tires of such size were fitted to passenger cars.

F. E. Watts said that the published results of the French fuel economy contest showed that whereas the French cars were groomed to the highest pitch and handled with great skill, the American cars were poorly handled. He thought if the American cars had received treatment equal to the French, they could have done substantially as well. The French were getting more miles, but not more ton miles per gallon.

O. A. Malychevitch said that one difference between French and American practice was that, whereas in this country cars were generally completely designed by factory engineers, in France many cars were designed by independent engineers. After the design of the car was completed, it was passed on to the factory production specialists, who then worked out the production problems. This, he said, was one reason for the better economy of the French cars. H. M. Crane pointed out that an economy contest, as usually conducted, was a very inconclusive affair, for the reason that many expedients were resorted to in order to reduce the consumption that the ordinary driver would never think of in regular use. He mentioned particularly one car with which he was familiar, which won an economy contest some years ago. This had a special rear axle reduction of 1½ to 1, was equipped with silk cord racing sulky tires, was lubricated throughout with light machine oil, had a special high compression engine, and was lightened in many ways.

Low Mechanical Efficiency at Low Loads

H. L. Horning dwelt on the low mechanical efficiency of the gasoline engine at the loads usually carried in car operation. He said that the friction between the piston and the cylinder walls accounted in many cases for 50 per cent of the indicated horsepower, and he felt that there was much opportunity for reducing this loss of energy.

Prof. Berry said he would not like to have the idea spread that economy contests are of no value. He would like to see the S. A. E. or some other body hold a yearly contest of that kind, and to make it of practical value, the rules should be so drawn that it would be required to meet certain performance requirements before the economy contest, and let the adjustment of the car remain the same. H. M. Crane said he hoped Prof. Berry's suggestion would be taken up by the proper people and a suitable set of rules be worked out.

Mr. Wolf asked Dr. Slocum why the fixed point in the new chassis suspension described in his paper was located at the rear end of the engine. The answer was that in most cars already built it was easiest to place it at the rear end, but in new cars it could be placed at the front end just as well.

Hydraulic Transmissions

Mr. Davids wanted to know whether the difficult gear changing, to which reference had been made in one of the papers, could not be overcome by the adoption of hydraulic transmission. Mr. Williams said he knew of one hydraulic transmission which originated in Minneapolis some 15 years ago, which showed a loss on the testing stand of only 15 per cent. It was then brought East and an attempt was made to apply it to automobiles, but it was found that the oil heated and when metal particles got into the oil they caused much wear. Mr. Manly said he had had experience with hydraulic transmissions extending over a long period, and that such transmissions were successfully used for operating gun turrets on battleships, in which service they proved very efficient. He did not expect to see hydraulic transmissions applied to passenger cars, as they were too heavy, but for commercial vehicles they were giving satisfactory results.

A paper by D. McCall White, on Modern Chassis Construction, could not be presented, owing to the absence of the author and the lateness of the hour.

The Aeronautic Engineering Session

By J. Edward Schipper

COMMERCIAL aviation is about as highly developed as the art of aviation, if the impression conveyed by the aeronautic engineering session of the Winter S. A. E. meeting is correct. We are about to witness the dawn of some highly important developments in the art due to the discovery of new thick wing sections which offer great structural as well as aerodynamic advantages. Because of the high lift-drift ratio of these new sections it will be possible to carry greater loads on lighter weight planes with smaller engines, and consequently to operate at higher efficiency.

From a development standpoint the engine is ahead of the plane. In fact, from the opinions of those presenting papers at this session it is unnecessary—or at least should be unnecessary—to use the highly refined products for commercial aviation that we used during the war. Grover C. Loening stated in his talk that commercial aviation had been set back more than ahead by the war time developments. It is the general consensus of opinion that it should be unnecessary to use engines weighing around 2 lb. to the horsepower, and that engines of from 3 to 5 lb. per horsepower are sufficiently light with the new wing developments, the additional weight in the engine going into reliability, endurance and economy in manufacture.

F. W. Caldwell, who spoke on propellers, told of some very interesting and important developments in new propeller materials. The bakelite propeller in his opinion is about the most valuable type that we now have on account of its freedom from the bad effects of weather and its ability to resist chipping in striking rain. He also spoke very favorably in regard to some of the specially constructed steel designs which have been recently put out. Like other propeller men he was enthusiastic over the prospects opened up by the reversible propeller both for military and commercial purposes.

For commercial purposes it makes it possible to use planes that have high landing speeds, the retarding effect of the propeller being sufficient to check the run of the plane after alighting in a very short distance. This, of course, permits the use of machines for commercial purposes which have very high air speeds, making them more economical of operation, capable of carrying greater loads per engine horsepower besides being a factor in the saving of time for transporting freight and passengers. For military use, the reversible propeller opens up the possibilities of a great many new maneuvers outside of being able to land in restricted fields or, in the case of the navy, on ship deck platforms.

C. D. Hanscom presented a highly technical paper on the subject of airplane wings, dealing with some of the new sections which have recently been worked out in the various laboratories. He stated that the possibilities of thick wing development have not even reached their infancy. He showed a number of slides of the new wing sections, the best having an L/D of 14.2. In the discussion, however, a section was mentioned without any details being disclosed with an L/D of 21.8.

Speaking of front and rear flaps, Hanscom stated that they were not of great benefit except at high speeds. He said that the U. S. A-27 section with a 10 deg. flap at the leading edge and 5 deg. at the trailing edge gives very good results at high velocities. A point which was made very apparent in his talk is that a slight modification of the wing curve causes tremendous variations in the characteristics. This was brought out graphically in several instances by showing the wide variation in characteristic curves due to very slight changes in section contour.

Major T. H. Bane was unable to be present, but a résumé of military progress was given by a brother officer. This consisted practically entirely of slides and some very interesting moving pictures of the latest army parachute developments. An astonishing number of jumps have been made without accident, and from the examples shown no difficulty whatever is being experienced in making successful descents. Fireproof gasoline tanks covered with a coat of live rubber are being worked on and are giving promise of very successful results in preventing leaks from holes made by the various kinds of ammunition now in use.

The Commercial Aviation Session

By Herbert Chase

GLENN L. MARTIN presided at the commercial aviation session and presented the first paper. He spoke of the progress of aviation in Europe, mentioning in particular the regularity of the Paris-London service, which has been carried on during the past year with only four interruptions chargeable to defects in the machines. He cited also the efficiency of the forest patrol, in which aircraft have been used to splendid advantage. He called attention to the fact that the modern plane will fly in any weather, fog and darkness being the only hazards not yet completely overcome. He urged the construction of more air terminals and favored the Federal control of aircraft, including licensing of pilots, inspection, etc. He stated that stunting over cities and other flying, except at sufficient altitude, to enable reasonable certainty of safe landing in case of engine trouble, should be prohibited.

The paper on "Commercial Aviation in Europe," by Professor E. P. Warner, was an extensive review of the aeronautic situation in Europe. He contrasted the encouragement given aviation by the British, French, German and other European nations with the lack of such encouragement given by the United States Government. He stated that the airship has been proven more feasible for extremely long runs than the heavier-than-air type, but that the latter is very extensively and regularly used for mail and passenger carrying even over very long distances. As a rule, it is advisable to provide for regular landings at least once in each 250 miles. The fare from London to Paris is now about $36, or 15 cents per mile, and will probably be materially reduced in the near future.

Both England and France are laying extensive plans for using aircraft as a means for binding their respective empires together. England maintains an extensive ground organization, flying fields, issues weather reports and

warnings, and assists designers by extensive research work, engineering conferences, and competitions intended to develop new types.

The author predicted the development of large machines in which six to eight engines will be used, these being so arranged that individual engines can be stopped and repaired en route when this becomes necessary.

Ralph H. Upson presented a paper entitled "Transportation of the Immediate Future," in which he analyzed the economics of aircraft operation by means of charts which were explained in detail. This paper was followed by an informal talk by Major Lent of the U. S. Aircraft Mail Service. He stated that the cost of operation of the DH4 machines, being used by the Government, is approximately 70 cents a mile, and that this figure can be reduced to one-half by the use of machines especially designed for the purpose. The DH4 machine is equipped with a 400-hp. Liberty engine and carries only 400 lb. of mail, while it is possible to carry 1000 lb. in a machine equipped with a 200-hp. engine. Major Lent regards the multiple engined plane as necessary only as a means of avoiding an emergency landing. He prefers the use of a number of small planes in preference to one large machine for the reason that if the latter type fails in a given trip, the service is 100 per cent interrupted, whereas if four machines are used for the same service, it will seldom prove impossible for less than three to make a given trip. Hence the service will almost invariably be at least 75 per cent perfect. It is important to improve the reliability of aircraft, and to provide definite location finders in order that machines can fly above the clouds in case bad weather is encountered.

The session was concluded with a paper by S. W. Sparrow of the Bureau of Standards, the purpose of which was to show the effect of variations in compression pressures on engine performance.

Standardization and Co-operation Features of S. A. E. Body Session

By Norman G. Shidle

THE beginning of serious efforts at body standardization was the feature of chief importance which transpired at the body engineering session, while the need for better co-operation between chassis and body engineers was emphasized. The use of plywood, the training of competent workmen and the trend in body styles also came in for discussion.

Although the matter of body standardization was treated only briefly, an exceptional amount of interest attached to the discussion, and several very earnest pleas were voiced for action of some kind. One speaker, during the discussion, very emphatically declared the need for S. A. E. body standards to be vital since body men were now compelled to rely upon the standards set up by the manufacturers of the various products. He cited aluminum, cotton batting, and lumber as examples of materials for which standard specifications are necessary. He declared that trade names were used as a substitute for standards, so that it was, consequently, impossible to determine what sort of material was actually being bought.

The only paper which referred directly to this phase of body work was that of Kingston Forbes. Though discussing this subject very briefly, Mr. Forbes did make some concrete suggestions as to factors upon which work might be started. Some of the items suggested by Mr. Forbes which could be seriously considered for standardization are as follows:

1. Lumber specifications.
2. Cushion spring wire.
3. Fabricated cotton hair and burlap.
4. Imitation leather.
5. Top materials.
6. Webbings.
7. Closed body and windshield glass.
8. Automobile hardware.
9. Body bolts.
10. Curtain fasteners.
11. Bow sockets.
12. Top hardware.
13. Bow-bendings.
14. Back curtain lights.
15. Door handles.

Discussing the future of body standardization, David Beecroft, the new President, stated that a Body Standards Committee would probably be appointed and that he felt that definite action would be started along this line at once. He said, however, that he was unable to indicate exactly the direction which would be taken immediately by this work.

It would appear certain, however, from the discussion in regard to body standards, that there is a definite need for activity in this direction and that such activity is to be expected at once.

Co-operation with Chassis Engineers

Nearly every speaker, both those who read papers and those who entered the discussion, emphasized the need for closer co-operation between the body and chassis engineers. It was felt that very often the chassis engineer was allowed to complete his work according to his own ideas and that the body engineer was compelled to build a body to fit the conditions imposed by that chassis regardless of the possibility of doing so successfully.

The necessity for such co-operation was strongly urged by Charles A. Heergist in his paper on "Can Automobile Body Weight Be Reduced?" which was read by A. P. Cardwell. He brought up the question as to whether the chassis should be designed strongly enough to carry the entire weight or whether the body should be required to carry a large share. He stated that "if the metal frame sags, as the body is screwed to the metal frame, it carries the body with it at every downward movement; consequently the carrying capacity of the frame should be proportioned to the number and weight of the passengers, and the body built as light as is consistent with stability."

Such problems as these inevitably require close co-operation between chassis and body builders, since it is impossible for the latter to do his best work if he is forced to meet predetermined conditions.

George Kerr, body plant manager, Mitchell Motor Co., contributed some very valuable suggestions in discussing this phase of the subject. He cited an instance of a body concern which was building an almost exactly similar body for two different automobiles. Great trouble was being

experienced in connection with one of these machines, complaints coming in constantly that the bodies were shaking to pieces very rapidly and were giving very poor service.

Mr. Kerr believes that a four-point engine support reduces very greatly the wear and tear on a body as opposed to the three-point support, and in investigating the reasons for the difference in performance in these two cases, he immediately looked for this feature. He found that the car on which the bodies were giving such poor service had a three-point engine support and that the car on which they were giving good service had a four-point support. To this difference could be traced the variation in performance between the two makes.

The three-point engine support reduces vibration on the engine, but increases it on the body. Mr. Kerr pointed this out as an instance of what may be lost by lack of co-operation between body and chassis designers. When each one works according to his own ideas, the resulting job is not the best that might be turned out and the result is likely to be a "passing-the-buck" between body and chassis designers.

Uses of Plywood

Considerable discussion centered about the possibility of using plywood or laminated wood in bodies as a means of reducing weight. While various difficulties had been experienced by the different speakers, nearly every one agreed that there was some difficulty great enough to render it impracticable for production use.

Accurate Workmanship Difficult to Obtain

One of the chief difficulties in body work appears to be that of getting workmen to accurately carry out the ideas of the body designer. It was felt that the training of men capable of doing good body work was one of the big problems of the body designer or manufacturer.

Many times it has been impossible to get the drawing of the body engineer visualized in concrete form by the foremen and workmen who are responsible for the actual manufacture of the product.

Trend in Body Design

The trend in body design is toward a design that will please the majority of people, and because of quantity production needs inclines toward a reduction in the number of models offered by each manufacturer. This is the opinion expressed by George J. Mercer in his paper on "Style in Automobile Bodies."

"The number of different body models that will prevail during the coming season," Mr. Mercer said in part, "is less than in past years. For example, a few seasons ago one manufacturer listed 14 body styles that were in regular production. The greatest number of models listed by one manufacturer during the past year was eight; the majority listed four and this latter number probably will be the number of different models made by most manufacturers in the coming period or, if the touring car is considered, in two divisions, a total of five styles.

"The models that will prevail during the coming year are the five-passenger touring car, the two-passenger runabout, the five-passenger sedan and the four-passenger coupe. The seven-passenger touring car and the seven-passenger sedan will be made in limited numbers; at times the latter will be built with a division, thus making it a two-compartment car. The touring body, that has remained stationary for so long as regards development, is surely developing into two divisions to meet existing needs. . . .

"The four-door sedan as we have it today comes nearer to meeting with universal approval than any body design that has ever been introduced. It has superseded all other forms of closed body for general use except the coupe, which finds favor because it is a miniature of the four-door sedan. The sedan has been simplified in construction by using belt molding that runs all the way around, and the same condition exists at the drip. These two moldings eliminate the welding of the panel. The drip molding covers the top material edge effectively or at least permits the use of a small corner molding under which the top cloth is finished, without its being evident. . . .

"While there is a general tone of simplicity, the tendency is to make up in quality what is lacking in variety. It is reasonable to believe that this will be the prevailing spirit for the season to come. The automobile body is so well known, so generally used and so thoroughly understood by the public, that its intrinsic worth is becoming its best advertisement.

"Builders of the more expensive cars will always make their product of an approximately special-to-order class, Purchasers who are able to buy without counting the cost insist on body designs that are uncommon. Those who produce cars in large numbers for this class of trade usually follow a design that is not extreme, and that relies for its attractiveness upon the fine quality of the workmanship and the high quality of the material used. The chauffeur-driven car is the rule. The limousine and two-compartment sedan will prevail, with the town limousine, the town brougham and the cabriolet as the types having the lighter bodies."

Mr. Mercer also pointed out that there is a return to the type of body lines that preceded the prevailing style; that is, the straight line with angular corners is giving way to moderately rounded surfaces. At the same time, however, the straight line effect is being preserved to a large extent.

Production of All Metal Body

An interesting paper on "Passenger-Automobile Body-Designing Problems" was presented by Andrew F. Johnson.

George E. Goddard, of the Dodge company, presented an extremely interesting motion picture showing the methods used in manufacturing the Dodge all-metal body. He stated that it would take six months to make the dies necessary for this job and that a minimum production of 100 a day was necessary to render the process economical. The dies will last from four to five years.

In his paper on "The Body Engineer and His Relation to the Industry," Kingston Forbes divided the body engineer's task into two parts: artistic and mechanical. In the designing of custom-made bodies, he said, the artistic side is probably the most important, but he pointed out that in quantity production especially art had to be satisfied by dies and stamping machines.

The body engineer, according to Mr. Forbes, should be familiar with all the various trades which go to make up the finished body. While it is difficult for him to obtain this knowledge, he should obtain as much of it as possible. In this connection, the work of the body engineer might be divided into six divisions:

1. Body construction, open and closed.
2. Sheet metal, body metal, fenders, hood, radiators, etc.
3. Trimming.
4. Top building.
5. General hardware.
6. Painting and enameling.

This was the first session devoted entirely to body engineering ever held by the S. A. E. and over one hundred men attended. The discussion developed many interesting ideas, and an intense interest was manifested in the several questions mentioned previously. The meeting was in every way successful. It should pave the way to new achievement in the field of body engineering and help promote co-operation between chassis and body designers.

The Highway Session

By Clyde Jennings

THE first S. A. E. highway section meeting was instructive, interesting and, finally, entertaining. It was quite well attended, there being at one time fifty persons in the room and the total attendance reached a much higher figure. The attendance included a number of automotive engineers, several truck manufacturers and a considerable number of men who make highway work a chief factor in their every day affairs.

Col. H. W. Alden presided, and in his opening remarks called attention to a marked difference between the development in automotive and other means of communication. He said that in the case of the railroads, telephone and telegraph, the means of communication had been entirely within the custody of the persons who were responsible for the development of the theory. In automotive communication, men made the vehicles and then sent them out to run on a road that was outside of the control of the makers of the machine. The development of the means of communication had been everybody's business and, consequently, was not well attended to.

Responsibility of Automotive Engineer

The time had come, said Col. Alden, when the highways must be developed and the automotive engineer could not longer afford to neglect this problem. He called attention to the fact that the engineering schools had not developed a sufficient number of engineers to handle the great amount of work that is now called for.

Referring to the responsibility of the automotive engineers, he said:

"Merchandise transportation depends not only on cars and roadbeds, automobiles and highways, boats and waterways and, I might add for the future, airplanes and blue sky, but on the manner of use of these agencies. Here again we can learn a lesson from railroad experience. In the past the development of freight terminals and rail transportation has been under the same general guidance and the development of the two has been consistent and logical. The recent projection of the automobile into the transportation field has made possible wonderful changes in the methods of distribution of all commodities, but here again the automotive industry, as a whole, has neglected its full responsibility.

"It has failed to shoulder this responsibility for the correct use of the new instrument which it has produced, and for the proper correlation of it with previously existing instruments. I believe we are emerging gradually from our fools' paradise of money-making into a realization of this larger responsibility. How the railroads, highways and waterways can be best joined together in the general function of merchandise transportation is worthy of any man's time and intensive study. The correct solution and the proper arrangement of these three agencies will have a wonderful effect on the future of our industry.

"Freight cars average little better than 25 miles per day, due to terminal delays which could be eliminated largely if the motor trucks and railroads were in proper relation. This daily average could be lifted easily to 75 or 100 miles if the inefficiency of present terminal methods were eliminated. This is no idle dream. The basic trouble is that railroads are doing an enormous amount of less-than-carload, short-haul work for which they are not so well equipped as is the motor truck. The average distance that each ton of freight is hauled by rail is less than 200 miles, due to this large amount of short-haul tonnage.

"A proper re-arrangement wherein the motor truck would do the short-haul and the less-than-carload work and the railroads the long-haul work would give us a regular freight transportation more speedy than to-day's average express shipments and at a cost far less than anything dreamed of to-day. However, I have seen little indication of study of this problem by the automotive industry as a whole, or of co-operation with the railroads in its solution, until very recently. We cannot pass the blame on to the railroads.

"The responsibility is our own. It is a challenge to the brains of the automotive industry and, unless we get busy and assist in the solution of this problem, the progress of the truck industry will be slow where it might be rapid. The details of these questions are numerous, but they are not difficult of solution. They must, however, be honestly faced and understood. Then, if honestly attacked, the results will revolutionize our transportation business.

"I am fairly well acquainted with what our industry has done in the fields of highway development and merchandise transportation, but I repeat that what has been done is only a drop in the bucket. I am greatly pleased that our Society is showing signs of life in these two directions, as they are at the very foundation of our future success and expansion. It behooves every automotive engineer to devote a goodly share of his time to studying these two questions. I hope what I have said will direct our attention more and more to these fundamental problems, the solution of which is as much our responsibility as it is that of the railroad and highway engineers."

Bureau of Roads Tests

A. T. Goldbeck, engineer of tests of the U. S. Bureau of Roads, showed many lantern slides concerning the research and experimental work of the Bureau. In showing these slides, which were photographs of the equipment for the experiments, the operations and of curves of deduction, he asked that those present do not accept the figures given as final as to detail. He said that the Bureau was checking the data gathered and shortly would issue a bulletin in which much of this data would be compiled. In the meantime he asked that his talk be construed as merely a progress report. His talk was especially interesting as to determining the weight distribution on the wheels of the vehicles by means of the device which is buried in the soil under the surface of the road. Thin brass sheets are arranged to measure the slightest change of pressure in the subsoil through the breaking of the electrical circuit. This device has suppplied new data as to the extent of the pressure under the wheel of the truck. The change in pressure, of course, varies with the nature of the subsoil.

He also showed the experimental bits of roads built with a view to determining to what extent moisture can be kept from the subsoil by waterproofing the shoulders of narrow surface roads. He showed the machinery and operations for determining the impact of trucks on a given set-off in the road surface. One rather peculiar feature developed in this experiment was that while there was a wide range of difference in impact in favor of a new solid tire as against the seriously worn solid tire, and again in favor of the pneumatic tire as against any solid tire, there was a comparatively slight range between the pneumatic with 160 lb. pressure and the pneumatic at 130 lb. This difference was much less marked than was expected.

This statement was subject to some discussion and Goldbeck explained that while the under-pressure pneumatic was regarded as a more comfortable tire for riding on a rough road, this was due to the time element entering into the impact.

Goldbeck, in summing up, said that with increasing loads he had become interested in the problem of distributing the load on more wheels. The parallel for this, he said, was in the railroad work. As the size and weight of locomotives increased, the number of wheels had been increased. He also said that the question as to the relative cost of the highways and the cost of the motor trucks that passed over it had been raised, and in his opinion the question of designing either the highway or the motor truck might ultimately be determined by economic considerations.

Later in the discussion, David Ludlum of the Autocar Co. asked Goldbeck how many types of trucks had been used in these experiments and how many would be used before the question as to the design of a truck was passed upon. Goldbeck in reply said that seven or eight designs had been employed, but that these experiments were for the purpose of determining highway research material and not with a view of deciding upon any truck design. In answer to another question by Ludlum, he said he would be quite glad for the opportunity of using a short wheelbase truck in the experiments. He passed the question as to the use of data gathered in these experiments in advertising certain trucks, by saying that so far only progress reports had been issued and that he would much prefer that no such reports be made. His idea was that the data should not be made public until completed, but that in government work it appeared to be necessary to issue reports from time to time, and that these reports were often mistaken for complete reports and so used. He could not stop this practice.

William E. Williams, a consulting engineer, read a paper on "Highway Road Construction," on experiences drafted chiefly from civil and railroad engineering. Williams expressed slight patience with much of the research work on highway problems, strongly favoring a brick and concerete road of sufficient thickness—10 in. appeared to be sufficient to him—to support the traffic. He said that if such a highway was made, there need not be much worry about the subsoil pressures and drainage. The paper was the subject of quite a number of comments in the discussion, in which many statements were disputed. Most of those present appeared to think that Williams had ignored the necessary question of cost.

H. E. Breed of the New York State Highway Department, in his paper on "Variable Factors That Influence Highway Design," made the political side of road building the prominent one. He favored a department that was not a part of the political booty. Political domination, he said, was one of the chief evils of the day.

Another variable factor of importance is the volume and character of the traffic of to-morrow. He said that he did not believe any engineer to-day faced this problem with confidence. He passed quickly over the other variables, which he said were foundation, surfacing, drainage and maintenance.

A. E. Masury showed two lantern slides of a device that he had built for measuring the effect of road jolts on the truck. The measurements are made on a paper cylinder by a pencil controlled by an air cylinder. The seismograph chart is timed and relative data can be obtained over the same roadway. This entire work, he said, was in a very experimental stage.

One of the highly interesting contributions to the discussion was that of State Highway Engineer Meeker of New Jersey. His view was that the greatest single factor in the highway problem was that of maintenance. The present tendency was to build a highway—good, bad or indifferent—and then forget it until it was necessary to build it over. It would be well, he said, to follow the railroad practice, where regularly section gangs were responsible for certain mileage of track. Highways needed repair men constantly on the job, they needed track walkers, they needed renovations and general repairs in the fall and spring; the first to prepare for winter and the second to repair the damage of winter. With this sort of treatment, Meeker said, many types of highways now condemned would stand the heavy traffic wear. Others who participated in the discussion were David Fenner, Cornelius Meyers, S. M. Williams, H. W. Slauson.

In adjourning the session Chairman Alden said that he understood that it was the plan to hold future sessions of this nature, and while this had been strictly a highway session, he thought that future meetings would be based on a consideration of the general subject of transportation.

The Standards Committee Meeting

By P. M. Heldt

THE Standards Committee met on Tuesday morning at the Engineering Societies Building, Chairman B. B. Bachman presiding. The first report presented was that of the Aeronautic Division, by H. M. Crane. It proposed a revision of the tables of turnbuckle dimensions, to bring the S. A. E. specifications in line with the specifications of the Bureau of Aircraft Production. In the discussion, an exception was taken to the wording of one recommendation, that the barrels should be made "of naval brass or an equivalent alloy." This brass is equivalent to S. A. E. non-ferrous alloy No. 73 and it was held to be more fitting to use the latter term. The suggestion to substitute this term was put in the form of an amendment, which was carried, and the part of the report dealing with turnbuckles itself was then adopted. J. L. Hartness said that the turnbuckles covered by the table were good for cables up to ¼ in. diameter, and since we were now getting into larger sizes of aircraft, it would be well to extend the table to include turnbuckles suitable for 5/16 in. cable at least. The suggestion was brought to the attention of the Aeronautic Division.

Federal Aircraft Registrations

The second part of the Aeronautic Division report was in the form of a special report on the regulation of commercial air navigation. Mr. Crane said that there was every evidence that legislation would soon be adopted by various states seriously restricting the use of aircraft, and that it was highly important for the S. A. E., which was an organization endeavoring to encourage experimental development of aircraft, to see to it that no undue restrictions be placed on machines which had not yet proven absolutely safe, provided that the men who did the flying were cognizant of the risks they were taking. Mr. Crane said that this was not entirely in line with the usual work carried on by the Standards Committee, but that it was necessary to take action on the report for the guidance of the Sub-Division on Performance and Testing. The special

report read as follows:

"A system of Federal registration of all aircraft for identification, and in addition, licenses for certain specific purposes or uses should be adopted.

"All aircraft carrying passengers for any purpose, or goods in commercial service, should be licensed by the Federal authority, which license shall indicate the aircraft licensed has complied with certain minimum requirements as to safety. By passengers is meant any person not a necessary member of the crew.

"Any aircraft not coming under the classification in the previous paragraph may be licensed by the Federal authority even though not complying with the safety requirements, but only for restricted service with a view to minimizing danger to persons or property on the ground. This is intended to cover experiment and special racing aircraft as well as privately owned aircraft not used in commercial or Government service.

"Minimum requirements cannot, even as regards the structural strength, be reduced to rules and figures capable of application in inspection except by persons of adequate engineering training in this field, and other necessary minimum requirements regarding safety of operation are the result of compromise and can only be applied by persons with trained judgment.

"Any definite requirements or figures should not be written into legislation at this time, because these matters would be handled best by the regulation and ruling of the Federal authority which should be created by legislation.

"Aircraft, which, in accordance with previous paragraphs, require a license, should be periodically inspected to insure that they continue to be in a safe operating condition."

Ball and Roller Bearings

W. R. Strickland made the report of the Ball and Roller Bearings Division. The first item covered a proposed extension of the standard for angular contact ball bearings. It was recommended that the bore, outside diameter and eccentricity tolerances specified for light, medium and heavy series annular ball bearings, be adhered to for the angular contact type, and that the tolerances for the overall widths be specified with the footnote reading: "The width tolerances for the individual ring shall be the same as those for the corresponding sizes of annular ball bearings of the light, medium and heavy series." It was also recommended that the angular contact type bearing tables be published as separate and complete standards. The recommendation was adopted.

Under the heading of the separable (open) type, it was recommended to revise the present standard by changing the heading in the column "Width of individual ring" to "overall width," and to add tolerances of plus or minus 0.002 in. to the overall width dimension. A footnote is to be added, referring to overall width, to the effect that "The nominal width of individual rings shall be the same as for the overall width in the above table, but shall have tolerances of plus or minus 0.001 in. This was adopted.

It was further proposed to change the designation "extra wide type" to "wide type," to add a note to the effect that "The bore and outside diameters for wide type annular ball bearings shall be the same as for the corresponding size annular ball bearings in the light, medium and heavy series," and to add a footnote referring to the title, to read: "Normally these bearings are a double row type of construction." This was adopted.

Shaft and Housing Fits

Under the heading, "Shaft and Housing Fits and Tolerances for Ball Bearings," there were presented two tables which it was proposed to print in the S. A. E. Handbook for general information only. These tables gave the nominal dimension, plus and minus tolerances of the inside diameter of the bearing, the shaft diameter, the outside diameter of the bearing and the housing bore. H. M. Crane thought that the information contained in the tables should be presented in a slightly different form. On steering knuckles, for instance, it would be commercially impossible to work to limits of 0.0005 in. He suggested that instead of giving the nominal diameter with plus and minus tolerances, on both the hole and shaft, only the extreme permissible differences between the shaft and hole sizes be specified. For instance, for the 30 mm. bore size of ball bearing, these figures would be 0.0002 in. looseness and 0.0009 in. tightness. It might be practical to work to a limit of 0.0005 in. in the manufacture of ball bearings, but it was not commercially practicable to work to such close limits in machining the bores of wheel hubs, for instance. Mr. Strickland explained that the figures in the tables were based on grinding fits, and he thought they were not as impossible as Mr. Crane suggested. These limits had been worked to by many manufacturers. In the larger sizes the tolerances were not of the order of 0.0005 in. but approached 0.002 in. Mr. Cookingham said he could not see how they were going to check such close dimensions, as a micrometer was absolutely unsuitable for checking dimensions given to the 10/10000 part of an inch, and very fine instruments would certainly be required. Mr. Scaife voiced the opinion that a looseness of 0.0002 in. would never do, because even with a ground surface, the bearings would soon begin to shake and give trouble, and with a machined surface it would be still worse. Mr. Gurney said that the limits which had been put into the tables were almost impossible, and that the only way to get the desired fit in most instances was by selection. Where this was impossible, the figures given might be used as a guide. Mr. Crane said he had had a great deal of experience in studying tolerances in connection with the manufacture of aircraft engines for the Government during the war, and that they had finally agreed on the system which he now proposed, which system was greatly appreciated by the shop men. Mr. Crane's amendment to present the dimensions in a somewhat different form was carried, and the report thus amended was adopted.

Electric Vehicle Battery Jars

The next report presented was that of the Electric Transportation Division, which related to electric vehicle storage battery parts, for passenger and commercial vehicles. The report was presented by E. L. Clark, and was merely a revision of an earlier standard. W. E. Holland suggested that in the two-ribbed type of jar, where the centers of the ribs were shown 3½ in. apart, this dimension be left off, as some of the jar manufacturers were making the ribs 3¼ in. apart and it would be a very expensive matter for them to make this change, for which there was no particular reason. An amendment to this effect was carried, and then the whole report was adopted.

Lighting and Starting Batteries

Next the report of the Electrical Equipment Division was taken up, being presented by A. D. T. Libby. This division appointed a sub-division on storage batteries during the year 1919, to cooperate with the Bureau of Standards and the Motor Transport Corps in the formulation of specifications for starting and lighting storage batteries for military automobile and motor truck service, for the use of the Government, and to revise the present storage battery standards. Under the heading of "Rating" it was recommended that "Batteries for combined starting and lighting service shall have two ratings. The first rating shall indicate the lighting ability, and shall be the capacity

in ampere-hours when the battery is discharged continuously at the 5 hr. rate to a final voltage of not less than 1.7 per cell, the temperature of the battery beginning such discharge being 80 deg. Fahr. The second rating shall indicate the starting ability and shall be the capacity in ampere-hours when the battery is discharged continuously at the 20 min. rate to a final voltage of not less than 1.5 per cell, the temperature of the battery beginning the discharge being 80 deg. Fahr."

Under the heading of Terminal Posts, it was recommended that when taper posts are used for terminals of lead-acid storage batteries, the dimensions shall be 5/8 in. for the small diameter on the negative post, 11/16 in. for the small diameter of the positive post, 1⅓ in. taper per foot, and 11/16 in. minimum length of taper. When straight terminal posts are used, the diameter of both the positive and negative posts shall be 13/16 in. and the minimum clear length of the post shall be 13/16 in. On the subject of terminal posts, there was a communication from Robert H. Combs, in which objection was raised to the decision to make the positive and negative posts of different diameters if they be tapered, but of the same diameter if they be straight. The explanation given was that straight terminal posts had never been made of different diameters, and since it was the object of the Standards Committee to simplify construction and reduce the number of different parts, it was not considered opportune to recommend straight posts of different diameters.

The principal changes from present practice recommended in the report may be summarized as follows: The report was specifically limited to lead-acid storage batteries, in order that the specifications would not be applied to Edison storage batteries. The S. A. E. Recommended Practice for posts for small cells was omitted, as the battery sizes proposed for adoption did not require the use of small terminal posts. The compartment height of 10 in. specified in the former S. A. E. standard for storage battery compartments was changed to 10⅛ in. The former S. A. E. standard for dimensions of lead-storage batteries for starting and lighting service was revised to specify a list of the sizes and capacities based on present practice, which was considered comprehensive enough for practically all commercial requirements. The former S. A. E. standard for ratings of lead-storage batteries for starting and lighting service was revised to conform to acceptable commercial practice.

The specification regarding fuel capacity was changed, the following passage being deleted: "With a current 25 per cent greater than the rating, the fuse shall open the circuit without reaching a temperature which will injure the fuse tube or terminals of the fuse block." It was recommended that the fuse clip and fuse ferrule should be nickel plated and that the fuses should be tested in both the vertical and horizontal positions. This section of the report was adopted.

Spark Plug Tests

Another section of the report dealt with spark plug tests. Last year the Division co-operated with the Motor Transport Corps in the establishment of a Government specification for the testing of spark plugs, and from this work were developed recommendations for commercial use. The recommendations were prepared by a sub-division, and tried out by making tests. The following was accepted as recommended practice in making spark plug tests:

"A sufficient number of sample spark plugs drawn at random from stock are to be furnished to equip at least two of the engines under consideration.

"The spark plugs submitted for test must conform in all important dimensions to the engine builder's drawings.

"Preignition and leakage tests are to be made in the following manner. An engine of the type for which the plugs are intended shall be equipped with a set of the spark plugs to be tested. The spark plug gaps shall be carefully adjusted with a suitable thickness gage to the desired dimension and these gaps shall not be disturbed throughout the tests. The engine shall then be coupled to a suitable dynamometer and the circulating water maintained at a temperature of not less than 40 deg. Fahr. or more than 60 deg. Fahr. The engine shall then be started up and as rapidly as possible brought to the speed corresponding to the maximum torque, the throttle and the spark adjusted for this condition, and the circulating water temperature brought up to a temperature of not less than 190 deg. Fahr. nor more than 210 deg. Fahr. as rapidly as possible and this temperature maintained for the remainder of the run. Torque and speed readings shall then be taken at 30-sec. intervals for a period of 15 min. Appreciable loss of torque or speed, missing or backfiring which can be attributed to the spark plugs, will be considered grounds for rejecting the spark plugs under test, provided the engine is of proved design and has previously demonstrated its ability to run steadily under these conditions. During this run, tests for gas leakage shall be made by covering all joints of the spark plugs with oil and inspecting for leaks.

"Following this 15-min. run at the speed corresponding to maximum torque, the engine shall be brought up to the speed corresponding to maximum horsepower and be held at this speed for not less than 5 min. Obserations similar to the previous will be made during this run.

"Spark plugs shall also be subjected to road tests to determine how well they will function under normal service conditions.

"Spark plugs which have successfully passed the above tests will be considered satisfactory for use in so far as the following points are concerned:

"(1) Breakage owing to sudden temperature changes.
"(2) Liability to cause preignition.
"(3) Leakage.
"(4) Power performance.
"(5) Permanance of gap.

"The following procedure for determining the relative susceptibility of the spark plugs under text to fouling is intended to servev merely as a guide in making such tests, since general engine influences and more particularly lubrication and carburetion conditions varying as they do in different makes of engine, prohibit the setting of one strictly standard method applicable to all engines.

"The engine equipped with the spark plugs under test shall be run on the dynamometer with the circulating water at not less than 40 deg. Fahr. nor more than 60 deg. Fahr. The inlet manifold shall be kept at as low a temperature as practicable, all heating means being disconnected so far as possible. The engine shall be run with no load and a wide open throttle, the speed being held down to between 1000 and 1500 r.p.m. by causing the carbureter to feed an abnormally rich mixture. The engine shall be run in this manner for 3 min., following which the carbureter adjustment shall be restored to standard condition and the load applied to hold the engine at a speed of about 1200 r.p.m. It is assumed that the torque which is to be expected of the engine under test at this speed, has been previously determined. At the end of 2 min. running after applying the load as above explained, the percentage of standard torque which the engine is capable of developing will be considered as a figure of merit for the spark plugs under test. For instance, if at the end of 2 min. operation under load following the "choked" run, the engine is capable of pulling its standard torque, the spark plugs shall be considered 100 per cent satisfactory in this regard. If, however, the engine pulls but one-half its regular torque, the figure of merit will be 50. These tests should be re-

peated a sufficient number of times to insure a consistent average result."

Magneto Standards

Under the heading of Magneto Dimensions it was recommended that the present standard be extended to include small magnetos used on motorcycles and isolated electric lighting plants, these magnetos to have the same size taper as given in the present Recommended Practice for larger type motorcycle magnetos. This was adopted.

It was also recommended that on flexible disk magneto couplings "cups or a similar form of grip washers shall be used on the flange bolts on each side of the disk, to reinforce the material against tearing out." This recommendation was objected to by Fred W. Andrew, on the ground that the S. A. E., by standardizing features of flexible disk couplings for magnetos, and not standardizing other types of couplings, gave the impression that the flexible disk was the only type recommended for magneto use. The very fact that grip washers were recommended in the report showed that this coupling as now used gave trouble, and since there were other types of couplings, it was suggested that the matter be referred back to the committee and that the present standard for flexible disk couplings for magnetos (covering diameter of disks and spacing of bolts) be eliminated from the records of the Society. It was voted to refer the matter back to the committee.

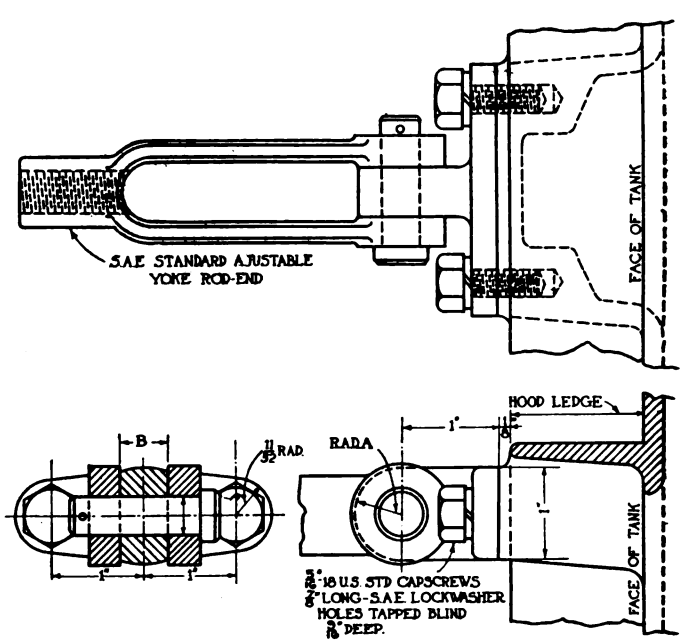
Starter Pinions and Brushes

In connection with starting motor pinions it was recommended that the pitch-line clearance between pinion and flywheel, which is now specified as 0.015 in., should be specified as 0.015 to 0.025 in. After some discussion it was decided to substitute the phrase, "Clearance on the pitch-line," for pitch-line clearance, and thus amended the recommendation was accepted.

The Division had been requested to standardize commutator brushes for generators and starting motors, but found that the only thing that could be done at the present was to recommend the following: "All dimensions for brushes used in starting motors and lighting generators shall vary by even increments of 1/16 in. and the maximum tolerances from nominal size shall be plus 0.000 minus 0.010 in. for width and thickness and plus 0.000 minus 0.031 (1/32 in.) for length." This was adopted.

It was also recommended to delete from the records of the Society the following standard which had never come into practical use: "Before any electrical appliance is added to a gasoline car, as it is sent out from the car manufacturer's plant, a description of the said appliance should be submitted to the car manufacturer as to suitability for and the best method of application to the car." This was agreed to by the committee.

K. F. Walker presented the report of the Radiator Division. It was recommended that in cast radiators "inlet and



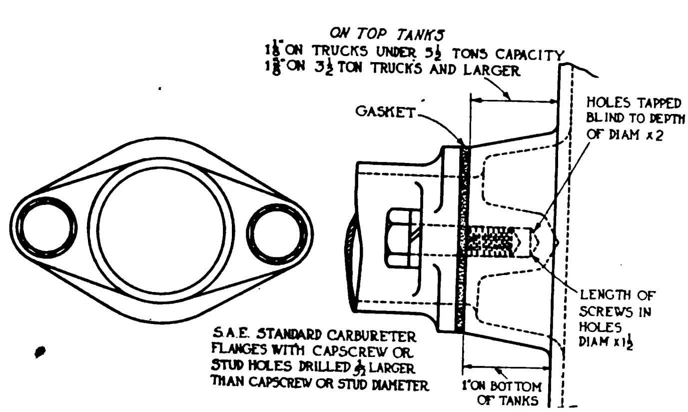
Cast radiator tie rod fittings

outlet fittings shall be cast separate from the radiator tank" and that they "shall be attached to the tank by flanges which conform to the present S. A. E. Standard two bolt type carbureter flanges of the 1, 1¼, 1½, 1¾ and 2 in. sizes. The finished face of the pad cast on the radiator tank shall extend ⅛ in. outside of any other projection on the tank. The drilled holes in the fittings shall be 1/32 in. larger in diameter than the cap screw or stud diameter. The tapped holes in the pad on the tank shall be blind with a maximum tapped depth of twice the cap screw or stud diameter. The length of the cap screws or studs in the tapped hole shall be 1½ times the diameter.

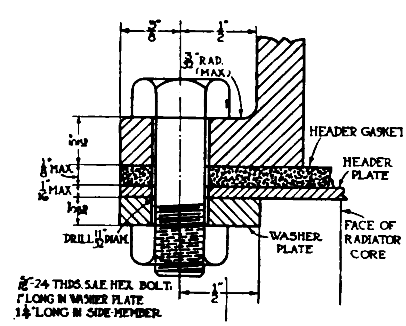
"In the tubular radiators, having internal overflow tubes, the tubes shall be of seamless brass or copper, attached to the bottom tank by a ½ in. American standard pipe thread brass plug. The jacket tube shall be ⅝ in. diameter and the overflow tube shall be ⅜ in. diameter.

"The size of the tapped hole for radiator drains shall be ⅜ in. American standard pipe thread. Bolt hole centers of header flanges shall be spaced 2½ in. apart wherever possible. Cast radiator tanks shall be designed without ribs or cooling flanges. Tie rod fittings shall be in accordance with the illustration.

"A pressure of 5 lb. per sq. in. shall be used in making all tests for radiator leaks. Header plate widths shall be 5, 5½, 6, 6½ and 7 in. The hood ledges of cast radiators shall be 1 in. wide on motor trucks having a nominal capacity of less than 3½ tons, and 1½ in. wide on motor trucks having a nominal capacity of 3½ tons or more."



Inlet and outlet flanges



Cast radiator header flange dimensions

In connection with passenger car radiators, the following recommendations were made: "The tie rods connecting the body (dashboard) and the top of the radiator shall be flexible. The hood ledge shall have a minimum width of 7/8 in. Hood lacing shall be not less than 3/8 in. wide, and not less than 1/8 in. thick." The whole report was adopted as presented.

S. P. Thatcher presented the report of the Tire and Rim Division. This contained only a single suggestion, namely, the extension of the present wood felloe dimensions standard for pneumatic tire rims, to include the 34 x 5 in. wood felloe having a width of 2½ in. and a depth of 1⅝ in., plus or minus 1/16 in. This was adopted.

New Non-Ferrous Alloy Specifications

J. J. Aull read the report of the Non-Ferrous Metals Division, which had revised all of its previous standards. This report included four specifications of white bearing metals or babbitts, Specifications Nos. 10, 11, 12 and 13. These were adopted as presented. Then there were four specifications of aluminum alloy, of which the first three were old and the last new. These specifications, Nos. 30, 31, 32 and 33, were accepted as presented. Next came eleven specifications of brasses and bronzes. One speaker said he regarded the requirement of 8 per cent elongation in specification No. 64 (phosphor bronze) as very high, as it was the practice of his firm to call for 4 per cent only. He was reassured, however, that the elongations requirements for specifications 64 and 65 were well within the limits of practical possibility. This set of specifications was adopted. Next No. 69 was taken up, which covers a new wrought aluminum bronze. This also was accepted. Specification No. 70, covering commercial brass sheets, embodies only a slight change, made to bring it into line with the A. S. T. M. Specifications. This was adopted. No. 71, covering copper sheet, was also adopted. Specifications Nos. 72, 73, 74 and 75 covered brass rod and tubing, and were adopted.

Tractor Belts and Governors

E. A. Johnston presented the report of the Tractor Division. In this it was recommended that belt pulleys and clutch diameters for new equipment should not be less than 12 in. and the pulley width should not be less than ½ in. wider than the belt required. Tractor drive belts for all purposes should be 5, 6, 7, 8 or 9 in. in width. This was adopted.

It was also recommended that farm tractors and engines intended for belt operation be equipped with a governor and so designed that a suitable speed indicated device might be attached. This was also adopted. On a previous occasion, the Society adopted a standard testing form for tractor engines. Mr. Johnston said that this had never come into practical use, and the Division wanted it eliminated from the standards of the Society. This was agreed to.

Screw Thread Standards

W. R. Strickland read the report of the Miscellaneous Division. This covered two items, namely, the proposal to adopt as an S. A. E. standard the American standard taper pipe thread, and a revision of the present S. A. E. oil and grease cup thread standards. At present taper threads are used in only a few of the S. A. E. Standards, namely, flared tube unions, ells and tees, fuel vacuum tanks, pipe flanges and oil and grease cups. In 1919, a committee of the A. S. M. E. held a public hearing for the consideration of international pipe threads, and following this hearing, the S. A. E. was requested to give official endorsement to the American standard taper pipe thread and to authorize an American representative in Europe to use the endorsement in propagating the standard among European manufacturers and technical organizations, prior to a contemplated international conference. It was decided to adopt the American standard taper pipe thread as an S. A. E. Standard.

In August, 1920, the Society adopted ¼-36 and 5/16-32 threads for oil and grease cups. There has been much criticism of this standard, for the reason that the common standard fine thread pitch for ¼ in. diameter is 32. The Miscellaneous Division at this meeting, therefore, recommended the addition of a No. 10-32 size and to change the ¼-36 to ¼-32 thread. This recommendation was accepted.

Engine Division Report

In the absence of any members of the Engine Division, the report of that Division was read by Manager Burnett of the Standards Committee. In this report it was recommended that "mufflers shall vary in diameter and length by even inches, and shall be supported by bands extending around the circumference." In connection with flywheel housings, it was recommended that the following recommended practice be added to the present standard: "The clearance space for crankshaft flange bolts shall be 6⅛ in. maximum diameter, and at least ⅝ in. deep." At the suggestion of the Truck Division, it was recommended to add two sizes to the present fan belt and pulley width standards, namely, belts 1¾ and 2 in. wide, and pulleys 2 and 2¼ in. wide, the limits on the belt widths being plus and minus 1/32 in. and the limits on the pulley widths plus and minus 0.005 in.

It was also proposed to standardize the air inlet openings of tractor carbureters so as to facilitiate the fitting of air cleaners. The recommended practice is as follows: "The nominal diameter of the carbureter intake shall be the inside diameter, which shall vary in even quarter inches (from ¾ to 4 in. diameter) so as to take standard tubing sizes as listed in the present S. A. E. Standard for Flexible Metal Tubing, page 35b, S. A. E. Handbook, Vol. 1. This also applies to the outlet of carbureter air cleaners, and similar devices wherever tubing is used." It was also recommended to cancel the present S. A. E. Recommended Practice for carbureter air heaters, as this practice had become obsolete. All of the recommendations of the Division were accepted.

Motorcycle Standards

Mr. Burnett also read the report of the Motorcycle Division. This included a recommendation for a slight change in the chemical composition of the steel for motorcycle spokes and nipples so as to make this specification identical with S. A. E. specification No. 1045. It also recommended a slight change in the specification of the steel used for motorcycle wheels and rims so as to make the latter identical with S. A. E. specification No. 1010. A further recommendation was to cancel the recommended practices for spark and throttle controls, clutch and brake pedals and gearshifts, which were formulated as military standards. All of these recommendations were accepted.

Truck Standards

A proposed standard emergency rim clamp so designed that a truck equipped with 36 x 6-in. wheels in front and 40 x 8-in. wheels in the rear can carry a 38 x 7-in. rim as spare with a 40 x 8-in. tire (the latter being a standard oversize for 38 x 7-in.) and thus make it unnecessary to carry two sizes of spare tires was submitted, but was referred back to the committee because the discussion made it evident that the proposed lug had not been sufficiently well tested to make certain that it would prove satisfactory in actual service. A slight revision of the present standard rim clamp bolts was approved, as was also a set of standard dimensions for passenger car wheel spokes.

Completion of Front Hub Standards Postponed

By J. Edward Schipper

HUB standardization has received a six months' setback chiefly because the report covering the proposed standard specifications was not presented in a form acceptable to the S. A. E. Standards Committee. While members of the committee were almost unanimous in their approval of the spirit of the report, it was felt that the printed report brought before the standards meeting did not satisfactorily present the work of the committee and that it would consequently be advisable to refer the matter back. Action to this effect was taken with the result that the report will not come up for final actions until the summer meeting of the Society is held.

The discussion of the report brought out the fact that all the manufacturers vitally concerned approve of the work. Objections were made by the Gurney Ball Bearing Co. that the report did not cover the installation of ball bearings, and in view of these objections the title of the report, when it next appears, will be Roller Bearing Front Hubs for Trucks instead of Hubs for Wood and Metal Wheels.

In discussing the objections of the ball bearing manufacturer to these recommendations, it was pointed out that 95 per cent of the installations are roller bearing, the notable exception being that in the White trucks. This company manufactures its own axle and consequently does not materially affect the situation from a standards standpoint. It was also pointed out in answer to many questions on this point that it is impracticable to have a common standard for both the ball and roller bearings because, where the same diameters can be used, the capacity rating of the ball bearings will be about 70 per cent of the roller bearing capacity.

Campaign Begun Last June

Largely through the efforts of AUTOMOTIVE INDUSTRIES, which has frequently noted with concern the annual waste and inconvenience to the trade of unstandardized hubs, the program for motor vehicle hub standardization was inaugurated in June, 1920, by representatives of wood and metal wheel manufacturers in cooperation with manufacturers of axles, hubs, bearings, rims and tires. This program has been carried out by a committee consisting of four representatives of prominent manufacturers of axles, C. T. Myers, chairman, and the Standards Manager of the S. A. E., ex-officio, secretary.

The standardization of wheel hubs for front and rear axles for both passenger cars and motor trucks was too big a task to be undertaken at one time, hence it was agreed that consideration of rear axle hubs should be deferred and that only front axle hubs for motor trucks, which afforded better opportunity for immediate progress should be considered in the first instance. Following completion of this part of the program, work will proceed on passenger car front axle hubs and then on rear axle hubs for both types of vehicle.

It is evident that since real hub standardization depends upon bearing sizes and location, which in turn depends upon spindle design, the logical procedure was to design a series of spindles for load capacities that would cover the range of the various motor truck models having load capacities from ¾ to 5 tons.

In order to have a minimum number of spindles, the passenger car and motor truck requirements were studied and ratings selected that permit the use of the lighter truck axles on heavy passenger cars, or vice versa. From this followed the selection of proper bearings for these spindles and the design of wheel hubs to fit these bearings.

The proposed designs for the five sizes of spindles and hubs for motor trucks have been laid down on the basis of definite maximum load ratings in pounds on the tires at the ground, so that they can be checked up to determine whether or not any particular spindle is being overloaded, by simply running the front wheels of a motor truck onto a platform scale. These ratings were selected with reference to existing practice in motor truck construction, and to the load rating of the solid tire and wheel built around each spindle and hub.

The spindles and hubs have no other rating, however, than that of their capacity in pounds on the tires at the ground. No matter what the rated load capacity of the motor truck may be, the spindle and hub to be used will depend upon the weight distribution of the loaded vehicle, which determines the load the front wheels must carry. This weight need not be as of estimate only, as it can be checked by the scales measurement.

The spindles are so designed that the center of the tire where it touches the ground is vertically under the center of the inner bearing. This arrangement differs from that in many designs of truck front hubs now in use in that it brings the point of contact of the tire on the ground considerably nearer the projection of the steering pivot center on the ground and makes steering much easier. For a given tread and frame width it permits a greater angular movement of the front wheel and therefore a shorter turning radius. It also reduces to a marked extent the pressure on the steering pivot and its bushings. The location of the tire so that the load is under the inner bearing instead of between the bearings, also reduces the bending moment, which is due to the vertically applied load on the spindles. In the case of many axles now in use, this bending moment is three or four times as great as in the case of the proposed standard spindles.

Spindle Design

The spindles have been designed with large fillets at the shoulder, an important feature that has often been slighted in the past. It strengthens the spindle at the point of maximum stress and has the effect of moving the shoulder toward the load line, thereby decreasing the moments by shortening the lever arm to the point of load application. General practice among axle makers is to use a low nickel or chrome nickel steel, such as S. A. E. No. 2340 or 3140, for spindles, but the stresses in the proposed spindles will be low enough to allow the use of S. A. E. Steel No. 1035 if it should become necessary to do so under extraordinary circumstances.

It may be questioned why smaller spindles are not proposed in order to lighten and cheapen the axles and work

the steel closer to its elastic limit. This is not done because absolutely safe practice must be observed for standard use; bearings large enough to serve in these hubs permit the use of the spindle sizes recommended; the proposed spindles actually weigh less than many spindles in present use for the same service; and in event of a shortage of alloy steel a carbon steel can be used.

The selection of the bearings was guided by a study of the types, sizes and extent of their use for this application in the trade at this time. Figures for 1919 show that about one and a quarter million bearings were used on commercial car and motor truck front axles. Taper roller bearings constituted about 90 per cent of the total, straight roller bearings constituted less than 5 per cent, and ball bearings about 5 per cent of the total. The main advantages of roller bearings over ball bearings on front axle spindles are greater durability, ability to withstand heavy end thrust loads, permissible use of smaller sizes and their lower cost.

This work was started with the intention of establishing, if possible, hub and spindle dimensions whereby ball and roller bearings would interchange, but it was found that there would be difficulty in getting recommendations from the manufacturers of ball bearings and roller bearings by which such interchangeable dimensions could be developed. After careful consideration, it was not deemed reasonable to burden the entire industry with the extra expense and weight which such a set of hubs would entail in order to afford interchangeability for a type of bearings that constitutes but one-twentieth of the production for motor truck front axle hubs. Further, this one-twentieth part is practically accounted for by the bearings used in the motor trucks of a single large producer, which to some extent makes its own bearings. Long experience in the use of these bearings has made it evident that they are so large that they could not be worked into the proposed standardization with any reasonable expectation of adoption.

Eliminating the bearings used by the one company referred to it was found that roller bearings covered by the spindle sizes proposed have been used by practically the entire motor truck industry. To do otherwise than adopt these sizes would offer grounds for grave criticisms, and would undoubtedly open the way for rejection of the program by those most interested in it.

There are at least four manufacturers of taper and straight roller bearings which can furnish interchangeable bearings for the proposed hubs. Even had the hubs been made large enough to take the bearings recommended by the ball bearing manufacturers, they would have varied enough from the roller bearing dimensions to have necessitated complete additional tool equipment, and real interchangeability would not have been possible.

The advantages of hub standardization have been dealt with in several articles in AUTOMOTIVE INDUSTRIES, and there is no fear among those who have been working with this project that this minor setback will discourage the members of the committee. Such minor differences as have existed are already wiped out, or are well on the road to being eliminated. The revised report will doubtless be adopted at the summer meeting.

The Business Session

By Herbert Chase

PRESIDENT VINCENT opened the business session with an address in which he reviewed the work of the past year and indicated in what direction he felt this work could profitably be extended. He stated that the Society is taking part in the work of the American Engineering Standards Committee while still reserving its right to independent action, but has declined the invitation to join the American Federation of Engineering Societies largely because it is felt that the funds the S. A. E. would be called upon to expend in this direction are considerable and can be used to better advantage in other activities. He favored continued co-operation with the American Petroleum Institute and said that he believes the standards work of the Society should have more publicity during the formative stage in order that all who have a legitimate interest will be able to follow its progress and offer constructive criticism. He stated that the Council of the Society has decided to appoint a research committee with authority to plan and promote research work, securing the necessary funds to push the work forward, but without itself conducting the actual tests involved. It is understood that the Society will co-operate with the Bureau of Standards and the American Petroleum Institute in this connection. Mr. Vincent favors a campaign of education that will instruct the automotive engineer in matters pertaining to the oil industry as well as to keep them advised concerning the latest developments in fuel research.

In concluding his remarks, President Vincent spoke of the need of fostering aircraft development not only in commercial lines but as a means of developing personnel that will prove a military asset in case of need.

Treasurer Whittelsey reported that the total assets of the Society are in excess of $150,000, these assets having increased by over $30,000 during the fiscal year ending Sept. 20, 1920. Over $22,000 was spent for standardization work last year.

Chairman Beecroft of the Meetings Committee reported that the total attendance at Society meetings last year was about 2500, and that 88 papers had been presented at the various meetings.

The Membership Committee reported an increase of 16 per cent in the membership during the last year, the membership as of Jan. 1 being 5231.

In the report of the Council it was brought out that the Society expends annually over $58 per member, although the dues for member and associate grade are only $15 per year.

The business session was concluded with talks by Henry M. Crane and Herbert W. Alden on the engineer's place in the industry. Mr. Crane held that it was the duty of the engineer to know not only the principles of the vehicle he designs but the principles of production of the various parts in order that these may be intelligently designed for economical output. He stated also that the engineer must be conversant with what the public wants in order that the vehicle produced will be readily salable; this, of course, involving co-operation with the sales department. Mr. Alden indorsed Mr. Crane's remarks and indicated that the value of an engineer and his standing in any organization is usually dependent upon his ability to co-operate and willingness to accept responsibility. He urged greater thoroughness in making investigations and a merging of individuality with a view to serving all departments of the business.

The tellers appointed to canvass the mail vote covering

annual election of officers reported that the ticket named by the nominating committee had been almost unanimously elected. President-elect Beecroft thereupon acknowledged his appreciation of the honor conferred upon him and pledged his best efforts in advancing the work of the Society during his administration.

David Beecroft, the new president of the Society, is Directing Editor of the Class Journal Company. The following biographical sketch is furnished by the Journal of the Society:

President Beecroft was born in 1875 at Marnock, Ont., Can. His business life started in 1893 when he taught a country school for one year previous to finishing university work at the Barrie Collegiate Institute. This was followed, beginning in the fall of 1895, with a six-year period of school teaching in St. Thomas, Ont., during most of which time he was connected with the editorial department of the St. Thomas *Daily Times*.

Leaving St. Thomas in the summer of 1901, he went with the Chicago *Daily News* as an advertising solicitor, remaining until December, 1902.

In December of 1902, on resigning from the Chicago *Daily News*, he took the editorship of the *Automobile Review*, which was until then a monthly automobile publication printed in Chicago. It was at once changed to a weekly, and he continued there for about fifteen months, resigning on March 1, 1904, to take the position of assistant editor of *Motor Age*. He served for two years in this capacity, and when *Motor Age* was purchased by the Class Journal Co. of New York he became editor.

In July of 1911 he took, in addition to the *Motor Age* work, the position of managing editor of *The Automobile*. In November of that year he also became managing editor of *Commercial Vehicle*, and in February of 1914 he took a similar position with *Motor World*.

Since entering the automobile industry he has been particularly active in connection with automobile contests. He drafted the first stock car racing rules and pioneered the registration of stock cars. He has served on the A. A. A. Contest Board for many years.

Mr. Beecroft became a member of the Society in 1911 and has served on the Council for four years. He has been a member of the Meetings Committee for five years and its chairman for four years.

A Brilliant Annual Dinner

By Clyde Jennings

THE chief feature of the successful annual dinner at the Hotel Astor was the introduction of C. F. Kettering as toastmaster, upsetting the long established precedent of employing a professional for that task. It is a safe probability equation that the membership will never vote to go back to the paid individual. This is said without casting any aspersions on the former toastmasters, who were very good in their way but who sometimes displayed a lack of exact understanding of the industry from an engineering point of view. With Kettering, of course, it was a case of entirely co-ordinated knowledge and jokes, with an ability to pass compliments and criticism, founded both on fact and personal friendship, backed by an ever ready wit and novelty of expression.

President Jesse G. Vincent opened the program by reviewing in few words the year just closed. He spoke especially of the fine support given to the officers of the Council and the members, and said that if the members and the Council would continue this same measure of support he knew that the new administration would prosper. He introduced Mr. Kettering.

The toastmaster had much sport with David Beecroft, the newly elected president, whom he introduced. He said that the society had run out of engineers for president, so they had done the next best thing and had followed the trend of fashion and had selected an editor.

President Beecroft in a brief speech made the points that the engineers of this country had accomplished a great task in taking the vehicle as developed in Europe and making an efficient production job of it. This was the task for American engineers because production was the great need of this country.

Now that this task had been accomplished, there remained the task of adapting the vehicle to the great uses of the world. This problem was before the engineers and the speaker thought it necessary that the engineers go to all parts of the world and study the needs of the vehicular transportation where the vehicle will be used and design accordingly. When this is accomplished, he said, the great world's markets will be open to American manufacturers, and this in turn will profitably utilize the expanded manufacturing space that was bequeathed to the industry through the war.

Much interest was shown in the talks of the evening. R. E. M. Cowie, vice-president of the American Railway Express Co., introduced himself as the representative of the largest motor truck operator in the world. After reviewing the history of the express business, and its growth, he put before the engineers the problem of simplified construction and a smaller maintenance cost for their vehicles. He said while the internal combustion engine and its consequent vehicle might not appear complicated to the engineer, it did appear so to the user.

But it was when he touched upon aviation that the speaker most impressed his audience. He spoke of the great need for the faster transportation vehicle and said that he was one of those who believed that the Government should go to full length in developing this means of transportation. He said that the small beginning made in airmail experiments were only a taste of what should be done and that he hoped that in the near future the Government would supply for air transportation all that it was now supplying for marine transportation.

Following this talk, Toastmaster Kettering made a plea for more members for the Aero Club of America, which, he said, had been transformed into an organization of great possibilities and promise, with Myron T. Herrick of Ohio as president.

George E. Roberts, a vice-president of the National City Bank, was the last speaker. He is not one of those who promise great prosperity for the immediate future, but told how production had been thrown out of balance during the war and even to a greater stage since the armistice. The great problem now, he said, was to restore this balance. This had been the objective of the bankers in their credit adjustment beginning almost a year ago.

At present, he said, the price on farm products had been restored to a near normal point. Because of the great bulk of business depending upon the prosperity of the agricultural interests, it is necessary to adjust the manufacturing prices and industrial wages to a balance with the farm prices.

Observations at the New York Truck Show

Few changes of a radical nature in evidence. Influence of war designs seen in fitting of bumpers and tow hooks on many models. Flexible frame a feature of Ward-LaFrance. Most heavy trucks use radius rods, but take torque on springs. Many models have improved facilities for lubrication of chassis parts. Closed cabs are fitted in many cases.

By P. M. Heldt

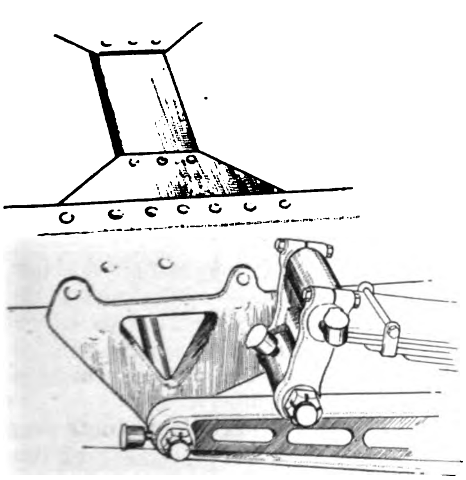
ALTHOUGH it was held in two large buildings—the Twelfth Regiment Armory and the First Field Artillery Armory—the New York motor truck show was not a national or a manufacturers' show, but rather a dealers' show, and many of the most prominent truck makers, such as Packard, Pierce, Mack, White, Autocar, etc., were not represented. However, there was a sufficient array of trucks of all capacities to make an interesting exhibit. A few truck models, mainly of the speed wagon type, were shown the first time, but on the whole novelties were not particularly plentiful.

Truck design is not stationary; that it is progressing could easily be demonstrated by showing side by side a number of 1910 and 1921 trucks. However, most frequently the changes are matters of detail and can hardly be observed on the complete truck, while more important changes or complete redesigns often are separated by intervals of years.

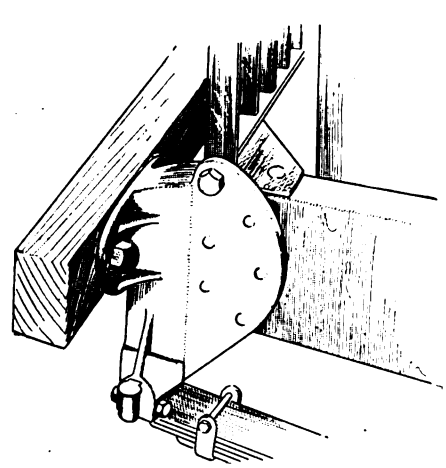
Frame Design

One important problem in connection with motor trucks is the design of the frame. It is fully recognized that it is impossible to make the frame rigid, as it is a flat structure and has to support heavy loads, the dead load, moreover, being augmented by road shocks. Flexibility of the frame is therefore allowed for, especially weaving of the frame, which means twisting around a longitudinal axis. In view of the absolute certainty of weaving occurring in service, both the engine and the transmission (where the latter is mounted separately) are now always mounted with a three point support. It has been found that, owing to the continuous distortion of the frame and the shocks and jars to which the chassis is subjected, the trunnion support wears more rapidly than might be expected, and this gives rise to an unpleasant chatter. To minimize this wear these trunnion supports are now made of much larger diameter (about 3 in. on large units) than formerly. In the most careful designs provisions are even made for readily adjusting the trunnion in case of wear.

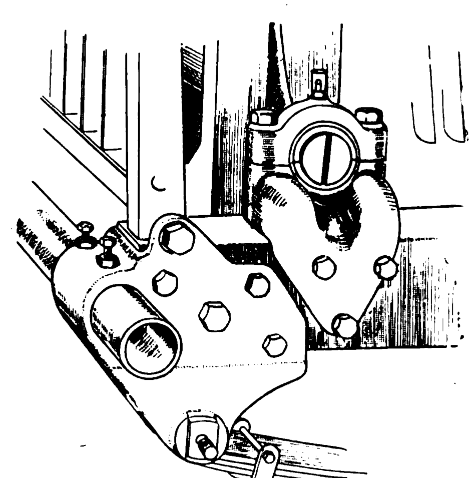
Some designers specially aim at great flexibility of the frame in a vertical direction and in the new Ward-La France truck there are no regular cross members, only tubular spacers. To secure the necessary stiffness or resistance to distortion in a horizontal plane two diagonals of strap iron are used at the middle part of the frame, the junction of these members being reinforced by a drawbar and tubular spacers. Such diagonal braces are also used on other makes of trucks, usually at the rear end. They obviate the necessity for heavy gusset plates and are probably more effective. Some truck frames were noticed in which practically no provision was made against distortion in a horizontal plane; that is, there were neither diagonals nor substantial gusset plates, and the cross members were few and light. There is no doubt that such construction is responsible for many breakages of engine arms and trouble with radiators. The necessity of making



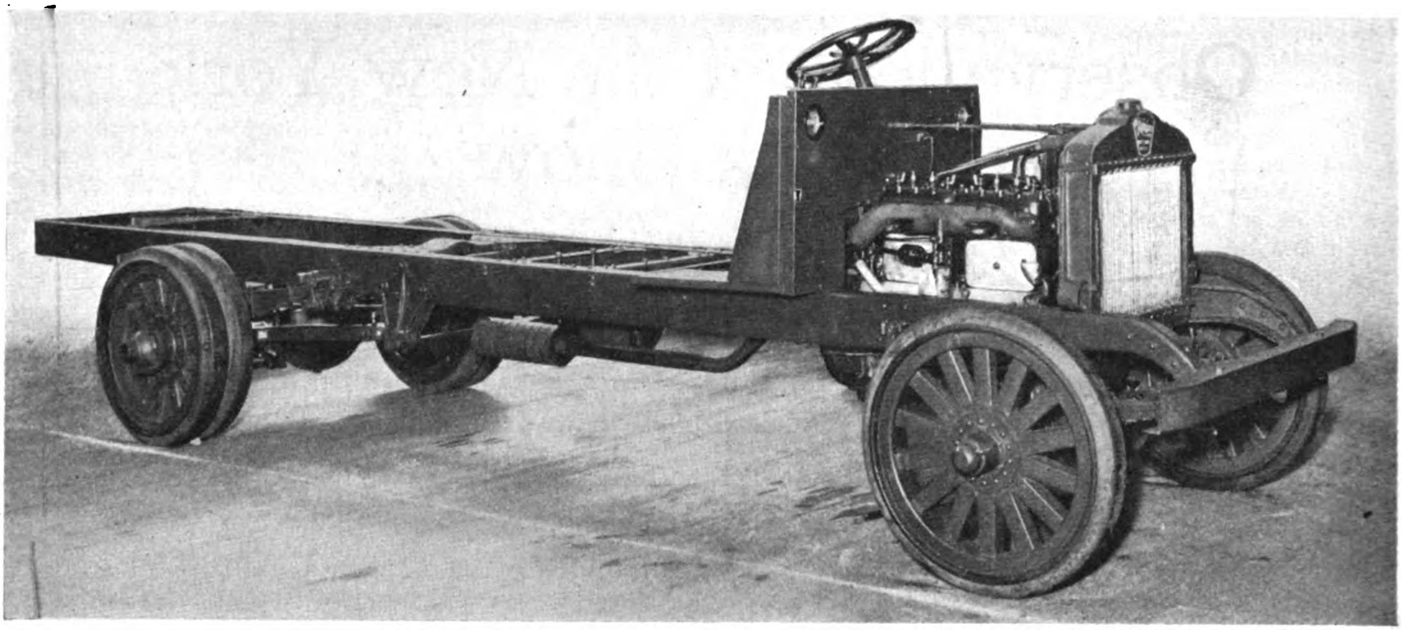
Central cross-bracing of frame on Clydesdale



Wooden bumper on Indiana truck



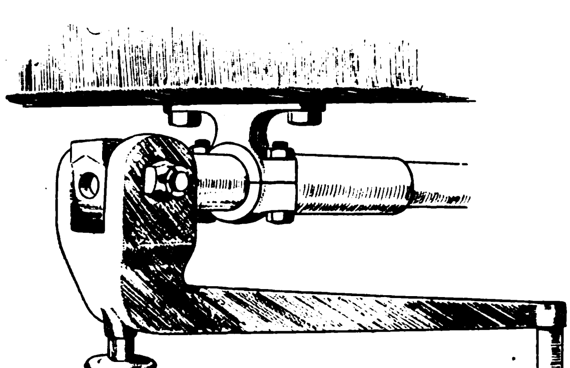
Combination spring and bumper bracket on Selden



New Rainier 3½-ton truck chassis

the engine supports flexible is realized more and more. In the new Service speed truck, for instance, all the engine holding down bolts have coiled springs under their heads, so that the supporting arms can withdraw slightly when the frame distorts. Also, in the heavier trucks it has now become the practice to use four universal joints, two between the engine and gear box and the other two between the gear box and rear axle.

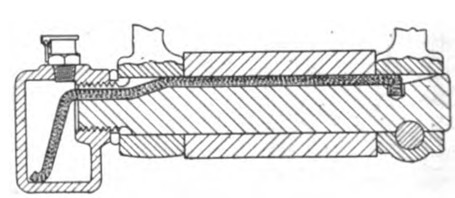
While military truck design has had some influence on commercial truck practice, it has not led to the general adoption of the Hotchkiss drive, as was predicted by some engineers. The general practice on heavy trucks appears to be to take the torque reaction on the rear springs but to provide radius rods for the driving thrust. An exception is found on the large Bridgeport truck. In this the drive is taken by the rear springs, whose forward ends are pivoted to the frame. Then there are members which look very much like radius rods, which are hinged to lugs on the forward side of the rear axle housing and to a bar which is adapted to slide forward and backward in a guide formed by a frame bracket. Radius rods generally have a universal connection with the frame at the forward end, an eye bolt parallel with the frame side rail being mounted in a frame bracket and having the forward end of the radius rod pivoted to it. This construction is evidently somewhat cheaper than a spherical joint.



Folding starting crank on Transport

Special attention was paid to the different ways of mounting the frame on the rear springs. The springs are always outside the frame, and owing to the overhang there is a considerable tendency to twist the side rail. In most cases the frame is provided with a cross member at the rear spring front brackets, which gives the necessary rigidity at this point. In the Clydesdale and one or two other makes this provision against torsional stresses on the frame side bars due to the overhang of the springs is particularly effective. The spring bracket and the bracket for the forward end of the radius rod are in one piece. The radius rod forward ends are pivoted on the ends of a round cross bar about 8 in. below the frame rail, and in addition there is a channel shaped cross member, with its open side down and with its top even with the top of the side rails. In some cases the rear ends of the rear springs are mounted on the ends of rather slender cross bars, and one could not help getting the impression that under heavy load these cross bars would "spring" considerably, which would mean rapid wear of the spring bushings. Of course, where the rear spring bracket comes close to the rear frame cross member, the latter may lend sufficient stiffness to the bracket in which the cross bar is mounted. However, a form of spring bracket which supports the spring bolt at both sides of the spring would be preferable even in that ease.

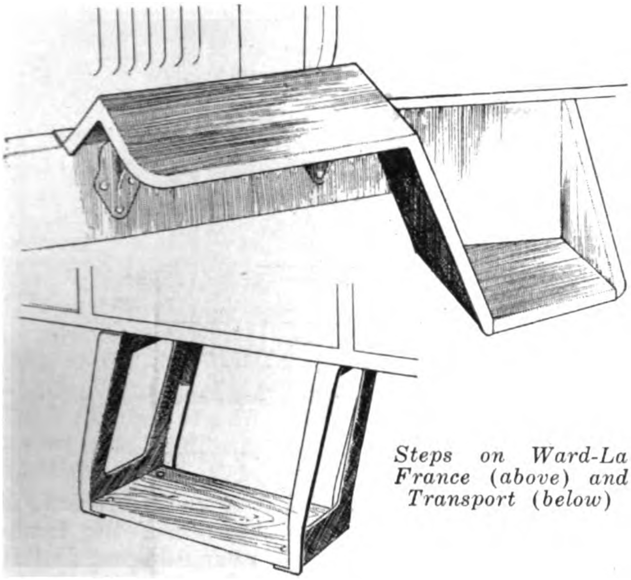
Wick-oiled spring bolt on Transport



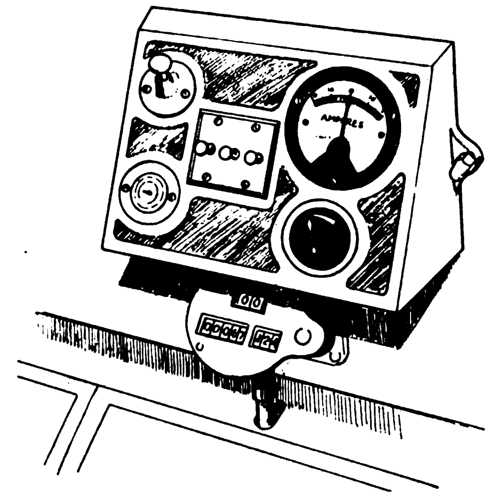
Trussed Frames

A large majority of the truck frames are now made of pressed steel, but the frame side members, as a rule, are tapered very little toward the ends, particularly the rear end. This is no doubt due to the different load distribution as compared with a passenger car. The Clydesdale was the only truck noticed in which there was considerable taper in the side members.

It is rather remarkable that not more trucks have their frames trussed, as quite a saving in weight could evi-



Steps on Ward-La France (above) and Transport (below)



Instrument panel on Clydesdale

dently be effected by the use of trusses. Frames of railway cars are always trussed, and of the German motor trucks surrendered to the American Army a large number had trussed frames, though it is possible that in the latter case the trusses were put on after the trucks were built, to take care of the additional stresses due to the use of wood and steel tires. At the show the only trucks with trussed frames noticed were Nash Quad and the Indiana.

Towing hooks are now fitted to the front ends of the frames of many of the larger trucks. These were required on all war trucks and were found a most handy fitment in an emergency. As they cost but little and as their usefulness must be apparent to every purchaser, it seems a good plan to make them a part of the regular equipment. Design of bumpers also has been influenced by war experience, and the latest Transport and Indiana models are fitted with wooden bumpers similar to that on the Class B war truck.

Brackets and Fittings

The brackets and fittings of truck frames are gradually getting neater, and quite a technique is developing in motor truck design. Some trucks are fitted with channel steel bumpers whose ends are curved slightly backward, and in that case the spring horns are formed with projections which accurately fit into the bumper channel. Combination brackets save on machining and are used largely for the forward ends of truck frames. An example of this is found on the new Selden model. A single casting serves as a spring bracket, bumper bracket and radiator guard bracket.

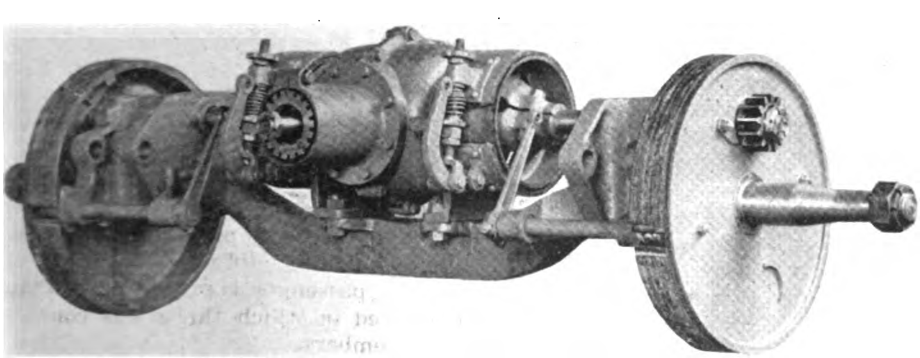
The Nash Quad, although not a new truck, arrests attention because of its many unusual features. Thus the half elliptic springs are very light, giving a very flexible suspension for relatively smooth roads, but in addition to these there are volute auxiliary springs, which share the load with the half-elliptics when unusually severe bumps are sustained.

There is considerable variety in the design of steps. The most common practice is to use two pressed steel hangers, and either a wooden or embossed metal step. On the Ward-La France truck, the step is made of pressed steel and forms a part of the front fender. Some manufacturers object to making the step a part of the front fender, arguing that the continued use of the step will tend to cause the fender to get out of shape. On the Transport truck the fender consists of two cast hangers riveted to the frame and an easily renewable wooden step. Wood for the step has the advantage that it does not get slippery with wear.

New Type of Internal Gear Drive Axle

The Kelly-Springfield Motor Truck Co.—now a part of Hare's Motors—exhibited a new 3½-ton model with an overhead type of internal gear drive rear axle. Heretofore the chain drive has been standard on Kelly-Springfield trucks. The new axle, which is made for the Kelly-Springfield by the Clark Equipment Co., has a chrome nickel steel supporting member with a downward bend at the middle, which is forged with lugs to which the housing of the differential and bevel drive gear is bolted. From this housing extend the jackshafts which do not have the usual tubular coverings but instead carry drums for the service brakes on both sides of the housing. This model now also has a four-speed and reverse gear, while the engine remains the same. The torque reaction is taken on the springs, while the drive comes on the radius rods.

Among the models exhibited for the first time was the Moline 1½-ton truck, which has the same engine as the Moline Universal tractor. This engine has its valves in the head and the valve cover is water jacketed, which permits of arranging the water outlet centrally on top of the engine as in an L or T head engine. This is specially desirable in the present case because thermo-siphon circulation is used. Formerly the piston pins in the Moline engine had a bearing



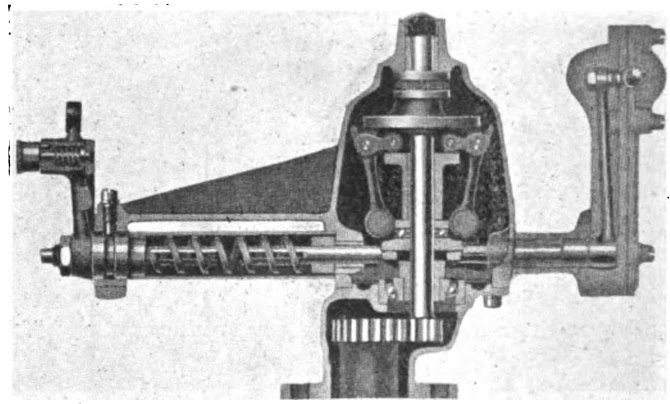
Clark overhead drive internal gear axle on Kelly-Springfield truck

directly in the piston bosses, but now the bosses are bushed. Instead of the Remy electric control system, the Pharo governor is used. Ignition is by a Splitdorf magneto. The pressure gage and the throttle control lever are mounted on a fixture on the steering post so they are in plain sight of the operator. The choker can be operated both from the dash and from in front of the truck. This is convenient in cold weather, when the driver sometimes wants to partially close the choker when the engine is still cold and therefore operates irregularly. Circulation of the cooling water is by thermo-siphon action, and the radiator fan is enclosed in a shroud. Fisk pneumatic cord tires are fitted all around. The wheelbase is 130 in. and the weight of the chassis complete is 3635 lb. The rear system is the Torbensen internal gear drive. The four cylinder Moline engine has a bore of 3½ and a stroke of 5 in. The crankshaft is exceedingly robust, being 2½ in. in diameter, and the connecting rod head is of such large size that the piston and connecting rod cannot be withdrawn from the engine through the cylinder when the cylinder head is taken off, but must be removed from below.

A new line of trucks, exhibited for the first time, was the Clinton, manufactured by the Clinton Motor Truck Corp. This line comprises four models, of 5, 3½, 2½ and 1½ tons capacity, respectively. Standard parts are used throughout, including the Continental engine, Brown-Lipe clutch and change gear, Timken axles, Parish & Bingham frame, Spicer universal joints and Ross steering gears.

On one model of the Clydesdale was shown a pair of electric headlights of rather unique design. These were pyramidal in form, with an octagonal front, and bolted to the sides of the radiator. On this same model there was a neat instrument panel secured to the dashboard (see sketch). The instrument panel was slanted so as to give the driver a good vision of the instruments, and contained the ammeter, oil gage, magneto lock switch, lighting switches and choker.

On some makes of motor truck the starting crank is supported by a bracket bolted to the forward end of the engine crankcase and is then sufficiently far back so it will not be injured when the truck runs into an obstruction. On other trucks, however, the starting crank is carried by brackets under the front cross member of the frame, and in this case the starting crank, when in its operating position, is the most forward portion of the truck, hence, is easily injured. In that case it is necessary to give the crank a folding or swiveling form, and fold it out of the way when not in use. On the Indiana truck, for instance, the starting crank is carried in a swivel bracket, depending from the forward cross member of the frame, and when not in use, the crank is swung around and its arm is held by a clasp in such a position that the whole crank lies horizontally. On the Transport truck (see sketch) the crank can be swung around through an angle of 90 deg. and locked in both the working position and the position of rest, by means of a spring latch.

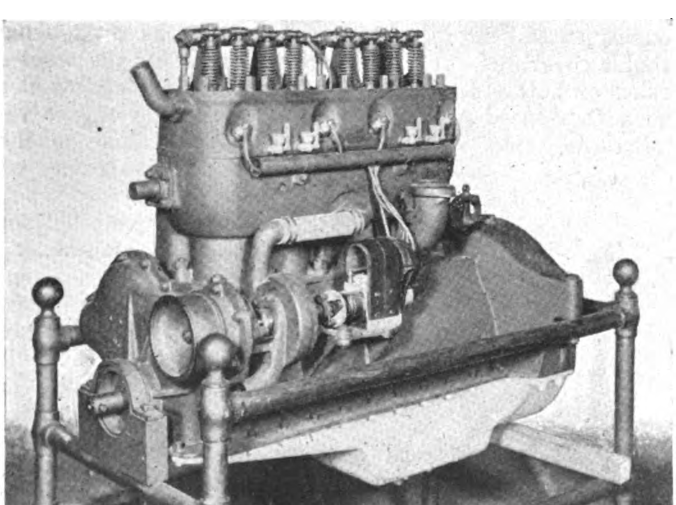


Section of Hinkley governor

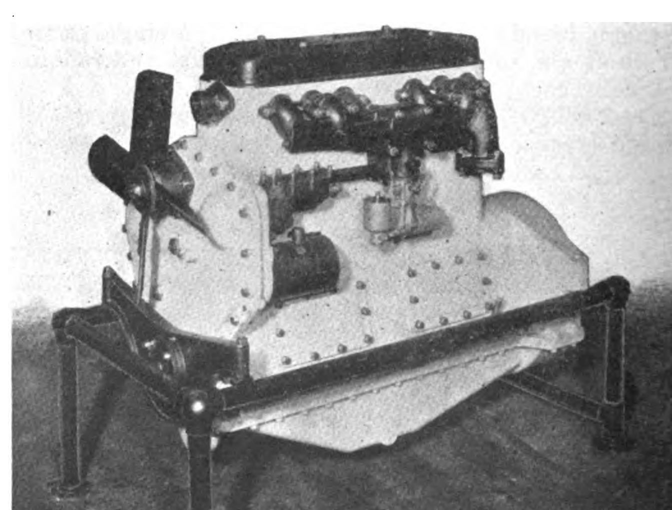
Improved Chassis Lubrication

Much attention has been given in recent years to the subject of chassis lubrication, and many trucks exhibited at the show were provided with either the Alemite system of grease lubrication, or with a wick oiling system. On the Transport truck, for instance, the spring bolts are provided with an oil chamber at the outer end, into which extends a wick which passes through a slot in the bolt, extending practically the entire length of same. On the 3½-ton Transport model, these wick oilers on the spring bolts are intended not only to lubricate the spring bolts themselves, but also the spring leaves.

The Hinkley Motor Corp. exhibited for the first time the model HA-1600 truck and tractor engine, which is of the overhead valve type. This has a bore of 4½ in. and a stroke of 5½ in., giving a displacement of 352 cu. in., and weighs approximately 900 lb. The oil pan is of aluminum and has an oil capacity of 8 qt. A chrome nickel steel crankshaft is used. Provision is made for both magneto and battery ignition, and also for an electric starter and generator. The engine is provided with an SAE No. 2 bell housing. Three point support is used, there being a large trunnion



Hinkley overhead valve engine



Van Blerck truck engine

bearing at the front end. Lubrication is by the force feed method, a gear pump being mounted in the oil pan below the oil level. Any standard make of carbureter can be fitted, in conjunction with a hot spot manifold.

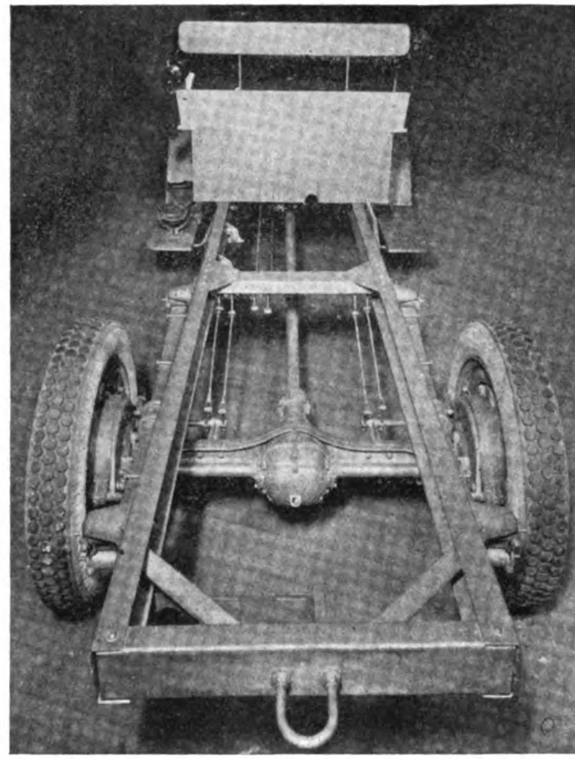
Hinkley Governor

The feature of the new engine is the governor, which is original with Mr. Hinkley. It is of the flyball type, and is mounted at the rear end of the engine, being geared up from the camshaft. The governor has four flyballs, which revolve on a vertical axis. The centrifugal force on the flyballs is counteracted by a coiled torsion spring, acting through a lever on the sliding collar of the governor. The outer end of the torsion spring is secured to the hub of an adjusting lever, which is adapted to move over a sector with a number of adjustment holes in it. Thus the governor can be readily set to hold the engine down to any maximum speed within wide limits. The governor is very sensitive, and when set in any definite position, controls the speed of the engine within narrow limits between no load and full load.

An exhibit was also made of the Van Blerck engine, which was described in these columns last winter, at the time of the Kansas City tractor show. This is an engine designed for use as a tractor, marine or truck engine, certain features being made differently for the different applications.

The Parish Mfg. Co., manufacturers of pressed steel frames, showed a complete truck frame of alloy steel. This company is now prepared to furnish frames of molybdenum steel, which when properly heat treated is said to have an elastic limit of 150,000 lb. per sq. in.

A large proportion of the heavy trucks exhibited were shown with closed cabs, and there is little doubt that these cabs will become a standard feature of truck construction in the future. These cabs are fitted with windows all around, so as to allow the driver free vision in all directions, and they enable him to operate his truck in comfort in all kinds of weather. Provision is made to open practically all of these windows in mild weather, and the driver therefore need never be without fresh air. It is now customary to mount the headlights inside the cab, against the rear side of the dash. This has the advantage that the lamps throw some light through a side lense on the dash, making it easier for the operator to read his instruments in the dark, and in the case of kerosene lamps, which are most generally used, there is no danger of the lamps blowing out in stormy weather.



Rear view of Moline speed truck chassis

In addition to complete trucks and chassis, there were shown a number of trailers and truck bodies, as well as several exhibits of truck parts and accessories. Prominent among the latter were traction devices and chassis lubricating means.

A Winter Truck Cab

WITH the increase in long distance hauling and trucking, and realization of the need of weatherproof cabs in winter time, these units are rapidly being developed. The Acme Motor Truck Co. has just brought out a standard winter cab which can be furnished on all of its models. It is so designed as to preserve the lines of the vehicle and it is recommended for use with the Acme truck because of its better fit and blending of lines with body.

Winter top for Acme trucks

This new cab is constructed of oak and built around the regular seat box. It is completely ironed at points of stress and designed to stand up under rough service. The side sections are constructed of waterproof veneer panels, curving toward the rear with a sheet metal corner construction running full height. An opening 5¾ by 11¼ in. is provided in each corner. This is fitted with Pyralin so the driver has a clear view of traffic approaching from either side. The back of the cab is fitted with sliding windows which can be opened or closed for ventilating purposes. Each of the side panels has a 6 by 11 in. Pyralin light. The doors run full height of the cab and have a 9 by 11 in. Pyralin light which can be increased to approximately 10 by 15 in. The doors swing toward the front and are provided with anti-rattle locks. The top of the cab is built of ribs and slats covered with a heavy grade of oil duck.

The general dimensions of the cab are as follows: Width, 48 in.; height from top of frame, 61 in.; depth from front to rear, same as on standard models; height from top of cushion to inside of roof, 40 in.; length of ventilating windshield, 41¼ in.; height, 23½ in. The list price of this winter cab is $125.

Drop Forgings in Automobile Construction

METAL parts in automobiles or other machines can be made by several different processes. We have first of all castings, which are used to a considerable extent in the engine and also for many of the more complicated parts of the chassis. Then there are drop forgings which include practically all parts made of mild steel and medium carbon steel except those which can be advantageously made from sheet or bar stock. Rods, shafts, studs, bolts, etc., are made from bar stock and numerous housings, covers, etc., are pressed from sheet steel.

In passenger car practice the parts which are made by each of the different processes are pretty well fixed. These cars, or the components of which they are assembled, are as a rule made in sufficient numbers to warrant the making of dies, the expense of which sometimes militates against the adoption of drop forgings when only a moderate number of parts is wanted.

In truck manufacturing drop forgings are not used to quite the same extent as on passenger cars, and in tractors their use is still less common. Tractor manufacturers of the old school use rolled section steel, mainly angles, very largely, but there is no doubt that when tractor design becomes more settled drop forgings will be almost as numerous in the tractor as they are now in the automobile. When required in sufficient numbers, drop forgings can often be made more cheaply than castings. They require no straightening, there is not much loss from imperfect forgings and the parts are usually stronger and more reliable than when cast. The majority of drop forgings are made of medium carbon steel, but for parts subjected to high stress the forgings can be made of alloy steel.

The extent to which drop forgings are used in car construction is shown by the following list of forgings for a four-cylinder car. The list includes 122 different parts and 190 pieces. The Packard passenger car, for example, contains 200 forgings and the Packard truck an even 250 forgings. In the Packard passenger car there are, moreover, 175 stampings and 240 castings. For the following list we are indebted to T. W. Siemon of the Union Switch & Signal Co.

No. of Pieces	ENGINE
1	Crankshaft
4	Crankshaft counterweights
1	Crankshaft drive gear
4	Connecting rods
1	Camshaft
1	Camshaft drive gear
8	Rocker arms
8	Rocker arm brackets
8	Valves and stems
8	Valve lifter plungers
8	Valve lifter guide yokes
1	Magneto drive gear
1	Magneto idler gear
1	Generator drive gear
1	Generator strap tee, upper
1	Generator strap tee, lower
1	Pump shaft gear
1	Distributor drive shaft gear
1	Starting crank
1	Starter pedal
1	Starter pedal pad
1	Starter shaft lever
1	Starter operating shaft rod
1	Starter motor drive gear
1	Water pump drive gear
1	Oil pump adjusting shaft
1	Carbureter pipe flange
1	Throttle control lever
1	Spark control lever
1	Accelerator pedal
1	Fan supporting arm
1	Front motor support
1	Rear motor support
	TRANSMISSION
1	First speed and reversing gear
1	Direct drive and second speed gear
1	Countershaft
1	Countershaft gear
1	Countershaft first speed gear
1	Countershaft second speed gear
1	Reversing pinion
1	Gear shift lever
1	Gear shifter shaft
1	Shifter rod
1	Shifter rod end

No. of Pieces	
1	First speed and reversing gear and shifter fork
1	Direct drive and second speed gear shifter fork
1	Clutch pedal
1	Clutch pedal pad
1	Clutch pedal stop
1	Clutch throwout yoke
1	Clutch shifter lever
1	Clutch shifter shaft
1	Clutch spring sleeve
1	Clutch hub
1	Clutch drum
1	Drive shaft universal joint
1	Drive shaft universal joint flange
1	Drive shaft universal joint sleeve
1	Drive shaft universal joint sleeve yoke
	RUNNING GEAR
1	Front axle
1	Steering knuckle, right
1	Steering knuckle, left
2	Steering spindles
1	Pitman arm
1	Steering arm
1	Steering yoke
1	Steering gear worm sector
1	Steering gear worm
1	Steering rod
2	Front spring shackles
2	Front spring plates
2	Front spring clip spacers
2	Rear spring brackets
1	Hand brake lever
1	Hand brake lever latch
1	Hand brake lever latch end
1	Hand brake tube rocker arm
2	Hand brake cross shaft levers
2	Hand brake cross shaft rocker arms
2	Hand brake cam levers
2	Hand brake levers
2	Hand brake lever clevis
1	Foot brake pedal
1	Foot brake pedal pad
2	Foot brake cross shaft rocker arms

No. of Pieces	
2	Foot brake cross shaft levers
1	Foot brake operating lever
2	Foot brake band adjusting clevis
2	Foot brake band links
1	Brake equalizer draw bar
2	Brake equalizer draw bar clevis
2	Brake control turnbuckles
2	Brake pull rod clevis
2	Front brake band lever clevis
1	Torque arm
1	Torque arm pillar
1	Differential gear
1	Differential pinion
1	Differential pinion spider
1	Differential driving gear
1	Differential driving pinion
2	Rear axle nuts
2	Rear spring shackles
2	Rear spring plates
	ACCESSORIES
2	Windshield side arms
2	Tire carrier arms
2	Toe bolts
2	License tag clamps
2	Top support adjusting brackets
2	Top support wing bolts
2	Gasoline tank strap draw bolts (front)
2	Gasoline tank strap draw bolts (rear)
1	Valve tappet wrench
1	Valve tappet adjusting screw wrench
1	Valve lifting tool
1	Water pump stuffing nut wrench
1	Exhaust manifold packing nut and differential bearing adjusting nut wrench
1	Crankcase main bearing bolt and flywheel oil plug wrench
1	Spark control and oil reservoir drain plug wrench
1	Rear axle pinion shaft bearing gage

Accurate Methods in Keeping Stock Records

A stock keeping system proves itself good or bad when called upon to meet a real test. The system described in this article was able to tell within three days every article that a large fire had consumed. Accurate stock records are especially necessary in these times of business economy.

By Fred J. Huntley*

ON Christmas Day building No. 11 at the main plant of the Cadillac Motor Car Company in Detroit was destroyed by fire, and with it went great quantities of supplies and tools. On Monday following, just three days later, A. M. Elmer, superintendent of general stores, was able to report the exact value of all property lost.

This may seem at first thought almost like a bit of fiction, but it is true. And, furthermore, if fire again should visit the plant, an equally prompt report would be forthcoming. The records were so complete and so satisfactory that the company had no difficulty in settling this particular loss.

But this is not all there was to that Cadillac fire. Certain of the equipment in this building was covered by separate records kept by an old pen-and-ink method. When the adjusters reached these there was a different story and considerable delay resulted before everything was straightened out. The Cadillac Motor Car Company is not the only concern that has had experience with stock records when fire has stepped in. Many have experienced days and even weeks of delay with the inevitable accompanying loss, simply because their records were inadequate.

To give a clear picture of the way posting is handled and what constitutes the posting media in keeping Cadillac stock records, it will be best to trace a requisition and purchase order through the various steps.

Posting to the "Incoming" or debit side of an account is made from "T-requisitions" on the Purchasing Department and also invoices. The posting media for outgoing material include inter-plant transfers, requisitions, inter-department transfers and sales orders. Since requisitions make up the bulk of posting, it will be well to tell first how they are handled. To begin with, they are made in quadruplicate and then sent to an "Approval Clerk," whose duty it is to look up the stock sheet for the item ordered. If it is stock, the clerk sends the triplicate to the stockroom, where it is authority for making the delivery. The second copy goes to the factory Accounting Department, and the original is used as a posting medium. This the clerk inserts next to the account affected in the ledger tray.

When a sufficient number of requisitions have thus been "stuffed" into the ledger tray it is sent to another girl who figures the value of the articles requisitioned. As the work is done on a machine, it only takes a few seconds to make the extensions. The tray then is sent to the posting clerk. Debits and credits are posted in separate runs. The requisition is posted to the credit side of the quantity record and also to the value record.

After posting debits, the clerk locates the first account with a credit to be posted, designated by the requisition "stuffed" alongside. Thus it only takes a second or two to handle each item.

Since no posting is to be made to the "On Order" record, the sheet is turned so that the bottom half is in printing position. Date, classification, department letter and number are posted in one operation. The machine carriage then moves into position where the old balance is printed. Since there is no debit entry, the carriage is moved to the "out" position, where the withdrawal is listed and automatically subtracted. The new balance, which has been extended automatically, is printed in the "on hand" column and the carriage is shifted into the "value section." Here again the old balance is picked up; then the unit value shown on the last debit entry is listed. The credit as shown on the requisition is entered and the new balance extended. This done, the sheet is restored to the tray and the requisition turned face downward. This procedure is followed until all credits have been posted.

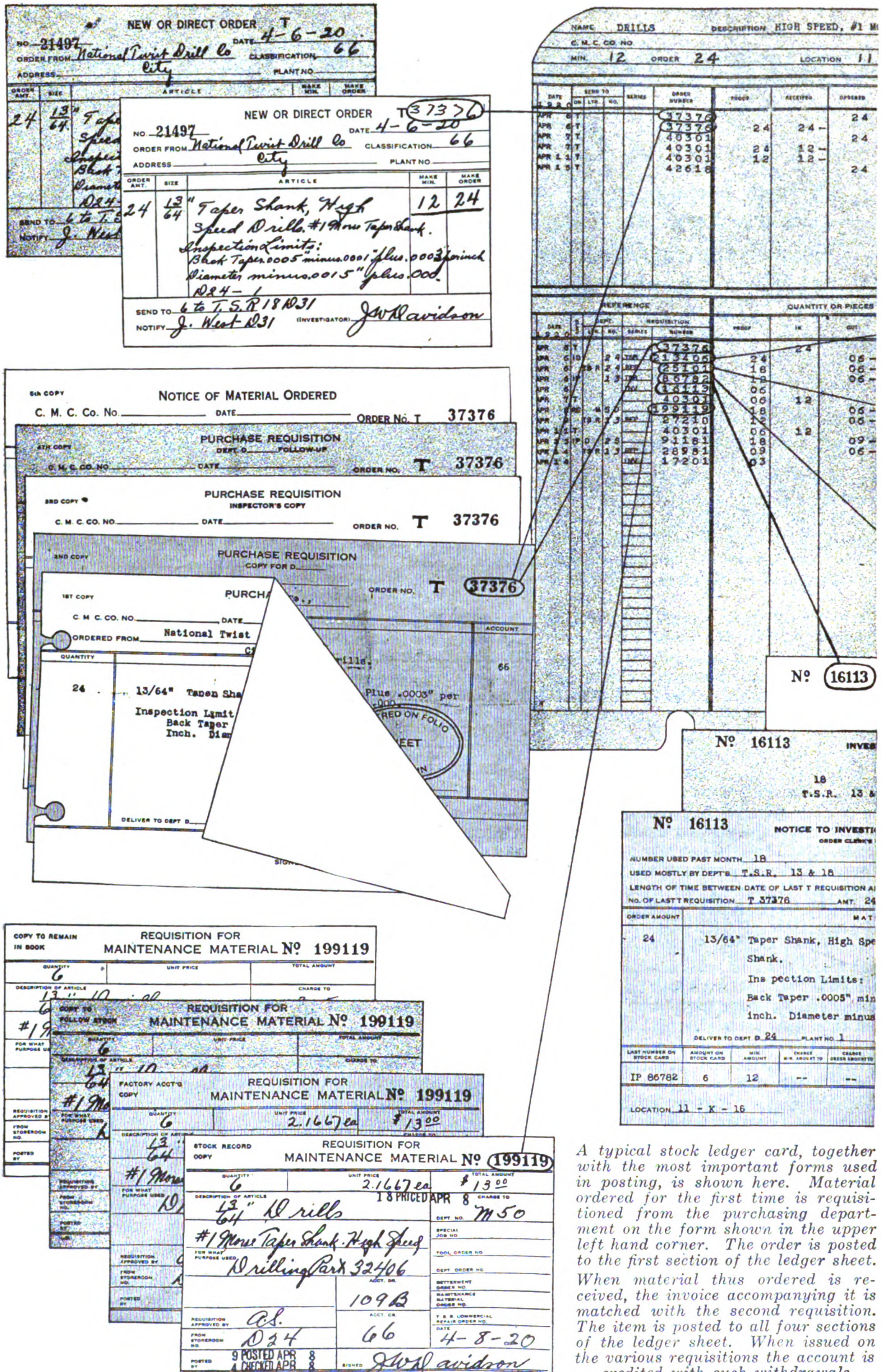
As the debits already have been posted, the tray is sent to a girl whose duty it is to prove the work. She does this by multiplying the quantity on hand by the unit value and if the results check with the new balance in the "value section" she knows the account has been posted correctly. She also makes sure that the entry shows the proper department and reference number. Now as to the case of a purchase or debit. When the girl, in pricing outgoing material, discovers that this issue will reduce stock beyond the minimum shown at the top, she inserts a cardboard slip with the warning, "Stock below minimum."

After a tray has been posted a girl looks it through for these "low water marks" and writes a "notice to investigate stock." The warning then is turned upside down where the printed line "Notice Written" is shown. The notice finally goes to an investigator, who ascertains the probable demand for this item and the length of time required to replenish the stock, also the approximate cost. If the facts warrant, he directs on his report that a new minimum be set or that the quantity ordered be changed.

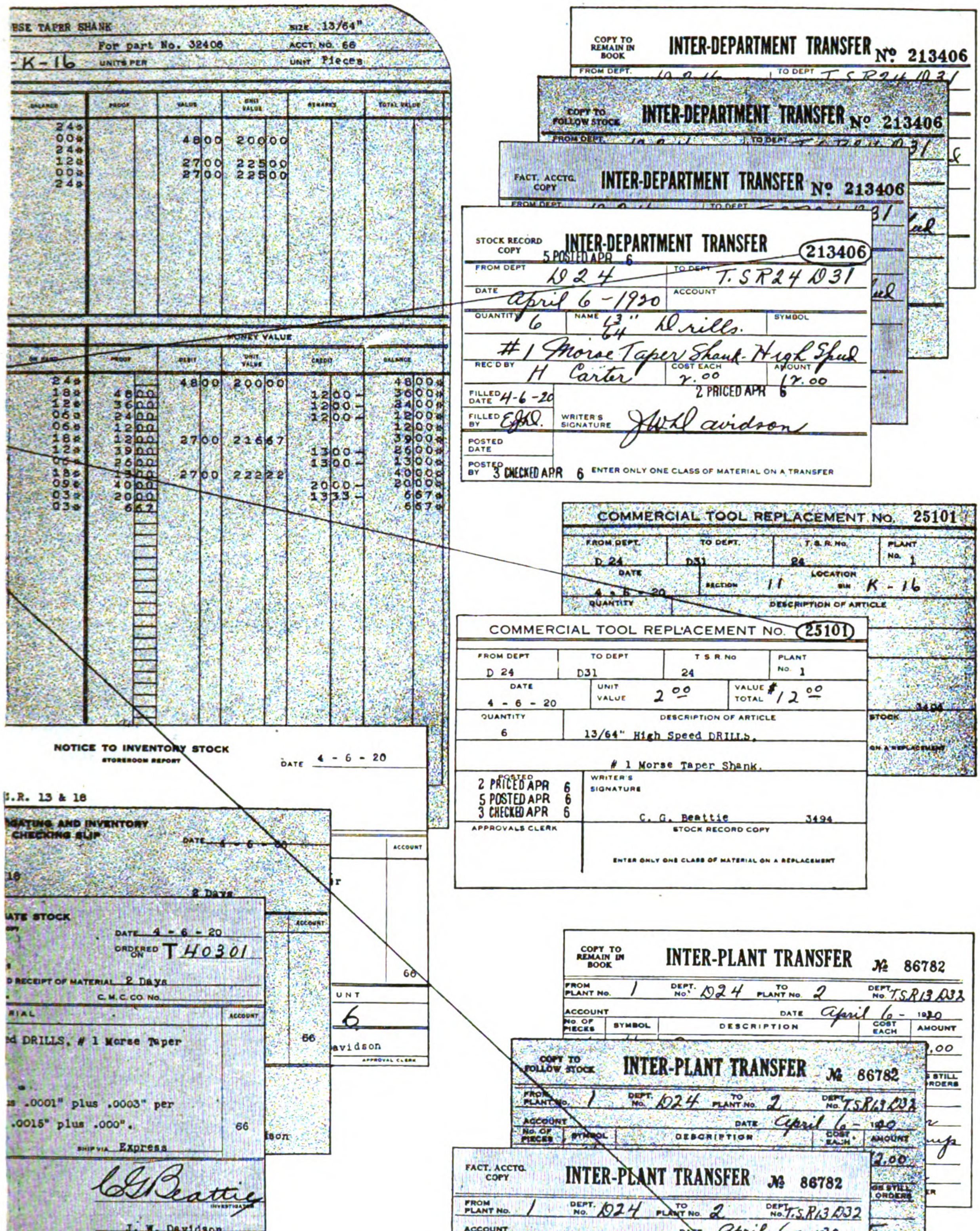
When this report is received a "T-requisition" is written and, if approved, the "T-requisition" is posted. The posting in this case is to the "On Order" section of the stock ledger. This purchase requisition is "stuffed" in the ledger and is posted as a debit. The "Notice Written" strip then is removed and the requisition is sent to the Purchasing Department. The third copy of the requisition is a "Notice to Inventory Stock" and goes to the stockroom, where a physical inventory is made of this item. This constitutes the only inventory the Cadillac Motor Car Company takes of tools and maintenance material.

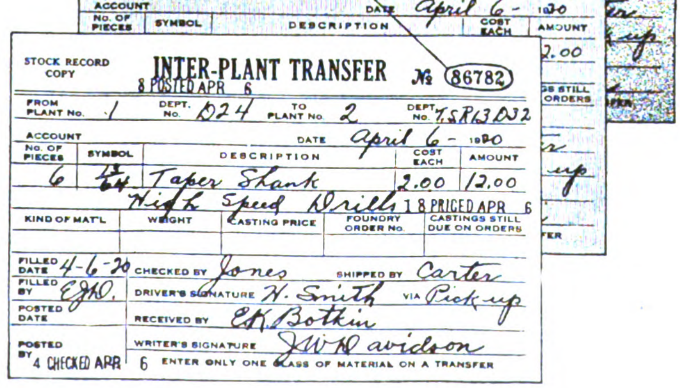
When material is received it is checked by an inspector, and a copy of the purchase order is matched with the in-

*Advertising Service Division, Burroughs Adding Machine Co.



A typical stock ledger card, together with the most important forms used in posting, is shown here. Material ordered for the first time is requisitioned from the purchasing department on the form shown in the upper left hand corner. The order is posted to the first section of the ledger sheet. When material thus ordered is received, the invoice accompanying it is matched with the second requisition. The item is posted to all four sections of the ledger sheet. When issued on the various requisitions the account is credited with such withdrawals





The price clerks, posting clerks and checkers stamp these orders so that any error may be traced. Checking methods play an important part in the efficiency of the stock record. Burroughs calculators are used in figuring of extensions and proving of postings.

The "Notice to Investigate Stock" is written when the posting clerk has called attention to the fact that stock is low. The triplicate is returned after the stock clerk has made an inventory of this item, and his report is checked by perpetual inventory clerks with the ledger account

voice and receiving slip, and goes to the invoice clerk to be "stuffed" into the ledger.

The clerk first figures the new unit value by dividing the balance on hand in money value by the new balance on hand in pieces.

The posting clerk enters receipts in all four sections of the stock account. The quantity received first is posted to the "On Order" section, and the new balance on order extended. The money value and the unit value of the items on the invoice then are posted. The sheet next is turned up and an entry made in the quantity section, the new balance being extended. Finally the value section is posted and the new balance extended. The new unit value as shown on the slip also is listed. When a tray is finished and the clerk encounters such an entry, she proves the work by multiplying balance on hand by the new unit value.

The accounts are carried on heavy loose-leaf sheets kept in steel trays. Each sheet has four divisions so as to show a record by quantity, a record by money value, the quantity on order and the value of each invoice. There are thirty-six trays—twenty-seven for plant one, six for plant two, two for plant three and one for plant four. Various colors are used to indicate the plant or department where the stock listed on each sheet is located.

The machine repair accounts are filed numerically, a code system being employed so that the number indicates style or type and size of machine. Commercial tools and supplies are filed alphabetically. In order to standardize the description of each item, a "specification" sheet is carried with each group of accounts listing similar articles.

As soon as the work of gathering the necessary information is completed, these specification sheets will show every department and operation requiring the tool or material described. This will serve as a guide in buying, because the probable requirements may be easily ascertained from the departments listed.

Steel Chart for Engine Manufacture

IN the design of gas engines it is essential that the material selected for the various parts be of a grade best suited to withstand the stresses to which that particular part is subjected. Much has been written about the advantages of the different steels, but very little about their specific use. In the accompanying chart the grades to be used for the parts of an engine are arranged in a convenient form, together with their physical properties and proper heat treatments. The chart was compiled by E. Everett Buchanan.

Parts	*Material*	*Physical Min. Requirements Lb. per Sq. In.*	*Heat Treatment Deg. Fahr.*
Carbonizing stock Camshaft Cam follower Thrust bearings Cold drawn tubing	Carbon, .10-.20 Manganese, .30-.60 Sulphur, .040 max. Phosphorus, .045 max.	Scleroscope, 75 For tubing— Ultimate, 55,000 Yield, 35,000 Compression test must show no cracks	Carbonize 8 hrs. at 1650-1700, cool in pots Quench 1650-1675 Quench 1450-1475 Draw 300 or more
Sheet steel Push rods Rocker arms	Carbon, .20-.30 Manganese, .30-.40 Sulphur, .045 max. Phosphorus, .045 max.	Ultimate, 60,000 Yield, 40,00 Elongation, 1 Reduction area, 50%	Quench 1540-1660 if necessary Anneal?
Water pump shaft nuts, etc.	Carbon, .30-.40 Manganese, .50-.80 Sulphur, .045 max. Phosphorus, .045 max.	Ultimate, 90,00 Yield, 60,000 Elongation, 15 Reduction area, 50%	Quench 1530-1570 Draw 950-975
Cylinder studs Main bearing studs Engine bed bolts Connecting rod bolts All other bolts Gears	Carbon, .25-.35 Manganese, .50-.80 Sulphur, .045 max. Phosphorus, .045 max. Chrome, .40-.70 Nickel, 1.00-1.50	Ultimate, 150,000 Yield, 130,000 Elongation, 14% Reduction area, 40% Gears Brinell, 325-365	Quench 1540-1560 in oil Draw 890-910 Draw gears 8000
Piston pins Rocker arm pins, etc.	Carbon, .30-.40 Manganese, .30-.60 Sulphur, .040 max. Phosphorus, .040 max. Chrome, 1.00-1.50 Nickel, 3.00-3.50	Ultimate, 175,000 Yield, 140,000 Elongation, 12% Reduction area, 40%	Quench 1520-1540 in oil Quench 1450-1470 in oil Draw 800-820

Parts	*Material*	*Physical Min. Requirements Lb. per Sq. In.*	*Heat Treatment Deg. Fahr.*
Crankshaft Connecting rods	Carbon, .35-.45 Manganese, .60-.90 Sulphur, .040 max. Phosphorus, .040 max. Chrome, .80-1.25	Ultimate, 130,000 Yield, 110,000 Elongation, 15 Reduction area, 40% Brinell, 260-290	Heat to 1550-1575 Cool slowly Quench 1510-1540 in oil Draw 1075-1100
Valves	Carbon, .45-.65 Manganese, .20-.30 Sulphur, .030 max. Phosphorus, .030 max. Chrome, 2.50-3.25 Tungsten, 13.00-14.00		
Valve springs	Carbon, .40-.50 Manganese, .60-.90 Sulphur, .040 max. Phosphorus, .040 max. Chrome, .90-1.20 Vanadium, .15	Ultimate, 170,000 Yield, 160,00 Elongation, 16 Reduction area, 55%	Quench 1670-1700 in oil Quench 1570-1600 in oil Draw 980-1000
Annular bearings	Carbon, .85-1.20 Manganese, .20-.35 Sulphur, .020 max. Phosphorus, .020 max. Silicon, .18-.24 Chrome, 1.30-1.60	File hard Test for brittleness	Heat in salt bath to 1500-1525 Quench in oil Draw at 575 in oil
Balls	Carbon, .90-1.05 Manganese, .30-.45 Sulphur, .025 max. Phosphorus, .025 max. Silicon, .20 max. Chrome, 1.10-1.30	Crushing strength 3 ball method 1 in., 67,000 ¾ in., 45,000 ½ in., 23,000 ⅜ in., 12,000	Quench 1450-1500 Draw 500

Gasoline Vehicles for Explosives Transport

FOR some years before the war British Inspectors of Explosives had been pressed to obtain approval of the conveyance of explosives in gasoline motor vehicles, but in view of the number of fires occurring in connection with such vehicles they considered they would not be justified in accepting the risk involved. From the very outbreak of war, however, the employment of gasoline motor trucks became a matter of necessity, and it was therefore deemed desirable to legalize the position by obtaining the approval of the Secretary of State to the temporary use of these vehicles under certain specified conditions for the carriage of explosives during the war only. As a result, however, of the vast experience gained during the four years of war, the authorities recommended that this approval should be made permanent, subject to certain conditions. In October last these facilities were further extended by the approval of the conveyance in any mechanically driven vehicle of modern design of small-arm nitro-compound in quantities not exceeding 500 lb., provided all reasonable precautions are taken to prevent accident.

Trends Shown by Statistics of New York Show

These trends are, frankly, not representative of the industry. They are comparisons of the cars exhibited in the New York show. The list of exhibitors and the number of cars shown by each should be kept in mind. Perhaps the most interesting feature is the trend in number of cylinders.

DESPITE various differences in engineering and merchandising features, the outstanding statistical fact of the 1921 New York Show was its similarity to the 1920 exhibit.

Exactly the same number of exhibitors were represented, although the ratio between accessories and car exhibitors changed slightly. Of the 307 exhibitors in 1920, only 81 presented cars, while this year there were 86 different car exhibits. Seven more cars were shown than last year.

Three electric cars were represented by seven models, while one steam car was shown. One of the electric cars exhibited a stripped chassis.

The sharpest change in statistics is noted in the relative number of four-cylinder and six-cylinder models shown. In the four-cylinder models there was an increase of 15 over last year, while a decrease of 10 in the number of six-cylinder models appears.

These statistics are especially interesting, since an analysis of the figures for past years shows an almost continuous increase in the proportion of six-cylinder models shown each year since 1914 and an almost proportionate decrease in the four-cylinder type. The six-cylinder type comprises about 62 per cent of the total, however, and so must still be considered as the dominating model.

There were 31 eight-cylinder cars shown as against 29 last year, the change being so slight as to indicate merely that this type is holding its own. There were but three twelve-cylinder cars shown this year, all by the same exhibitor.

Only two exhibitors showed air-cooled cars, the total cars of this type being seven. There were 12 sleeve-valve motors, the other 321 being tappet valve types.

The L-head type of valve placement was numerically the largest with 180, being followed rather closely by the valve-in-head type with 119.

The four and five-passenger touring car was the most popular of the open models, while the increasing popularity of the sedan is indicated by the fact that 80 models of this kind were shown. Thus two-thirds of the closed models exhibited were of the sedan type.

Despite a goodly number of disk and wire wheels, artillery wheels, usually of wood, were used on 63 per cent of the cars exhibited.

Several features which appeared in past years were no longer found, even in small numbers at this year's show. The two-cylinder car, which appeared for a brief space in 1914, was missing, while the last motorcycle exhibit has apparently disappeared from the automobile show. In 1920 one motorcycle was shown, but this year no exhibit of this kind was to be found.

NEW YORK SHOW STATISTICS

General Statistics	1913	1914	1915	1916	1917	1918	1919	1920	1921
Total Exhibitors	424	349	317	319	323	331	198	307	307
Car Exhibitors	89	78	80	84	95	79	56	81	86
Gasoline	..	..	..	..	..	..	..	..	83
Electric	..	..	..	..	..	..	..	..	3
Accessory Exhibitors	320	259	223	306	227	252	141	225	221
Cars Exhibited	276	269	228	264	282	263	225	334	341
Gasoline	226	265	221	251	272	252	223	324	334
Electric	10	4	7	13	10	11	2	8	7
Steam	..	..	..	..	2	4	0	2	1
Chassis Exhibited	49	37	51	56	54	34	..	..	38
Four-wheel Brake	..	..	..	..	..	..	..	..	1
Engine Characteristics—Gasoline Cars									
Two-cylinder	..	2	..	..	..	..	..	..	..
Four-cylinder	229	183	146	158	146	94	40	65	80
Six-cylinder	133	131	160	154	161	171	141	223	213
Eight-cylinder	..	..	8	50	55	40	34	29	31
Twelve-cylinder	..	..	..	17	16	9	8	7	3
Air-cooled	5	6	3	3	..	..	..	..	7
Water-cooled	261	258	218	248	..	..	..	..	325
Tappet valve	215	254	213	247	270	252	..	..	321
Sleeve valve	10	10	6	15	2	..	..	..	12
Revolving disk valve	..	..	..	..	..	..	..	..	1
Valve-in-head	..	..	..	..	..	..	..	..	119
L-head	..	..	..	..	..	..	..	..	180
T-head	..	..	..	..	..	..	..	..	29
Body Styles—Gasoline Cars									
Open cars	213	195	175	194	195	175	127	176	163
Roadsters 2-3 pass	52	51	51	76	68	40	..	..	40
Touring cars 4-5 pass.	{164}	{145}	{129}	{125}	{140}	{143}	{...}	..	91
Touring cars 6-7 pass.								..	32
Enclosed cars	53	43	36	28	37	77	79	119	120
Coupes 2-3 pass	19	17	7	6	6	13	..	..	23
Sedans 4-5 pass	2	2	3	2	..	43	..	..	80
Other closed 6-7 pass	23	16	19	14	19	8	..	..	27
Wheel Styles—Gasoline and Electric Cars									
Wire wheels	..	..	..	..	..	..	..	..	70
Disk wheels	..	..	..	..	..	..	..	..	56
Artillery wheels	..	..	..	..	..	..	..	..	215

HOTEL EXHIBITORS 1921

Total exhibitors	13	2-3 passenger roadsters	3
Cars exhibited (all gasoline)	19	4-5 passenger touring cars	2
Stripped chassis exhibited	2	6-7 passenger touring cars	4
Four-cylinder	12	2-3 passenger coupes	2
Six-cylinder	4	4-5 passenger sedans	5
Eight-cylinder	3	6-7 passenger (other closed cars)	1
Air-cooled	1	Wire wheels	4
Water-cooled	18	Disk wheels	4
Tappet valve	18	Wooden wheels	11
Sleeve valve	1		

As usual a number of exhibits were shown in the hotels, but the statistics concerning these cars follow out very closely the general trends indicated by the figures on the show itself. There were 19 cars in the outside exhibits, 12 of which were four-cylinder jobs, 4 were six-cylinder, and 3 were eight-cylinder. The sedan dominated in the closed-body field of this group as well.

THE Index to Vol. XLIII of AUTOMOTIVE INDUSTRIES, covering the last half of 1920, is just off the press and will be forwarded without charge to subscribers who send their name and address with request for a copy. The index is mailed only to those who request a copy. Now is the time to ask for one if you wish it.

If You Are Planning to Sell Trucks to Corn Belt Farmers

Here, condensed for quick reading, is the experience of 831 farmer-truck owners in Mississippi Valley states. Their opinion of the trucks they now use should be well worth while to the sales manager who is planning a campaign for farm sales. Roads, after all, is the big question.

SUMMARIZING the experience of 831 corn-belt farmers who own motor trucks, the United States Department of Agriculture found that in the opinion of nine-tenths of these men, the greatest advantage in owning a motor truck is "Saving Time"; in the opinions of three-fourths of them the greatest disadvantage is "Poor Roads," and 91 per cent believe that their trucks will turn out to be a profitable investment.

The reports, however, indicate that on most of these farms the truck has not reduced expense to any great extent, and that it supplements rather than replaces work-stock and other equipment.

On the average these trucks travel 2777 miles per year and the cost of operation is between 16½ cents and 17 cents per mile, making the total annual cost from $460 to $470. Each truck displaces an average of 1.2 head of work-stock. With the cost of keeping a horse a year in the corn belt around $200, the reduction in expense for this item is in the neighborhood of $240 per farm. For all farms the average amount of hired help saved by the trucks is $163. On most farms these are the only two items of direct reduction in expense which can be credited to the truck, and on the average they amount to $60 or $70 less than the total cost of operating it.

To offset this added cost, custom hauling done with the trucks amounts to about $50 per year for all farms, leaving only something like $10 or $20 annual net expense, which must be more than balanced by the saving of time of the owner, and members of the family, the ability to get crops and livestock to market in better condition or at better time, and other benefits which are not directly measurable in dollars and cents, if the average truck is to be a profitable investment.

It must be remembered that most of these farms where trucks are owned are larger than the average, and are located at a considerable distance from market.

The investigation was made during the past winter and spring. Farmer-truck owners in Indiana, Illinois, Missouri, Iowa, southern Wisconsin, southern Minnesota, southeastern South Dakota, eastern Nebraska, and eastern Kansas, who raise corn as one of their principal crops, and who practice the general grain and live-stock farming characteristic of the corn belt, reported to the department the use they make of their trucks, the cost of operating them, the advantages and disadvantages of trucks for farm use, and other related information.

A study of the reports of 831 of these farmers has just been completed by the Division of Rural Engineering of the Bureau of Public Roads and the Office of Farm Management and Farm Economics.

Some of the important facts revealed by the investigation are:

The average size of the farms is 346 acres and their average distance from market is eight miles.

Only 14 per cent of them are less than five miles from market, and 20 per cent are 15 miles or more from market.

A little over one-fourth of these men have changed their markets, for at least a part of their produce, since purchasing trucks. For those who have changed market, the average distance to the old market was seven miles, and to the new market is eighteen miles.

The rated capacity of these trucks varies from one-half to two tons. Seventy per cent of them are rated at one ton, and only 9 per cent of them at less than one ton.

Experience with trucks has caused 57 per cent of these men to decide that the 1-ton size is best for their conditions, 25 per cent that the 1½-ton size is best, and 12 per cent that the 2-ton size is best. Practically one man in four has decided that a truck larger than the one he now owns would be better suited to his conditions.

Ninety-one per cent believe that their trucks will prove to be a profitable investment.

As compared with horses and wagons the trucks save about two-thirds of the time required for hauling to and from these farms.

On the average there are over eight weeks during the year when the roads are in such condition on account of mud, snow, etc., that these trucks cannot be used. The roads on which nearly 95 per cent of them usually travel are all or part dirt.

The condition of the roads prevented the use of the trucks with pneumatic tires a little less than seven weeks during the year covered by the reports, and of those with solid tires a little over nine weeks.

Twenty-four per cent of the trucks are equipped with pneumatic tires, 27 per cent with solid tires, and 49 per cent with pneumatics in front and solids in rear. However, experience has convinced 58 per cent that pneumatics are best for their conditions, 35 per cent that solids are best, and 7 per cent that pneumatics in front and solids in rear are best.

These men have return loads for their trucks about one-third of the time.

A majority of these men still use their horses for some hauling on the road.

On more than half of the farms all the hauling in the fields and around the buildings is still done with horses and wagons.

About 40 per cent of these men did some custom hauling with their trucks during the year covered by the reports. The average amount received by those who did such work was $132.

Their owners estimate that on the average these trucks travel 2777 miles and are used on 112 days per year.

The average estimated life of these trucks is six and one-half years, and on this basis depreciation is usually the largest single item of expense in conneciton with their operation.

The average cost of operation, including depreciation, interest on investment, repairs, registration and license fees, fuel, oil, and tires, is 15.2 cents per mile for the ½ and ¾-ton trucks, 15.2 for the 1-ton, 21.3 cents for the 1¼ and 1½-ton, and 25.8 cents for the 2-ton.

The average cost of hauling crops, including the value of the driver's time, is 50 cents per hour, is 24 cents per ton mile with the ½ and ¾-ton trucks, 24.1 cents with the 1-ton, 23.3 cents with the 1¼ and 1½-ton, and 21.5 cents with the 2-ton trucks.

Nearly 85 per cent of these trucks had not been out of commission when needed for a single day during the year covered by the reports, and 80 per cent of the owners stated that they had not lost any appreciable time on account of motor and tire trouble, breakage, etc., when using their trucks. About one truck in 15 was out of commission more than 5 days, however, and one owner in 40 reported a loss of more than 5 per cent of the time when using his truck.

Fifty-six per cent of these men have not reduced the number of their work-stock since purchasing trucks. Twenty-four per cent have disposed of one or two head, and 20 per cent of more than two head. The average reduction for all farms is 1.2 head.

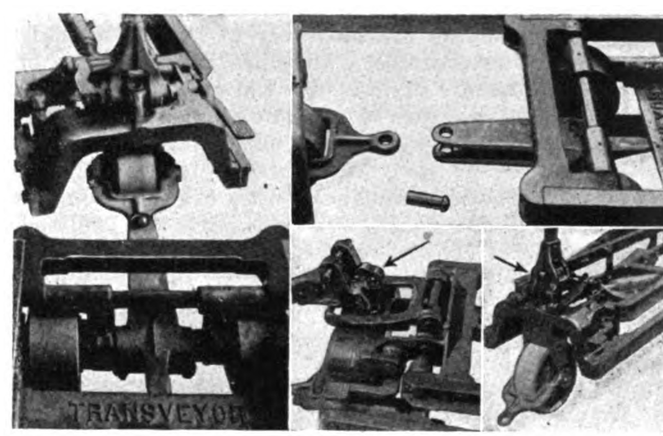
Half of these men own tractors as well as motor trucks. Most of the tractors are owned on the larger farms, however. **Only 33 per cent of the men whose farms contain 160 crop acres or less own tractors, while 65 per cent of those with over 320 crop acres own them.** The number of work stock kept on the farms where both trucks and tractors are owned is only slightly less than the number kept on the farms of corresponding size where only trucks are owned.

Seventy-eight per cent of these farmers state that their trucks reduce the expense for hired help. On those farms where there is a reduction, the operators estimate that it amounts to $209 per year on the average.

Transveyor Trailer Attachment and Safety Handle Latch

AN attachment recently developed for the Cowan Type G Transveyor enables the latter to be used as a trailer behind industrial trucks, either singly or as a train. The attachment fits on to the front wheel fork and hitches to the draw bar on the rear axle of the Transveyor ahead of it, or the draw bar of the electric truck. We are informed that with this attachment the trucks track quite closely and the turning radius is such that a train of ten can be turned in a 20-foot roadway. Plenty of up and down play is allowed, so that there will be no binding as the machines go over door sills or the top of steep inclines.

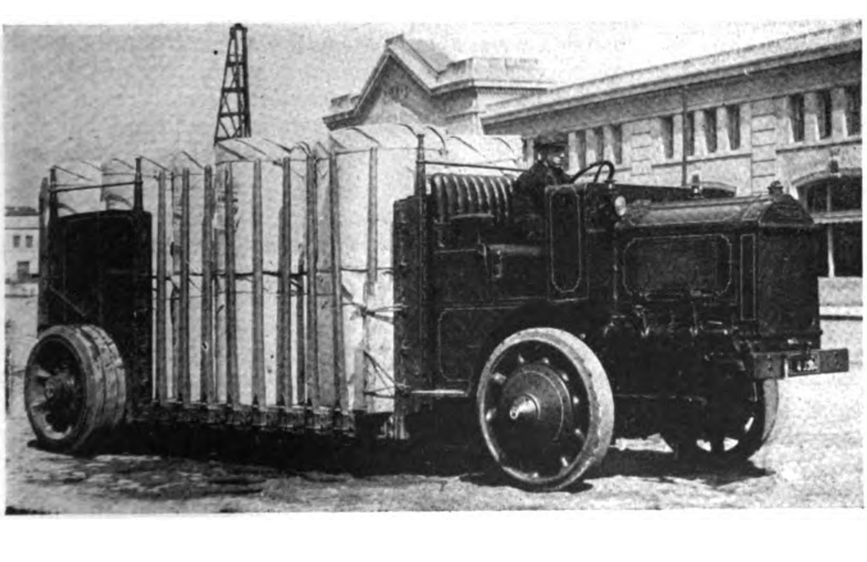
The safety handle latch, also illustrated, is the result of calls from safety engineers for a handle that will not fall down under any circumstances. The latch is made of tempered spring steel attached to the top of the king pin of the front wheel fork. It has two leaves.



Transveyor trailer attachment and safety handle latch

As the handle is thrown back into a vertical position, it slips over the spring, and jarring will not cause the handle to fall forward. The latch, however, does not interfere with the free movement of the handle, when it is necessary to bring it down to manipulate the Transveyor.

McDonald Front Drive Truck



A SPECIAL design of truck chassis, particularly adapted to low bed construction, has been developed by the McDonald Truck & Tractor Co. The drive is to the front wheels, through a chain and an internal gear. The main load frame is carried on three-point suspension, while the powerplant rests on a separate frame and spring. Steering is accomplished by the McDonald hydraulic steering gear, and the brakes are also hydraulically operated. All of the mechanical parts are located at the front end, which is referred to as the chassis, exclusive of the rear wheels, tires and bodies.

There is considerable latitude in the type of body which may be fitted to this truck chassis, but so far the company has been specializing on low bed trucks.

Protective Machinery in Danger of Becoming Cumbersome

As protective organizations are multiplied, or as machinery for the settlement of labor disputes is erected, the efficiency of our productive system decreases. In both business and political affairs, the smallest amount of system which will insure order is the most efficient.

By Harry Tipper

ONE of the things which we are apt to forget in the consideration of modern and social industrial affairs is the extension of the machinery for organization protection and legislation in all kinds of occupations and in all kinds of industrial groups.

Where such organizations perform a real service in increasing the understanding, improving the knowledge or otherwise developing the efficiency of the individual or concerns who are members, they are a part of the productive development of industry and can be accepted as valuable in the progress of the industrial world. Where, however, their primary purpose is to protect the members from outside aggression, from legislative difficulty or to protect their privileges, such organization adds nothing to the total productive capacity of the individual members and is concerned either with the retention of their profits, with the extension of their privileges or the maintenance of their position against other groups.

This, of course, includes to a very large extent the work of the operating parts of government. For while it is true that all these protective organizations, including the government bodies, are concerned with the improvement of knowledge in some of their endeavors, they are more largely concerned with protecting the social body at large or the industrial group from the aggressors who would destroy its peace and order.

Most of the members of these organizations have no concern either immediate or remote with the increase in the country's productivity, or the efficiency of the social organization. They do not add anything to the wealth, but instead reduce the wealth by the amount required to maintain them and to continue their operations. This does not mean that they are unnecessary. It simply means that they cannot be viewed as an advantage to the social or industrial organization, except as the organization requires protection against itself in its inability to co-operate peacefully and fairly in the work of improvement.

It means also that extensions of such organizations and particularly extension of government operations should be weighed very carefully as the continual development of the government expense is a continual additional drain upon the industrial capital, from which no corresponding return is received.

We are already burdened with a multiplicity of laws and with a wealth of technical detail in law which requires an enormous amount of information and still greater amount of advice and consideration in regard to its proper interpretation.

If the departments of government are multiplied and additional machinery provided with the idea of curing every economic ill from the labor trouble to the cost of raw product, new restrictions will be required and new departments for the enforcement and interpretation of those restrictions must be developed. This is just as true of the machinery of organization for the settlement of the labor problem.

Suggestions are made on all sides looking to the erection of national and State machinery for this purpose and the development of new tribunals before whom adjustments may be made. It is possible to carry this organization to such a degree that it becomes burdensome in the extreme without developing any hopeful basis for the solution of the problem.

Reference is frequently made to the machinery for the adjustment of labor problems in Great Britain, but this machinery has not lessened the demands or ended the warfare in industry in that country. On the contrary it has made the local settlement of a problem much more difficult; so that the ponderous machinery of the whole labor organization may be put to work all over the country for the settlement of a matter which was originally confined to a question of personal privilege in a single shop. It is not so long ago that the discharge of an employee on one of the railroads brought the country within a day of a complete railroad strike.

Unless this machinery of organization makes for enlightenment, for a better understanding between the individuals in each case, and for a better co-operation between the small groups, it is an addition to the governmental machinery which is not productive, which does not increase the wealth and which on the other hand withdraws some of the labor from productivity for the maintenance of its own organization.

Carlyle once called attention to the ability of the Anglo-Saxon to get along with a small amount of government as one of the strong features of the racial development. At all times the minimum amount of government required to maintain order is the maximum amount of efficient government.

The tendency to centralize organization authority both in political and industrial matters enlarges the governmental operation in both cases without materially enlarging the usefulness and efficiency of the result.

It is still true that if you have co-operation and order in each community in a state, it will not be difficult to

secure order throughout the state. It is still true that if there is co-operation and decent measure of justice between each employer and his employees there would be no general problem of industrial unrest.

Government is necessary so that chaos may be avoided and the industrial and social organizations continue to function, but there is a tendency to burden the government of the country and the state on political matters, the group governments of industry on industrial matters, with innumerable operating questions and innumerable precedents, traditions and restrictions. These are supposed to take the place of the co-operation between the individuals in the small group, the industrial or social unit and force improvement from the general to the individual. All this machinery is very expensive and it will not do the work which it is supposed to do, because the improvement grows from the individual to the small group and from the small group to the larger group.

This type of organization is expensive because it removes from productive work the man power which is required to maintain it and the capital which is required to pay for that man power.

In one of the articles a week or so ago, we stated that system was of no value unless the spirit of improvement and adjustment were there, and the spirit of improvement begins with the individual, with the understanding between individuals and adjustment of their relations by virtue of their understanding.

Whether in business or in political affairs, the smallest amount of government system which will insure order is the most efficient amount because it removes from the production of necessary commodities only those men who are absolutely essential for the maintenance of the order and the establishment of improvement in the spread of knowledge, the spread of understanding and the development of justice.

There is a tendency for all organizations of this type, whether they are concerned with politics or industry, to enlarge their own operations, to feed upon themselves, and this tendency is sharply indicated by the developments which have taken place in the last year and the developments which are foreshadowed in recent demands for future organization in politics and business.

If half the money were spent upon the education of the young citizens which is spent on the extension of restrictions for the adult, the necessity for those restrictions would be materially lessened and the money which had been expended would have been productive of a better type of citizenship and a more efficient organization. If half the money spent by industrial organizations, whether labor, professional or capital, were expended upon providing a better basis of understanding, a better common ground of knowledge and a visible area of fair play, the necessity for such protective work would be materially decreased and the efficiency of the industrial machine notably strengthened.

At this time when there are so many patent medicine venders, each with a system of restriction which is calculated to organize the nation into the millennium both industrially and politically, it is well to scrutinize with very great care every proposed extension of organization activity and see whether it is founded upon the positive platform of education, improvement and understanding in the development of justice, or whether it is formed on the negative platform of protection of privilege and rights, maintenance against aggression, and so forth.

Furthermore, all these proposed extensions of present systems or developments of new systems should be subjected to the acid test—how they will affect John Smith who is working for you and your managers, or how they will affect your neighbors and the other citizens of your community.

Unless they are inclined to bring a better element of understanding into your organization between the management and the men and between the owners and the management, they are of little use industrially and will simply add a burden to that which we already carry. Unless they are inclined to increase the understanding between the members of your community and to develop order in that community, they are of little use politically and will simply add a new burden for which industry must pay.

This does not mean that either the private citizen or the industrial owner should be allowed to retain his privileges if they are not consistent with the general good, but it does mean that a lot of the systems suggested and the additional operations talked about are suggested and talked about in the hope that they will take the place of better education and better understanding—in the hope that they will cure our troubles without labor and without thought, by some magic in the systems themselves.

Placing Responsibility in Kansas

ONE point in a recent decision of the Kansas Court of Industrial Relations is of particular interest from the employers' point of view. The law under which the court operates, it will be recalled, provides not only that strikes may not occur in certain basic industries, but that manufacturers may not arbitrarily cease operations at their own discretion. Recently a complaint was brought by employees against the Topeka Flour Mills, which not long ago closed down to about half of its capacity. A part of the Court's decision was as follows:

"The people of Kansas have solemnly declared by legislative act that workers engaged in this industry shall at all times receive a fair wage and have healthful and moral surroundings. In the reduction of hours of operation, therefore, the millers should be very careful and solicitous concerning the matter of labor.

"Skilled and faithful employees should be given such treatment as will enable them during the period of limited production to support themselves and their families."

Such a statement would seem to imply that with industry organized on a capitalistic basis, the responsibility of providing at all times an opportunity to gain a fair living wage to those who are willing to work rests upon the employer. A discussion of this decision is expected to develop some interesting opinions and information.

DURING the year 1919 there were in Great Britain 747 trade disputes resulting either in a strike or a lockout. During the first six months of 1920 there were 1,004 such disputes, or 34 per cent more for six months than in the whole preceding year.

The number of persons involved in the 1919 disputes, however, was 1,434,000 as against only 592,000 in the first half of 1920. This would indicate that although the 1920 troubles were more numerous, their importance was less in the average case.

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The S. A. E. Meeting

THE plan of holding simultaneous sessions on diversified subjects at the annual S. A. E. meeting proved highly successful and will no doubt be followed at future meetings of the Society. The only reason for not following this practice heretofore has been the belief that the attendance at one or more of the sessions held at the same time would be too small to make the practice worth while. Quite the contrary has turned out to be the case. All the sessions were well attended and at all of them the attendance was larger than was that at some of the sessions of the annual meeting of the American Society of Mechanical Engineers, a much older organization with about double the membership of the S. A. E.

There is still much room for improvement in the actual presentation of the papers, particularly those which are in type at the time of the meeting. Announcements of the meeting stated that authors would give short, crisp digests of their papers without boring the audience with details contained in the printed manuscript which all can read at leisure. This was done in some few cases, but in others quite the reverse was true. Another mistake, which should be avoided in future, is that of having several papers presented without pause for discussion and then allowing all the discussion to come at the end. By so doing many important points which should be brought out in the discussion are lost and the author's summary in reply is frequently not given at all.

The life of a meeting is usually in the discussion, providing the chairman is, as he invariably should be, familiar with the subject. The chairman should be selected well in advance of the meeting, should be furnished with copies of all papers to be read at his session, and should have before him a list of men specially qualified to discuss the subjects in hand. These men should all receive copies of the manuscripts in advance so that their discussion will be well thought out and to the point. Whenever possible all members should receive preprints of papers with request that they forward written discussion if they cannot be present at the meeting.

When simultaneous sessions are held there should be ample time for discussion, and the chairman who knows and performs his job will see that this discussion is brought out even at the expense of missing some of the papers scheduled. It is, of course, unfortunate to disappoint an author who has spent much time in preparing a paper, but it is worse to throttle discussion which is pertinent and timely, even though this may cause criticism on the part of the author whose paper is not read. Reading a paper before an organization of such standing as the S. A. E. should be regarded as a privilege; that is the Society does the author an honor by asking him to speak on a subject—the author does not confer a favor by consenting to speak. Consequently if a given subject excites unusual interest the chairman must think of the greatest good to the greaest number and perhaps forego the reading of one paper in order that another which seems to attract much interest may be fully discussed.

Correct Registration Figures

THE registration of motor cars and trucks in the United States for the year ending Dec. 31, 1920, was announced in these columns last week as 8,873,-572. This figure was a surprise to even the most optimistic. We believe that it is as accurate as was possible under the circumstances, meaning the haste in which the figures were gathered.

The difficulties of gathering registration statistics are not generally understood and frequently some one undertakes this task without a full knowledge of it. State governmental departments are often cumbersome. There is a fixed way of doing things and these methods are not responsive to an effort to gather figures promptly. Then, too, each state has peculiarities of registration. It is a considerable task to learn in just what states the total figure given out includes re-registrations, trailers and the tractors used for industrial purposes, etc. In some cases dealer licenses are subtracted from the total. Other states do not follow this practice.

The figures we published represent an intelligent handling of the figures supplied by the State officials. In some cases these officials have asked the privilege of revision. The revised figures will be printed in the Statistical Number of AUTOMOTIVE INDUSTRIES on Feb. 17. Several of these revisions have been received since the publication of the table in our issue of Jan. 13. So far the revisions have not changed the State totals to any material extent.

While on this topic it should be said that if the registration figures are to be made of the greatest benefit to the industry, many State laws must be revised. This is merely another argument in favor of adopting the proposed Uniform Vehicle Law.

Effect of Weight on Fuel Consumption

THE subject of fuel economy is attracting so much attention to-day that makers of parts and fittings for automobiles generally are considering to what extent their products contribute to this factor. In this connection the question has come up as to how the weight of an automobile and its fuel consumption are related, and some experimental results have been quoted to us which make it appear that the consumption decreases, not in proportion to weight reduction, but much more rapidly. For example, a reduction in weight of 10 per cent is said to have resulted in a reduction in fuel consumption of over 20 per cent. This, however, is absolutely contrary to all previous experience. The resistance to the motion of an automobile on level road is made up of two factors, namely, road resistance and air resistance. The first is generally taken as directly proportional to weight being moved, and this assumption is in accordance with all physical laws and also with observations in tests. According to this law it requires at low speed exactly twice the force to move a loaded truck weighing six tons, as to move the empty truck weighing three tons.

At higher speeds account must be taken of the air resistance, and at 25 m.p.h., which is perhaps a good average driving speed, this resistance becomes an important item. The air resistance is entirely independent of the weight to be moved and varies only with the projected area and the form of the body and other exposed parts. It will readily be realized that even at a fixed speed the relation between the power necessary to overcome road resistance and that required to overcome air resistance varies widely, because of the different shapes which can be given the vehicle body. A car with a large windshield perpendicular to the axis of a car would evidently encounter much more resistance than one without windshield and modeled in true streamline form. For a touring car of average weight and dimensions the air resistance at 25 m.p.h. is about one-half the road resistance. The air resistance, of course, remains constant for a car of given dimensions even though, through the use of higher grade material, etc., the weight of the car be reduced. For instance, if the weight is reduced, say 10 per cent, the road resistance will be reduced in the same proportion, and the combined air and road resistance at a speed of about 25 m.p.h. would be reduced from 150 per cent to 140 per cent of the original road resistance. In other words, a 10 per cent reduction in weight at the speed mentioned should result in a fuel saving of 6 2/3 per cent. The saving would approach 10 per cent at very low speed and would practically vanish at very high speed.

The lighter the car the less fuel will be required for acceleration and for hill climbing, but here again the gain is substantially in proportion to the difference in weight, so long as the engine remains the same size.

The above is not intended to discourage designers who are striving to cut down the weight of their cars. Reduction of weight does result in economy, especially at low speeds at which the reduction in fuel consumption is substantially in proportion to the saving in weight. The chief reason why the light car consumes less fuel than the heavy car is due to the fact that a smaller engine can be used.

Just Taxation

THE question of federal taxation was one of the most discussed topics during the gathering of the motor vehicle manufacturers last week and the general attitude of the manufacturers was one that cannot but meet with the approval of all fair-minded people. The manufacturers frankly believe that if the recommendations in the annual report of Secretary of the Treasury Houston are made effective, their industry will be discriminated against. They believe that an industry which produces anything so thoroughly a utility as the motor vehicle should not pay a heavy burden of taxes. Indeed, a suggestion made early in the week that the automotive industry offer to pay taxes comparable with those imposed upon railroad locomotives and equipment was often quoted.

There is no spirit of evasion of a just share of taxes. The automotive manufacturers realize that this country is heavily in debt and that this debt must be paid. They are just as patriotic to-day as they were during the war. It is the apparent disposition in some quarters to class their products as non-essential that annoys them more than the amount of money involved. Then, too, the manufacturers believe that just as they are striving to reduce the fixed charges in their business, so the government should make every effort to reduce its fixed expenses and put into effect the most modern business methods for the saving of money compatible with efficiency.

The Tax Committee of the National Automobile Chamber of Commerce is considering the problems before it. Circumstances make this one of the most important committees of the national body. From all appearances this committee is setting out to do a constructive work. When its representatives appear before the Congressional Committee they will have something to say besides entering a protest against taxes, as recommended, and will endeavor to assist the representatives of the government in reaching a just solution of the problems.

Durant Picks Flint for New Plant

First Unit Slated for Old Home Town

Hohensee and Sturt, Chevrolet Officials, Join Former Chief—Organization in Process

NEW YORK, Jan. 18—The first unit of Durant Motors, Inc., incorporated at Albany late last week by William C. Durant, former president of the General Motors Corp., will be located in Flint, Mich. This decision was communicated to-day to the Flint Chamber of Commerce and was in compliance with earnest appeals to Durant to return to the city where he gained his first fame and which he is credited with having "put on the map."

News that Durant was going back into the automobile manufacturing field with a car of his own has created intense interest throughout the industry, but it caused a sensation in Flint, and ever since it was made his temporary offices in the Goodrich Rubber Co. building have been deluged with telegrams of congratulation and best wishes. They also have brought more substantial wishes, including an offer of a free site of 40 acres of land for a plant.

Durant has not told his plans in detail and probably won't for a month yet, but he already is rounding up an organization. The first man to join him was F. W. Hohensee, who resigned as a vice-president, director and member of the finance committee of General Motors the same day last week that Durant retired as a member of the finance committee and chairman of the executive committee. Hohensee has been known as one of the most capable men in General Motors, where he has been general manager of production for the Chevrolet company.

Durant to Design New Car

The second man to go with Durant was A. T. Sturt, chief engineer of the Chevrolet company. He has had much to do with the development of that car. The fact that these two Chevrolet executives have joined Durant adds significance to his announcement that Durant Motors would produce a 4-cylinder car which would sell for less than $1,000. It is understood, however, that the new car will include several features Durant has had in the back of his head.

It is probable it will be in a little higher price class than the Chevrolet, but will lend itself to quantity production. When it will be placed on the market has not been determined, but it is expected the company will be in operation by Aug. 1. In addition to the Flint plant another factory will be located in the East, and it is possible the company will have a separate unit for the manufacture of engines and other parts.

The authorized stock of the company will be $5,000,000, consisting of 1,000,000 shares of no par value. All the stock will be taken by Durant and close personal friends. It is significant that the day after the incorporation papers were filed there was active trading in the stock on the curb market on a "when issued" basis. It was the understanding that the stock was offered for subscription at $10 a share, but most of the trading was at between $13 and $14, and the turn-over approximated 3000 shares.

Durant made the following statement:

Friends and Self to Control

"While I am not ready at this time to make an announcement, it will probably not surprise you to know that I am still an interested and firm believer in the motor industry, and that I am organizing a company controlled by myself and several of my good friends, which will be in active operation Aug. 1. I cannot go into details regarding the corporation at this time other than to say it will bear the name of the Durant Motors, Inc., with one kind of stock, with no commissions, bonuses or reservations to myself or associates issued for experience, ability or performance. The Durant Motors, Inc., will be incorporated under the laws of the State of New York with authorized capital of 1,000,000 shares of no par value, 500,000 shares constituting the initial offering."

No further statement has been made as to the financing details or the names of Durant's associates. The three incorporators, besides himself, were office employees. When the company is finally organized the names of three or four men of country-wide reputation will appear on the directorate.

Decision to locate the first plant of the company in Flint was due partly to sentiment. Durant won his first success in that city and it always has been loyal to him. Immediately after he was forced out of General Motors the directors of the Flint Chamber of Commerce adopted resolutions which expressed "in behalf of the citizens of Flint the deep appreciation of his services to this community," and voiced "the hope that when his responsibilities permit he again will take up is residence here among the friends who love and respect him."

Replying, Durant said:

"You may say to the good people of the best little city in this country that one of the plants of Durant Motors will be located in Flint and say to those who so thoughtfully remembered me that I am most appreciative of and quite overcome by their kind messages of friendship, confidence and affection."

Show Sales Rate Up With Normal Years

Executives Regard New York Results as Auspicious—Credit Conditions Harmful

NEW YORK, Jan. 17—A final canvass of the New York show reveals these facts: Attendance compared favorably with last year and was generally accepted as better in "quality," a conclusion supported by the reports of exhibitors that "live" prospect lists obtained are far larger than those of 1920; retail sales on the floor aggregated between 50 and 75 per cent of the record of last year and were fairly well up to results of previous New York shows, except that of 1919 conducted by the metropolitan dealers and making the first public showing of automobiles after the armistice.

Show sales of cars in the class above $3,000 ran about 50 per cent of last year's, in the $1,500 to $3,000 class about 75 per cent and in the class below $1,500 a little less than 75 per cent. Some exhibitors made no sales, others did only 5 to 10 per cent of last year's business and four or five sold more cars than they did in 1920, but the average held pretty well between 50 and 75 per cent.

Wholesale business continued right up to the end of the show and was such as to give factory executives encouragement to prepare for a fair and steadily growing volume of late winter and early spring business. Dealers reported very little improvement in the stringent situation as regards financing of time sales and said bankers had not shown much inclination yet to extend additional credit for financing wholesale purchases. For this reason dealers in a good many cases placed orders for cars in small lots but expected to make almost immediate sales to finance further orders.

New York and suburban dealers expect to keep up a growing volume of sales as a result of the fine prospect lists obtained and factory executives are counting on similar aftermaths of succeeding shows to improve the situation throughout the country.

Attendance Within 10 Per Cent

Final attendance figures showed the crowds within 10 per cent of last year's except on the opening Saturday and Friday, when the attendance was poor. Friday there was rain, at times approaching the intensity of a cloudburst, practically all day. On Thursday the attendance was within 500 of the record of the New York shows. The aggregate attendance was well up toward the average of all previous years except the one held in 1920.

Many Companies Seek New Finances

Banks Aid Industry in Arranging Loans

Co-operative Spirit Helpful in Meeting New Money Strain—Credits Extended

NEW YORK, Jan. 17—Notwithstanding the easing of credit and the improvement in the general situation, the next few weeks are likely to prove the most critical encountered by manufacturers in the automotive industry since the post-war readjustment began. This is due to the fact that nearly all companies have had coming due since the first of the year large bank loans and bills to merchandise creditors.

Most companies are short of cash and as a consequence more than one large corporation has found it necessary to ask its creditors for an extension of time. This condition is almost universal and is not by any means confined to the automotive industry. As a matter of fact some other lines are in much worse plight.

Banks generally have assumed a constructive attitude and are willing to do anything within reason to keep the companies to which they have made loans moving along as going concerns rather than take action which might precipitate receiverships with a consequent shrinkage in assets. It is realized that few companies are in a position to pay all their obligations at this time.

A similar stand is taken in most cases by large merchandise creditors. They feel that if receiverships and involuntary bankruptcy petitions are avoided, they will be infinitely better off than they would be if the affairs of their creditors were placed under the direction of the courts. This means that appeals for extension of time on loans and bills are being received with sympathetic interest. In almost every case where it can be shown that the companies would be solvent under normal conditions—and there are innumerable cases of this kind—the accommodation asked is being granted.

No Stigma to Cash Shortage

Manufacturers and banks are a unit in feeling that no stigma attaches at this time to requests for extension of time. Almost everyone is in the same boat. For that reason, less significance than usual should be attached to meetings of creditors. In most cases they are being called by the companies themselves for the protection of creditors and in the hope that some amicable plan can be agreed upon to carry them through the crisis.

A great deal of refinancing is being engineered at this time although the negotiations have been completed in only a few cases. This applies to some of the largest companies in the industry. Important announcements along this line may be expected in the near future.

Banks have become more deeply interested in the automotive industry than they ever were before and they are convinced that its future is thoroughly sound. That is one of the reasons why they are perfectly willing to finance any sound company to which they already have made loans. They believe that by extending further help at this time, they can avert impairment of their investments.

If the next few weeks can be weathered safely, there is no need to fear serious casualties in the industry. Present conditions, however, make it even more dangerous than usual to rock the boat and invest with unusually sinister possibilities the circulation of reports that this or that company is in a bad way financially.

Implement Association Urges Standardization

ST. LOUIS, Jan. 15—More than 450 members of the Mississippi Valley Implement Dealers Association attended the fourteenth annual convention of the organization at the Planters Hotel in St. Louis, Jan. 11, 12 and 13. The annual election of officers resulted in the naming of Frederick P. Watson of Mt. Vernon, Ill., as president for the 1921 term. The name of the organization was changed to that of the Mississippi Valley Implement Vehicle and Hardware Association and the constitution and by-laws were amended so as to permit the inclusion in membership of dealers who retailed one or more of the lines.

According to the retiring presiding officer, Henry F. Woerther of Baldwin, Mo., the most important problems of the past year which promise to affect matters of the immediate future are power farming, elimination of deposits on tractor contracts, standardization of many vital spare parts common to similar implements and vehicles of various manufacture, one line contracts of motor and other vehicles, increased freight rates, C. O. D. shipments of repairs, well defined and exclusive territories and closer mutual understanding with heads of various farm bureaus.

COMET RESUMES PRODUCTION

DECATUR, ILL., Jan. 17—The Comet Automobile Co. re-opened this week with a small force of men. George W. Jagers, president, who has returned from a tour of leading Middle West dealers, said big distributers seemed more pessimistic over the future than the smaller ones, but general conditions warranted beginning of operations.

Treasury Revises Excise Tax Clauses

Top and Body Rebuilders Defined Manufacturers—New Adjustments Now Permitted

WASHINGTON, Jan. 17—Revision of tax regulations as announced here to-day by the Treasury Department imposes excise taxes on garagemen and others engaged in extensive repairs to automobile tops or bodies. The ruling places "a person, partnership or corporation engaged in business of building over automobile tops or bodies for installation on new or old chassis as manufacturers of automobile parts or accessories and subject to such a tax."

Furthermore, the Treasury has revised Regulations 47 relating to excise tax on sales by manufacturers which affect the industry. As to the basis of tax, there has been a simplification in accordance with rulings in force. Certain examples have been added outlining the method to be pursued by a manufacturer in quoting and billing the tax in order to arrive at a basis of tax and to reimburse himself for the tax which he pays.

The theory is that if a manufacturer quotes the selling price of the article and the tax in separate and distinct amounts or quotes a flat price with the statement that a certain proportion of the quotation represents selling price and a certain proportion tax, the tax attaches only to that portion representing the actual selling price of the goods.

The ruling in Regulations 47 permitting an adjustment of the tax in the case of an adjustment in price on goods sold over a period of time on a quantity rebate has been extended to permit an adjustment in the tax in the case of an adjustment in price under an agreement made at the time of the sale to make such adjustment in case of a decline in the market.

New Ruling on Manufacturer

Article seven defines a manufacturer. This article has been modified to provide that while a manufacturer is generally a person who (1) actually makes a taxable article, or (2) by changes in the form of an article produces a taxable article, or (3) by the combination of two or more articles produces a taxable article, that under certain circumstances such a person is not a manufacturer for the purpose of the tax; but that if a dealer or jobber owns a patent, trade-mark, formula or recipe for a taxable article and contracts with another person or firm for the manufacture thereof, the contract specifying that the article

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Nash Earnings Total $7,007,471 for Year

Company with $12,409,378 Cash in Unusually Strong Position —Sees Normal Year

NEW YORK, Jan. 17—A dividend of $10 a share on the common stock payable Feb. 1 has been declared by the Nash Motors Co. A regular quarterly dividend of $1.75 on the preferred also has been declared payable on the same date.

The annual report of the Nash Motors Co. for the year ending Nov. 30 shows a net income after Federal taxes of $7,007,471 equivalent after preferred dividends to $122.79 earned on the 54,500 shares of common stock of no par value. This compares with net income of $5,089,035 or $95.06 on the 50,000 shares outstanding in the preceding year. The profit and loss surplus at the end of the year was $12,531,837, an increase of $5,820,471 in twelve months. With $12,409,378 in cash, the company is in a tremendously strong position. The balance sheet as of Nov. 30 shows as follows:

Assets: Real estate, plant and equipment, $5,257,761; miscellaneous investments, $1,453,555; Liberty Bonds, $1,307,600; material and supplies, $6,212,163; notes receivable, $941,000; accounts receivable, $1,757,783; cash $12,409,378; prepaid expenses $20,023; total $29,359,263.

Liabilities: Preferred stock, $4,500,000; common stock (54,500 shares, no par value), $500,000; accounts payable $1,074,230, reserve for state and federal taxes, $7,468,858, other reserves, $3,284,337; surplus, $12,531,838; total $29,359,263.

In a letter to stockholders, President C. W. Nash said that sales for the year amounted to more than $57,000,000 or nearly $10,000,000 more than the preceding year. The company produced 37,263 passenger cars and 3,848 trucks. Its exports, not including those to Canada and Mexico totaled 2,700 cars and trucks. In his letter Nash said:

Milwaukee Plant Operating

"The first units of the new plant at Milwaukee are now completed and operations started. The new four-cylinder car being turned out there is meeting with a fine reception and it is expected that it will prove a great asset to the Nash motors line.

"We have put $1,573,083 into the Milwaukee plant for land, buildings, machinery and equipment, besides $1,280,709 for working capital. We also expended during the year $1,051,445 in the enlargement of the Kenosha six-cylinder passenger car and truck plant. We have practically no uncompleted construction on hand at present.

"For the first nine months of the fiscal year we were unable to keep up with the demand for our car, but beginning Oct. 1 we experienced a sharp drop which caused us to shut down our plant for a number of weeks and for the balance of the period up the present time to operate on a reduced schedule. We were expecting this reduction and when it came had on hand less than half a day's production.

"We intend to continue a conservative production policy because we regard our distributing machinery as the most vital part of our business and we also fully realize that the bankers who are co-operating with our dealers are just as much a component part of our organization as the dealers themselves.

"We are looking forward to at least a moderately successful year."

G. M. C. Consolidations Regarded Improbable

NEW YORK, Jan. 17—The General Motors Corp. closed 1920 in a strong position with its inventories of unfinished materials substantially reduced, its finances in good condition and comparatively few unsold vehicles on hand. It can be said with authority that the corporation does not contemplate any material expansion during the coming year, notwithstanding many reports now in circulation of consolidations with other companies.

It is felt the company's factories now are adequate to meet the demand for some time to come and that nothing will be gained by taking on additional lines. Efforts will be centered upon making all the various divisions as profitable as Chevrolet, Buick and Cadillac have been. There is a possibility that the company may abandon some of its activities not related to the automotive industry. It is understood the directors are not enthusiastic about retaining the big new Durant building in Detroit and they probably would not hesitate to sell it if an opportunity offered.

Cotta Offers Settlement at 25 Cents on Dollar

ROCKFORD, ILL., Jan. 17—Creditors of the Cotta Transmission Co., now in bankruptcy, have received a proposition from a syndicate composed of Rockford business men, to settle all claims upon the basis of 25 cents upon the dollar and the offer has been taken under advisement. The plant is also under consideration by a Chicago firm which proposes to utilize it for the manufacture of a new type of kerosene motor for tractors. If the creditors decide to accept the offer, it is likely that a deal will be arranged with the Chicago concern and the plant reopened for the manufacture of both engines and transmissions.

ROTH DENIES EMBEZZLEMENT

SANDUSKY, OHIO, Jan. 17—C. H. Roth, former secretary of the Erie Tire & Rubber Co., indicted on charges of embezzlement, has retained attorneys and proposes to fight the case to the end. He pleaded not guilty when arrainged and is now at liberty under bonds of $40,000. P. F. Wills, president of the company, has also been indicted.

Bankers Take Over Control of McGraw

Losses Due to Recent Market Conditions Cause Action—Choose New Directors

CLEVELAND, Jan. 17—The Maynard H. Murch Co., investment bankers of this city, has taken control of the McGraw Tire & Rubber Co. to protect the holders of preferred stock of the company. This action was taken pursuant to a right reserved when the Murch company bought a $2,500,000 preferred stock issue of the company in August, 1919.

At the offices of Mr. Murch it was stated that the rubber company suffered severe losses from two sources as follows: First, in operation through the reduction in tire prices that followed a slump in buying; second, through the shrinkage in value in the readjustment period of quantities of fabric and crude rubber, which were bought in too large quantities on a peak market. The Murch company on taking hold of the company directed that the inventory be written down to the present market prices for all assets on hand and that all losses through contracts that the rubber company had with firms throughout the country be charged off.

In making these reductions the McGraw Tire & Rubber Co. took a loss of $2,500,000. Most of the loss came about through marking down to present prices the fabric and crude rubber that had been bought when the market was soaring. A statement prepared by accountants showed that after taking the drastic action ordered by the Murch company, the rubber corporation had $2,800,000 of quick assets to its credit, while the debts amount to $1,700,000. In addition there is a plant account of $1,500,000.

Management Unsatisfactory

The Murch company, as guarantor of the preferred stock, has not been satisfied with the management of the company for some time, and it took the action indicated in order not only to protect the preferred stockholders, but to prevent affairs getting into a worse condition. Eight of the eleven directors of the company now are men selected by the Murch company. They are Maynard H. Murch, president of the Murch company; Walter S. Quinlan, vice-president of the Murch company; George E. Randall, president of the Foote-Burt company; William H. Marlatt, Cleveland lawyer; R. V. Mitchell, of the United Securities Co., Canton; A. H. Coffin of Counselman & Co., Chicago investment bankers; M. S. Bethel, of the Murch company, and Martin Gillan of New York, who represents New York City interests.

John Morgan was elected president of the rubber company; Quinlan, vice-president; Marlatt, secretary and treasurer. The chairman of the Board of Directors will be elected within three weeks and within the next month other announcements will be made about the personnel

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Highest Court Holds Seizures Authorized

Innocence of Owners Not Involved in Volstead Violations —Can Extend Ruling

WASHINGTON, Jan. 17—Seizures of automobiles or any conveyances in which liquors are being carried contrary to law, were held authorized by the Supreme Court here to-day whether or not the owner of the conveyance has been found innocent of contravening the law.

The decision was rendered in an appeal from a Georgia court decision. An automobile loaned by J. W. Goldsmith to a friend was seized by Federal officers when found carrying intoxicants. The court held that when he entrusted his property to another he assumed the risk of loss from whatever cause it might occur.

Justice McKenna, who read the opinion of the court, went back to the Mosaic statutes for initial justification of the Government's contention, quoting from the ancient tablets that "if an ox gore a man that he die, the ox shall be stoned and his flesh not eaten."

Counsel for Goldsmith had contended that affirmation of the decision of the lower court might mean that a Pullman sleeper might be seized if a passenger carried a quart of liquor on board, or an ocean liner forfeited to the Government, if, unknown to those in charge, a case of liquor was transported in the hold.

"Whether these indicated possibilities under the law are justified, we are not called upon to consider," Justice McKenna said. "And we also reserve opinion as to whether the section can be extended to property stolen or otherwise taken from an owner without his consent."

Excessive Insurance Hurts Foreign Trade

NEW YORK, Jan. 18—The Foreign Trade Committee of the National Automobile Chamber of Commerce, has received complaints from members that marine underwriters had increased in some cases 200 to 300 per cent rates on so-called floater policies covering shipments from factory to foreign destination. The only explanation is that losses have been incurred, pointing particularly to damage by exceptionally long exposure to the weather during the freight congestion on the railroads in the past year or two.

Manufacturers feel that this risk is quite eliminated now that normal movement of freight may be expected. It was pointed out also that the underwriters distinguish only between the type of ship and the destination in fixing their rates, giving no consideration, however, to the highly important feature of boxing. Manufacturers who have developed and use a good strong package feel that they are being penalized on this insurance matter for damages occurring on inferior packages.

Many suggestions were made looking for relief from the increased insurance rates, among them the possibility of co-operative or mutual insurance among automobile manufacturers, whose foreign shipments of cars and trucks last year totalled $200,000,000. It was felt that the higher rates are particularly unfortunate at this time when foreign exchange and other conditions are tending to restrict rather than assist exports.

This whole question, together with prevailing practices of booking and forwarding shipments was referred to a sub-committee for further investigation.

Cab Company to Make New Ambassador Car

CHICAGO, Jan. 15—Passenger cars and light trucks will be manufactured in quantities immediately by the Yellow Cab Manufacturing Co. of this city, according to an announcement of the president, John Hertz. The company foi several years has concentrated its efforts on turning out 2000 cabs yearly for use in taxicab service in this and other cities.

One of the passenger cars will be known as the "Ambassador" and will be built in touring, closed, sports and imperial sedan models of 2, 4 and 7-passenger sizes. Greater production, however, will be on a 4-cylinder car, of moderate price, worked out on the "Yellow Cab" chassis. This line will consist of a 4-passenger coupe, sedan, touring car and roadster.

The trucks will include a 1-ton speed wagon and a 1¼ ton speed truck.

The cars will be exhibited at the Chicago automobile show for the first time. The "Ambassador" will be on display at the New Drake Hotel and at the show rooms of the distributers, Esch and Hammond, this city.

Manufacture of the cars and trucks will be made in the new factory of the company at Menard and Dickens streets and will mean an investment of several million dollars, according to Hertz.

COST ASSOCIATION TO MEET

NEW YORK, Jan. 17—The Industrial Cost Association whose principal office is in Pittsburgh, will hold a meeting in the rooms of the American Society of Mechanical Engineers, 29 West Thirty-ninth Street at 8 P.M., Jan. 20, to organize a New York section. Several of the national officers and directors of the Association will be present to tell of this movement. Judge Gary of the U. S. Steel Corp. has been asked to speak.

2000 SHERIDANS ORDERED

NEW YORK, Jan. 17—D. A. Burke, president of the Sheridan Motor Car Co., a subsidiary of General Motors, announces that dealer connections have been established in the principal cities from coast to coast and that dealers already have filed orders for more than 2000 cars. The 8-cylinder job probably will get on the market this month.

Hartford to Sue on Starter Patents

Car Manufacturers and Starter Makers Believed Liable by Counsel—Test Suit Ready

NEW YORK, Jan. 18—The possibility of a long list of suits against manufacturers of motor vehicles equipped with self-starters, and self-starter manufacturers for infringement of patent rights, has been opened with the award of four patents for self-starting systems to E. V. Hartford, president of E. V. Hartford, Inc., manufacturer of equipment, with a plant in Jersey City. A test suit will be started this week against a manufacturer of a standard automobile by Dunn, Goodlett, Massie & Scott, counsel for the patentee. Both the name of the manufacturer and the place of suit were withheld for the time being.

In the belief of counsel, every two unit system now on the market and in use in automobiles is an infringement on the Hartford patents in some particular. Notice of the Hartford award has been mailed this week to 230 car manufacturers throughout the country, as well as to every firm making self-starting systems.

According to counsel, the four Hartford patents as granted by the United States Patent Office on Jan. 4, this year, cover sixty-seven claims. In almost every instance these are on two-unit systems, though one or two claims are on one-unit. Applications for the patents were filed by Hartford at different times between the years 1910 to 1913. Reasons for delay in granting the patents are ascribed by counsel to the constant litigation instituted by others who had worked out similar apparatus.

Brown Motors Settlement Sought by Stockholders

MOLINE, ILL., Jan. 18—Pending the outcome of court litigation, it was voted to postpone the annual meeting of the stockholders of the Brown Motor Co. for thirty days. The litigation now before the courts involves the relationship of President Walter F. Brown to the stockholders. The postponement of the meeting was agreed to by the executive. Preliminary to the annual meeting, an effort will be made to arrange a settlement. President Brown has intimated that he would be willing to accept $15,000 for his interests in the concern in lieu of the proposed dissolution. An informal counter offer of $5,000 was proffered subject to the approval of the stockholders. It is possible that concessions will permit an amicable adjustment of the controversy. President Brown invented an internal combustion engine for motor vehicles and the company was organized to manufacture the invention in quantities. When the postponed meeting is called for Feb. 10, it is expected that the settlement will be reached.

M. A. M. A. Directors Name New Officers

E. H. Broadwell Succeeds C. E. Thompson as President—Two Changes on Board

NEW YORK, Jan. 17—Directors of the Motor and Accessory Manufacturers Association at an organization meeting following the annual session of the members elected E. H. Broadwell, vice-president of the Fisk Rubber Co., as president to succeed Charles E. Thompson, president of the Steel Products Co., who had served two terms.

Other officers elected were: First vice-president, W. O. Rutherford, vice-president of the B. F. Goodrich Co., second vice-president, A. W. Copland, president of the Detroit Gear & Machine Co., third vice-president, H. L. Horning, secretary and general manager of the Waukesha Motor Co.; treasurer, L. M. Wainwright, president of the Diamond Chain Co.; secretary and assistant treasurer, G. Brewer Griffin; general manager, M. L. Heminway.

Two new directors were elected to the board to take the places of Christian Girl and E. W. Beach. They were F. C. Glover, vice-president and general manager of the Timken Detroit Axle Co., and H. L. Horning. Other directors besides these two and the officers are: C. E. Thompson, retiring president; J. M. McComb, vice-president of the Crucible Steel Co.; G. W. Yeoman, treasurer of the Continental Motors Corp.; C. H. L. Flinterman, vice-president of the Detroit Pressed Steel Co., and E. P. Hammond, president of the Gemmer Manufacturing Co.

The annual gathering of the association this year was one of the most successful ever held and a large number of new members were elected. It has been demonstrated that the legal and credit departments are of special value to members and this work is steadily increasing in importance. The work of Sidney S. Meyers, the general counsel, has expanded to such an extent in the past few months that it has been found necessary to add materially to his staff of assistants. The efforts of the credit department are along constructive lines and every effort is being made to save companies which are solvent but hard pressed for ready cash.

The parts and accessory makers were much gratified by the results of the New York show and are as confident as the vehicle manufacturers that the tide has turned and that business will improve from now on, although the upward trend will be gradual. It is significant that the relations between car and parts manufacturers are becoming more cordial.

OLIVER RIM OFFICERS NAMED

ATLANTA, Jan. 17—Elmer Oliver was re-elected president of the Oliver Rim Co., manufacturers of a new double jointed rim for automobiles, at the first annual meeting of the board of directors held Jan. 11 in Atlanta. C. E. Gregory was re-elected secretary and treasurer, and G. C. Whittaker, Southern representative of the Truscon Steel Co., was elected vice-president. The number of directors was increased to eight, the new members of the board being W. R. Massengale and J. S. Hollins, both of Atlanta; H. W. Crouch, of Johnston, S. C.; P. A. Redmond, of Aragon, Ga. The directors re-elected are Joseph A. Blount, F. A. Seegar, Neal Meier, all of Atlanta, and R. J. Aycock, of Pinewood, S. C.

Harvester Postpones Fort Wayne Plant Work

FORT WAYNE, IND., Jan. 17—All further work on the construction of the big new motor truck plant which is to be erected here by the International Harvester Co. has been suspended for two or three months according to local officials of the company. This action was taken following a visit to Fort Wayne by Cyrus W. McCormick, Jr., works manager for the concern.

Unfavorable business conditions over the country is given by Harvester company officials as the reason. However, assurance is given that just as soon as business conditions have improved the work started here will be taken up again and will be continued without further interruption. According to the officials it is not thought that it will be necessary to suspend operations for more than two or three months.

A great quantity of material for the plant is now on the grounds. A large part of the work on the belt line railroad which will connect the plant with the local railroads has been finished.

Receiver Appointed for Superior Truck

ATLANTA, Jan. 17—An involuntary petition in bankruptcy has been declared against the Superior Motor Truck Co., manufacturers of the Superior Truck, and Federal Judge Samuel H. Sibley has named Walter P. Andrews as receiver pending the outcome of the bankruptcy proceedings. The petition followed a verdict rendered against the truck corporation in the Federal court here Jan. 12, in favor of the Beaver Mfg. Co., for $2879. The petition was instituted by Hubbard Brothers, and the Shearer Machine Co., Atlanta, and the L. C. Case Co., Boston. The truck company is alleged to owe large sums to various creditors and to be insolvent.

VICTOR ON 300 DAILY BASIS

SPRINGFIELD, OHIO, Jan. 17—President H. H. Durr, of the Victor Rubber Co., declared today that the plant has been placed on a schedule of 300 tires daily, that this number will be increased gradually and that 140 men are at work. "The situation is clearing," said he, "I expect rapid resumption of business." The company plans an extensive advertising campaign.

Sales Restriction Charged to Jobbers

Canadian Tariff Board Asked by Dealer to Dissolve Alleged Combination

OTTAWA, ONT., Jan. 15—At the tariff inquiry just held here, R. L. Phillips of Phillips & Pringle, Fredericton, N. B., charged that business in automobile accessories was being unduly restricted in Canada. He claimed that this was due to the organization of jobbers once known as the Canadian branch of the National Association of Automobile Accessory Jobbers, but now known as the Automotive Equipment Association.

He asked that consideration should be given to the question of taking action under the Criminal Code or under the Combines Act to dissolve this "trust." He requested that the products of houses manufacturing automobile accessories, and who had little or no competition in Canada, and the sale of whose goods was practically confined to members of the Automotive Equipment Association, should be placed on the free list.

He requested, further, that legislation be passed next session to provide that a judge of the Supreme Court in any province, or other suitable person, might be empowered to investigate charges that the distribution of Canadian manufactured goods was being unduly restricted.

Vermont to Develop Airway Possibilities

MONTPELIER, VT., Jan. 15—The early establishment of landing fields in Vermont to keep pace with the progress of aerial transportation was urged as a means of developing the state's resources, in the inaugural address of Gov. James Hartness.

He pointed out that in each previous stage of transportation development, Vermont had been handicapped by its lack of navigable rivers and the ruggedness of its surface which made railroading difficult and costly, but that by taking timely action the state could be on even terms with others in air transportation.

"Our cost of road construction and our ever increasing cost of maintenance will more and more force us to use the airway which is all ready for use and costs nothing for maintenance," he said. "The future growth of towns will depend in a large measure upon the alertness in making provision for safe landings for aircraft. The landing fields are practically air ports.

"By the establishment of facilities of this kind our flying service will begin without further expense. I recommend an investigation of the needs of amending present statutes or enacting new statutes for facilitating the acquisition of landing sites by towns or under proper state or town control of private initiative."

Cincinnati Prices Firm for Present

Lower Wage Rates Prevailing as Industry Resumes—Look for Good Business

CINCINNATI, Jan. 17—Optimism has the right of way among the automobile and truck manufacturers around Cincinnati. Without exception they all are preparing for an increased demand. Labor trouble is believed to be a thing of the past and the men are showing a very different attitude toward their jobs than they did last year. In none of the plants has there been any general reduction of wages, but in some of them where men who were laid off during the slack times are being re-employed, they are being cut 20 to 25 per cent in wages.

M. Schacht, of the Schacht Motor Truck Co., said they are besieged by men looking for work who are willing to take the cut made, or an even greater one if necessary, to get employment. He emphatically states, however, that any reduction of wages cannot affect the price of trucks for the present, for there has been no great decline of materials.

The United States Motor Truck Co. has made no reduction in wages and contemplates making none for the present, according to General Manager F. J. Alvin. Only efficient men now are employed in that plant and men must produce if they expect to hold their jobs. Alvin does not believe there is any possibility of reducing the price on trucks for some time under present costs of material and production.

The Sayers & Scovill Co. is operating with about 85 per cent of its normal force. They have not laid off any men, but as men left they did not fill their places. They have not made any reduction in wages and are not contemplating any for the present. The plant operates on the piece-work basis.

The Armleder Truck Co. is operating all departments, but with a reduced force. No reduction in wages has been made, but just what will be done when the plant resumes full operations has not been decided upon. Manager Woodruff of the sales department said he could not see how it would be possible to make any reduction in the price of trucks for some time.

Armleder is preparing to send a man to Europe, where the prospects for a revival of export trade are said to be growing brighter. He will go to England, France, Scandinavia, Holland, and will also look into the possibilities of India. The company is planning a big campaign for business in Cuba and preparing to go after business in Mexico.

RANGER TRACTOR ADVANCED

HOUSTON, TEXAS, Jan. 15—The selling price of the Ranger tractor-cultivator manufactured by the Southern Motor Mfg. Assn., was advanced today from $1250 to $1375. This price includes cultivator gangs.

AERONAUTICS RECORD STEADY DEVELOPMENT

NEW YORK, Jan. 15—Notwithstanding many handicaps such as lack of aerial laws, landing fields and a strong government policy, there was a steady development in aeronautics in this country last year. Among the more important events were:

Flight to Nome, Alaska and return, from Mineola, a distance of 9,000 miles in 112 hrs. flying time by four Gallaudet remodeled DH.-4-B planes piloted by officers of the army air service.

The air mail operating between New York and Washington, New York, Chicago, Cleveland, Omaha, Salt Lake City and San Francisco transported approximately 100,000,000 letters at ordinary rates.

Aerial survey of the Panama Canal Zone made by the Navy.

Coast line of Haiti mapped by the Geological Society co-operating with the Marine Corps.

World's record altitude of 33,000 ft. established by Major R. W. Schroeder in an American designed and built Packard-LePere bi-plane.

Andes Mountains crossed by Donald Hudson in a Curtiss "Wasp" at an altitude of 30,000 ft. above sea level.

Flight by a Junker monoplane from Omaha, Neb., to Lancaster, Pa., without stop.

Production by the Wright Aeronautical Corp. of a cannon motor discharging 1½ lb. shells from the propeller shaft of an airplane in flight.

Kentucky Tire Receiver Asked in Second Suit

LOUISVILLE, Jan. 17—Ink was hardly dry on an order dismissing an action for a receiver for the Kentucky Tire & Rubber Co. in the Circuit Court yesterday when another similar action was filed, and it will be necessary for the officials to make another defense.

It was alleged in the petition that the officers of the company failed to begin operation of a factory in Louisville by Jan. 1 for the manufacture of automobile tires, and that the assets of the company were being dissipated by the payment of exorbitant salaries.

In dismissing the proceeding yesterday it was stated that the officers of the company waived any claim they might have had for damages against the petitioners on account of the proceedings. Those named parties to the two suits are H. P. Dedriksen, president; W. R. White, vice president, and J. E. and O. R. Peterman and A. D. Hite.

CAMP GRANT SCHOOL STARTS

ROCKFORD, ILL., Jan. 17—Equipped at a cost of $2,000,000, the automotive school at Camp Grant is now in operation with an enrollment of 400 students in the eight departments, each with its own experts and equipment. Captain John C. Daly heads this army school, assisted by Lieut. Roderick A. Stamey.

Cleveland Retains Men at Old Rates

Reductions Made in Only Individual Instances—No Surplus of Skilled Men

CLEVELAND, Jan. 17—Cleveland automobile manufacturers are not taking advantage of present economic conditions to arbitrarily force down wages faster than the cost of living declines. Manufacturers agree that the present is an opportune time to build up a morale in their factory organizations for the future when business regains a normal condition. They agree that the morale can be built up by not taking un unfair advantage of labor at this time.

Some factories in Cleveland have reduced wages slightly, from scales that were imposed on automobile makers by abnormal conditions. Spring prices have not been made, and at this time no one could say what would be done in this respect as a result of labor conditions. There is not a surplus of skilled automobile mechanics here, although there is a surplus of semi-skilled men.

At the White Motor Co. the number of employees for January, 1921, is 6218, while a year ago the number was 5826. On Dec. 1 the men at this plant were notified that beginning Jan. 1 they would work five days a week. They had been working 49 hours a week; under the new schedule they work 45. The night force, which had been working 50 hours a week, and paid for 75 hours, was notified that in January they would work four nights one week, five nights the next week, and that they would work 10 hours a night and be paid for 15 hours. The men were notified Jan. 1 that on Feb. 1 they would work eight hours a day for four days each week, or 32 hours a week, and this proposal, as well as the first one, was gracefully accepted by the men. There has been no reduction in wages at this plant.

The Chandler Motor Car Co. is maintaining 70 per cent of its working force five days a week. This is an increase of one-half day a week over December. There is no surplus of skilled help at this plant.

Winton Reduces Some Wages

At the Winton plant they report there is no surplus of automobile mechanics, but that there is a great surplus of semi-skilled men. Some of the employees who have been retained at the Winton plant received reductions in wages ranging from 15 to 20 per cent.

At the Templar factory all employees have received a 20 per cent reduction, and in view of the economic conditions the reduction was accepted gracefully.

At the Grant Motor Car Co. there has been no reduction in the pay of old employees with the exception that the 10 per cent bonus has been taken off. All new men hired are taken on at 10 per cent less than the rates paid the old employees of the company.

$637,500,000 in Fund For 1921 Road Work

Total Available for Highways in 48 States Doubles Panama Canal Cost

NEW YORK, Jan. 17—For public highways—$637,500,000.

This is the staggering total available in the 48 States of the Union for expenditure this year on road construction. The total includes Federal, State and county appropriations. This amount is nearly 50 per cent more than was spent in ten years in building the Panama Canal and nearly six times as much as New York State spent on its great barge canal.

The amount is the largest ever made available in any one year for road building, and it is believed that with materials lower in price, labor plentiful and transportation normal, the mileage of construction will surpass any previous mark. A quarter of the total comes out of the Federal aid fund, and this source of supply will be exhausted by the beginning of 1922 unless additional funds are provided by Congress, which is not likely at this session which has "economy" as its slogan.

With such an enormous amount to be used in road building, the various agencies interested in improvement of highways are actively concerned in having it expended wisely and economically. The main purpose is to have the roads built where they will do the most good and carry the most traffic. The subject of substantial and economical construction is next in importance. One of the important factors in lower costs is found in the fact that labor is not only plentiful but cheap. Common labor for road building is available in some of the Southern States at $1.50 a day.

Army Planes to Fly Cross Country in Day

WASHINGTON, Jan. 17—The Chief of Air Service, United States Army, officially announced that on Feb. 22, 1921, an attempt will be made to cross the United States by airplane within a period of 24 hours.

The route chosen extends between Florida and Southern California. The starting point in Florida will be Pablo Beach, Jacksonville, and the starting point in Southern California will be San Diego. The former point is within the 8th Corps Area and the latter point is within the 9th Corps Area. The distance flown will be 2079 miles. There will be two participants in this flight. Lieut. Alexander Pearson, Jr., will take off from Pablo Beach, Florida, making the flight in three hops; from Jacksonville, Florida to Ellington Field, Houston, Texas, 804 miles; from Ellington Field to El Paso. Texas. 660 miles; from El Paso to Rockwell Field, San Diego, Cal., 615 miles. The participant from San Diego, whose name has not been announced, will reverse this schedule, making the flight on the same day.

It is believed that this flight will produce records of performance which will be of extreme interest in the furtherance of both commercial and military aeronautics and will be the first in history in which the United States has been completely traversed in so short a period of time.

Trucks to Be Shown at Tractor Exhibit

COLUMBUS, Jan. 15—After considering the question for some time, the executive committee in charge of the National Tractor Show, which will be held at Columbus, Feb. 7 to 12 inclusive, has decided to admit trucks to the exhibits. This action was taken at a meeting of the executive committee in Chicago recently when the Columbus committee made such a recommendation. Attending the meeting were W. J. Longbon, chairman of the local committee and E. E. Whaley, manager of the show.

The space to be allotted to truck manufacturers will be plotted in the near future and contracts for space will be closed. This space is somewhat limited, although very desirable and is located in the Coliseum, which is the central building used for the show. There will be space for from 30 to 50 trucks.

This action of the committee meets with the approval of many people who have urged that trucks, especially those used for farm work be admitted to the show. It was urged that since the teachings of the show is the motorization of the farm, trucks could not be excluded.

Army Develops Machine to Test Brake Linings

WASHINGTON, Jan. 17—The Engineering Section, Motor Transport Division, in connection with the Bureau of Standards, has developed a machine for testing brake-lining. Manufacturers of brake-lining who may be interested are requested to send ten feet of ¼ x 2-in. of their standard lining to the Motor Transport representative at the Bureau of Standards. These samples are to be sent by Parcel Post, prepaid, and addressed to R. B. Burton, Motor Transport Representative, Room No. 238, Industrial Building, Bureau of Standards, Washington, D. C. Any communications regarding the tests should be addressed to the Motor Transport Depot, at Camp Holabird, Md.

RENTZ SPARK PLUG FORMED

ATLANTA, Jan. 17—The Rentz Spark Plug Co., manufacturers, has been organized and incorporated in Atlanta with $500,000 capital, by W. C. Rentz, P. H. Orr, Asa G. Candler, Jr., John S. Hurt and George D. Webster. The company will establish a large plant here for the manufacture of the Rentz spark plug, invented by W. C. Rentz.

New York Road Plan To Increase Car Tax

Responsibility for Maintenance Means Addition of $1,000,000 to Present Rates

NEW YORK, Jan. 17—Through the placing of responsibility for the maintenance of New York State highways solely upon motor vehicle owners, as advocated by Governor Miller and as expected to be approved by the Legislature, an additional burden of at least $1,000,000 in taxes will devolve upon owners. This is the estimated difference between road upkeep expense and the present return from motor vehicle sources.

Legislative sanction will be accorded the plan outlined by Governor Miller in his first message to the lawmakers, according to Senator Charles J. Hewitt, who has been named chairman of the Senate Finance Committee.

"A slight increase in horsepower rates on each passenger car will make up the required revenue," Senator Hewitt said. "I also believe that motor trucks should bear their part in the contemplated increase in proportion to that saddled upon passenger car owners. Trucks have never borne their share of the motor vehicle tax."

During 1920, automobile owners paid about $9,000,000 to the State for licenses, etc. One-fourth of this was turned back to counties, as provided by law, for county road work. About $7,500,000 was spent by the State Highways Department in maintenance work. Maintenance for the fiscal year had been estimated at $15,000,000, but this will be reduced by the Legislature in view of the proposed method of raising the fund.

YOUNGSTOWN CARRIAGE SOLD

YOUNGSTOWN, Jan. 17—Sale of the buildings, land and fixtures of the Youngstown Carriage Co., to the Henderson-Overland Co., has been completed. The price was about $300,000. Possession will be given to the purchaser April 1. The Youngstown Carriage Co. sold Studebaker passenger cars and Federal trucks. These lines have not been placed with new representatives. The Henderson-Overland Co. is distributer for the Willys-Overland line of passenger cars, the Handley-Knight, and the Garford truck. It will continue these lines.

PUMP COMPANY RESUMES WORK

FORT WAYNE, IND., Jan. 17—Operations at the Wayne Oil Tank & Pump Co. were resumed today with about three-fourths of all the employees on duty. About 150 workers will continue to remain idle until repairs and moving of machines at the plant are completed. It is expected that these workers will be given employment in a short time. The company manufactures tanks and storage systems for filling stations, etc.

Tractor Show Topics Cover Many Points

Noted Experts on Agriculture to Speak to Farmers at Columbus Exhibit

COLUMBUS, Jan. 17—The most comprehensive educational program ever arranged for a large gathering of American farmers will be the main feature of the coming National Tractor Show, which will be held in Columbus Feb. 7 to 12 inclusive. Farm problems of every kind and every phase of tillage of the soil will be touched upon during the show in the educational program. Methods of handling, caring for and repairing farm machinery will also be touched upon at the meetings.

The men selected to explain the various farm questions are authorities in their lines. One of the speakers will be F. I. Mann, of Gilman, Ill., a brother of Congressman Mann on "Soil Conservation," Hammond Olney of St. Joseph, Mo., editor of "Power Farming," will speak on "Adapting the Farm and Farm Business to Power Farming."

"Factors Which Determine the Type and Size of Tractor to be Purchased" will be explained by I. W. Dickerson, Charles City, Iowa, editor of the Agricultural Engineer. "The Modern Trend of Tractor Design," is the subject to be treated by J. B. Davidson of the Iowa State College, Ames, Iowa. Prof. O. W. Sjogren of the College of Agriculture of Lincoln, Neb., will talk on "Ignition Troubles and Their Remedies." "Tractor Hitches" will be explained by Prof. Daniel Scoates of A. & M. College, College Station, Texas.

Two Ohio State University professors will be on the program. They are G. W. McCuen and F. W. Ives. The former will lecture on "Lessons to be Learned from a Tractor Survey in Ohio" and the latter on "Housing the Tractor and Tractor Tools."

Purdue University is sending Professor William Aikenhead who will talk on "The Tractor and Belt Power" and Pennsylvania State College is sending Prof. R. U. Blasingame to talk on the "Advisability of Purchasing Tractors and Tractor Tools in Community Groups." F. W. Duffee, a former student at the Ohio State University will explain "Laying off the Field for Plowing." Practical farmers will also be on the program and it is planned to have general round-table discussions of all questions pertaining to farming and tractors.

DART TRUCK NAMES OFFICERS

WATERLOO, IOWA, Jan. 17—The following officers have been elected by the directors of the Dart Truck & Tractor Corp., President, C. C. Wolf; vice-president in charge of engineering, W. H. Johnson; vice-president in charge of sales, M. D. Herron; secretary, G. J. Bondurant. The company still is in limited production but reports showed that prospects are bright for 1921.

ROLLS-ROYCE TOASTS FIRST AMERICAN CAR

SPRINGFIELD, MASS., Jan. 17—A dinner was given by the officers of Rolls-Royce of America, Inc., to the foremen and heads of departments to celebrate the completion of the first chassis built in the plant here under English supervision. The chassis now on test is American built even to the radiator. Preliminary operations were begun at the American works on July 12 and have been almost constantly under way since that time. The company now has on hand in this country more than $1,500,000 worth of unfilled orders. The dinner was attended by about 50 of the English experts in charge of production. L. J. Belnap the president, was toastmaster.

Elwood Company Formed to Build New Tractor

MADISON, WIS., Jan. 15—Production on a new design of two-wheel tractor will shortly be started by the Elwood Tractor Co. of this city. The designer is C. D. Elwood, who has long been connected with the farm machinery business, having represented the McCormick company, Parlin & Orendorff and the American Seeding Machine Co. in Canadian territory. In 1908 he was with the Hart-Parr Co. In the fall of 1914 he began a course of study in mechanical engineering at the University of Wisconsin.

The Elwood machine is similar in appearance to the Moline Universal and the Allis-Chalmers small model. Development work on the tractor has been going on four years and the last model built is the ninth. Madison has not yet been definitely selected as the location for the factory.

The officials of the company are W. H. Heddles, president; C. D. Elwood, vice-president; H. A. Burd, secretary and treasurer.

LEONARD BUYS HEGGIE PLANT

GRIFFITH, IND., Jan. 17—Leonard Tractor Co. of this city, has purchased the James C. Heggie & Sons Co. plant in Joliet, Ill., and will manufacture a four wheel drive farm tractor. The plant at Griffith will be removed to Joliet at once and it is hoped to start production early in the spring. H. M. Leonard, inventor of the tractor, is president and general manager of the company. His headquarters are at Gray, Ind., and he was formerly connected with the Jackson Automobile Co., and also was special engineer with the Lewis Truck Co. In 1914 he designed a truck for the Duplex Truck Co. F. E. Parks and A. A. Parks, both of Joliet, are interested in the company and will assist in the financing. John Hurlburt of Gary, Ind., is secretary-treasurer. When in full operation the plant will produce five machines per day.

Maxwell Concurs in Creditor's Suit

Petition Filed by Jenks & Muirs in Suit for $6,064 Accepted by Company

NEW YORK, Jan. 18—The Maxwell Motor Co., Inc., has concurred with petitions filed by the Jenks & Muirs Mfg. Co. of Detroit for an injunction restraining creditors from interfering during the pendency of a suit for the recovery of $6,064 as well as for the establishment of claims of creditors and assets. The action was filed in United States District Court in Detroit.

In the bill of complaint the manufacturing company states that about 150 other creditors hold claims against the Maxwell company. These claims approximate $4,000,000, the petition states, and it is added that other indebtedness in the form of loans brings the company's total liabilities to $16,000,000.

The petition states that the Maxwell company has assets aggregating more than $25,000,000 but that this cannot be converted into cash at this time without great loss. The plaintiff contends that the immediately realizable assets of the Maxwell company are not sufficient to meet the claims of creditors.

There has been considerable speculation as to why the company has concurred with the petition, but no statement has been forthcoming from the management committee which recently declared operative the plan for a consolidation of the Maxwell and Chalmers company. Not all the stock of the Maxwell company has been deposited under this plan. It is understood there are outstanding about 20,000 shares of the second preferred stock and about 31,500 shares of the common stock.

Persons familiar with the affairs of the Maxwell company believe it possible that this suit may be designed to force the owners of the outstanding stock to give their consent to the plan under penalty of being excluded entirely from its benefits. It is not believed the suit will have any effect upon those stockholders who have assented to the plan.

BERGOUGNAN COMPLETES PLANT

TRENTON, N. J., Jan. 14—Construction work has been completed on the new factory units undertaken several months ago by the Bergougnan Rubber Corp. and it now has one of the most modern and complete tire plants in the East. The work was continued notwithstanding the slump in the tire market. The plant will produce pneumatic tires for passenger cars, motor trucks and motor cycles as well as inner tubes for its tires. The company has invested several hundred thousand dollars in enlarging the factory, machine shop and storage facilities. Provision has been made for the comfort of the employees and the new building includes an up-to-date cafeteria.

Congress Considers Revision of Tariff

N. A. C. C. Committee Heads Show Possibilities of Foreign Trade Development

WASHINGTON, Jan. 14—Establishment of a uniform tariff rate of 30 per cent on automobiles and a national policy of reciprocal relations were advocated to-day by J. Walter Drake, chairman of the foreign trade committee of the National Automobile Chamber of Commerce at a hearing before the House Ways and Means Committee. The proposal for a revision of the tariff downward and reciprocity aroused great interest in Congress because practically all other industries were demanding higher rates as a protection against foreign competition.

Though it is quite too early to predict the action of the Ways and Means Committee, indications were that the Committee had been impressed with the proposition that the tariff duty on the higher priced cars should be reduced from 45 per cent to a basis of 30 per cent, which now prevails for the lower priced automobiles. Drake made it clear that the revenues would not be reduced as a result of this proposed cut in rates, but on the contrary, would stimulate importations of the higher priced automobiles.

"The imports of high-priced cars during 1920 amounted to 6 per cent," Drake said, "and those of lower priced motor vehicles to 94 per cent of total automobile imports. According to numbers there were 50 high-priced and 654 low-priced cars. The revenue from the former was $99,305 and $153,986 from the latter.

"The smaller number consisted of automobiles selling in the country of origin at more than $2,000.

"Reason for smaller imports of that type of vehicle may be ascribed to higher United States duty. With a uniform duty of 30 per cent, however, the imports of higher priced cars will proportionately increase, and consequently result in higher revenue. Despite the fact that this measure may directly affect their interests, American manufacturers of high-priced cars are adherents to this policy, believing it of general benefit.

Can Change with Conditions

He pointed out, however, that the present recommendations have to do only with existing economic conditions and does not necessarily foreclose the automotive industry from advocating a rearrangement as conditions warrant.

According to the chairman of the N. A. C. C. foreign trade committee, stabilization in the industry must be brought about by the cultivation of foreign markets.

"At the present time," he said, "the export trade is considerably hampered by great depreciation in foreign exchange. To afford manufacturers in countries with depreciated currency opportunity to sell their products in the United States will tend to right this condition. Although it is fully realized that the increased imports of automobiles, even if the duty on high-priced cars is reduced, will not be such as to materially improve the exchanges, still even minor influences of this kind, if multiplied in other trades that will not be greatly affected thereby, are certain ultimately to bring about the desired results."

Chairman Fordney manifested considerable interest at the mention of the retaliatory measures adopted by the French last summer. Various committee men questioned the witness about this phase of foreign trade of the automobile industry.

Cites Action by French

That favorable results from a uniform duty may be expected, it was said, is shown in the action of the French automobile manufacturers, who informed their government that the English, Belgian, Italian and French syndicates had collectively voted for a uniform tariff of 33-1/3 per cent. This duty was to apply to all automobiles imported into and from any of the countries that entered into the agreement. The French Ministry, however, cited the United States tariff of 45 per cent on automobiles of over $2,000 in value, and fixed the French duty at that rate on automobiles of the type most exported from the United States. It also added that a further reduction may follow if American duty should later be reduced.

The Committee was informed that American cars represent the greatest value for every dollar of cost. Statistics were submitted showing the differences in prices and horsepower of representative American and foreign machines. The data stressed the fact that the advantage remained with American manufacturers.

Drake further contended that reciprocity was essential for the expansion of American foreign trade. He stated that a uniform rate and reciprocal relations would stimulate trade in that the rate would apply to motor vehicles from such countries only as grant equality of treatment for American products.

As to the advantages of reciprocal measures, the committee was advised that wherever countries discriminated against American trade, there should be applied additional duties to be determined by law or expediency. Drake suggested that the President should have the power to ascertain what countries discriminated against the United States in tariffs and take protective measures.

Aluminum Tariff Opposed

Opposition of the automotive industry to proposed increases in tariff duties on aluminum, was made known to the Ways and Means Committee by G. A. Bauer of the N. A. C. C. foreign trade committee. He declared that automobile manufacturers were the largest individual users of aluminum and higher tariffs would mean adoption of cheaper substitutes.

Treasury Revises Excise Tax Clauses

Change in Computing Retail Tax —Define Overpayments— Simplify Export Rulings

(*Continued from page* 137)

can be manufactured only for such dealer or jobber and that it will be sold by such dealer or jobber as the manufacturer, the dealer or jobber is held to be the manufacturer for the purpose of the tax.

Revision of Article 34 allows the manufacturer who sells both at wholesale and retail to arrive at the basis of tax with respect to retail sales. The law provides that in such a case the manufacturer may base the tax on a retail sale on the price for which like articles are sold by him at wholesale. The revised regulations permit the manufacturer to arrive at this average by taking his actual wholesale sales for a given month and using this average until such time as his records show a material change.

Article 41 has been amplified to define in detail the difference between an "overpayment or overcollection" as distinguished from an "illegal or erroneous" payment or collection. The law permits a taxpayer to take credit for an overpayment or overcollection whereas an illegal or erroneous payment or collection must be recovered through a claim for refund of the excess payment.

Articles 42 and 43 have been practically rewritten with a view to simplifying them. Under Regulations 47, Revised, an article is regarded as having been sold for export if the manufacturer has in his possession at the time title passes or of shipment an order or contract of sale or document incidental thereto, or a certificate from the purchaser to the effect that the article is to be exported prior to use, re-sale, or further manufacture in the United States. This is held sufficient proof that the article in question is sold for export and provides temporary exemption from the payment of tax for a period of six months.

Must Submit Proof of Export

Before expiration of this six months period in order to establish the fact that the article in question has been exported in due course it is necessary for the manufacturer to have in his possession certain proof of exportation, which shall consist of a certificate of exportation filed with the manufacturer by the purchaser or in the case of a direct exportation by the manufacturer, of a copy of the export bill of lading or a certificate of the export carrier showing exportation of the article. Where such proof of exportation is not furnished within such period of six months it is necessary for the manufacturer to pay the tax on the article in question, and if subsequently the proof of exportation in due course is furnished, the manufacturer may make claim for refund of the amount of tax so paid.

Truck Sales Backed by New Corporation

Manufacturers Trust Organized in Chicago with $10,000,000 Capital to Aid Dealers

CHICAGO, Jan. 15—As a solution of the financing problems of the motor truck manufacturers on which David Thomas, general manager of the Motor Truck Manufacturers Association, has been working for some time, the Manufacturers Trust, a $10,000,000 finance company, has been organized here with Col. C. R. Vincent of the Vincent Trust of this city as president.

Although the company has been formed largely through the instrumentality of Thomas as general manager of the association, his aim being to obtain "methods of financing that would be sound and flexible enough to meet all the requirements of the motor truck manufacturer who is conducting his business on a sound safe basis," it is in no way connected with the Motor Truck Manufacturers Association itself.

The methods by which the Manufacturers Trust hopes to attain its purpose of meeting the reasonable financial requirements of the motor truck business from the manufacturer to the user are co-operative but the amount of stock the manufacturer may purchase has been limited to $15,000 or 1500 shares of a par value of $10. This has been due to the feeling that the manufacturer can well use his money in the manufacturing end of his business and that to require him to place a large amount in a finance company to finance his time sales would be like requiring him to "raise himself by his own boot straps."

The finance committee of the company, which passes upon the soundness of every undertaking, is composed entirely of bankers so that no partiality may be shown the manufacturers who may be stockholders in the company.

The position of the dealer is explained in this wise:

Dealers Afforded Wide Benefit

"The local bank is the corresponding bank which passes on any transaction between the local dealer and the user involving the Manufacturers Trust, this, of course, with a complete knowledge of the methods and policies of the Manufacturers Trust. In this way the local dealer wherever he may be located is afforded the benefits of a local finance company plus the facilities of a big company doing business nationally.

"The dealer of the manufacturer who has stock in the Manufacturers Trust is encouraged to buy a small amount of stock in the Manufacturers Trust more as evidence of good faith than anything else, unless it be the stabilizing influence that the convention might have upon the dealer himself and the closer relationship which this investment encourages between the dealer and the manufacturer."

TO OPERATE TRUCKS ON RAILWAY TRACKS

WINCHESTER, VA., Jan. 15—The Winchester & Western Railway Co., whose line from this city to Wardensville, W. Va., is almost completed, has successfully worked out a plan whereby powerful motor trucks, equipped with flanged wheels will be used instead of steam locomotives.

The passenger and freight trains will be shorter than those usually hauled by steam power, but there will be more trains. Practical tests recently made with a small automobile led the officials of the company to experiment with powerful trucks, and the scheme has been found to work admirably. Trains will be running into Wardensville within a month, it is declared. That town has assumed a "boom" atmosphere.

Studebaker Produced 52,000 Cars in 1920

SOUTH BEND, IND., Jan. 17—The Studebaker Corp. turned out 52,000 motor cars in the year ending Dec. 31. Its best previous production was 38,300 cars in 1919. The company reports that the total of unsold cars on hand is only 1600 or about two weeks supply. Both the South Bend and Detroit factories have resumed operations on the basis of an output of 800 cars a week equally divided between the two plants. The company will devote its efforts exclusively to the manufacture of automobiles, having disposed of its old farm wagon business to the Kentucky Wagon Co. of Louisville, with the right to use the Studebaker name for two and a half years.

Nash Boosts Output to 40 Cars Daily

KENOSHA, WIS., Jan. 14—Former workmen to the number of 2000 have been re-employed by the Nash Motors Co., which has been operating with a greatly reduced force. Its output is now forty cars daily, and it is planned to return to normal as quickly as conditions warrant it.

DUTY MOTORS TO MAKE TRUCK

CHICAGO, Jan. 15—The Duty Motor Corp., which has been incorporated for $500,000 under the laws of the State of Illinois, is manufacturing a 2-ton capacity truck which sells for $1,490, and is contemplating the erection of a large factory in the early spring in Greenville, Ill., to increase production. The following have been elected officers of the corporation: President, W. H. Ruther; vice-president, W. J. Gubser; secretary-treasurer, J. P. Snowden, and sales manager, Paul Harnetiaux.

Half of Car Sales on Part Time Basis

Acceptance Corporation Statistics Show Necessity of Credit—Farmers Aided Most

NEW YORK, Jan. 17—Statistics gathered by the General Motors Acceptance Corp. through the issuance of a questionnaire to dealers show that between 45 and 50 per cent of all automobiles being sold in the United States today are marketed on some deferred payment system. This is considered the first authoritative figure issued covering this difficult point. The replies from dealers covered sales of 149,136 cars of which 69,729 were sold on time.

The period for which the questionnaire asked information was that from Aug. 1, 1919, to July 31, 1920, and therefore includes the latter half of a summer selling season, the following fall, winter and spring seasons, and the first half of the succeeding summer. Selling conditions over a full yearly cycle are thereby exemplified.

City dwellers paid cash more frequently than farmers, only 44.9 per cent of urban sales being on credit arrangements, while 48.2 per cent of new cars delivered to farmers were on time. On trucks 53 per cent of those sold in cities were financed while 59.9 per cent were financed of those sold to farmers. Maximum time allowed to city dwellers on deferred payment sales averaged 9.3 months and to farmers, 11.1 months. The average down payments on all deferred payment sales was 40.3 per cent of the cash selling price.

Commenting on the statistics, the corporation asserts that by more intensive use of deferred payment facilities the automobile industry may be able to increase its sales by approximately 25 per cent. This is based on the estimate by economic experts that 25 per cent of the industry's production always will be sold for cash.

Bankers Take Over Control of McGraw

(*Continued from page* 138)

of plant executives. The McGraw Tire and Rubber Co., was organized in 1910 and until the present time it had been prosperous, paying to stockholders approximately 88 per cent in cash dividends and 86 per cent in stock dividends. The present capitalization is $2,500,000 of preferred stock and 100,000 shares of no par value common.

The action taken is expected to strengthen the position of preferred stockholders, assure a vigorous and businesslike management and the prediction was made that the company will come through O. K. E. S. McGraw, one of the organizers and for many years head of the corporation died a year ago and Morgan succeeded him as President.

Unsecured Creditors Delay Goodyear Plan

Highly Optimistic Reports on Rehabilitation of Company Considered Premature

NEW YORK, Jan. 19—Conferences of representatives of the various banking groups which are interested in the reorganization of the Goodyear Tire & Rubber Co. are being held here almost daily, but one of the leading factors in the refinancing program declared to-day it was impossible to forecast accurately what the result would be, although everyone concerned was hopeful a solution satisfactory to all would be worked out.

Highly optimistic reports, which have been current in financial circles the past few days, are somewhat premature. The chief stumbling block to the success of the negotiations is the attitude of the merchandise creditors. A large banking house has agreed to underwrite an issue of first mortgage bonds which it has been proposed to issue for the further protection of secured creditors. In connection with this proposal is another to issue junior securities in the form of 20 year debentures and first preferred stock to the unsecured creditors. This plan is not satisfactory to a large proportion of those to whom bills for merchandise are payable. It is intimated, however, that unless this offer is accepted the only alternative is a receivership under which the merchandise creditors would have to take what they get.

Several new banking houses have been brought into negotiations, including J. P. Morgan & Co., and bankers who are interested in other tire companies are lending their aid because of the sincere desire to keep Goodyear out of the courts. It is realized that a receivership would have a bad psychological effect upon the entire industry.

Most of the conferences are being held in the offices of Paul D. Cravath, and they are being attended by bankers not only from New York but from Cleveland, Pittsburgh, Chicago and other cities. Among the participants are Charles H. Sabin of the Guaranty Trust Co., and James S. Alexander of the National Bank of Commerce of this city.

A definite decision must be reached before Feb. 15, when Goodyear must pay \$18,000,000 to the banking syndicate headed by Goldman, Sachs & Company.

G. M. TRUCK INCREASES OUTPUT

PONTIAC, MICH., Jan. 17—At the present time the General Motors Truck Co. in Pontiac is employing more than half of the normal working force and the number of men will be increased steadily as conditions warrant it. According to general manager, W. L. Day, the company will probably be in production on its five models in March. Production is now about nine a day on one light truck and in February production will be started on a second light truck.

Report Vim Bought by Standard Steel Car

PHILADELPHIA, Jan. 19—The Vim Motor Truck Co. has been reorganized and taken over by responsible financial interests. No announcement has been made as to the details of the transaction but it is understood the company has been purchased by the Standard Steel Car Co., which has plants at Butler and New Castle, Pa., and Hammond, Ind.

The Vim company resulted from a reorganization in 1915 of the Touraine company, which produced the Vim delivery cars. The company has devoted itself to the manufacture of commercial vehicles.

G. M. C. Makes Changes in Executive Personnel

NEW YORK, Jan. 17—At a meeting of the directors of the General Motors Corp. last Thursday, the resignation was accepted of W. C. Durant as a member of the finance committee and as a member and chairman of the executive committee.

The executive committee was designated as follows: P. S. du Pont, chairman; J. J. Raskob, J. A. Haskell and A. P. Sloan, Jr.

The resignation was accepted of F. W. Hohensee as a director, vice-president and member of the executive committee.

F. D. Brown was elected a member of the finance committee.

C. F. Kettering was elected a vice-president. A. H. Swayne was elected a director and vice-president.

Lewis Named Chairman of Tire Maker's Section

NEW YORK, Jan. 19—The tire manufacturers division of the Rubber Association of America has elected as its chairman Seneca G. Lewis of the Pennsylvania Rubber Co. and Joseph C. Weston of the Ajax Rubber Co., vice-chairman.

H. J. Zimmerman of the B. F. Goodrich Co., has been elected chairman of the traffic committee of the Rubber Association with A. D. Phillips of the Fisk Rubber Co., as vice-chairman.

C. W. Wilson of the Dural Rubber Corp. has been made chairman of the foreign trade division, with R. H. Daniels of Goodyear, as vice-chairman.

SIMPLEX RE-NAMES OFFICERS

CADILLAC, MICH., Jan. 17—The Simplex Wire Wheel Co. has re-elected the old board of directors and officers: President, J. P. Wilcox; vice-president, W. E. Curry; secretary-treasurer, J. C. Ford. The other directors are J. B. Wagner, W. A. Kyser, C. B. Smith, C. A. Saunders, George J. Sandel and C. F. Williams. The concern was formerly the Kolben Wheel Co., Detroit.

Interlocking Tire in Receiver's Hands

Stockholders and Minor Officers Join in Petition Alleging Mismanagement

AKRON, Jan. 15—Elihu Harpham, prominent Akron real estate operator, today took charge of the affairs of the interlocking Cord Tire Co. of Akron and Mogadore, following his appointment as receiver by Judge W. I. Ahern in Common Pleas court, on petition of several stockholders and minor officers of the company. They charge mismanagement and alleged fraudulent work upon the part of certain officials of the company. This petition is signed by shareholders, including E. E. Ammons, vice-president of the company; Walter G. Scott Herman; Gustave J. A. Gibson and W. Dorn.

The petition contains the allegation that the company attempted to buy real estate in Mogadore for its new plant without legal action upon the part of its directors and that the value of real estate is carried on the books at \$38,000 while only \$16,000 was paid. Charges also are made that bills and accounts receivable are listed at over \$63,000 while not more than \$30,000 can be actually realized on them; that the company's books show products valued at \$100,000 while the actual value thereof will not exceed \$50,000 and that the company is delinquent to the extent of \$8,000 in payment of wages and salaries to employees.

The petitioning shareholders further charge that officers of the company have received rebates on contracts awarded for construction of company buildings and that they have spent approximately \$115,847 as commissions on sale of stock. The company recently completed a new plant at Mogadore. The firm is capitalized for \$1,000,000 of which \$310,000 remains unpaid on subscription lists.

Walter Kline is president of the company.

Harpham was directed to-day to conduct an immediate audit of the company's books to determine the exact amount of assets and liabilities. The plant at Mogadore has been closed for several days due to shutting off of power by the Northern Ohio Traction and Light Co. through failure of the company to contract for power, the shareholders charge in their petition.

BULL TRACTOR REGAINS FUNDS

INDIANAPOLIS, Jan. 19—At a hearing held Jan. 12 before Harry C. Sheridan, referee in bankruptcy in the case of the Bull Tractor-Madison Motors Corp. of Anderson, the Royal Indemnity Co. of New York was ordered to pay to Fred Dickson, trustee of the corporation, \$15,000 deposited with it at the time the Bull Tractor Co. and the Madison Motors Co. were consolidated. The money was deposited by the tractor company to cover any revenue taxes incurred by the Madison company before the consolidation.

INDUSTRIAL NOTES

Automatic Products Corp. has succeeded the Tock Screw Machine Products Corp., taking over its assets and assuming its liabilities. There will be no change in personnel and the business of the company will be carried on as heretofore.

Robertson Resilient Wheel Corp., New York, has taken a long lease on space in the Armour Postal Station Building, Chicago, and will occupy it as general office of the company, about Feb. 1.

Mercury Body Corp. has been organized at Louisville, Ky., to build automobile bodies. A plant soon to be built will have a capacity for 6000 bodies a year, constructed under a new process.

Duesenberg Automobile & Motors Co. plans for the Indianapolis factory have been approved by Fred Duesenberg, vice-president and engineer, and construction will soon begin.

Cleveland Tractor Co. has opened a district sales office in St. Louis with S. C. Mitchell in charge. Territory covered borders the Mississippi from Illinois to the Gulf.

F. D. Wilson has been elected president of the Wilson Tractor Co., formed by him to build tractors at Ottumwa, Iowa. He was formerly with Deere & Co.

American Power Shovel Co. has removed its offices from Chicago to Milwaukee, where the main manufacturing activities of the company are centered.

Port Houston Tire & Rubber Co., Houston, Texas, has taken over the plant and property of the Universal Tire & Rubber Ass'n.

Master Rubber Co., Dayton, Ohio, has resumed operations with its full force of employees after a six-week layoff.

Sewell Cushion Wheel Co. showed an increase in business in 1920 of 61 per cent over the previous year.

Automatic Safety Tire Valve Corp. beginning Feb. 1 will handle sales direct from its New York office.

Pioneer Truck Co., Chicago, has had plans prepared for a $500,000 factory building at Valparaiso, Ind.

Willys-Overland Co. will re-open the Toledo plant Feb. 1 on a schedule based upon current sales.

Advertising Clubs Rap Wizard Car Advertising

NEW YORK, Jan. 18—Advertising of the Wizard Automobile Co., Charlotte, N. C., is branded as a flagrant offense against truth by the national vigilance committee of the Associated Advertising Clubs of the World, in a special bulletin issued here. The bulletin asserts that the company claimed enormous profits before a single car was produced and that a large outlay for factory and equipment was made before the design of the car was perfected.

A concern known as the Manufacturers' & Exporters' Alliance, which the Wizard company is reported to have said would take presumably 10,000 cars in 1921, was investigated by the vigilance committee and it declares it found no ground for great confidence in its financial responsibility. Charles F. Hamel, said by the vigilance committee to have been president of the Cyclomobile Co., Toledo, is declared by the committee to be sales manager of the Wizard company.

F. W. Edwardy, Sr., president of the company, is asserted by the vigilance committee to be a professional promoter with no experience in manufacturing automobiles. F. W. Edwardy, Jr., secretary and treasurer, is found by the committee to be unknown to officers of the Packard and White companies, with whom, it is asserted, he claimed previous employment.

Dodge Officers Named to Higher Positions

DETROIT, Jan. 17—While officials of the Dodge Bros. do not yet know when the plant will be re-opened, it is nevertheless expected that an announcement will be made within the next few days. It is very possible that the company will again be in production sometime during the first few days in February.

Further promotions have been made among officials of Dodge Bros. Arthur T. Waterfall, who was assistant general manager, retains this title and becomes also vice-president of the company. Harry V. Popeney has been made secretary and Reginald J. Fry assistant secretary. C. W. Matheson, who was acting general sales manager, is now made general sales manager.

The board of directors of the company is now made up as follows: Howard B. Bloomer, chairman, and Frederick J. Haynes, Arthur T. Waterfall and John Ballantyne.

Truck Line to Carry Crops to Los Angeles

NEW YORK, Jan. 17—Results of an experiment in motor transport service which is to be undertaken by the recently formed California Rapid Transit Co. on the Pacific Coast are being awaited with interest by motor truck circles. The company plans to operate a fleet of twenty Mack trucks in the Los Angeles Valley on four routes covering the entire fruit and produce belts in this territory. The trucks are to be specially built to carry fruit, vegetables, milk and merchandise of various sorts.

The routes projected are from Los Angeles to Redlands, from Los Angeles to Mecca, from Los Angeles to Alessandro and from Los Angeles to San Bernardino, with stops at all intervening towns and cities. It is expected that trucks will be in operation by July.

RAMBLER TIRE RECEIVER NAMED

NEW YORK, Jan. 19—Federal Judge Hand has appointed receivers for the Rambler Tire & Rubber Co. in a suit brought by a creditor with a claim for $3,500. The company was organized under Delaware laws in 1920 to manufacture tires and rubber goods. Its liabilities are $28,872 and its assets $60,690. It is asserted that the company is solvent but that it has no working capital and is unable to meet current obligations.

METAL MARKETS

IN some of the markets for raw, semi-finished and finished metal products the buyer is once more confronted with a dual set of prices. The disparity in prices this time is not between producer and producer. There is one market for iron and steel and most of the non-ferrous metals in which the buyer with the requisite ready cash wields the power of an autocrat. This is the market for material now ready for delivery and eating up warehouse space and interest on the value it represents. The other market is that for material which must first be produced. In the latter sellers' views as to what prices they must obtain, in order to make both ends meet, are firm as compared with the former. It was reported in the trade the other day that a sales agency offered 5000 tons of No. 2 plain foundry iron at a furnace base of below $30 a ton, without being able to find a taker. This was, by no means, "resale" iron, as that term is commonly understood. The holder was to all intents and purposes the producer who, in all probability, would have balked at booking an order for a similar tonnage at below $30, if he had to undertake production of the iron in the course of the next few weeks. It was also reported that a producer had sold 1000 tons of sheet bars at $45.50, or $1.50 a ton below the Corporation's price. Undoubtedly this "cut" price applied to a specific tonnage all ready for shipment which the producer was anxious to turn into cash. There are no indications that independents are disposed to pare the Corporation's price levels on material that must first be made. With the possible exception of lead, all non-ferrous metals can be bought cheaper for spot than for deferred maturities. In other words, there is a very pliable price for pig iron, metals and steel products that producers are now holding pending the appearance of buyers, and there is another set of prices for future production. The latter is not so easy to be budged as the former. Then, of course, there is, in addition, a certain amount of actual "resale" material in the keeping of "second hands," but the latter tonnages are comparatively light. That automotive purchasing agents are rather apathetic is to be seen from the fact that the pleas of American aluminum and alloy steel producers for higher import tariffs is not causing any haste to cover anticipated requirements at present price levels.

Pig Iron—Quotations in the trade press are far from being a guide to prices at which sizable tonnages can be obtained. Individual negotiations govern in each case. Most buying, however, is in carload lots.

Steel—A somewhat better demand for cold finished steel bars is ascribed to improvement in the automotive industries. The market for hot and cold rolled strip steel is steadying. Fresh sheet buying is of light proportions.

Aluminum—Foreign metal is still offered at 25 per cent below the reported spot price of the producer of American virgin. So far the possibility of an advance in the market through increased import duties has not engendered any buying activity.

Copper—Prediction of an 18c. market by the sales manager of a leading interest is taken no more seriously than was that made, last year, by John D. Ryan when he prophesied the return of 23c. copper. Much of the surplus is being taken off the market, however, by exports.

FINANCIAL NOTES

Fisher Body Corp. proposes to issue five shares of new common stock of no par for each share of present stock and to increase its common stock by an amount sufficient to make the exchange for Fisher Body Ohio Co. stock. The corporation will give one of its no par common shares for each common share of the Ohio company plus $2.50 in cash, provided at lease 40,000 of the 45,000 shares publicly held accept the offer. The Fisher company already owns 55 per cent of the Ohio company common stock. The corporation will then guarantee full payment on the Ohio company preferred stock by July 1. 1922, of all accumulated dividends to Jan. 1, 1921 and quarterly dividends to July 1, 1922.

Packard Motor Car Co. directors have deferred payment of the common stock dividend usually payable Feb. 1. F. R. Austin, secretary, said the company's accumulated surplus and cash position warranted payment but the deferment was decided upon in view of the disturbed business conditions.

Root & Van Dervoort Corp. has reduced its liabilities by $1,000,000 since July and for the next six months expects to eat into both inventory and floating debt in good style. The company is now devoting itself exclusively to the manufacture of automobiles.

Wire Wheel Corp. of America has notified stockholders that the payment on Jan. 1 of a 2 per cent dividend on account of its deferred dividends on preferred stocks has been postponed to conserve for the present its cash resources.

Timken-Detroit Axle Co. paid a dividend of 2 per cent on the common stock on Jan. 15. A 7 per cent cash dividend has been declared on the preferred stock, payable in quarterly instalments of 1¾ per cent each, the first on March 1.

Doss Rubber & Tube Co., Atlanta, has filed a petition requesting permission to amend its charter increasing the capital stock to $1,000,000. If granted the new issue will be in preferred stock.

Republic Motor Truck Co., Inc., for the nine months ended Sept. 30, shows total sales of $14,303,862 and gross profit of $2,989,598. Net profit for the period is $1,248,065.

United States Motor Truck Co. paid on Jan. 10 the annual 7 per cent cash dividend on preferred stock and 2½ per cent cash dividend on common.

Van Briggle Receiver Files $100,000 Action

INDIANAPOLIS, Jan. 17—Another chapter in the troubles of the various Van Briggle industries was begun Jan. 10 when William E. Reiley, receiver for the Van Briggle Mfg. Co., filed suit in the Marion Superior Court, asking damages of $100,000 in behalf of the company against L. H. Van Briggle, Ulric Z. Wiley, Henry Rominger, Frank Hilgemeier, George Weidley and Joseph Shepard, directors of the company. The company has been operating plants at Mooresville and Fowler, this State.

The suit is similar in character to the one brought several weeks ago by the receiver of the Van Briggle Motor Device Co. for damages amounting to $275,000.

The complaint charges that the company was organized without assets or without the actual sale of stock. The company was incorporated last May for $1,000,000 and shortly after that acquired the two plants above mentioned, both of which were liabilities rather than assets. The Fowler plant was assumed with an indebtedness of $30,000. The Mooresville plant, the complaint charges, was bought for more than it was worth.

Austin Seeks Funds to Finance Output

LONDON, Jan. 7—(*Special Correspondence*)—Sir Herbert Austin, chairman of the Austin Motor Co., in a circular to stockholders, explains the reasons for not paying the final preference dividend until after the stockholders annual meeting in March as a step to finance the company's output, and that deposits amounting to over $35,000,000 have been paid.

It is contemplated to issue short term (well secured) debentures, a form of financing at present in favor in Britain.

The material and supply trade doing business with the Austin company has agreed to take nearly half of the proposed issue. The other moiety will be offered to employees, stockholders and customers, and the general public.

Ford Calls Employees to Receive Bonuses

DETROIT, Jan. 17—During the first three days of this week 22,600 workers of the Ford Motor Co. are on the list to call and receive bonus checks. To-day 3,300 employees of the Highland Park plant and 5,500 usually employed at the River Rouge works. On Tuesday, 2,600 are to receive their bonus in Detroit and 5,100 in River Rouge; while for Wednesday, there are 3,700 scheduled to come to the Highland Park plant and 2,400 to the works in River Rouge. The men are being called in by groups and according to their badge numbers. All told, 52,000 of the workers of the entire Ford organization which embraces besides the Detroit and River Rouge plants, all the assembling plants in the country and in some of the foreign countries are to get bonus money. The total to be distributed will be approximately $8,000,000 it is said, and the amount per man will range from $50 to $450.

STEPHENS RESUMES FEBRUARY 1

FREEPORT, ILL., Jan. 17—Stephens Motor Co., will resume operations Feb. 1. Contracts signed with distributers of Chicago, Spokane and San Francisco, forces the resumption of operations somewhat sooner than anticipated. Starting with the New York show, the Stephens company will exhibit at twenty-one other shows from coast to coast, and, from these orders are anticipated which will insure the steady operation of the plant during the entire year. Orders so far received in 1921 are greater than during the same period of 1920 The total cars shipped in 1920 was 6,956.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Jan. 20—The large withdrawals of Government funds from local banks had no outward effect on the money market last week. The break in money rates, which had long been expected, came on Monday of last week, when call loans were made during the day at 6 per cent. The range for the week was 6 per cent to 7 per cent, as against a flat 7 per cent the week before. On Thursday the renewal rate was 6 per cent, at which rate it has since remained. A greater break came in the outside market, where call money was quoted at as low as 4 per cent on Wednesday, the lowest rate in more than a year. Time money also eased considerably. Sixty and ninety day paper and four and five months' paper were quoted at 6 per cent, while six months' paper was quoted at 5½ per cent to 6 per cent. A week earlier 7¼ per cent to 7½ per cent was quoted for sixty to ninety day paper and 7 per cent to 7¼ per cent for the longer maturities. The rates last week were the same for loans secured either by regular mixed collateral or all-industrial collateral.

The reserve position of the New York Federal Reserve Bank last week was the best since November. Total gold reserves decreased $8,524,000, and total cash reserves decreased $5,560,000. On the other hand, net deposits declined $35,645,000, total bills on hand $82,422,000, and total earning assets $67,337,000.

Total earning assets at $969,760,705 were the lowest in more than a year. Only once last year was this item reported under $1,000,000,000; on Jan. 16, 1920, is was $993,321,620. Federal Reserve notes in circulation, $800,121,480, were the lowest since last February.

Receiver Appointed for Watson Products

SYRACUSE, Jan. 19—Milton Delano, president of the State Bank of Canastota, N. Y., has been named receiver for the Watson Products Corp., manufacturers of Watson motor trucks. The appointment was made by Federal Judge George W. Ray at Norwich following a friendly equity action designed to conserve the assets of the company and is a part of a reorganization program. The new company will be known as the Watson Truck Corp. and creditors of the Products Corporation have signified their willingness to accept stock in the truck corporation in part payment of present claims.

ALLEN PRICE DOWN $200

COLUMBUS, Jan. 19—A price reduction of $200 on open models was announced to-day by the Allen Motor Co. They are reduced from $1595 to $1395. More elaborate models are to be featured, giving the choice of four colors, three styles of wheels and cord tires.

Men of the Industry

H. H. Hill has been appointed superintendent of the Petroleum Experiment Station of the United States Bureau of Mines at Bartlesville, Okla. Hill, who for the past year has been superintendent of the station, succeeds E. W. Wagy, who recently resigned to accept a position as production engineer with the Standard Oil Company of California. M. J. Kirwan, formerly State oil and gas supervisor for the California State Mining Bureau, and who recently spent a year in Japan with the Nippon Oil Company, has been detailed to the Bartlesville station to have general charge of the drilling and production work.

Fred H. Ayers, sales manager for Fisk Rubber Co., has been promoted to director of sales, in charge of the sales, advertising and publicity departments. His successor as sales manager will be William Weild, formerly assistant in this position. Leon N. Southmayd and Charles H. Gage have been made assistant sales managers. Karl S. Chamberlin, formerly assistant manager of export sales, has been made manager of this department.

L. G. Fairbanks has been made director of sales of the Firestone Tire & Rubber Co., a post heretofore held by Vice-President A. G. Partridge. Fairbanks was formerly general manager of the Firestone Steel Products Co. He has already appointed G. A. Richards in charge of all Firestone activities in Michigan; George Burkitt, manager of the Detroit branch, and P. M. Thomas, office manager of the Detroit branch.

J. W. Pickavant, of J. W. Pickavant & Co., Birmingham, England, is in the United States in the interest of the British motor, motorcycle and engineering trades. He plans to sail for home the last of this month. Pickavant says that the British motoring public has demonstrated its willingness to use American automobile accessories and that large quantities of them now are being used in that country.

Gaylord A. Hoyt and **W. N. Grounsell** have joined the sales force of the Franklin Automobile Co., Syracuse. Hoyt was with the Bell telephone system for the past twenty years and for the past twelve years had acted as district plant superintendent for the New York Telephone Co. Grounsell was for eight years with the Buick Motor Co., acting as a special representative under W. C. Durant.

H. A. Oswald, secretary and treasurer of the Hamilton Motors Co., Grand Haven, Mich., and recently factory manager, has been made acting general manager, succeeding W. G. Jarmon. Adolph Pricken, president, of New York, plans to devote a good share of his time to the management of the factory.

George T. Briggs, in charge of the automotive department of the Sinclair Oil Co., was elected president of the Motorcycle and Allied Trades at its annual meeting last week. E. H. Wetzell was elected vice-president, Arthur Davidson, treasurer, and W. H. Pearson, secretary.

Edward R. Tinker, director in the Willys companies and various other automobile corporations, has been elected president of the Chase Securities Corp., a subsidiary of the Chase National bank. He succeeds A. H. Wiggin, who becomes chairman of the board.

E. Hives, who has been for more than ten years chief of the experimental department of the Rolls-Royce British plant, is in America checking up on certain points in connection with the products of the American factory at Springfield, Mass.

Joseph E. Pogue, who has been manager of the department of economic research for Sinclair Oil Corp., has resigned from that company's service and has opened an office as consulting engineer on fuel topics at 29 Fifth Avenue, New York.

A. P. Sloan, Jr., a vice-president of the General Motors Corp. and president of the United Motors Corp., has been elected a director of the Penn Seaboard Steel Corp. Ernest du Pont also is a director of the company.

Myron T. Herrick, former ambassador to France, has been elected president of the Aero Club of America, succeeding Col. Jefferson De Mont Thompson. Herrick has been interested in aviation since the early flying days.

W. C. Chapman has resigned as export advertising manager for Hares Motors, effective Feb. 1. He formerly was with the Packard Motor Car Co. in the same capacity and has been in export work for five years.

E. A. Taylor, production engineer for the Pierce-Arrow Motor Car Co., has become general manager for the Liberty Motor Car Co. It is expected that his advent will result in several changes in the Liberty personnel.

R. W. Levenhagen, prominent in paint and varnish circles from coast to coast, through his long identification with the Sherwin-Williams Co., has joined the organization of the Glidden Co., Cleveland, O.

Arthur H. Blanchard, consulting highway and transport engineer, Ann Arbor, Mich., has been retained by the city of Colorado Springs in connection with its $1,200,000 paving program.

Fred Lampe, formerly production engineer for the Remington Typewriter Co. at Ilion, N. Y., has become superintendent of the Automatic Straight Air Brake Co. factory in New York City.

B. J. W. Kelley, formerly with Gray & Davis, Inc., has been appointed eastern representative for the American Distributing Co. He will open a New York office in the near future.

H. V. Goodenough, general manager of A. J. Miller & Co., Bellefontaine, for the past six years, has resigned to accept a similar position with the Lorraine Car Co., Richmond, Ind.

L. P. Prossen, formerly vice-president of the Nilson-Miller Co., has become connected with the Ortig Motors Co., Inc., New York, as secretary and treasurer.

A. R. Johnson, formerly of the Cadillac Motor Car Co., Detroit, has been appointed assistant sales manager of the Auburn Automobile Co., Auburn, Ind.

Henry Kissel, formerly service manager for the Splitdorf Electric Co., is now in charge of the repair department of the American Bosch Magneto Co.

Robert T. Walsh, formerly advertising manager of King, has been appointed assistant sales and advertising manager of the Apex Motor Corp.

G. W. Hoyt has severed his connection as chief engineer of the Oakes company and is preparing to enter the manufacturing business for himself.

L. G. Peed, formerly territorial man in the East for the Willys-Overland Co., has been made manager of the Toledo branch.

Joseph W. Bramwell has resigned as sales and technical engineer of the American Bronze Corp.

REEVES ON SPEAKING TOUR

NEW YORK, Jan. 18—Alfred Reeves, general manager of the National Automobile Chamber of Commerce will leave to-day for Milwaukee where he will speak to-morrow before the Wisconsin State Automobile Dealers Association. This address will be the first of the series before representatives of all branches of automotive industries. Reeves will be in Des Moines, Jan. 21, Omaha, Jan. 24, Kansas City, Jan. 25, St. Louis, Jan. 26 and 27, and Chicago, Jan. 28. He will tell the dealers and others the present situation in the industry and show them that there is no reason why they should be despondent.

VISIBLE PUMP NAMES OFFICERS

FORT WAYNE, IND., Jan. 17—At the annual election of directors held by the Visible Pump Co., the following were elected: A. Z. Polhamus, H. E. Dean, S. B. Rohrer, W. M. Roth, C. E. Shell, C. S. Fair, Allen M. Hartzell, W. H. Schnelker, Fred Wehrenburg and C. F. Koelinger. Following the election the directors met and named the following officers to serve during the ensuing year: President, A. Z. Polhamus; vice-president, H. D. Dean; treasurer, S. B. Rohrer and secretary, W. M. Roth.

WOODHOUSE VISITS AMERICA

LONDON, Jan. 5—(*Special Correspondence*)—The chairman of the S. T. D. (Sunbeam, Talbot & Darracq) motor combine told the stockholders that the combine's purchase of Jonas Woodhead & Sons, Inc., the leading leaf spring makers to the British motor industry, has shown extremely satisfactory results, and that the managing director of the company was then in America "with the object of studying improvements which American spring makers have made during the war."

JULIUS WEISS DIES

CHICAGO, Jan. 14—Julius Weiss, a pioneer in the automobile business and president of J. Weiss & Son, builders of automobile bodies and builders of one of the first automobile bodies in Chicago, died at his home here last week. He was aged 55.

T. J. KELLEHER DIES

NEWARK, N. J., Jan. 17—Thomas J. Kelleher, mechanical superintendent for the Splitdorf Electric Co., died at his home here after a brief illness following an operation. He formerly was with the Hendee Mfg. Co. at Springfield, the Remy Electric Co. at Anderson, Ind., and for 21 years with Western Electric Co.

Calendar

SHOWS

Jan. 22-27—San Francisco, Second Annual Pacific Coast Automotive Equipment Exposition, Auditorium.

Jan. 22-29—Baltimore, Annual Automobile Show, Baltimore, Automobile Dealers' Ass'n, 5th Regiment Armory, J. C. O'Brien, Mgr.

Jan. 22-29—Cleveland, Annual Passenger Car Show, Cleveland Mfr's & Dealers' Ass'n, Wigmore Coliseum.

Jan. 22-29—Montreal, Annual Automobile Show, Montreal Automobile Trade Ass'n, Motordrome Bldg.

Jan. 29-Feb. 4 — Chicago, National Passenger Car Show, Coliseum, Auspices of N.A.C.C.

Jan. 31-Feb. 5—London, Ont., National Automobile Show of Western Canada, London Chamber of Commerce, Armories, T. C. Kirby, Mgr.

Feb. 5-12—Minneapolis, Annual Automobile Show, Minneapolis Automobile Trade Ass'n.

Feb. 7-12—Columbus, National Tractor Show, Columbus Tractor & Implement Club, Ohio State Fair Grounds

Feb. 7-12—St. Louis, Annual Automobile Show, St. Louis Automobile M'f'rs & Dealers' Ass'n, Robt. E. Lee, Mgr.

Feb. 12-19—Hartford, Conn., Annual Automobile Show, Hartford Automobile Dealers Ass'n, Armory, Arthur Fifoot, Mgr.

Feb. 12-19—Kansas City. Annual Automobile Show, Kansas City Motor Car Dealers' Ass'n.

Feb. 14-19—Winnipeg, Western Canada Automotive Equipment Show.

Feb. 18-28—San Bernardino, Cal., National Orange Show, Fred M. Renfro, Mgr.

Feb. 19-26—San Francisco, Fifth Annual Pacific Automobile Show, Exposition Auditorium, George Mahlgreen, Mgr.

Feb. 21-26—Louisville, Annual Automobile Show, Louisville Automobile Dealers Ass'n, First Regiment Armory, C. L. Alderson, sec'y.

Feb. 21-26—Salt Lake City, Annual Automobile Show, Intermountain Automotive Trades Ass'n, W. D. Rishal, Mgr.

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Atlanta, Annual Automobile Show, Atlanta Automobile Dealers' Ass'n, Auditorium, Virgil Shepard, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April— Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Jan. 22-29 — Colombo, Ceylon Motor Show.

Feb. 7—Delhi, India, Delhi Motor Show.

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

CONVENTIONS

Feb. 2-4—Chicago, First Annual Meeting, Automotive Electric Service Assn. Hotel La Salle.

May 4-7 — Cleveland, National Foreign Trade Council.

Oct. 12-14, 1921—Chicago, Twenty-Eighth Annual Convention National Implement & Vehicle Ass'n.

Rubber Association to Have Export Section

NEW YORK, Jan. 18—Directors of the Rubber Association of America, meeting here to-day, determined to go ahead at once with the formation of a foreign trade department which would seek to aid member manufacturers of tires and rubber goods in the expansion of export trading. This department was recommended at the general meeting of the association held during show week but was referred to the directors for final action.

Under the plans for the new department, an export manager will be employed and the activities gotten under way at once. These will consist of research, publicity, advisory and other work of a similar nature.

Further consideration of the program of expansion also recommended at the general meeting was held up until the next meeting in February. This additional program includes the establishment of departments of publicity, cost accounting, industrial relations, research, statistics and technical and standardization.

GILBERT & BARKER BUILD

SPRINGFIELD, MASS., Jan. 17—Several large additions to the plant of Gilbert & Barker Mfg. Co., this city, are being hurried to completion in anticipation of an early return to normal manufacturing conditions. The new units are a foundry, 400 x 100 ft.; three-story manufacturing building, 240 x 60 ft.; sheet metal department addition, 180 x 160 ft.; storage building addition, 40ft.; addition of two turbine units to power plant. Nearly a whole city block has been bought adjoining the present factory site to allow for future expansion. The company manufactures gasoline filling stations, lubricatig oil storage and distribution systems for factories, and heat treating furnaces for the metal trades.

Mexican Trade Good; Sales on Gold Basis

SAN ANTONIO, TEX., Jan. 17—According to Ralph Trejo, general sales manager for the Triangle Sales Co., who has just arrived here from a six weeks' sales trip through Mexico, business conditions in that country have been especially good recently, so far as selling automobiles and accessories are concerned.

"Automobile Row in the City of Mexico is a most interesting highway," said Trejo. "All sales are for cash and almost all is gold, very little silver being in circulation, and no currency. The accessories flank the automobile shops proper, and are a vital part of the business. French and English cars, in very high-priced models, are sharp competitors with American-made machines, but in the medium-priced and cheap cars the American has practically no competition."

U. S. C. C. SETS CONVENTION

WASHINGTON, Jan. 15—Selection of Atlantic City as the meeting place of the Chamber of Commerce of the United States was announced here to-day. The ninth annual convention will be held April 27, 28 and 29. The representatives of American business will assemble in an effort to shape a definite program of co-operation.

Belgium to Continue December Exhibits

PARIS, Jan. 5—(*Special Correspondence*)—Belgium has fixed on the period Dec. 3 to 15 for her next automobile show which, like previous events, will be held in the Cinquantenaire Palace, Brussels. This show will be open to the entire automotive industry and will be international. In order to eliminate rival events, it has been decided that no automobile exhibits shall be allowed at the Brussels Trade Fair, to be held during the summer. Firms taking part in this will be refused admission in the Brussels, London and Paris automobile shows. Belgian automobile manufacturers have also decided to boycott the motorcycle and bicycle show announced for next March in Brussels.

The European show program is now complete, the series opening with the Paris exhibition in the Grand Palais on Oct. 5 to 16. London will hold two shows, the first one being devoted to trucks on Oct. 14 to 22, and the second one for passenger cars being held from Nov. 4 to 12 inclusive. Belgium closes the series with Dec. 3 to 15. It is not known if Milan will have a show, and a motor exhibition in Berlin next winter is doubtful.

NASH TO ADDRESS N. A. D. A.

ST. LOUIS, Jan. 15—The annual master address at the convention of the National Automobile Dealers Association will be made by Charles W. Nash, president of the Nash Motor Co. The convention is scheduled for Chicago during National Show Week there and it will sound the "Back to Selling" war cry of the association to 35,000 members.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLIV NEW YORK—THURSDAY, JANUARY 27, 1921 NO. 4

Cost Accounting as a Basis for Selling Cars

On the competitive market that is before the vehicle manufacturer, the car that supplies the best value for the money will win. It behooves the maker to know the cost, in order to intelligently meet competition. This article explains one method.

By Clyde Jennings

HOW much does the vehicle you are building cost?

How much does each part cost?

Are you building these parts cheaper than you could buy them?

Is your direct charge for direct labor, indirect labor, factory maintenance or sales too high?

Can you discuss these items with your neighbor and if you do, will you use the same words with the same meaning?

These are a few questions that were suggested at a recent meeting of the Industrial Cost Association. The object of this meeting was to organize in New York a section of the association. The section was organized and will hold monthly meetings. At these meetings the members have promised that they will sit around the table and discuss costs. First, they will establish definitions for the various terms so that they can understand each other.

The men gathered at this meeting were very frank about present conditions. They freely admitted that following the free sales period of the past few years they were now confronting a falling market. Cost has gained a greater importance than ever before. Competition is certain to be sharp and many factories will need to know exactly where the high spots in the cost are. They will need to get down to bed rock so that they can sell as low as possible and yet not lose money. They will also need to analyze their costs and compare them with other factories doing similar work to be sure that these costs are within reason.

To do this, it is necessary to have a recognized terminology, so that the confréres may speak the same language.

Prof. W. Rautenstrauch of Columbia University, who also is a practical and active manufacturer, talked for some time on this line of thought. He said that in his work he often felt the need of discussing the cost of "tools per man" with factory managers who are doing a similar work to that done in his factory. This need not mean a similar product, but working with similar materials. In such cases most of the time of the discussion is apt to be taken up with reaching an understanding as to how depreciation is charged off and what items are included in certain other charges.

The speaker cited the advance made in the study of chemistry since all chemists spoke the same lan-

guage and used the same measurements. He also cited the recent accomplishments of the astronomers in measuring the star Betelguese with its hundreds of millions of miles in computations. The thing that we need to do now, he said, is to establish standards whereby we can accurately measure some of the factors in our everyday affairs.

The story of the organization of this Association is interesting. A. A. Alles, Jr., as a member of the cost committee of the American Gear Makers' Association, attempted to gather material for a paper to read before that body. He wrote to practically all of the industrial associations and to many large manufacturers for assistance, but the replies that came back were requests for assistance from him. He found that while many industrial associations had attempted to establish systems, most of them had not been able to make much progress, because they had confined themselves to the distribution of forms rather than to the extension of their work to explain why such a system was recommended. One or two associations had made definite progress, but they had confined their work exclusively to their lines of business and had not really attempted a solution of the great fundamental problems.

It occurred to Alles while working with this problem that cost accounting education should not be limited to a definite industry, but that its fundamentals should be the same for all industry. As a result of this correspondence it became apparent that there is great need of co-operation on the part of practical business men in seeking a solution of this question. So this organization was formed by representatives of firms who asked permission to co-operate in the dissemination of this information. This movement, Alles explained in telling the story to the New York section, is entirely apart from any similarly named movement on the part of professional accountants. Regardless of the merits of accounting systems, this body of men are looking at the problem differently. They have nothing to sell and they will get benefit only as they join in the mutual understanding and practices of other manufacturers, so that they can discuss costs with their neighbors. Any direct value will have to come to them through the elimination of that competition which is founded on a lack of understanding. The membership in the association does not bind the firm or trade association to an adoption of the methods suggested.

The prospectus of the Association says, "It is not a matter of regulating costs or prices. That would be contrary to public policy." This prospectus says the objects of the association are:

(a) To stimulate the interest of all manufacturers in correctly determined costs.

(b) To standardize cost and accounting terminology; to establish governing principles; and to simplify cost accounting.

(c) To educate our members in the use and advantages of graphic charts and other modern methods of cost analysis and control.

(d) To assist members of the Association who are identified with cost committees of trade organizations in formulating uniform cost methods, and to recommend to our members the adoption of such uniform methods.

(e) To provide a forum for the discussion of cost problems and practices through general and local meetings; and to gather and disseminate news of interest to our members.

(f) To establish a library of cost literature, and to maintain a bureau of information through which members may be assisted in the solution of their individual cost problems.

(g) To co-ordinate the efforts of our members to the end that cost production may be considered in its proper relation to the complex problems of industrial management.

The method of carrying out these objects is simple. It is the intent to arrange the national membership into groups and that these men shall meet and discuss definite topics. One evening might be devoted to "direct labor." Another to what it is proper to charge to the sales department. A transcript will be made of these discussions. They will be sent to the central body committees and there digested. It is hoped in this way to finally arrive at a satisfactory definition of the terms that now figure in costs and which are now so variable.

One of the speakers at the recent New York section meeting was C. H. Smith, who is in charge of clerical work for the Westinghouse Air Brake Co. He said that his company had joined this association because it had been unable to solve its own problems and wanted assistance from all sources. He said that when the effort was first made to learn what were the costs of manufacture of that company's products, only confusion resulted. Each of the factories had its own method of figuring cost and the gathering of data on labor, sales and other items were useless because they could not be compared. Patient effort had brought some order out of this confusion, but the desired results were still far in the future. Smith told an interesting story of a recent conference on this subject, at which one of the confrères was a professor of cost accounting for a correspondence school. This man said that the proper method of charging overtime was to divide it equally between the factory maintenance charge and the sales charge. His reason for placing the charge against the sales department was that if the sales department had not sold the goods, the overtime would not be incurred.

All through these talks was a running comment on the difficulties that manufacturers have recently experienced in solving the questions of federal taxes and of the estimating of depreciation to obtain the proper credits in making tax returns. The present confusion, it was maintained, is due to the fact that there is no existing standard or understanding which the government can adopt for the making of these returns. Such an understanding, it was asserted, would have saved the manufacturers a great deal of expense and confusion.

The membership of this Association is quite large, considering that it is less than a year old. The roster of firms and trade associations is an imposing one. It apparently does not include any automobile manufacturer, but it does include many parts manufacturers.

The lesson for the automotive industry that is to be drawn out of the work would seem to be this:

The selling of automotive vehicles is to be strictly competitive for some time in the future. In the end, the man who gives the best value for the money will win. The best method of making sure to give the best value for the money is to know exactly the cost.

Profitable selling, of course, means getting back the cost with a reasonable profit. So cost must become the basis of selling. Cost can be separated into its several elements and the manufacturer who cannot meet the prices of his competitors can then pick out the points of excessive cost. Without adequate cost data, the manufacturer does not know where to cut, for he does not know in what regard his costs are too high.

A. A. Alles, Jr., 1501 Peoples Bank Building, Pittsburgh, is executive secretary of the Association. F. G. Roberts of SKF Industries, 165 Broadway, is secretary of the New York section.

Friction Metal for Brake Linings

An adaptation of European practice facilitated by manufacture in this country of a copper-lead alloy said to possess exceptional friction qualities. Tests with V-shape brake on truck promise well. Elimination of brake squeaking said to be effected. High friction coefficient claimed.

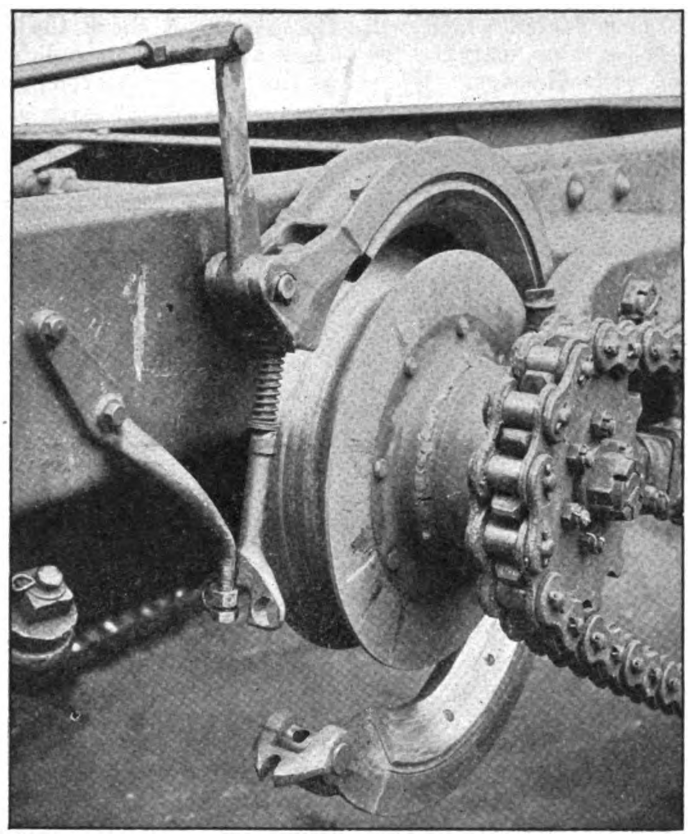
IN the United States and Great Britain it is now the almost universal practice to line motor car brakes with a woven friction lining of asbestos, cotton, rubber and wire. In Continental Europe, on the other hand, metal to metal brakes are extensively used, and, of course, all railroad braking is by metal to metal brakes. One objection to metal brakes for motor car work in the past has been that such brakes lose a great deal in holding ability when oil gets onto their braking surfaces. It is quite possible that with improved methods for packing the axles, so as to prevent the escape of oil from them, this objection is no longer valid.

The Super-Refined Metals Co., manufacturers of the well-known Kelly metal for bearings, have developed a copper-lead alloy called Kelmet which has exceptional friction qualities and which they plan to market as a brake metal. It was found that lining an ordinary brake shoe or sector having a flat cylindrical friction surface with the metal, did not work out to the best advantage, as the brake then was too harsh in action. Consequently a brake with V-section surface was designed, and this is said to have overcome the harshness.

The manufacturer of this metal made some tests with these brakes on a Mack truck at Los Angeles. These tests attracted the attention of the International Motor Co., manufacturers of the Mack truck, and at their invitation officials of the metals company came to New York recently and had a set of their brakes fitted to a Mack 5½-ton truck with which braking tests were made. The total weight of truck and load was 21,845 lb. The first test was made on a hard surfaced road in New York City which is mainly used for trucking purposes in unloading ships. The road consists mostly of sand and gravel but has a subtantial foundation and is very good. The results of these trials were as follows:

Speed, M.P.H.	Distance,* Ft.	Time, Sec.
15	23 2/3	2 1/5
14	17	1 4/5

*Traveled after brake was applied.



V-type brake with metallic friction surface applied to Mack truck

The second test was made on Fort George Hill, which has a roadbed of stone blocks and a grade of 12 per cent. The results of this test were as follows:

Speed, M.P.H.	Distance, Ft.	Time, Sec.
20	96 1/6	5 2/5
20	86 1/4	4 3/5

These tests were under the supervision of the Mack company testers and several officers of the Super-Refined Metals Co., including G. H. Beaton, president; F. C. Harding, vice-president, and H. A. Walker, who devised the method of application of the Kelly metal with the V-type of brake.

The Mack company on Oct. 26 held a similar test with the same truck equipped with its standard fabric lined brakes. The results of these tests on the level roads were as follows:

Speed, M.P.H.	Distance, Ft.
12	20 11/12
12	20 11/12
12	20 1/4

The tester then made a first adjustment of the brakes, after which he made two more trials as follows:

Speed, M.P.H.	Distance, Ft.
12	32 1/4
12	24 1/4

On the Fort George Hill only one trial was made, with the following results:

Speed, M.P.H.	Distance, Ft.
15	56 1/3

Reducing all the tests held under the same conditions to a common basis of 12 m.p.h., the average stopping distance on the level with Kelmet brakes was 13 5/16 ft., and with fabric brakes 24½ ft.

Reducing the Fort George Hill results to a basis of 15 m.p.h., the truck with the Kelmet brakes stopped in 56⅓ ft. and the truck with the fabric brakes in 51¼ ft. These test results therefore do not appear very consistent, for while in the tests on the level the truck was stopped with Kelmet brakes in little over half the distance as with fabric brakes, on the 12 per cent down grade the relative distance covered before coming to a stop was only slightly less than with the fabric brakes.

The alloy used for brake lining has a melting temperature of 1650 deg. Fahr. and is claimed to have a friction coefficient roughly 22 per cent greater than asbestos fabric.

New Wright Aeronautic Engine Succeeds the Hispano-Suiza

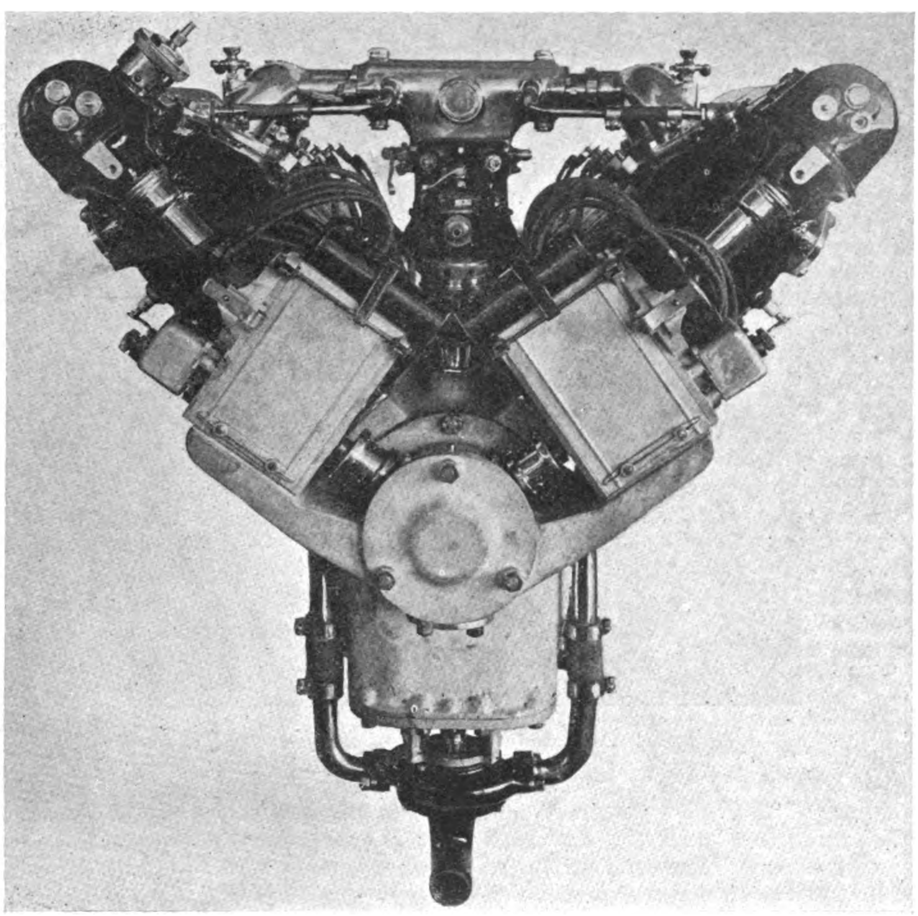
New job resembles predecessor in many detail parts, retaining steel sleeve and combination valve stem and tappet, but embodies many changes originally developed by Wright company, including better cooling and simplified lubrication systems. New magneto mounting provided.

By A. Ludlow Clayden

THE Wright Aeronautical Corp., the successor of Wright-Martin Aircraft Co., who manufactured Hispano-Suiza motors in large quantities during the war, have just produced a new engine which will be known as the Wright model E-2, this marking the abandonment of the connection with Hispano. While the new engine embodies many features which are similar to Hispano practice there is scarcely a detail that is not an original development of the Wright Aeronautical company's engineering work. In fact the new model resembles the original Hispano only to about the same extent as the Liberty engine resembled the original Mercedes.

There are two typical Hispano features retained, namely, the cylinder construction, which consists of steel sleeves threaded into a common aluminum water jacket, and the well known combination valve tappet and valve stem. Even in these parts there are changes, notably in the heads of the steel cylinders, which are very much thicker, a change which has been found to do away almost entirely with valve warping. Probably the thick cylinder head remains actually cooler in operation than a thin head, in just the same way that a thick piston head has been found to enable a piston to run cooler.

Better valve cooling has been still further insured by altering the shape of the exhaust valve ports. These are oval in normal section, giving a large area with but small depth, so that there is plenty of room for water beneath the ports and above the cylinder heads. Tests on the block and in the air indicate that the valve life has been at least doubled as compared with the Hispano original design.

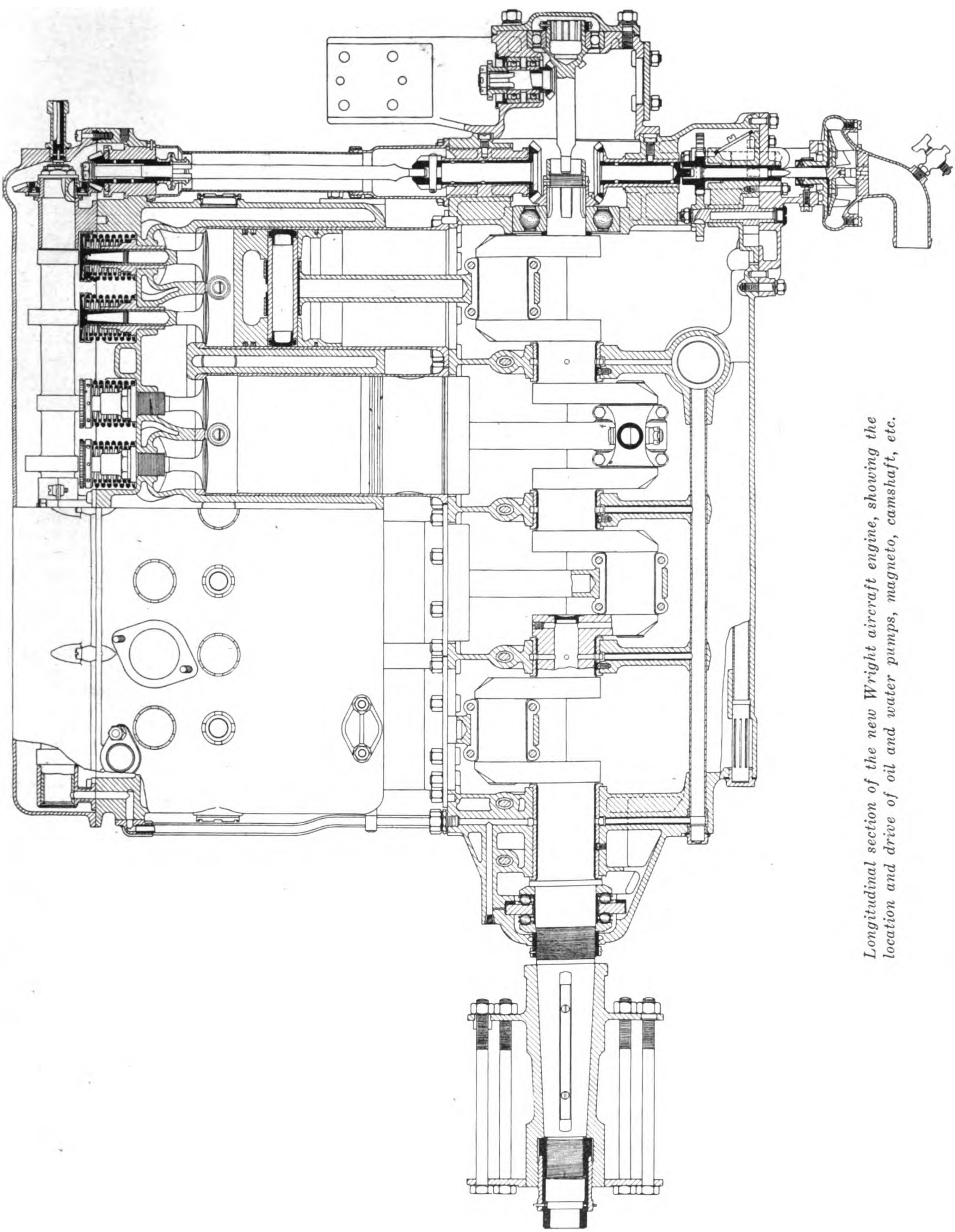


Rear view of Wright aeronautic engine, showing new inclined mounting of magnetos

A deeper water jacket is used, coming low enough to cover all the piston rings at the bottom end of the stroke. This provides enough extra piston cooling to allow a slight increase in compression with corresponding increase in power. The change in compression is not great but just enough to be perceptible, the depth of the combustion space having been decreased by 5 mm. by the thicker cylinder heads.

The pistons have no webs beneath the heads and are generally similar to the 300-hp. design, but the four rings have individual grooves and there is a change in the piston pins. On the 300-hp. pistons the pins floated and were held endwise by fixed aluminum plugs like the Liberty design. The piston pins used in the new engine also float, but cylinder scoring is prevented by bronze plugs pressed into each end of the pin. This considerably simplifies the piston machining and is equally effective.

Perhaps it is in the lubrication system that the Wright



Longitudinal section of the new Wright aircraft engine, showing the location and drive of oil and water pumps, magneto, camshaft, etc.

engines have departed furthest from Hispano practice. It may be remembered that the Hispano motors had vane pumps for the pressure side and gear pump mounted on the extreme rear end, behind the magnetos, sucked oil from the crankcase and delivered it to the tank.

While perfectly effective, this design had three drawbacks. Firstly, the vane type of pump requires delicate fitting in the first place and is subject to loss of efficiency by wear. Secondly, the single suction pump having only one crankcase connection, needed a case with a deep sump. Thirdly, the separation of the two pumps called for rather a lot of external piping.

This design was first departed from in the Wright 300 hp. by the substitution of a single assembly of three gear pumps in the crankcase. The Wright E-2 has carried still further the elimination of connections, while the completeness of the distribution of oil has been improved.

As for the 300 hp., there is a single assembly of two suction and one pressure pump. This group of pumps is mounted on a base plate which mates with a surface on the bottom of the shallow crankcase. The main pressure line is internal, and so is the suction line which goes to the front end of the case. The ends of these two lines are brought to holes in the crankcase base, which holes register with ports in the base plate of the pump so that there are only two external connections to be made, one the delivery from the engine to the oil tank and radiator, the other the intake from the tank to the pressure pump.

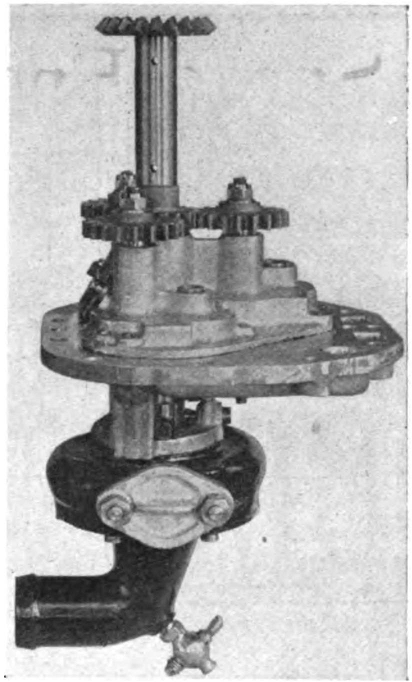
Oil is supplied in the first place to grooves in the bearing bosses of the crankcase which encircle the bushings, through the crankshaft to the connecting rods, and thence by spray to the other crankcase parts. From the front main bearing a lead goes to each of the front camshaft bearings, thence the oil flows through the camshafts, and out through holes which are drilled in the approach face of each cam, as well as through others leading to the center and rear end camshaft bearings.

In the original Hispano, excess oil from the camshafts found its way back to the base through the hollow vertical shaft which drives each camshaft from its rear end. This successfully disposed of excess during climbing, but when flying on an even keel or diving there was always a possibility of sufficient oil collecting to rise over the tops of the valve guides, with consequent fouling. To overcome this, the new engine has a return lead at the front end of each block of cylinders as well as holes around the vertical shaft bearing at the rear end.

Another improvement in lubrication is the taking of a separate pressure lead from the main channel to the ball thrust bearing, it being believed that lack of adequate oil has sometimes caused this bearing to drag and so rotate a little in the crankcase.

Another feature of conspicuous advantage is found in the magneto mounting. The old design used two magnetos which were set in a horizontal plane on a transverse bracket bolted to the rear end of the crankcase, the drive being from the end of the crankshaft through a slot and tongue to a smaller shaft bearing a spiral gear, and thence to a cross shaft with a magneto coupling on each end. This construction called for one right hand and one left hand magneto and also had the disadvantage that the magneto bracket came in such a position that the bed timbers of fuselage could not be extended rearward.

In Model E-2 the magnetos are set at an angle to each other, which lifts them out of the way of the fuselage members. Also, instead of the single transverse shaft the bracket carries two short shafts each provided with a bevel pinion the two meshing with a single bevel which takes the place of the spiral gear. This makes the rotation of the magnetos both alike and so simplifies the handling of spares.



The three oil pumps grouped in a single assembly fitting into the crankcase, with water pump below and outside the crankcase

Positive clutch used in camshaft drive to enable fine angular adjustment in timing valves

Mentioning spare parts, it has been an object in laying out the new model to use as many as possible of the details of the 180 hp. engine, which was made in large numbers by the Wright-Martin Corp. and for which there are still fair stocks of spares in various places. Thus the marine type connecting rods which were the first American innovation and the first departure from Hispano practice are retained unaltered. The crankshaft and camshafts are identical, the water pump is the same, although it attaches to a quite different type of oil pump, and so on throughout the smaller parts.

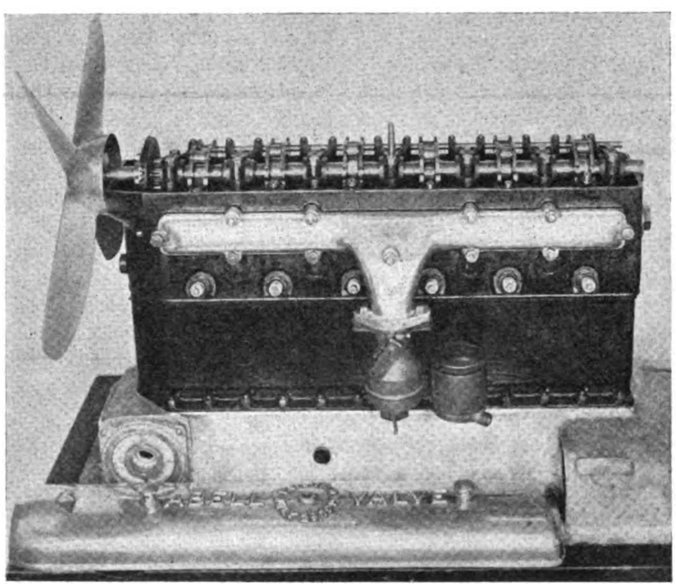
WHILE it is important to maintain a low-pouring temperature for casting aluminum alloys, it is equally important to avoid overheating the metal in the furnace charges. Doubtless some advantage is gained when overheated melts are allowed to cool to the correct pouring temperature, and part of the danger of overheating is minimized by so doing. Nevertheless, for aluminum, overheating is very objectionable, because of the rate of dissolution of iron from cast iron melting pots and of the reduction of silica from clay crucibles, as well as absorption of gases from the local atmosphere. For molten metals, the absorption of gases increases with rising temperature, this being possibly due to the fact that metals form loose compounds with hydrogen and nitrogen. The absorbed gases are often held by the metal until solidification starts, when they are liberated and cause unsoundness. Hence, an overheated melt would contain more absorbed gases than one not overheated, and it would be expected that castings poured from former would be more unsound than those poured from latter.

IT has been the experience of the R. A. F. in Palestine and Mesopotamia, where atmospheric temperatures are generally quite high, that water-cooled engines almost invariably boil their water away, whereas air-cooled engines continue to work. The explanation offered is that an air-cooled engine will continue to function at higher temperature than that at which water boils away.

A High Speed Engine With Positively Operated Valves

But one poppet valve per cylinder is used, this being put in communication alternately with inlet and exhaust ports by a rotary distributor placed lengthwise of cylinder head casting. Yoked rocker levers have two rollers in contact with opposite sides of cam. Cooling of valves by incoming charge makes it possible to use higher compression without knock.

WHILE the ordinary spring-returned poppet valve works satisfactorily at low speed, difficulties are encountered at extremely high speeds which are used in racing engines and some stock engines. Naturally, the higher the speed of the engine the stronger the spring must be to keep the cam follower in contact with the cam, and the stronger the spring the greater the strain on the valve and usually also on the material of the spring itself. The difficulty usually lies either in noisy operation or in excessive strain on the valve mechanism at high speed. Moreover, the speed at which the engine gives its maximum output is dependent upon the ability of the valve and valve follower to follow the cam outline.



Abell engine, showing crankshaft, double roller rocker arms and neat inlet manifold

In racing engines mechanically opened and closed valves have been used repeatedly in the past. The problem of designing a poppet valve mechanically operated both in opening and closing involves considerable difficulty, for whereas the pressure within the cylinder during the compression and power strokes takes up any slackness there may be in the valve mechanism and moves the valve toward its seat, if it is not already there, the suction in the cylinder during the inlet stroke tends to raise the valve off its seat and to allow spent gases to be drawn back into the engine if there is any slackness in the mechanism. And it is, of course, impossible to eliminate all play and flexibility from a valve operating mechanism consisting of several very light parts.

In a design of engine due to R. Abell, and which is illustrated herewith in cross section and longitudinal elevation partly in section, only a single poppet valve is used per cylinder. This valve serves for both the inlet and exhaust. The function of the valve is determined by a rotary distributor which places the poppet valve pocket in communication alternately with inlet and exhaust ports.

The engine is a six cylinder block cast type of 3¼ in. bore x 5 in. stroke. Both the poppet valve and the distributor are mounted in the cylinder head, which is detachable and is bolted to the cylinder block with the usual copper-asbestos gasket between. The combustion chambers, which are located in the cylinder head, are hemispherical in shape and are completely machined. Two spark plug bosses are provided, on opposite sides of the cylinder head. The overhead camshaft is located in the center plane of the cylinders and is operated from the crankshaft through a vertical shaft at the forward end of the engine which is provided with bevel gears both at top and bottom. This vertical shaft is a high speed shaft, being geared up from the crankshaft in the ratio of 3 to 4, and can therefore be quite light. It is enclosed in a "V" shaped extension at the forward end of the cylinder casting and is provided with a splined sliding joint to make allowance for the heat expansion of the cylinder block.

The valve rocker levers are yoke shaped and are provided with rollers on opposite sides of the cams. The cams are of unusual shape and they completely fill up the space between the rollers throughout the cycle. There is, therefore, no lost motion in the whole mechanism at any point of the cycle, and the valve must absolutely follow the outline of the cam. The rocker levers are mounted on a hollow shaft which is carried by the caps on the camshaft bearings, and after removing the nuts from the studs of the bearings, the entire valve mechanism, including the camshaft, can be removed from the engine. The poppet valve, which is bowl shaped for lightness and ease of opening and closing, has a clear diameter of 1 13/16 in. and a lift of 7/16 in. The seating of the valve can be adjusted by means of a spool which is locked in place by a castellated nut and cotter pin. In adjusting the valve, it is brought to within a few thousandths of an inch of its seat, and the inertia on the valve and the compression pressure can be relied upon to close it. The poppet valve begins to open 45 deg. before the end of the power stroke and closes 45 deg. from the beginning of the compression stroke, thus remaining open for a period corresponding to a crank motion of 450 deg. When the crank is in the top dead center position at the end of the exhaust stroke the distributor is in its central position, both the inlet

and the exhaust port being closed. Consequently, the exhaust port closes and the inlet valve port opens simultaneously irrespective of speed.

The compression chamber is so dimensioned that a cold compression of 90 lb. is obtained, and with this compression there is said to be absolutely no knocking with the ordinary commercial gasoline. This is ascribed to the fact that there is no overheated exhaust valve with which the combustible gases come in contact and become ignited. After each exhaust stroke the incoming cool charge passes over the exhaust valve and cools it to such a degree that it never reaches a temperature beyond that corresponding to the bluing temperature of steel. It is claimed that, owing to the thorough cooling of the valve, it is possible to use a compression 20 lb. higher than is ordinarily employed. This results in a higher explosion pressure, increased power and reduced fuel consumption. Owing to the fact that the poppet valve has no spring and its spool is quite free on the end of the rocker lever, the valve continuously creeps around on its seat, which results in uniform temperature conditions and uniform wear over the whole valve head and prevents pitting and other valve troubles. Since the valves are not held down to their seats by springs and remain open throughout the exhaust and inlet strokes, the energy consumed in operating the camshaft is considerably reduced.

The distributor valve is made of cast iron and is cored out for lightness. To facilitate machining and foundry work it is made in halves, with a tongue and grove joint at the center.

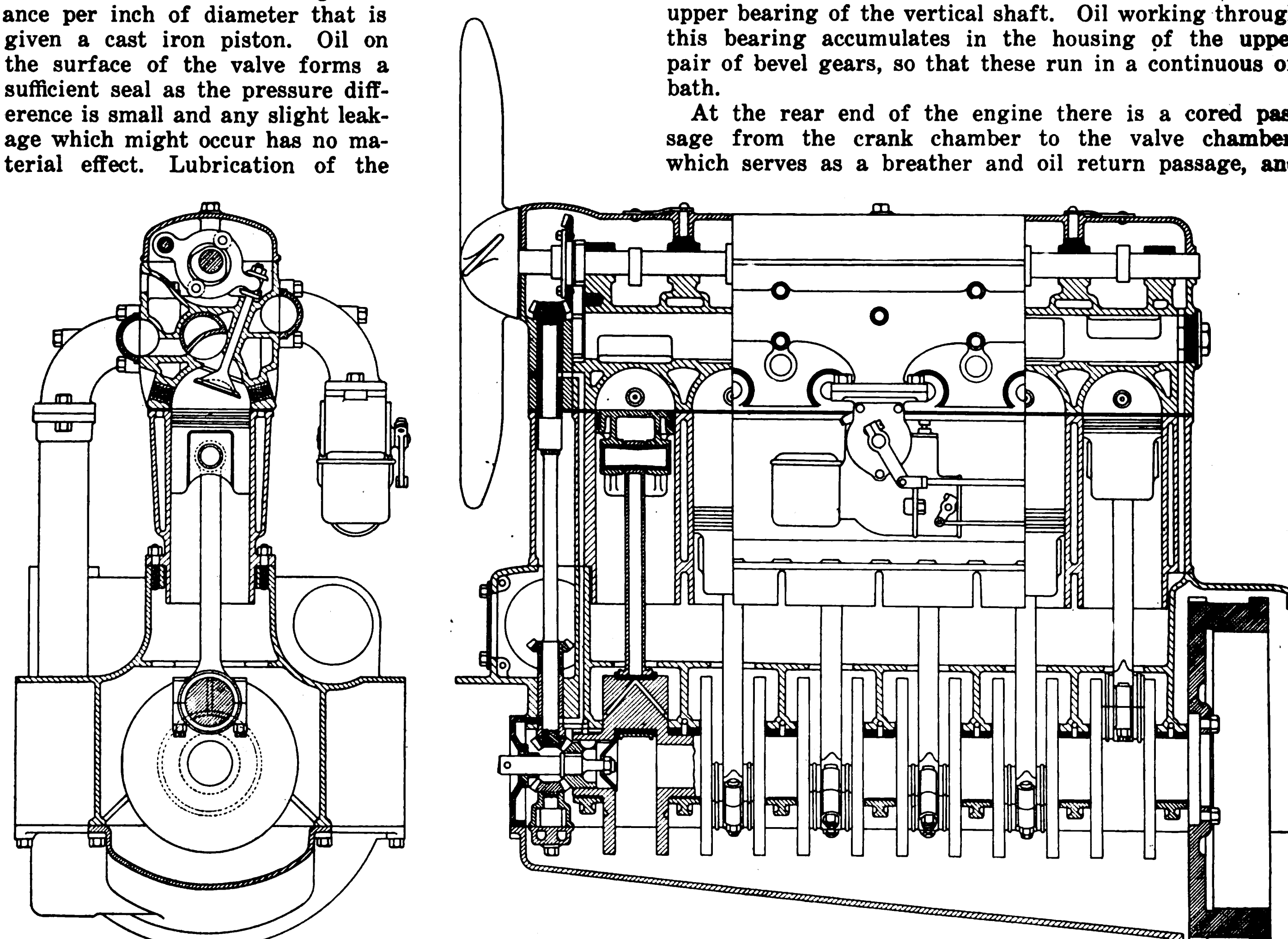
The distributor valve is given about the same clearance per inch of diameter that is given a cast iron piston. Oil on the surface of the valve forms a sufficient seal as the pressure difference is small and any slight leakage which might occur has no material effect. Lubrication of the distributor valve is effected entirely by oil spray in the exhaust. Additional lubrication has been provided in some experimental engines, but was found to be superfluous, ample lubrication being provided by oil deposited by the exhaust gas. The temperature of the distributor valve is not high, due to the cooling effect of the charge which absorbs heat left by the exhaust gases.

One advantage of the construction employed is the fact that the incoming charge passes over surfaces of the distributor and poppet valves which have just been heated by the exhaust. This results in vaporizing the fuel and provides in effect the same hot-spot which in engines of the conventional type is arranged in a quite different manner.

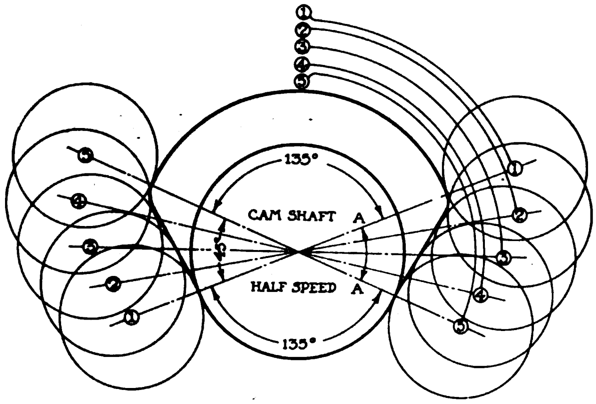
The large bevel gear at the forward end of the camshaft is made of bakelite in order to secure noiseless operation. This gear has 40 teeth, while the crankshaft pinion has 20.

Lubrication of the engine is by the pressure system from a gear pump mounted below the crankshaft ahead of the forward main bearing and driven by a bevel gear from the crankshaft bevel pinion. The crankshaft is supported in seven bearings. The main journals are 2½ in. diameter, and the crank cheeks or webs are in the form of complete disks. Oil from the pump is delivered directly to each main bearing and thence finds its way through circular grooves on the crank disks and drill holes in the crank cheeks and crankpins to the crankpin bearings. A vertical oil passage is drilled in the forward wall of the crank chamber and the cylinder block. Through this oil is forced to the upper bearing of the vertical shaft. Oil working through this bearing accumulates in the housing of the upper pair of bevel gears, so that these run in a continuous oil bath.

At the rear end of the engine there is a cored passage from the crank chamber to the valve chamber, which serves as a breather and oil return passage, and



Transverse and longitudinal sections of Abell engine, showing positively operated poppet valve and rotary distributor valve



Layout of cam used on Abell engine

insures that the valve mechanism operates in an oil mist.

The valve mechanism is protected by a cast aluminum cover. Both parts of the crank chamber are also of aluminum, and the weight of the complete engine without starter and generator is only 360 lb. The cylinder barrels extend some distance into the crankcase, and baffle plates are provided in the upper half of the crankcase to prevent over-oiling and cylinder carbonization. The pistons are cast of aluminum and are of the slipper type. Each piston is provided with three rings at the upper end. The connecting rods are tubular, 10 in. long and of 13/16 in. outside diameter. The hollow piston pin has an outside diameter of 1 in.

In view of the fact that the engine is designed for operation at high speed, an attempt was made to reduce to a minimum the weight of reciprocating parts. The total weight of the piston, rings, piston pin, connecting rod, cap and bolts is only 2½ lb.

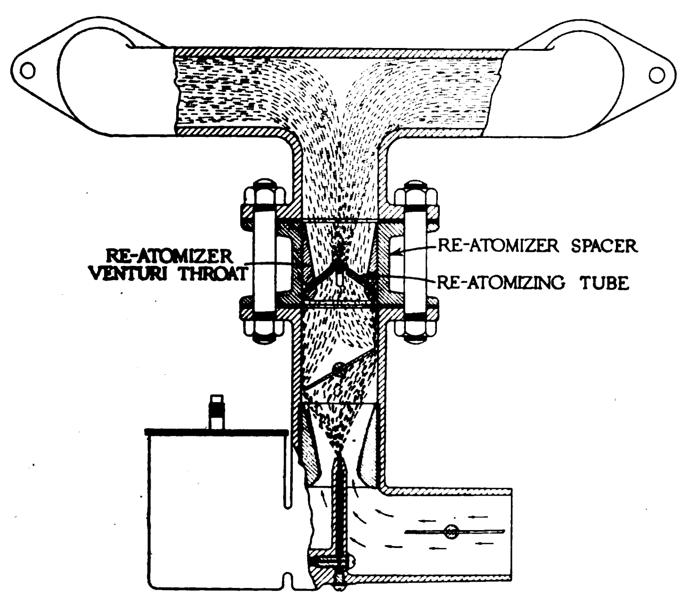
This engine is expected to develop its maximum power at 4000 r.p.m. and to show a straight horsepower line up to 3000-3200 r.p.m. It is expected to obtain 30, 60 and 90 hp. at 1000, 2000 and 3000 r.p.m., respectively, this estimate being based upon the performance of previous designs.

One of the features of the Abell engine is the arrangement of the manifolds. These are formed one-half in the cylinder head casting and one-half in the manifold castings. Each half of the gas passage being of semi-cylindrical form, these passages can be ground and polished, so there will be no obstruction to which unvaporized fuel particles can adhere. A baffle plate is cast into each manifold between the third and fourth cylinders, so that there can be no interference between the front and rear cylinders. The firing order is 1-5-3-6-2-4. A 1½-in. carbureter is fitted. The radiator fan is secured directly to the front end of the camshaft and no separate fan drive is required. The fan is four-bladed, is cast aluminum and is provided with a friction clutch to take care of sudden acceleration and deceleration of the engine.

A Re-atomizing Device

THE carbureter department of the Penberthy Injector Co. announces the Ball & Ball re-atomizer, a device recently invented by F. O. Ball, which is placed between the carbureter and the manifold. It comprises a spacer into which is pressed a venturi throat carrying four small tubes. The spacer contains a passageway of the same diameter as the intake manifold.

The grade of gasoline sold to-day is extremely difficult to vaporize completely, and even when the vapor has been made it is easily condensed by striking obstacles to its free passage. The butterfly valve used in all carbureters, when only partly opened presents such an obstacle. As the vapor strikes this butterfly valve, the larger portion of it is condensed and thrown against one wall of the carbureter and some passes up the wall of the manifold in a liquid form and cannot be equally divided between the various cylinders.



Sectional view of re-atomizer

Around the lower outside edge of the re-atomizer is a groove or annulus which forms a small circular chamber between the inside or the spacer and the outside of the re-atomizer. The ejector effect of air flowing by a tube extending into the air stream in the direction of flow of the air is very well known. This principle is the basic idea of this re-atomizer. The ejector effect on the four tubes which extend into the throat tends to draw into the annulus any liquid gasoline which may be passing up the wall of the carbureter and to eject it from the tubes in an atomized condition so that it floats in the air stream and goes equally to the different cylinders.

It is claimed that this re-atomization of the gasoline makes it possible to adjust the carbureter for a much leaner mixture, thus lowering the fuel consumption and reducing crankcase dilution.

THERE is a grave necessity for adequate records covering inventions, if the inventor is to gain the full fruits of his ideas and labor. "Where litigation cannot be avoided, thousands of dollars are lost annually by the failure of inventors and their associates to keep adequate records of their inventions, their development and reduction to practice, and early commercial history. . . . This expense is unnecessary if adequate records are kept of the essential steps and their dates in connection with inventions."

To point out these essential steps and direct the inventor how to take them is the purpose and scope of the little volume on "How to Keep Invention Records," recently published by D. Appleton & Company.

The first part of this 82-page volume discusses the general nature of industrial property and monopolies granted to protect it. A practical method of insuring this recording of dates is presented in the second part, while a final chapter deals with methods of patent investigation.

Some New Parts Seen at the New York Show

Two new axles, one of which uses two cone clutches in place of differential, are shown. New flexible universal of laminated steel, an automatic advance magneto coupling, and a lubricating system for transmission universals and axle, are among the recent developments.

By P. M. Heldt

A NEW line of axles was exhibited by the U. S. Axle Co. The front axle is designed to permit turning in a small radius and will be made for either right or left hand steering. The axle center and steering knuckle are drop forgings, heat treated. The steering knuckles swing on adjustable tapered roller bearings and the front wheels turn on bearings of the same type. The steering arms, of drop-forged chrome vanadium steel, are designed with a high factor of safety. The tie rod is behind the axle center and thus well protected. It is made of seamless steel tubing tapered toward both ends. This axle has a load capacity up to 1400 lb.

The rear axle is of the semi-floating type with helical bevel gear drive. It has a load capacity up to 1900 lb. and can be made in a larger range of gear ratios. The axle shaft housings are of tapered, seamless steel tubing with spring seat and brake anchor riveted to the outer end. The inner ends are flanged and bolted to malleable iron or aluminum alloy gear housings. The pinion housing can be furnished of aluminum alloy or malleable iron, adjustable or non-adjustable type; it carries two adjustable taper roller bearings which take both thrust and radial loads. The drive and differential gears are of alloy steel and the axle shafts of molybdenum steel. Axle shafts are ground to size and are splined to fit the differential; they can be easily removed without disturbing either the gear housing or the differential assembly. The outer end of the shaft is mounted in a self-aligning, double row ball bearing. A heavy spring is inserted between the wheel hub and the ball bearing to minimize lateral shocks.

Hubs of symmetrical design are furnished, for wood, wire or disk wheels. Both the service and emergency brakes are of the expanding type and are arranged side by side within the same drums. The service brake is 1¾ in. wide and the emergency brake 1 in. The pressed steel brake drum is 14 in. in diameter and the brakes are actuated by means of cams. The reason given for using expanding brakes only is that where contracting brakes are used it often happens when non-skid chains are fitted the cross chains tear, catch the brake rigging and practically rip it off the axle.

A rather radical design of rear axle was exhibited by the Stokes Engineering Co., Inc. No differential gear is used, but instead there are double friction clutches in each wheel, of the conical type. These clutches are operated automatically by means of steep pitch, square thread screws in the hubs of the central driving gear. One of the clutches is used for forward drive and the other for reverse.

A universal joint employing flexible members of laminated steel was exhibited by Chilton Universal Joint, Inc. The laminations are made by punch press operations of

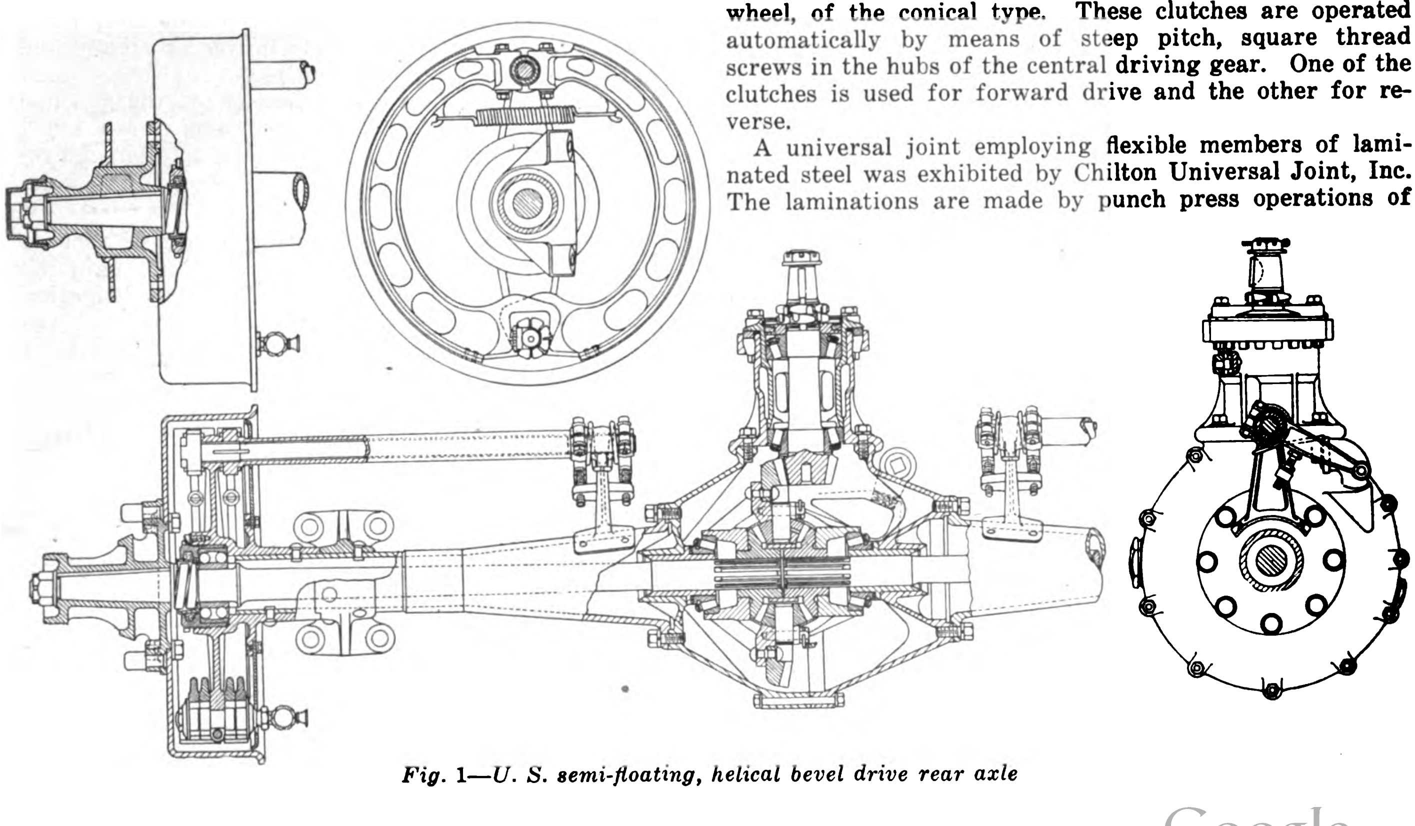


Fig. 1—U. S. semi-floating, helical bevel drive rear axle

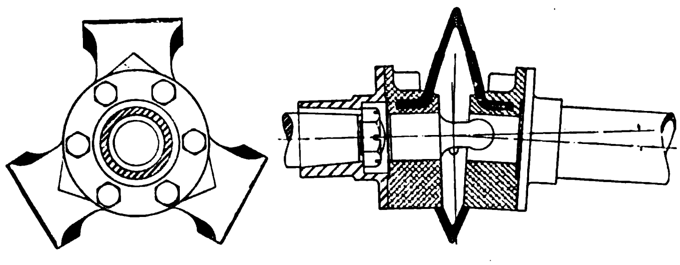


Fig. 2—Chilton flexible universal joint

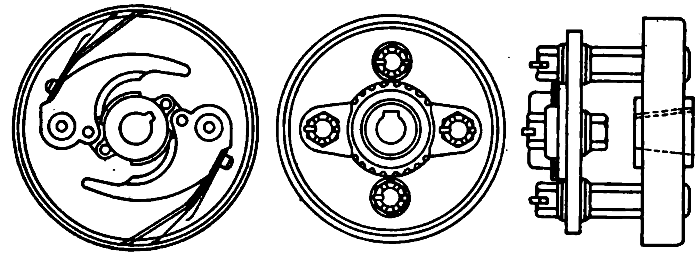


Fig. 3—Splitdorf automatic advance coupling

tempered and polished blue spring steel strips. The hubs are flanged for connection to the usual automobile transmission shaft flanges; they are of a special alloy and are cast around the ends of the driving springs in permanent mold machines. The spring ends extend far into the hubs and are notched to insure a perfect bond. It is stated that on tests to destruction the springs will be broken without loosening in the hubs. Three sets of laminae are used in each joint. As the flexible members are cast in the hubs the whole joint is one piece, and it requires no lubrication or attention by the operator. The illustration shows the construction. When two of these universals are used in an automobile drive no slip joint is required.

The Splitdorf Electrical Co. has brought out an automatic advance coupling for magnetos. It consists of a centrifugal governor of simple and compact design as shown in Fig. 3. The governor weights are pivoted to the housing and connect by links to a spider on the shaft in such a way that as the weights move outward from the axis of rotation under the action of the centrifugal force and against the pressure of laminated springs secured to their outer sides, the shaft is angularly advanced relative to the housing substantially in proportion to the speed. The Model V is made for truck and tractor engines and can be installed on any Splitdorf magneto without change in the magneto. The minimum advance is obtained at 600 r.p.m., the maximum at 1300 r.p.m. The coupling weighs only 1 lb. 3 oz. Model W is designed for use on passenger car engines. It gives a minimum advance at 400 r.p.m. and a maximum advance at 1800 r.p.m., the weight being 1.5 lb.

A transmission and drive lubricating system was exhibited by the Merchant & Evans Co. A gear type pump is located in the rear axle housing, an oil reservoir on the forward side of the dashboard and a sight feed or circulation indicator on the instrument board. The oil from the reservoir passes through the transmission, the hollow propeller shaft and the hollow bevel pinion shaft into the differential housing. While the car is standing there is a tendency for the oil to flow toward the rear by gravity and when it is first started up the oil level in the differential housing is somewhat above normal. As soon as the car is started the pump delivers some of this oil through the circulation indicator to the reservoir, movement of the oil continuing until the level in the differential housing falls below the pump inlet. The indicator therefore will show oil flow only for a short period after starting the car. One of the advantages claimed for the system is that by maintaining a constant oil level in the rear axle housing oil leakage from the axle is prevented. In order to apply it to a car it is necessary that the universal joints as well as other parts lubricated be oil-tight. When first filling the system the oil should preferably be heated, as it will then flow more freely. It is necessary to add about a pint of oil to the supply in the tank every month. A test plug is located in the differential housing at the level at which it is desired to carry the oil, and oil is poured into the tank until it begins to flow from the test hole.

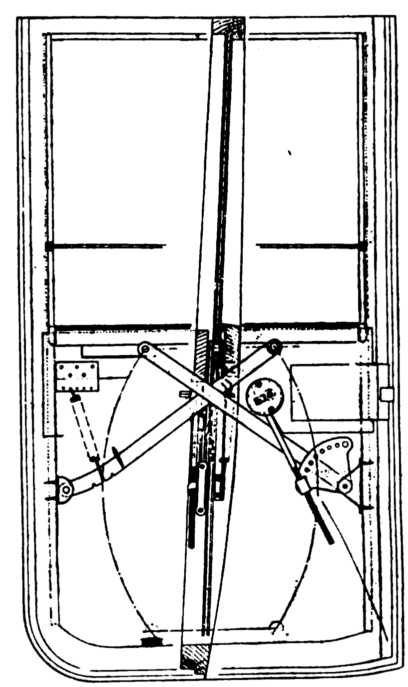


Fig. 5—Crank type of Dura window regulator

Models of the Dura window regulator were shown by the Dura Mechanical Hardware Co. This window regulator for closed cars is made in three types, the lever type, the crank type and the Clement type. The advantage of the lever type is that it permits the window to be raised and lowered very quickly, with less than half a turn of the lever. The weight of the window is counter-balanced by a spring. The full depth of the door pocket space can be utilized. For a certain class of work the crank type of regulator seems to be required. The lever and fulcrum mechanism is retained, but the lever is operated through a crank, a pair of helical gears and a screw and nut.

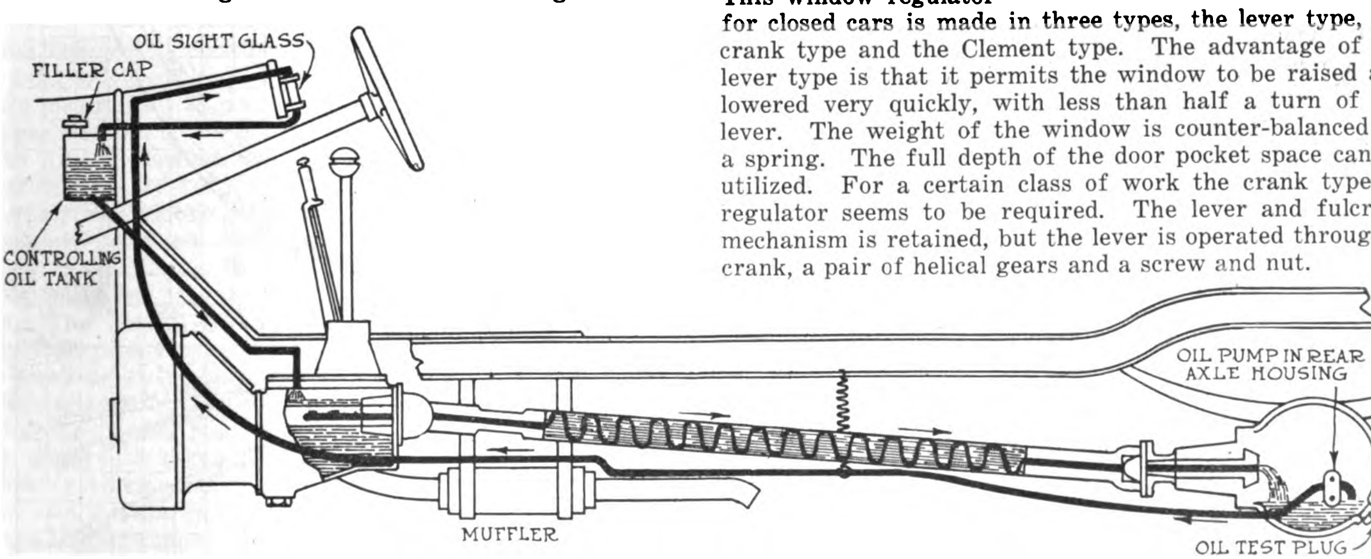


Fig. 4—M. & E. transmission and drive lubricating system

Broader Viewpoint Needed in Effort to Solve Fuel Problem

Author demonstrates the importance of breaking away from outworn notions, and shows how by thorough tests and careful analysis of results it has proved possible to nearly double the mileage of a given car per gallon of fuel, while at the same time power is increased, and general performance bettered. New constant clearance piston also described.

By A. L. Nelson*

THE object of this paper is to appeal for a broader viewpoint and give a few illustrations and tests which show that the solution of a problem may lie in an entirely different method than that which often becomes stereotyped by sheer usage, rather than by its specific merit. We know off-hand the general engine characteristics of our engines at full, three-quarter, one-half, and one-quarter load. We know the power, friction losses, economy and the like. This is all very proper and applies very well to what the engine *can do*, but how about the more important questions of engine characteristics while working at loads that it is *called upon to carry* in the car? How much specific information can we give off-hand on these more important engine characteristics so vital to the solution of the fuel problem?

Power Required to Drive the Car at Constant Speed

Fig. 1 shows the engine brake horsepower required to drive the car tested, the brake horsepower available and the percentage of available power used at each speed.

The method of obtaining these data was to drive the car on a given course at constant speeds corresponding to a fixed carbureter throttle setting, then to remove the engine from the car to the dynamometer stand and determine the power developed at those settings and the engine speed corresponding to the car speeds. It was necessary to duplicate very accurately the fixed throttle settings when the engine was put on the dynamometer; hence, a micrometer adjusting screw was attached to the carbureter throttle-shaft. The speed of the car was obtained by timing with a stop-watch on a ½-mile measured course, driving in both directions for each setting, to eliminate the effect of wind resistance, and taking the average speed. The engine speed was calculated from the number of revolutions per mile made by the rear wheels. Several important details, such as cooling water temperatures, oil temperatures, air pressure under the engine hood, and the like, need not be given here. For accurate work it is suggested that, in addition to the use of fixed throttle settings, manometer readings be taken of the intake-manifold depression together with the air temperature. Referring again to Fig. 1, note that at average driving speed the engine is working at only 16 to 19 per cent of full load. Poor economy is caused by misapplication of the engine rather than poor engine economy. The analysis should give us relative values on which to consider the feasibility of using two-speed rear axles, or more speeds in the transmission. Or

Particulars Concerning Car Tested, Test Conditions, Course, etc.	
Outdoor temperature (average), deg. fahr.	76
Barometer (average) in. of mercury	30.15
Weight of car with fuel and two spare tires, lb.	4,340
Weight of driver, lb.	180
Total weight of car and driver, lb.	4,520
Tires	Firestone Cord
Size of tires, in.	33 x 5
Air pressure, rear tires, lb. per sq. in.	50
Air pressure, front tires, lb. per sq. in.	45
Course	Indianapolis Speedway
Pavement	Brick
Length of course, miles	½
Direction of driving	North and south
Revolutions of rear wheel per mile	600
Exhaust cutout	Open
Oil	Mobiloil B

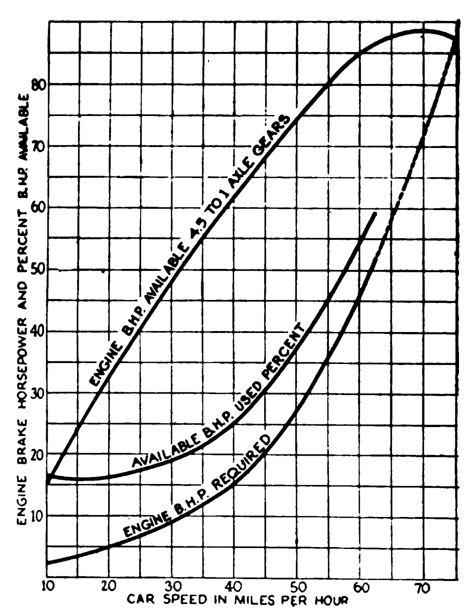


Fig. 1—Comparison of engine power with power required to propel car; showing low load factor

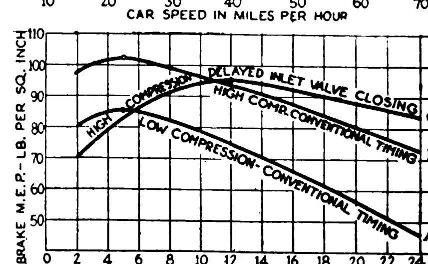


Fig. 2—Effect of valve timing and compression on mean effective pressure

*Condensed from a paper presented at the annual meeting of the Society of Automotive Engineers. Mr. Nelson is chief engineer of the Premier Motor Corporation.

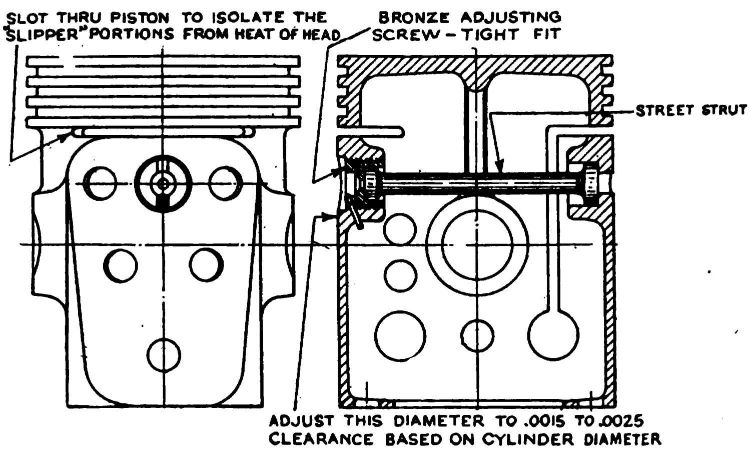


Fig. 3—Constant clearance aluminum piston, showing means for adjusting initial clearance

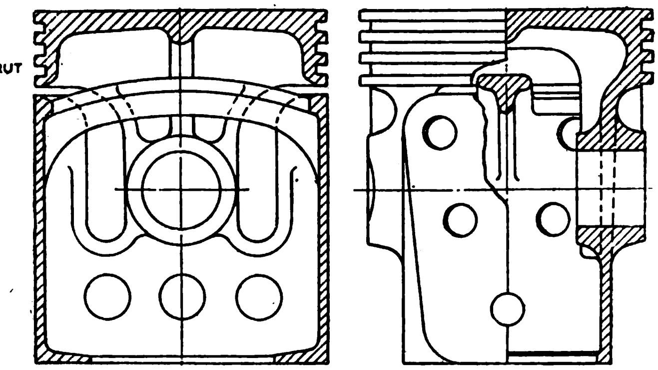


Fig. 4—Type of constant clearance aluminum piston with steel strut cast integrally with slipper portion

perhaps an entirely new and better way will be devised eventually to keep the load factor of the engine high to obtain better economy.

The conditions revealed by the correlation of engine and car characteristics are so bad as to make it evident that both the public and engineers need a decided change in viewpoint; the public in what they demand, and the engineer in what to furnish and in what to educate the public to expect.

Higher Compression Ratios

As an illustration of the need for change in viewpoint, let us consider the effect of using higher compression ratios. We all know that the compression ratios used in aviation engines give us much higher fuel economy than those used ordinarily in automobile engines. Then why not use high compression ratios for automobile engines? We are told that higher compressions make the engine knock badly. The simplest and generally accepted way of getting rid of knocking is to lower the compression ratio. Shall we accept this way as final? Why not try to accomplish the same result some other way and at the same time maintain the higher economy?

An engine at full load may knock badly at 500 r.p.m. and perhaps will not knock at all at 1200 r.p.m. If we study the curve of brake mean effective pressure, we will find that, at 500 r.p.m., the brake mean effective pressure is greater than at 1200 r.p.m Curve *B*, Fig. 2, illustrates this. By lowering the compression to eliminate the knock, we obtain curve *A*. Suppose we go back to the higher piston compression ratio and at the same time we delay the inlet-valve closing. Experiments show that we get a brake mean effective pressure in accordance with curve *C*, the peak of the curve coming at a higher speed than that given by the conventional timing. The pressures at the lower speeds are reduced, which is the desired result to overcome the knocking, while the pressures at the higher speeds are materially increased.

The exact timing to use depends on the valve sizes, intake passages, carbureter characteristics and similar factors. The results obtained are more far-reaching than merely keeping the pressures within a range to eliminate the knocking at the lower speeds, and increasing the power at higher speeds. The most desirable results are obtained under car-driving conditions. The small charge of mixture required is taken into the cylinder and compressed to a smaller volume than in the case of the lower compression; also the charge is purer, due to the better scavenging of the higher compression pistons. Tests for 5 to 1 and 4.25 to 1 compression ratios at full load show increases of 13 and 24 per cent in the brake thermal efficiencies at 700 and 2100 r.p.m. respectively; while at these same speeds and at loads required by the car the increases are 22 and 41 per cent respectively. (See Figs. 23 and 24, at 20 and 60 m.p.h.. respectively.) These results are representative of only the first attempt, yet they are quite appreciable gains in economy, due solely to the change in compression ratio.

Consider next the aluminum piston, which is almost universally used in aviation engines. The high thermal conductivity of aluminum allows the heat to flow from the pistons more freely than from any other metal commonly used, contributing highly to the best known results obtained from high-speed internal-combustion engines. Why are the aluminum pistons for automobiles, though largely used, condemned by some of our leading designers of national reputation? They know the sterling qualities of the aluminum aviation pistons that make the high power and economy of aviation engines possible, yet for their automobile engines they use cast iron which perhaps could not possibly be used in the aviation engines with the high compression ratios. They tell us the trouble is that the aluminum pistons expand so much when heated that they require excessive cylinder clearance and that this allows them to slap at the lower speeds, or, if fitted closer, to stick at the higher speeds. As an alternative they select cast-iron pistons, use lower compression and get lower economy and greater torsional vibration of the crankshaft due to the heavier reciprocating parts and occasionally scoring the cylinder blocks. Some engineers say, in addition, that the hotter cast-iron piston helps to vaporize the liquid fuel that comes in contact with the head of the piston.

Constant-Clearance Aluminum Piston

The specific heat of aluminum is greater than that of iron, but the density of iron compared with that of aluminum gives us a heat capacity per unit volume of aluminum only 68 per cent that of iron. However, the conductivity of aluminum is 2.85 times that of iron. From these figures it will be seen that even if the iron piston was 1½ times as hot as the aluminum piston, the heat flow to the liquid fuel in contact with the aluminum piston-head would be about 30 per cent greater, and that, for same temperatures, the heat flow would be about 94 per cent in favor of the aluminum.. Since the aluminum piston-head is usually made thicker than that of cast iron, the amount of heat available would be approximately the same in both cases. It appears that the two pistons are on a par, except that heat flow is greatly in favor of the aluminum piston. It has become a habit to think that aluminum pistons must expand. Why not design an aluminum piston that cannot

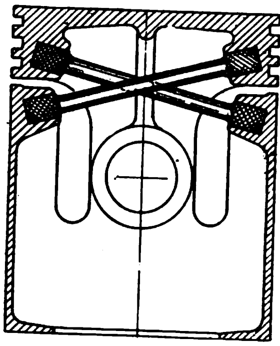


Fig. 5—Type of aluminum piston in which clearance increases as the piston is heated

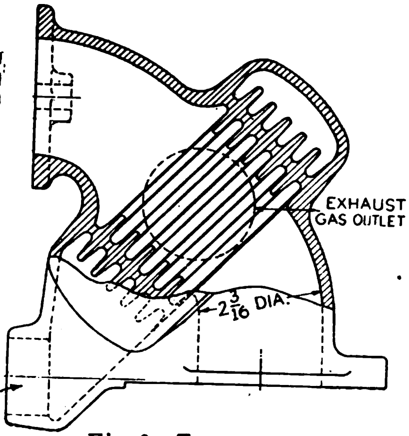


Fig. 6—Transverse section of intake pipe, showing exhaust heated ribs for vaporizing fuel

expand as far as cylinder clearance is concerned? This viewpoint changed the complexion of the whole problem and led to the development of an aluminum automobile piston design that gives results believed to be in advance of the combined merits of the aviation piston and the cast-iron piston.

This piston is illustrated in Fig. 3. In this design the adjustable *steel* strut controls the cylinder clearance in the direction which prevents piston slap. It will be noted that the *aluminum* has nothing to do with the cylinder clearance. The strut is subject to almost the same temperature range as the cylinder; hence, the clearance remains constant through the range from a stone-cold to a steaming-hot engine. This type of piston proved very successful from the outset. It is the only type of piston, regardless of material or design, that we have not been able to make stick under abnormal conditions. It has absolutely no slapping tendencies even in a stone-cold engine. Maximum car speed can be maintained indefinitely without causing the pistons to stick. For a more severe test the pistons were run at full load for 30 min. at 3000 r.p.m., with the radiator cooling water shut off so that the engine steamed continuously during the run. This run was made at the end of a full day of high-speed testing with no provision for cooling the oil.. The cylinder clearances of the pistons were less than those of any cast-iron pistons that are so far as we know used in quantity production. Two of the pistons had cylinder clearances of 0.0015 in., based on the diameter. The other four pistons had clearances from 0.0020 to 0.0025 in.

In spite of all the abuse we have been able to impose on this type of piston, the pistons have always come out of the tests entirely free from any scoring marks and show a decided general tendency to polish-up smoother than the conventional aluminum piston. This undoubtedly follows from the maintenance of the proper clearance at all times, thus avoiding excessive bearing loading. Another striking characteristic of the pistons is their smoothness of operation, indicating that even when the slap in the conventional piston is not audible there is a rumbling sound which becomes noticeable when compared with the operation of the constant-clearance piston. This difference is very marked at both high and low speeds. When the pistons are used with the conventional timing, the knock at full load and low speeds is very materially subdued compared to the conventional type of piston. This clearly shows that cylinder piston clearance has much to do with the degree of audibility of the knock.

Fig. 4 illustrates a design which has the strut cast integrally with the "slipper" portion of the piston, the latter being well insulated from the heat of the piston-head by being separated from it. An alternative of this design is a steel strut cast in place or fastened in some suitable manner.

Fig. 5 illustrates an aluminum piston that *contracts* when heated, so far as cylinder clearance is concerned. The steel struts in this case are shown cast in place. The reason the cylinder clearance increases with the heat on the piston is that the ends of the steel struts attached to the piston-ring-groove portion of the piston-head are carried outward, drawing the "slipper" portion inward since they are attached to the opposite ends of the struts. A large variety of designs can be made embodying the strut idea to accomplish variations of cylinder clearance adjustment and the like, as may be desired for particular cases. It is hoped that these piston illustrations will fix the idea firmly that, so far as cylinder clearance is concerned, we have nothing to fear from the highly expansive aluminum as a piston material.. As for the practical merits of the constant-clearance type of piston, they must be tried to be appreciated, because the results they give are so far in advance of one's highest expectations. The results are indeed a striking illustration of what can be accomplished by a mere change in viewpoint.

Fuel Vaporizer

Consider now the general experience with exhaust-heated intake-manifolds. It is generally agreed that the results are fairly good, at the expense of a loss of maximum power due to heating the air. On heating the fuel by "hot-spots," the air is also heated. The experience has been so general that it has practically fixed in many minds as an irrevocable fact that using exhaust heat must necessarily and unduly heat the air. To show that this is not the fact, first let some suppositions be given which can be agreed to readily.

Suppose we run all the hot exhaust gases through a jacketed intake pipe, say some 10 in. long, to get ample surface for the "hot-spot"; that is, ample surface to transmit the exhaust heat required to vaporize the fuel, which, it has been observed, goes to the walls of the intake pipe or points of lowest air velocity. Such an intake pipe works well but it also heats the air, coming into contact with the large highly heated surface with the result that the maximum power cannot be obtained. Suppose we now corrugate the intake-pipe so that the air passage is say 2½ in. long, without reducing the area of the inner or outer surface. Fig. 6 shows a cross-section of such an intake pipe designed for the 295.2-cu. in. six-cylinder engine used in the tests. Note the relatively small amount of exterior exposed surface of the heating chamber, an important item for starting out with a cold engine, and the efficient heating of the pipe at low car speeds. The heated portion of the pipe is set at an angle above the carbureter so that the inertia of the fuel globules will throw them directly into the large highly heated surface. The flow of liquid following the wall is toward the inner or smaller radius of the bend. Gravity helps to make the liquid flow over the heated surface. It cannot get out again into the air-stream before being highly vaporized. The highly heated corrugated surface effectively traps the fuel and quickly vaporizes and super-heats the vapor. Tests indicate that the air is very slightly heated while the fuel is highly vaporized. Kerosene is vaporized as readily as gasoline, even at speeds as low as 200 r.p.m. with wide-open throttle. The air is slightly heated because only a very small portion of the air comes in contact with the edges of the ribs at the inner diameter. Tests in which the intake-pipe was *abnormally* heated, have been run with a loss of only 1.2 per cent of power at 1200 r.p.m. and 2 per cent loss of power at 2400 r.p.m., compared with the best results that could be obtained from the most favorable degree of heat or from unheated plain manifolds. The design as shown

does not strictly confine the heat to the ribbed portion for practical reasons.

The effect of the intake pipe construction upon the remainder of the intake passages to the cylinders is very important. Off-hand it would appear as though the deep ribbing would offer a severe obstruction to the fuel passing to the cylinders. Let us compare what happens with that of the ordinary manifold where the fuel as a rule travels very much slower than the air-stream flowing along the manifold walls. A considerable time interval occurs between the time the fuel leaves the carbureter nozzle and the time it reaches the cylinder. In the case of the intake pipe, Fig. 6, and the remaining passages to the cylinder, the heavier parts of the fuel are momentarily arrested, but they are highly vaporized quickly and pass to the cylinder at the same speed as the air-stream. Since a highly heated surface can be used without heating the air, the vapor becomes so highly heated that it does not condense while in the air-stream. Of course, the vapor going into the air-stream receives a high velocity on the outset, and the time interval for it to condense is small.

Most convincing observations are made when applying 2-in. carbureters to the engine, both on the dynamometer and on the road. For speeds below 800 r.p.m. with open throttle, the plain unheated intake-pipe could not be used at all. Even at higher speeds the economy was poor although the power was good, indicating poor distribution. With the new design intake-pipe the engine could be run as low as 200 r.p.m. with wide-open throttle. However, this was not true with 2-in. plain-tube carbureters which we have tried without making structural modifications in the design.

Application of the exhaust-heated intake manifold made

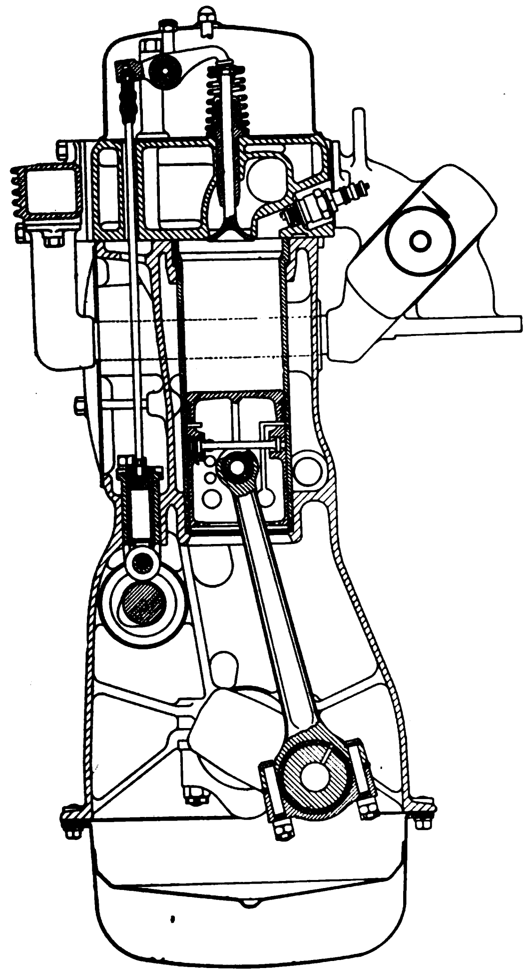


Fig. 7—*Transverse section of engine used in the test*

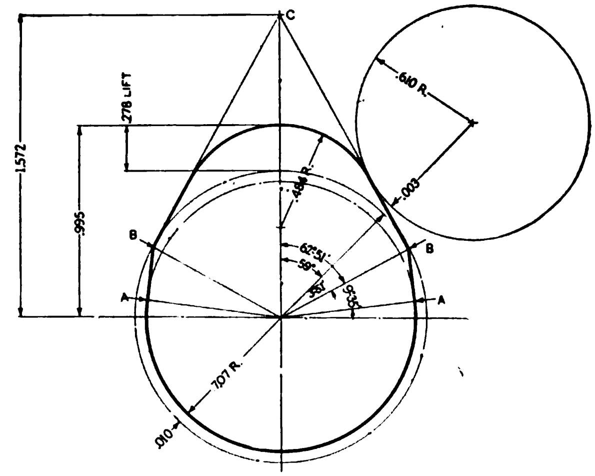


Fig. 8—Inlet and exhaust cam layout. AB and BC are straight lines intersecting at sharp angle at B

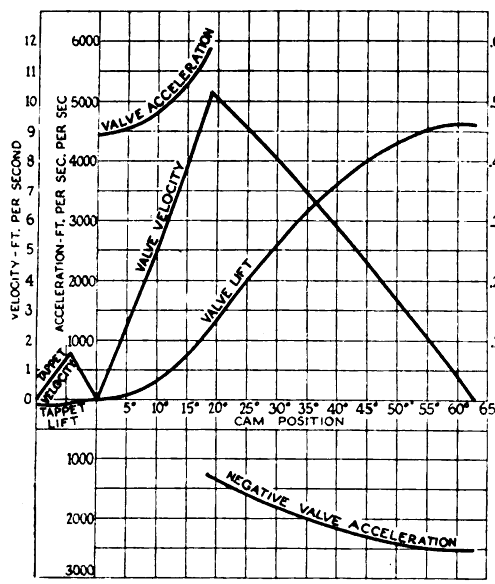
it possible to equip the engine with a 2-in. carbureter. The car accelerates well in cold weather, without using a choker, by the time it can be driven out of a cold garage onto the street. A manually operated valve is provided to force all the exhaust heat through the intake. This is used until the engine heats to the normal operating temperature, or it can be left on continuously without causing any harm except a slight restricted exhaust passage for high speed in this particular experimental design. The good acceleration while cold indicates super-heating of the fuel; in other words, it does not condense materially before reaching the cylinders, even when the engine is cold. When using the larger carbureter and developing correspondingly higher power at both low and high speeds, there is a smoothness in operation that never was obtained with smaller carbureters. The degree of flexibility, smoothness, economy and power are far in advance of the best previous results. The engine shows good torque, right down to the point of stalling. It is believed that even these preliminary investigations show that the conventional hot-spot method can be far surpassed and that the fuel can be heated without unduly heating the air. Here again the results obtained are a direct result of the change in viewpoint.

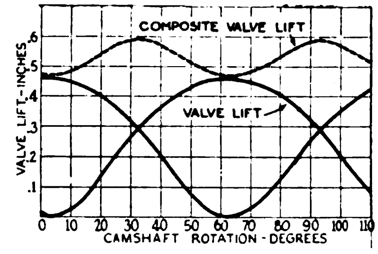
We will next consider tests showing the effect of a proper correlation of car and engine characteristics using 4.25 to 1 and 5 to 1 compression pistons in the same engine. First a brief description of the engine and testing apparatus will be given.

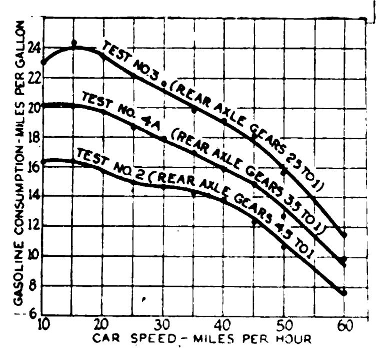
The Engine Used in the Test

The engine used in the test is a valve-in-head type with six-cylinders, 3⅜ x 5½-in. (295.2-cu. in. displacement). The cylinder block and upper crankcase is a one-piece casting of aluminum alloy, with inserted cylinder sleeves of cast iron machined all over. The cylinder-head is of cast iron and detachable. Fig. 7 shows a cross-section of the engine and gives a fairly good idea of the detailed construction. The crankshaft is of the three-bearing type and of liberal dimensions. The hollow crankpins are 2¼ in. in diameter and 1¾ in. long. The shaft is drilled for oil passage at 25-lb. per sq. in. pressure to all the main and connecting-rod bearings.

Attention is called to the unique cylinder-sleeve construction with particular reference to the application of the packing at the bottom of the sleeve. The sleeve at the bottom diameter has a snug slip fit in the aluminum case. The sleeve, however, has been shown to have a very slight axial movement here. This follows from the fact that the aluminum case is not subject to as great a temperature range as the cast-iron sleeve, the higher







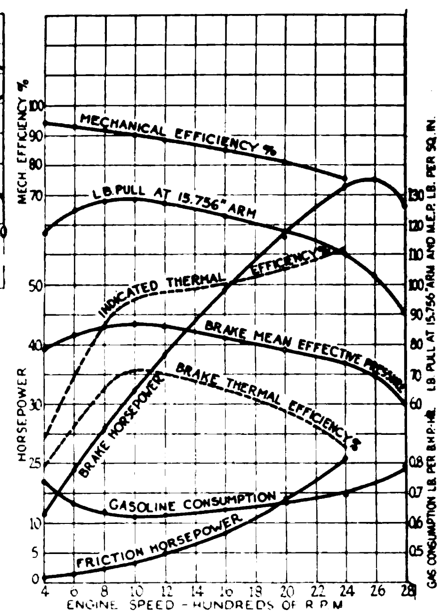


Fig. 9 (at left)—Characteristic curves of mechanism at engine speed of 3000 r.p.m. Fig. 10 (center, above)—Curves showing how inlet valves overlap in the six-cylinder engine used. Fig. 15 (at right)—Characteristic engine performance curves at full load. Compression ratio 4.25 to 1. Fig. 16 (center, below)—Curves showing relation between car speed and fuel consumption, with compression ratio of 4.25 to 1

coefficient of expansion of the aluminum being offset by the greater temperature range of the sleeve. The pressure on the combination cork and hydroil packing is in an axial direction only; that is, there are no radial components of pressure from the reactions of the packing to throw the sleeve out of round. This is the characteristic difference from other types of sleeve constructions and is necessary to make sleeve construction successful.

Fig. 8 gives the details of the inlet and exhaust cams, both cams being identical. This is a special type of cam* having a zero opening and closing valve velocity regardless of engine speed.

Fig. 9 gives the valve-mechanism characteristic curves for an engine speed of 3000 r.p.m. Attention is called to the design to obtain a high acceleration away from the cam and a low acceleration toward the cam; that is, the acceleration that must be produced by the valve spring to keep the roller following the round peak of the cam, the 0.484 in. radius shown in Fig. 8. The equivalent weight of all the accelerated parts considered placed at the valve is 0.7635 lb. The valve-spring pressure required at 3000 r.p.m. is 59.8 lb. per sq. in.; at 3200 r.pm. it is 68 lb. per sq. in.; at 3400 r.p.m. it is 76.8 lb. per sq. in. Great care is taken to have the master cam ground to a true radius at the peak of the cam. If the cam generated has any bumps on the peak radius, it is impossible to obtain high-speed operation for two reasons. The irregularities set up synchronous vibrations in the valve springs and the accelerations are immensely increased, making the springs too weak. For instance, if the 0.484 in. peak-radius has waves on it of 3/16-in. radius, the acceleration is increased 116 per cent. These points are mentioned because they are absolutely vital to the successful application of the valve mechanism of the roller type to a valve-in-head engine operated at high speeds.

Fig. 9 gives the inlet-valve timing overlap. This diagram shows that although the inlet-valve is held open fairly late, the valve of another cylinder is close to its maximum lift, preventing a blow-back into the carbureter. The valve timing is as follows: Inlet opens 4 deg. past top center and closes 60 deg. past lower center. Exhaust opens 52 deg. before lower center and closes 4 deg. past top center.

Fig. 11 shows a diagram of the intake-manifold passages. These are cast within the cylinder-head, making them of the shortest possible length. The firing order is 1, 5, 3, 6, 2, 4; therefore, the flow of gas is continuous in both directions from the center. The average gas velocity at 3000 r.p.m. at manifold inlet is 181 ft. per sec.; just above the valve it is 192 ft. per sec. and at full lift of the valve it is 247 ft. per sec. The throat diameter of the valve is $1\frac{1}{2}$ in.; the outside diameter is $1\frac{5}{8}$ in.; the valve lift is 0.445 in. The area at manifold inlet is 3.39 sq. in. The tulip-shaped inlet-valve is used to lessen the resistance and keep the velocity of the gas as high as possible on entering the cylinder as an aid to turbulence.

Fig. 7 shows the exhaust-gas pipe between the two center cylinders. The engine is equipped with a Delco generator and single breaker-point type of ignition, with automatic and manual spark advance. A Willard battery was charged during the tests and also was used for starting. Champion —Toledo No. A-63 metric two-piece plugs were used for all the runs. These plugs had much to do with the ease with which the tests were run. Only six plugs were used and at the end of the runs they were in perfect condition. This is saying a great deal for the spark-plugs, considering the high-compression pistons, power output and speed of this engine.

Fig. 12 shows the 2-in. Johnson Model B carbureter used. The air-valve spring and strangle tube were first worked out for the low-compression piston tests. The same parts worked out nicely in connection with the 5 to 1 compression pistons, with only a slight change of adjustment on the air-valve spring. Otherwise, in each set of tests, all adjustments were kept constant for both partial and full-throttle loads.

With the Sprague electrical dynamometer and the fine throttle adjustment, the proper load and speed were obtained readily.

The section at *AA* in Fig. 13 shows the equal distribution of the cooling water to the cylinder sleeves. The water goes from the pump to the tube inside the cylinder block. Two holes for each sleeve give a uniform distribution of the water. This keeps all the sleeves at the same temperature, an important feature for equal gas distribution and smooth running. The engine cooling

*A detailed description and mathematical analysis of this type of cam will be found in the 1917 S. A. E. *Transactions*, Part 1, pages 328 to 337.

water circulates through a standard radiator such as is used on the car. The radiator is cooled by circulating water from an outside source around the outside of the radiator; that is, the cooling medium is water instead of air as used in the car. However, since the water passing through the engine has the same resistance as in the car, it has the same temperature drop, for the quantity circulated is the same in each case. The temperature of the engine water is controlled very easily by this apparatus, and car conditions are duplicated. The temperature of the engine water outlet was kept at 150 deg. fahr. for all the tests.

Fig. 14 is a photograph of the connecting-rod, inlet-valve, exhaust-valve, piston-pin and the pistons. The connecting-rod length is 11 in., the weight complete with bearings is 46.35 oz. and the center of gravity is 2.60 in. from the center of the crankpin end.. Two pistons are shown at the upper part of the photograph. The one to the left gives the 4.25 to 1 compression ratio; the one to the right gives the 5 to 1 compression ratio and is of the constant-clearance type. At the bottom the latter piston is shown from a different angle. A set of 4.25 to 1 compression pistons of the constant-clearance type was not available for the comparative tests; however, 1/8-in. wide piston-rings were used in each case and the 4.25 to 1 compression pistons were relieved at the side in an endeavor to give the pistons approximately the same bearing area as the other pistons. The cylinder clearance given the low-compression pistons was 0.005 to 0.006 in. and that of the high-compression pistons 0.0015 to 0.0025 in. The weight of three 1/8-in. wide piston-rings is 1.82 oz.; that of the 4.25 to 1 piston, 13.52 oz.; that of the 5 to 1 piston, 18.65 oz.; and that of the piston-pin, 5.60 oz. The weight of the complete engine without the clutch is 660 lb. The weight of the complete powerplant, engine, clutch and transmission is 780 lb.

Testing Apparatus

A Weston tachometer was used to indicate the speed. This was checked repeatedly by a revolution counter throughout the entire range of speeds used. The engine cooling-water temperature was obtained by a radiometer calibrated for the range used.

Particular care was used in weighing the fuel for each run. Two fuel tanks were used, one for a general supply and the other for weighing the fuel consumed in 120 sec. The time interval was obtained from the second hand of a watch and the use of a three-way valve connecting the two tanks to the carbureter. Both tanks were equipped with gage glasses so that the level of gasoline could be kept almost the same. This scale balances readily within 1/100 oz., even when the rubber tubing connected with the fuel line is in place.

During the tests the windows of the laboratory were opened and the room temperature kept close to 65 deg. fahr. on all the runs. The average barometer readings for comparative tests Nos. 1 and 5 were 30.23 and 30.22 in. of mercury respectively. The gasoline used was Target brand, made by the Western Oil Refining Co. The weight of a sample gallon was 96.80 oz. and the heat value per pound was taken as 19,500 B.t.u. in the calculation of the thermal efficiencies.

Comparative Tests

Fig. 15 shows the engine characteristics at full load with the 4.25 to 1 compression ratio. The maximum brake mean effective pressure comes at 1000 r.p.m., with a considerable reduction at 400 r.p.m. due to the delayed inlet-valve timing. The maximum fuel economy is 0.613 lb. per b.hp. per hr. The mechanical efficiency is very good at low speed but drops off rather fast as the speed increases. The peak of the power curve is at 2600 r.p.m.

Fig. 16 shows the results of tests Nos. 2, 4A and 3, in terms of miles per gallon for 4.5, 3.5 and 2.5 rear axle gear ratios and 4.25 to 1 compression ratio. It will be noticed that a material increase in mileage is obtained as the engine load factor is increased by changing the rear-axle gear-ratio.

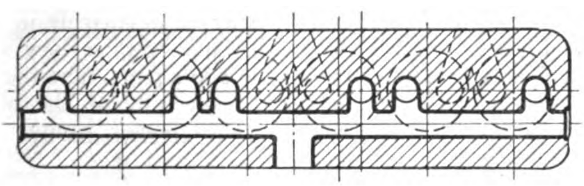


Fig. 11 (above)—Section of cylinder head showing short cast-in intake manifold

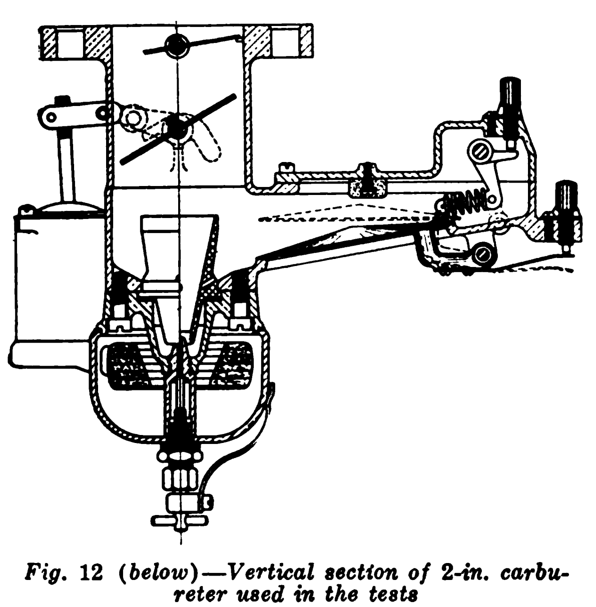


Fig. 12 (below)—Vertical section of 2-in. carbureter used in the tests

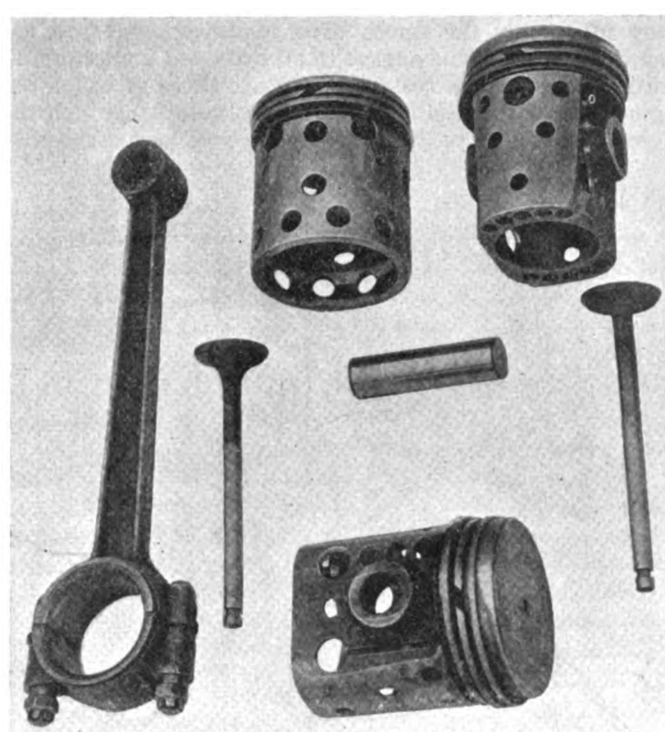


Fig. 14—Parts of engine used in test. Of the two pistons at top, the one nearer the center gives the 4.25 to 1 compression ratio, while that at the right gives a 5 to 1 ratio and is of the constant clearance type. Another view of the latter is seen at the bottom

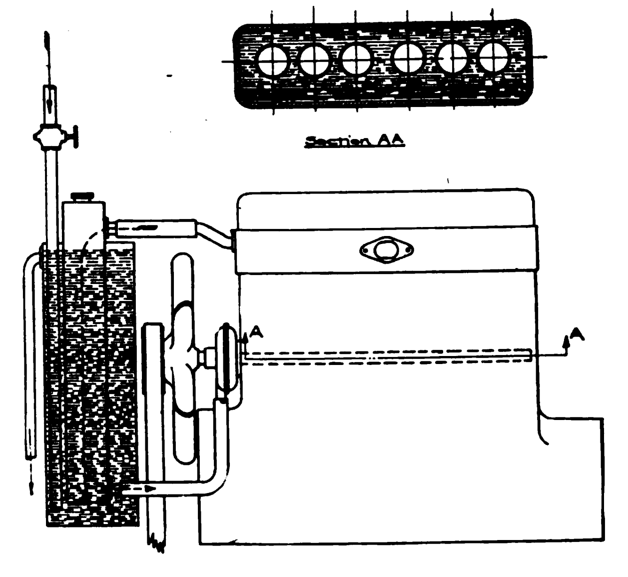


Fig. 13—Diagram of cooling water circulating system, showing method of cooling radiator used during block tests

Fig. 17 gives the engine characteristic under constant-speed driving conditions with 4.25 to 1 compression ratio and 3.5 to 1 axle gears. It will be seen that the full-load brake characteristics have been changed greatly, while the indicated characteristics have changed but little. The friction losses, which include the pumping losses, very materially lower the mechanical efficiency. Note that the engine is pumping against an intake-manifold depression of 15 in. of mercury at the lower speeds and the mechanical efficiency at 800 r.p.m. is only 58 per cent, compared with 91.7 per cent at full load.

Fig. 18 gives the engine characteristic when using the 5 to 1 compression pistons, everything else on the engine being identically the same. The readings given are not "snap" readings. The engine in all tests was kept running continuously and the results shown are those at which the engine runs with stability; that is, the result to which the engine settles at any given speed. It will be noticed that the maximum brake mean effective pressure is still at 1000 r.p.m., but it has increased from 86.2 (see Fig. 15) to 96.9 lb. per sq. in. It will also be noticed that the increase is greater as the speed increases. The peak of the power greatly increased, being 0.527 lb. per b.hp. per hr. at 1000 r.p.m. as compared to 0.613 lb. per b.hp. per hr. in the case of 4.25 to 1 compression. The mechanical efficiency is not as good below 800 r.p.m., but it is much better at the high speeds, being 81.4 per cent as compared with 76.1 per cent at 2400 r.p.m. The maximum brake thermal efficiency is increased from 21.1 to 24.8 per cent.

Fig. 19 gives the engine characteristics at constant car speed, with 5 to 1 compression ratio and 4.5 to 1 axle gears. Fig. 20 is for 2.5 to 1 and Fig. 21 is for 3.5 to 1 axle gears. Fig. 21 can be compared directly to Fig. 17, the only difference being the compression ratios. It will be noticed that the mechanical efficiency has not been materially changed; however, the fuel economy has been very materially increased. It is very gratifying to note that the relative increases are even greater than those at full-load. At 1000 r.p.m., the brake thermal efficiency has been increased from 11.5 to 14.1 per cent, and at 2100 r.p.m. it has been increased from 16.4 to 23.2 per cent.

Fig. 22 shows the miles per gallon at various car speeds for 5 to 1 compression ratio. This can be directly compared to Fig. 16. The results are materially higher all along the line. The overall increase at 15 m.p.h. is from 16.4 to 31 miles per gal., when changing both the compression and the axle gears.

On long road tests the results agree very closely with the curves considering the amount of time the engine is idled and the nature of the driving. On the speedway the results can be duplicated at constant driving speeds. They can be further increased by using light engine oil and higher tire pressure than those used in the tests to set the standard of brake horsepower required.

Comparison of Results

Fig. 23 gives a comparison of the engine full-load characteristics. The comparison as a whole is entirely in favor of the higher compression ratio, but shows a very slight loss in mechanical efficiency below 800 r.p.m. The increase in brake horsepower is marked, especially at the higher speeds. The percentage increase in power ranges from

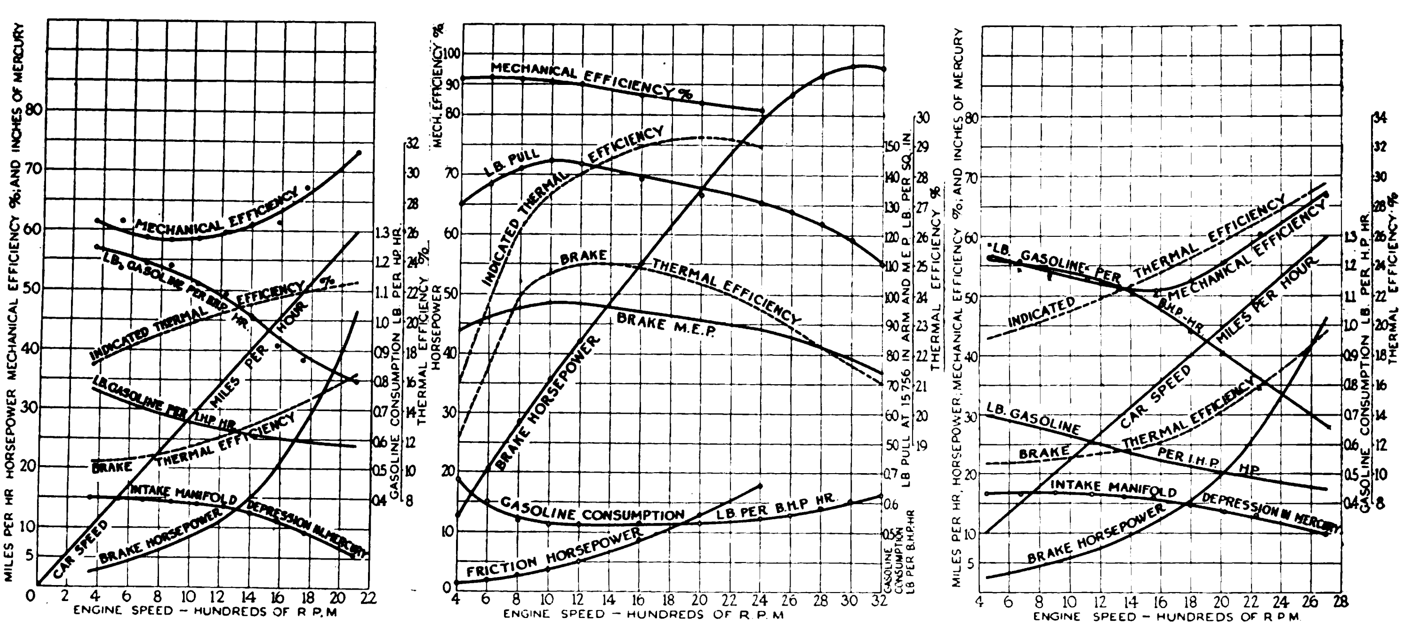
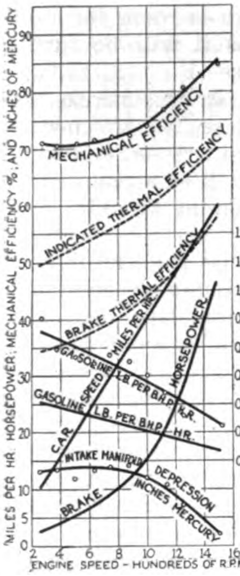


Fig. 17 (at left)—Characteristic curves of engine performance with 4.25 to 1 compression ratio when throttled to give power output sufficient to propel car on level road when using 3.5 to 1 rear axle gear ratio. Fig. 18 (center)—Characteristic engine performance curves at full load. Compression ratio 5 to 1. Fig. 19 (at right)—Same as Fig. 17 but using 4.5 to 1 axle gears and 5 to 1 compression ratio



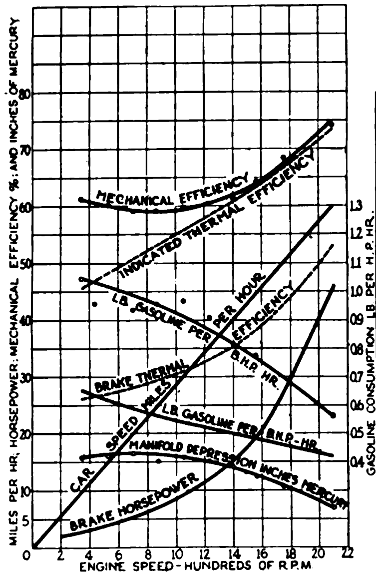


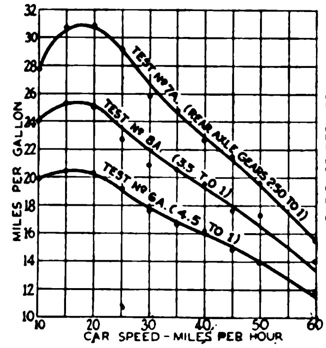
Fig. 20 (*at left*)—*Characteristic curves of engine performance with* 5 *to* 1 *compression ratio when throttled to give power output sufficient to propel car when using* 2.5 *to* 1 *axle gear*

Fig. 21 (*at right*)—*Same as Fig.* 20 *but using* 3.5 *to* 1 *axle gears*

10.5 at 400 r.p.m. to 37 per cent at 2800 r.p.m. The most important increase is that of the brake thermal efficiency. This ranges from 8 to 26 per cent.

Fig. 24 shows the result of increased compression ratio when keeping the rear-axle gears the same; namely, 3.5 to 1. The mechanical efficiency remains practically the same, due to identical engine speeds in each case. The increase in brake thermal efficiency ranges from 19 per cent at 10 m.p.h. to 41 per cent at 60 m.p.h. The saving in gasoline is from 16 to 28 per cent, and, at average driving speed, about 18 per cent.

Fig. 25 gives the comparative results of using the rear-axle gear ratios of 2.5 to 1, and 4.5 to 1, respectively with



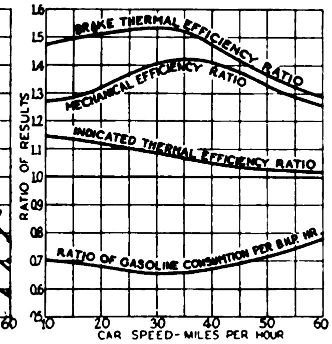
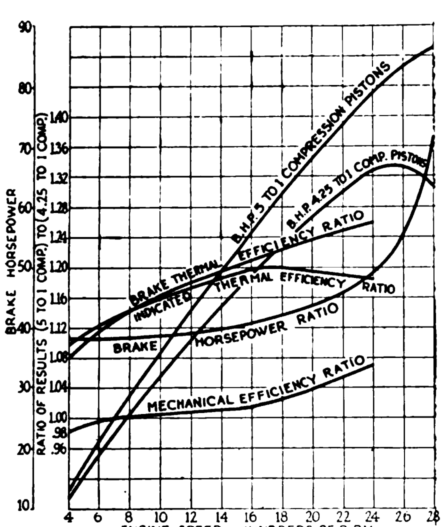


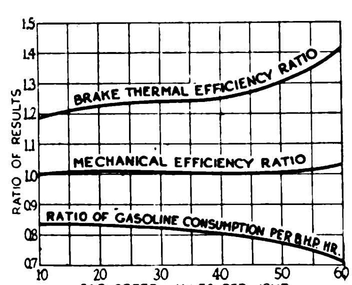
Fig. 22 (*at left*)—*Curves showing relation between car speed and fuel consumption when using* 5 *to* 1 *compression ratio*

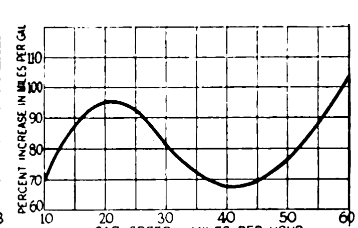
Fig. 25 (*at right*)—*Curves showing the effect of change in axle gear ratio from* 2.5 *to* 1 *to* 4.5 *to* 1 *upon fuel consumption, thermal and mechanical efficiency at various car speeds. Compression ratio* 5 *to* 1

5 to 1 compression ratio. The percentage increase in mechanical efficiency is very marked; the maximum gain is 42 per cent at 36 m.p.h. At 10 m.p.h. it is 27 per cent and at 60 m.p.h. it is 26 per cent. The maximum increase in the brake thermal efficiency is 53 per cent, at 29 m.p.h. It is 48 per cent at 10 m.p.h. and 29 per cent at 60 m.p.h. The gasoline saved is 30 per cent at 10 m.p.h.; 34 per cent at 29 m.p.h.; and 23 per cent at 60 m.p.h.

Fig. 26 gives the percentage increase in miles per gallon in the case of using 2.5 to 1 axle gears with 5 to 1 compression pistons, as against the use of 4.5 to 1 axle gears and 4.25 to 1 compression pistons. The increase in miles per gallon is 70 per cent at 10 m.p.h.; 95 per cent at 20 m.p.h.; 81 per cent at 30 m.p.h.; 68 per cent at 40 m.p.h.; 76 per cent at 50 m.p.h.; and 104 per cent at 60 m.p.h. **These are worth while increases in economy that cannot be passed by lightly, yet they are by no means as great as the economy that is possible.** Let us next consider the economy that is possible even with our present engines. For the sake of a name let us call it the "ideal" economy.







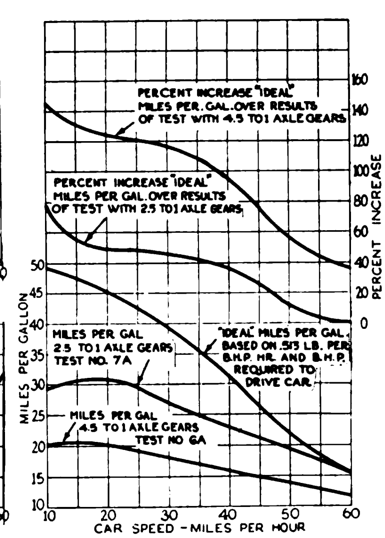


Fig. 23 (*at left*)—*Curves showing comparative effect on engine characteristics at full load of change of compression ratio from* 4.25 *to* 1 *to* 5 *to* 1

Fig. 24 (*center, above*)—*Curves showing effect of change in compression ratio* (4.25 *to* 1 *to* 5 *to* 1) *on fuel consumption, thermal and mechanical efficiency at various car speeds, with* 3.5 *to* 1 *axle ratio*

Fig. 26 (*center, below*)—*Per cent increase in miles per gallon of fuel when using an axle gear ratio of* 2.5 *to* 1 *and compression ratio of* 5 *to* 1, *as compared to using an axle gear ratio of* 4.5 *to* 1 *and compression ratio of* 4.25 *to* 1

Fig. 27 (*at right*)—*Curves comparing economy possible under "ideal" conditions of gear ratio, engine size and load, with economy determined in test when using* 5 *to* 1 *compression ratio and two different axle gear ratios*

We are a long way from the point where we utilize even the economy that is possible with our present engines. Fig. 27 gives a comparison which throws some light on what is meant. This chart is based on the actual engine economy existing at 60 m.p.h. when using 2.5 to 1 axle gears and 5 to 1 compression pistons. The economy is 0.513 lb. per b.hp. hr. Using this economy and the brake horsepower required to drive the car at each speed, we derive a curve that we have termed the "ideal" economy in terms of miles per gallon. It is not meant that this curve is practical with our present system of transmission of the power, but, if the proper gear ratio and engine size are used for any given speed, this economy can be obtained for the size of car used in these tests. From the ideal curve it will be seen that it is possible to get 49 miles per gal. at 10 m.p.h.; 45 at 20 m.p.h., 39 at 30 m. p. h., and 31 at 40 m.p.h. The comparison is made with the results of 2.5 to 1 and 4.5 to 1 axle gears, in connection with the 5 to 1 compression pistons.

The increase in the miles per gallon over that of the results with 2.5 to 1 axle gears is 76 per cent at 10 m.p.h. and 45 at 30 m.p.h. The increase over that of the results of 4.5 to 1 axle gears is 146 per cent at 10 m.p.h., 115 per cent at 30 m.p.h. and 36 at 60 m.p.h. Further, the ideal economy comparison with the results obtained from 4.5 to 1 axle gears and 4.25 to 1 compression pistons is an increase of 104 per cent at 60 m.p.h.; 163 per cent at 30 m.p.h., and 199 per cent increase in miles per gallon at 10 m.p.h. **These figures certainly are emphatic enough to arouse several changes in viewpoint of our present methods of applying our engines. Evidently there is room for very considerable progress and it is hoped it will be forthcoming in the near future.**

Means should be developed making it possible to use very high piston compression ratios. It seems certain that it can be done and to great advantage in increased economy. It is hoped that very decided progress will be attempted in piston development with a view to overcoming knocking and increasing the general efficiency.

As engines are made smaller to increase the load factor, carbureters will be made larger to avoid pumping losses and loss of maximum power. The fallacy that large carbureters are not as flexible or as economical as small ones is based, it seems, on the failure of certain types of large carbureters which it is thought are working on incorrect principles. **It is recommended that we try the plan of using large carbureters to operate small engines, rather than using large engines to operate small carbureters.**

The possibility of securing higher mechanical efficiency should be studied from every angle. The tests show that an absurd waste is rampant in our present method. How far our ingenuity can go in this direction is hard to predict. **One thing is certain, we must analyze carefully the gains that can be made. A close study from the brake-horsepower standpoint may justify changing both our transmission and our rear-axle drives. The latter combinations, together with engine developments, look the most promising at present. The progress we make undoubtedly will be measured by the extent to which we expand our engineering viewpoint.**

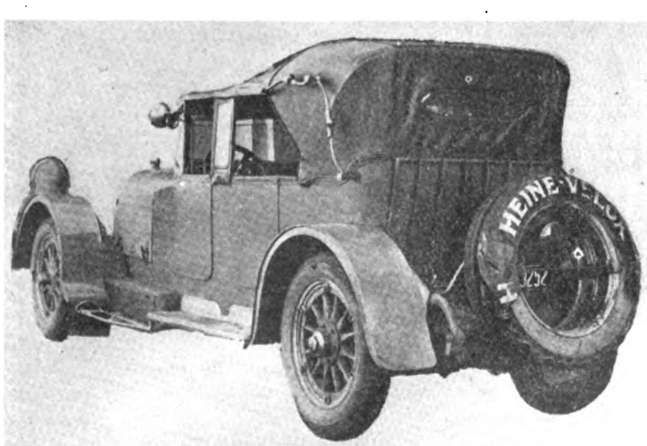
New High-Priced Twelve

A NEW high-priced car, the Heine-Velox, is announced from the Pacific Coast, the manufacturer being the Heine-Velox Engineering Co. One of the chief aims in the design of this car was to combine a low center of gravity with a fair road clearance, to insure easy riding qualities, freedom from skidding tendencies and long tire life. The car has a 148-in. wheelbase and can turn in a 53-ft. circle. The floor of the car is only between 22 and 23 in. from the ground where the car is loaded, and the drive from transmission to rear axle is then straight.

The engine has 12 cylinders, and is built partly by the Heine-Velox Engineering Co. from parts supplied by the Weidely Motors Co. It is said to be the same type as used on the H. A. L. car. One of the power plant features is an oil cooler, a desirable asset for a car used in mountainous districts. The weight of the sport model illustrated is 4500 lb. The oil level gage is in plain view of the driver. The windshield is of the clear vision type, without supports to obstruct the driver's view. The body is hung from the sides of the frame, instead of being suspended above it, and the floor is entirely inside the frame, making the top of the frame channels level with the top of the floor. The radiator front is in line with the rear side of the front axle. Four hydraulic brakes are fitted.

The instrument board and the brake and gear levers are placed in an unusual position, so that the driver can reach any part without inconvenience from his seat. The following instruments are used: oil pressure and oil level gages, Radi-meter, speedometer, clock, gasograph, ammeter, voltmeter, battery gage and altimeter.

This car will be furnished as a sport model, limousine sedan and racing runabout. The standard models sell at up to $17,000, and special models at up to $25,000. All bodies will be custom built in the Heine-Velox plant.



The Heine-Velox twelve with sporting type body

Muck-Raking in Demand

IT appears that the Danish Government has had the military flying service investigated by a committee appointed for the purpose, and that the latter is about to issue its report, concerning which some information has leaked out in advance. According to *Swensk Motortidning* the report will unequivocally condemn the whole service, which is declared to be uunworthy of any consideration. One of the first steps taken was to forbid the use of all military aeronautic material, comprising about twenty planes, and the Commission announced that all the equipment would be destroyed, notwithstanding the fact that much of it has never been used. Severe criticism is also passed upon the construction of a flying field and the training of military fliers, which is regarded as quite inadequate.

What Place Has Individual Personality in Industrial Relationships?

It is often said of plants where excellent industrial relations have been obtained, "It all depends upon the personality of Mr. Smith; if he were to die, they would have as much trouble as anybody." This article discusses the various sides of the question, and presents helpful conclusions.

By Norman G. Shidle

THE industrial relations story of many plants has been written. Very often a successful achievement along this line seems to revolve almost entirely about the personality of a single individual. In such cases a study of the particular story may yield but meager material for adaptation in other plants. Remove that individual and nothing may be left to the industrial relations policy of that firm.

In the Endicott-Johnson shoe factory, for instance, if consensus of journalistic opinion is to be believed, the success of the industrial relations policy revolves chiefly about the lovable personality of Mr. Johnson. Remove that personality, and there is but little story to write. Saying that if the individual is removed in such a case nothing is left of the industrial relations policy, is not to say, however, that the policy would necessarily fall to the ground immediately he was removed. It might—but it might not. It is this question that calls for further discussion.

Because personality has played such an important part in the success or failure of a number of plant labor relationships, a thorough analysis of that factor will be of value. It must be recognized, and it might as well be analyzed and estimated at its true value.

Various plans for employees' representation and industrial democracy have been formulated and advocated for use in any plant. Such plans, however, must be administered; a personal contact must occur somewhere along the line between employer and employee, whether such a plan is in effect or not—and again enters personality.

Even where mechanical means for organizing a labor policy have gone the farthest, the success of the plan rests largely upon how the administration is carried out, which in turn depends upon the composite or individual personality of the particular management.

The Greenfield Tap & Die Company, for instance, has had an industrial democracy plan in use for more than a year. It is working successfully. During that time the management has never yet exercised its power of veto on any recommendation made by the employees' representatives. Only three times has the management returned to the employees' representatives recommendations, asking that those representatives reconsider the recommendation. In each case the management has sent along with the request for reconsideration a full statement of its reasons for asking that the matter be discussed again. Each time that this has happened the employees' representatives have discussed the statement of the management and withdrawn the recommendation.

Note, however, that the management has the power of final veto; it could have simply vetoed these measures and that would have been the end of it. The method which it did use implies one sort of personality; the method that it could have used but did not, implies another sort. Had "the other sort" been in control the whole representation plan would probably have broken down before this. Personality, attitude of mind, habit of thought—whatever you may call it—plays a large part in industrial relationships whether in the person of a single individual or in that composite individual known to the workman as the management.

The constant and direct contact between management and employees, however, usually revolves to a large extent about one person; often the personnel manager. And it is through that man's personality that the management is reflected to the workmen. In the case of the Endicott-Johnson plant, it is through Mr. Johnson, according to reports. In the case of the White Motor Company, it is chiefly through one of the vice-presidents; in the case of the Filene store, through one of the vice-presidents; in the case of other companies through other individuals. The cases mentioned all involve companies which have been conspicuously successful in conducting the human relationships of their organizations.

The criticism of the policy of a plant which revolves so strongly around the personality of one man is that stated in the beginning of the article; if that man should die or be lost to the firm, the whole structure would topple over; it rests chiefly upon a personal adherence of the majority of employees to that one man. They love him, they respect him, they trust him, and admire him. If he goes, what becomes of the industrial relations policy?

The answer is fairly clear. It varies with different cases and may be divided in this way:

1. In some cases, the criticism given above is perfectly valid. The structure will fall to the ground when the particular personality leaves, because it has not only grown up around that personal adherence to an individual, but it is carried on upon the same basis.
2. In other cases, the man with this personality was necessary to start the work in the beginning. Perhaps the confidence and trust of the men has been built up on that basis. When that has been done, however, this man has been able to instil the same spirit throughout the management and executive organization until finally the composite "management" becomes an attractive and trustworthy personality to the employees. In such cases the work can be carried on without any diminution of success after the individual leaves.

(Continued on page 179)

Distributing Overhead Expense by the Machine Hour Rate Method

After describing briefly the four other methods of distributing overhead expense, Mr. Haigh shows in detail the advantages of the machine hour rate method. He believes that more knowledge of the expense element of manufacturing cost is obtained by this method than any other.

By Christopher Haigh*

An interesting discussion of the methods of distributing overhead expense, with particular reference to the advantages of the machine hour rate method, is contained in the following paper presented before the American Gear Manufacturers' Association by Christopher Haigh, Supervisor of Costs, General Electric Co.:

There are five methods in general use for distributing overhead expenses. These are:

Man Rate
Man hour
Sold hour
Material and Labor
Machine Hour Rate

The man rate method is the one in most general use, because of its simplicity. To use this method, it is only necessary to find the ratio of total expenses to total labor for a given business and to apply this ratio to the labor cost of each job. For a factory making one kind of product, this method of distributing overhead is quite satisfactory, but where the product itself is varied and the tools used in getting out the product are different for each of the various units produced, it is incorrect and misleading as to final results. There is no more justification for considering that one dollar's worth of labor actually applied to the product should always take the same percentage of expense than there is for the assumption that a lathe and a boring mill, which cost the same, are operated for the same amount and occupy the same floor space, or, further, that the overhead cost of maintaining benches and assembly floors is the same as the overhead cost of maintaining and operating machinery.

Defects in New Rate System

This method of applying overhead also assumes that the highest paid workman requires the most overhead expense, when actually the lowest paid man often requires the most supervision, and frequently the machine tools used by the low priced man are more expensive and require greater expenditures for operation and maintenance than those used by the skilled mechanic, because we incorporate in the machine which enables us to use lower grade labor the skill which the high grade man has in himself. Thus, if we design a semi-automatic machine for making any part, we can use a man who is not an expert mechanic to run this machine, or even several of these machines, but if we did not have this special equipment, we would require a skilled man in constant attendance on a more simple machine. It is obvious in this case that the overhead expense which is incurred in running the automatic machines is much greater in proportion to the wages paid the operator of these automatic machines than is the overhead incurred in running the mechanical equipment required by the skilled mechanic.

It is also true that even if the same wages were paid all men in a manufacturing establishment, it would still be wrong to apply the overhead to each job on the basis of a percentage to labor, for we would still have the condition of one man running more machines than another and of the difference in cost of the machines operated; also, that some men would be occupied on jobs such as cleaning castings, checking finished product, painting, etc., which require little mechanical equipment, and therefore do not increase the overhead expense at the same rate as their wages increase the direct labor payroll.

From the foregoing remarks, it would appear that the man-hour rate method of distributing expenses is a very dangerous one and that all manufacturers who use this method are certain of losing money. Therefore, it seems to be necessary for me to say a few words showing where this method may give results which will be satisfactory from a standpoint of profit.

When Equipment Is Standardized

In a manufacturing establishment where the mechanical equipment is fairly well standardized, where the products, while varied as to different types, still have the same average types of output, and where these types all require substantially the same machining operations; it will be found that the ratio of profit to total output will come up to expectations when the man rate method of distributing overhead is used. There is also a factor which must not be overlooked when considering any business, and that is, the amount of information which the man or men at the head of it have of that business independent of records, as I have frequently found that when estimating cost of new work, allowances are made by the owner of the business for a higher expected cost of the new work due to special facilities which will be necessary and to the expectations that the bigger machines in the plant will be used on the work. By making such allowances, the final price submitted includes some of the factors of expense cost which are not actually subject to proof from any records of overhead expense which would be available if the man rate of distributing overhead were in use, but which nevertheless result in the inclusion of these extra items of expense in the selling price.

There is, however, a question in my mind, and I think in yours, as to how many men who manufacture a wide variety of gears can give the necessary weight to all the expense factors which will increase or decrease the cost of

* Paper read before American Gear Manufacturers' Association.

a particular kind of gear, and it is undoubtedly true that many of the manufacturers who are making good profits on their total business are losing money on some particular type gear because of their lack of knowledge of the operating cost of their machines. Also that they turn down business on which there may be good profit because their selling price is figured on the basis of the average overhead which brings the price up higher than the buyer will pay.

The Man-Hour Method

The man-hour method of distributing overhead has for its base the number of hours spent on a job instead of the amount of wages paid. This method is subject to the same criticism as the man-rate method in that the assumption is made that the overhead expenses have a fixed ratio to the number of hours of time spent on a job. The advocates of this method point out that certain items of expense do bear a direct relation to the number of hours worked, and include under this head the expenses of the payroll and welfare departments, toilet articles, compensation, insurance and supervision, and we can agree that to a certain extent these items bear a closer relation to hours worked than to wages paid, but as these items are a small part of the total expense, and as it would be erroneous to distribute the major part of the overhead on this basis, I see no advantage in this method over the man-hour basis. Moreover, it can be pointed out that we do not reduce our payroll and supervisory force every time business falls off to such a point that we lay off some of the men, and therefore, the cost per man-hour of operating these departments would fluctuate sufficiently to nullify any advantage gained over the man-rate method, particularly where this advantage consists mostly in compensating for the difference in labor rates by substituting hours worked for wages paid.

Material and Labor (Prime Cost) Basis

The application of overhead on the basis of prime cost (material and labor) is not in very general use so far as I am aware. This method requires that the total expenses of a business be divided by the sum of the direct labor and direct material, and that the ratio or percentage so obtained be applied to the direct material and labor cost of each job turned out. It is manifestly wrong to apply this method to the product of a business which uses various kinds of material, but, where the product is all made from iron or steel, this method has some good points, as, by taking the material into consideration as well as the labor, we apply more accurately the expense of handling the material in the shop which, of course, varies with the size of the piece handled. In a shop using both copper and iron castings, this method would be worse than the two previous ones, as by adding the value of a copper casting to the labor of machining it, we would get a total figure which would carry a very high amount of expense which, when compared with the expense cost applied to an iron casting of identical size requiring about the same amount of labor, would indicate that the expense cost of machining the copper casting was as much higher than that of the iron casting as the difference in the price per pound of copper and iron.

This method has many of the same kind of inherent defects as the man-rate and man-hour methods, as we would still be applying an average expense to jobs instead of an actual cost, the difference between this and the other two systems being only that the material is added to the labor before determining the expense to be applied.

Even were this method the correct method for some businesses, the places where it could be applied are limited in number, and this method can never be applied generally. It is mentioned here, however, as it has been pointed out to me that the steel gear business is one of the very few where this system could be applied, and while I do not advocate its use, as I see very little, if any, advantage over the man-rate method, nevertheless, I think it well worth while to mention the system in connection with other methods of overhead distribution.

The Sold Hour Plan

The sold hour plan of distributing expenses provides that we take the total direct labor wages in a department and divide this total by the number of hours worked in the same period to get a flat average cost per hour for labor.

The time in hours consumed on any job is valued at this flat rate per hour, and the result is called the direct labor cost.

The expense is applied on the man-hour method previously mentioned.

This method is not in very general use and little can be said in its favor. The man-hour method of distributing expenses has been criticized before and much need be said regarding the determination of labor costs under this plan unless the rates paid workmen were practically uniform, we would include still another error in our final cost by using an average rate per hour for labor.

There are still other methods of distributing overhead for special businesses, but because of their limited application, no mention is made here. I have written about the four methods covered so far in this paper to enable me to show the contrast between the results obtained under these methods and the results obtained by using the machine hour method, which follows:

The Machine Hour Rate Method

This method consists of distributing all the manufacturing expenses of an establishment by a charge of each job of the overhead cost of operating the machines and other facilities used on that job. This overhead charge is not an average charge for the whole plant or department, but is, as nearly as possible, the actual overhead cost of maintaining and operating each of the machines, group of machines, benches, etc., which are found in the plant. By the proper use of this method it is possible to show the difference between the expense cost of a boring still and a lathe, a gear cutter and a splining machine, etc.

The advantages of this system are well covered in several books written by A. Hamilton Church, and I think it would be of benefit to those of you who have not seen these books if you would obtain a copy, as in this paper I cannot go into all the details of the system, nor do I think you would want to listen to an explanation of details even if the time permitted, and yet, to thoroughly appreciate the advantages of the system or to realize its disadvantages, a fairly complete knowledge is necessary.

Method of Determining Rate

To install a Machine Rate Method, we would first find the number of feet of productive floor space available for manufacture, eliminating the space used for foremen's offices, stairways, wash rooms, etc. We would use the number of square feet so obtained as a divisor for determining the cost per square foot per year for maintenance, depreciation, taxes, insurance and other kindred charges applying against the land and building. We would not include any expenses in this group which were incident to the actual operation of the machines, but only those charges which applied against the empty buildings ready for manufacture. We would include, however, the expense of lighting and heating and building and charges of a similar character. In this way we get a charge per square foot which is practically the same charge which the owner of

the building would make if he rented it to us and furnished the light, heat and water used in the building, except that he would require a profit on his investment which we would forego in the expectation of making this profit on the gears which we manufactured.

Factory Divided Into Production Centers

We would next divide the factory into production centers, including in each center machines of similar character located together, or individual machines where there were no convenient groups. We would never include different kinds of machines in one production center, as this would defeat the object of this system. After the division into production centers has been made, we would determine the number of square feet occupied by each center, including in this area the space required for the material waiting to go on the machines, the space required for the workman, etc., and would charge each center with a part of the rental of the whole building based upon the area occupied. This division would give us the rent per year for each production center, and in this way we would allocate the total charges of the building which we have called rental charges to various production centers. We have now got one part of our expenses divided in such a way that we can include them as one factor in the machine hour rate.

We would next determine the actual cost of the expense items incident to the operation and maintenance of each of the production centers. These expenses consist of depreciation of the machinery and equipment, taxes, repairs, small tools, cutting oils and other charges which can be definitely allocated to the one or more machines which have been included in one production center. If a small group of machines, all included in one center, require the entire time of one foreman, the wages paid this foreman would be included with the other expenses in arriving at the total cost of operating the center.

The distribution of the power charge can best be made on the basis of the horsepower required by each production center. In this power charge we would include the expense of running the power plant as well as the shafting, belting, etc.

The expenses which we are dividing should cover a period long enough to insure correct results, and should cover a period of normal operations so that our results will represent the hourly cost of operating our production centers in normal times and under normal conditions. The best results are obtained if the expenses for a whole year are used as a basis for the machine hour rate, and if these expenses are carefully analyzed and allocated to the various production centers, the hourly rates first determined will not require much adjustment. In fact, the success or failure of the system depends on the amount of attention given to the division of the expenses at the start, as, unless the first rates are approximately correct, the first results obtained from the system will be so disappointing and misleading as to cause a manufacturer to condemn it and to insist for all time that the plan is no good.

A Detailed Analysis

For the purposes of this paper, we will assume that the expenses analyzed cover a period of one year.

We have now divided two groups of the annual expense among the various production centers, and by adding the rental charges and the charges for operating and maintaining the machines, we have the basis for determining the hourly cost of expense applicable to work on the Machine Hour basis. To determine the hourly charge, we must estimate the total normal hours which each production center will work per year; we then divide the amount of the expenses allocated to each production center by the normal hours this center should operate, and the result is an expense cost per hour.

There still remain a few items of expense which have not been distributed, such as supervision, clerical and general administrative expenses. These expenses should be totaled, and this total divided by the sum of the normal hours of all the production centers. The result of this is another hourly expense cost which is to be added to each machine rate as a supplementary charge.

It must be brought to your attention that the machine hour rate is based entirely on the assumption that the production centers will work a certain number of hours in a certain time—a year having been used as the basis of this discussion. It is obvious to all of us that no man can predetermine accurately the number of hours any machine in his plant will be occupied, and many people reject the idea of installing this system for that reason alone. I think you will agree, however, that either by keeping records, or examining records already available, a close approximation of the normal working time of any machine can be found, and if the expenses of operating the machine are based on an approximately correct operating time, we have, by the machine hour rate method, a means of showing immediately the financial effect of any variation of the operating time of the machines from the predetermined normal or standard operating time.

In making up the hourly rates, we assumed that we had a certain amount of expenses, say $1200, to absorb in a certain period, say one year, over one production center. Let us say that we estimated that the normal hours that this center would be used in the year were 2400, or 200 per month. On this basis, the hourly expense cost operating this production center is fifty cents. By adding fifty cents for each hour that a job required the facilities of this production center, we would expect to absorb all the expenses connected with it. Now, if the jobs passing through this center in a month required the use of the facilities for only 180 hours, we would see at the end of the month that on this particular center we had failed to absorb $10 of our expenses. We would have the same information for all other centers and, therefore, for the whole shop, and would know at the end of the month how much of the manufacturing facilities had not been used or had been used more than we expected, this information being available both in terms of hours and money.

Supplementary Rates

It is not, of course, expected that any manufacturer would absorb all of the differences between the amount of expense actually absorbed and the amount which he expected to absorb, and to insure that all expenses are included in cost, a supplementary charge is made to each job to liquidate the amount of expenses which has not actually been absorbed through the machine rate in use.

This supplementary rate is a part of this system of expense distribution and is, in fact, a valuable factor because we know from the amount which we add to cost to absorb these supplemental charges, how far from normal the plant is running. In fact, one of the great benefits of this system is that the supplementary rate soon shows if machines are idle because the expenses which would be absorbed by machines which had work to do become, when these machines are not in use, a part of the supplementary charges, and the fluctuations in the monthly amounts liquidated by means of this charge show to a great extent the efficiency with which the facilities of the plant are being used.

It will be evident to you, if I have been successful in showing you how the manufacturing expenses of a business are distributed by means of the machine hour rate,

that this method allows of a very close knowledge and control of overhead expenses, and that by this system we can obtain actual costs of each job.

When comparing the way in which expenses are distributed through the use of machine rate costs with the distribution by means of any other method, it will be seen that, as far as accuracy is concerned, everything is in favor of the machine rate method. In fact, I think the claims of its advocates, that this method is the only safe and scientific way of expense distribution, must be allowed. All other methods of absorbing manufacturing expenses depend in one way or another on averages, and yet there is no more reason for averaging the expenses over costs of all the work produced than there is for averaging the material items.

I mentioned at the beginning of this paper that I was opposed to the application of any system to a manufacturing business which did not result in an increased knowledge of that business, and, through this increased knowledge, to a certainty of profits. I think that no one can, or desires, to refute the statement that more knowledge is obtained of the expense element of the manufacturing cost through the machine hour rate method than can possibly be obtained through any of the other methods used in business.

I am sure you will also agree that any of you who has this knowledge would use it to determine what business to take and what to refuse. If you were given the opportunity to bid on an inquiry for gears which would require your biggest machines, you would certainly make your price such that your expected profit would actually be profit on that particular job, and would include in the cost on which this profit was based the actual overhead expense of the mechanical equipment to be used. If your price, assuming that your profit was reasonable, was such that you lost the order to some one who was quoting a price based on an average overhead, you would feel perfectly sure that this other concern was taking business at a loss and would be willing to let them have the order. Conversely, there are many jobs which require less machinery and cheaper equipment, and your method of arriving at costs would allow you to take this kind of business at a price lower than the concern whose costs were not accurately determined.

I believe that the reason this machine rate method is not in more general use is because of the amount of work which is required in getting the system working, and the extra bookkeeping involved in keeping the records which must be available if this plan is followed. Most manufacturers have an objection to increasing the administrative expense of their business and would rather spend money for new machinery than for a system of records. This attitude is certainly correct if there is no doubt that the business as run without these records brings satisfactory profits and will continue to do so, and if the new machinery earns its keep, but in any business which is to any large extent competitive, the need for accurate records will sooner or later be felt, and I am firmly convinced that those concerns which have the best system of cost records will be in existence long after the manufacturer who figures his cost on the hit or miss method has gone out of business.

Sufficient Spare Parts a Necessary Feature of Proper Tractor Service

(Utilitor Service System)

"A TRIP through a prosperous Eastern agricultural section shows that tractors are being bought. There is little indication, however, that they are being *sold*," writes Donald Blanchard in a recent issue of *Motor World*. And again, "Service sells satisfaction and satisfaction sells tractors." The vast importance of proper service as an adjunct to sound tractor merchandising is becoming more widely recognized among tractor manufacturers every day.

In the case of any particular tractor there is, within certain limits, a comparatively fixed number of parts which it is highly desirable for the dealer to carry in proportion to the number of tractors to be serviced in his territory, in order to render rapid and efficient service, while still investing in parts the minimum amount of money.

The dealer is not always willing or able to take the trouble necessary to determine in a scientific way just what his approximate inventory should be. Because it is to the manufacturer's advantage that the dealer should have such an efficient inventory, however, many tractor manufacturers have studied the matter carefully and are giving their dealers the benefit of their investigations; in some cases even requiring that a certain fixed supply of parts be sold to the dealer with each tractor that he orders.

The Midwest Engine Company, manufacturers of a very small tractor, the Utilitor, is paying particular attention to the service features of its merchandising policy, and has developed some excellent practice along this line.

When a new distributer is signed, a letter is immediately written to him by the service director for the purpose of making his acquaintance, outlining to him the service ideals of the company, and welcoming him to the organization. Particular care is used to impress upon the distributer the necessity for carefully inspecting the tractor before he ships it to a dealer.

The number of each of the various spare parts necessary to properly service any given number of machines has been carefully worked out. Every distributer and dealer is required to accept a certain quota of spare parts with each machine.

The quota is so worked out that when a distributer or dealer has received three carloads—or 90 machines—he has on hand a small stock of each part which goes with the machine. With the first group of machines go those parts which are likely to need replacement soonest. When 90 machines have been received by the distributer or dealer, however, he has a sufficient variety of parts to build an entirely new tractor.

The allotments for these quotas have been made up by the factory service department on the basis of field data and a long series of careful experiments. The manufacturer requires that the stated quota of parts goes forward with each order of machines, and distributers are required to make a like demand on the dealers.

In this way the factory is certain that from the standpoint of spare parts, at least, adequate service can be rendered to every user of its product.

What Has the Manufacturer Done to Disturb Dealers?

History is of value only as it supplies a background for the making or unmaking of precedents. This article deals with two closed incidents—the allotments of cars and "drive-aways." These incidents are important only as they indicate whether the manufacturer profited in the long run.

By Clyde Jennings

THIS article must be read as a sequel to the article printed in Automotive Industries for Jan. 6. In that article it was established, by testimony of dealers themselves, that discontent exists. In this article we set forth some of the reasons for this discontent. Of course there are other reasons, some of them being much more serious. Later we will have something to say about the always interesting and important factor of contracts.

WE believe that it was fairly well established in a previous article that there is some existing discontent in the ranks of the dealers. In fact, we do not believe that any one will contend very strongly to-day that the automobile sales family is entirely harmonious.

It would be interesting, no doubt, to know just why this state of affairs exists. Perhaps you will recall that in the statements from dealers which were printed in the previous article that one dealer—No. 11—mentioned the fact that there was a charge of $15 a car for national advertising that the dealer was compelled to pass on to the buyer. That is one indication as to the direction of the wind that blows on the coals of discontent.

But last spring we were hearing much about the allotment of cars. We don't hear so much about this now, but how do the dealers feel about it? This was one of the questions put to a list of dealers by a man who is on the closest terms of friendship with them. Thirteen dealers answered and—

> **Not a single one of the thirteen defended the factory, without reservation.**

Do you get that? Not a single YES to the question:

> **Have the factories played square in the allotment of cars?**

We are passing on to you some of the answers. Not all of them will be printed, for they get just a bit monotonous. Some of each shading will do. The first three are especially severe (on the manufacturer). If I was a manufacturer and one of my big distributers would say these things about me, I would be inclined to worry somewhat. Read them and see what you think:

—

1—No, they have not. A good many factories have men high up who have stock in distributing agencies and they have furnished these agencies cars first. Then distributers on the ground got next preference. We distributers without a pull who stayed at home got only what was left.

—

2—Our factory, I know, has not played square in the allotment of cars. Some of the larger distributers have received freight shipments when other distributers have had to drive their cars all last winter and this spring.

—

3—The factories have not played square in the allotment of cars.

—

Here are several of the moderate answers. The details of these answers are so much alike that some have been shortened somewhat, but the wording of the part passed along has not been changed. These answers are interesting:

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4—Factories have played square only so far as they got full payment for their goods at factory door or could readily obtain equipment for shipping.

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5—As far as I can find out, our factory has given as cars pro rata to the number they manufacture, but we have always been very suspicious. I know of numerous dealers and distributers who have got very rotten deals along this line.

—

6—Our factory has played square with us and the dealer on the ground with the money has not been shown preference. I have reason to believe, though, that some distributers have not been so well favored and that preference has been shown in some instances.

—

7—The live-wire distributers who have had drive-away crews at the factories with instructions to take the cars as they came out of the doors and drive them away naturally have been favored.

—

8—I do not believe that all of the factories have played quite fairly in the allotment of cars. It is a fact that some of these factories have shown a decided preference to the dealer who was on the ground with sufficient money to take the cars and drive them away.

—

The previous article said that the dealers quoted are among the very best. Here is the proof of that statement. These dealers come in the class of "live wire"

business men, and, of course, they were the men who had men at the factory doors with money. In the following replies it is interesting to see how they justify this distribution.

—

9—Factories have not done in all instances what they should have done. We assume that they have done what most of us do—have taken the line of least resistance. There is no question in my mind but what a great majority of the factories have given preference to the man who has camped on the factory doorstep with the cash in his pocket when deliveries were bad.

—

10—As a general rule, it is my belief that the factories have endeavored to play fairly with the distributers and dealers. In answering this question it is, of course, necessary to take into consideration that we are all human and the factories, undoubtedly, to some extent like ourselves, the distributers, have given some consideration to the man who has been persistent to the point where we have, in some cases, given him automobiles to relieve his pressure. No doubt, the factories have in some cases done likewise.

—

11—Generally speaking, our factory has been very fair with us on monthly schedules, our increase this year being at a greater proportion than past showing would entitle us to. As to the day-by-day deliveries, however, I have known of some instances, personally, where dealers and distributers got cars to which they were not entitled. Also, nearly every time that Mr. Blank has gone to the factory he has succeeded in getting cars, whereas it was impossible to get them by correspondence.

—

12—I believe on the whole that the factories have been square in allotting cars to their dealers. The trouble with that lies in the fact that some of the largest distributers such as New York, Cleveland, Chicago and so forth, have been allotted larger proportionate contract allotments than the smaller points.

—

There is just one more reply that will be quoted. This man is very careful to speak for his factory only. It is the only real defense of a factory noted in the correspondence that is being quoted:

> **In so far as our company is concerned, I can truthfully say that in my opinion the factories have been absolutely square with us in relation to allotment and I do not believe that any other distributer with ever so much more money than we may have and by virtue of being on the factory doorstep can get any more cars than we can. Our factories have sold me on the fact that they are treating us all right.**

If I was an automotive manufacturer I would insist that this dealer remain in my organization.

—

We all know that one swallow does not make a summer, and that one point of discontent would not make for a seriously discontented dealer world. Last winter and spring we were hearing a good deal about freight charges and drive-aways. As this is to a large extent a closed incident, we thought it would be interesting to sound out the dealers and hear how they felt about it. If one can judge by the general tenor of the following replies, some of the dealers are inclined to be a bit sore on this question. Some of the dealers are located so far from the factories that drive-aways did not enter into their operations, but nearly all replied to the question directly. The question was:

In view of drive-aways, factories were not put to the expense of loading, blocking, etc. Was there any dealer credit allowance made as a consequence thereof?

—

1—Some of the factories have more than offset this by putting the cars in proper condition and filling the tanks with gasoline. This has been true with the Blank people, for instance. Other factories have made a common practice of doing nothing and putting in a small amount of gasoline, probably five gallons, and letting the dealers shift for themselves. These factories, therefore, have saved a great deal of money for themselves by so doing which, of course, is an injustice.

—

2—Factories have never made any credit allowance for drive-aways.

—

3—Factories have made no allowances on drive-aways. Have grabbed the money and paid no part of shipping expense away from factory—supplied no blocking and made no allowance.

—

4—The manufacturer has been giving the dealer enough gasoline to take him to the first filling station and it would insult him if you asked him for any credit allowance because he had to do no loading or blocking.

—

5—No factory has, so far as I know, made any allowance or credit for the money they saved in loading or blocking cars.

—

6—So far as my knowledge extends, no factory has made any allowance to distributers for driving, loading or blocking.

—

7—The factories have not made allowances to the dealer wherein they saved the expense of bolting, blocking and so forth on drive-aways.

—

8—No allowances have been made in the case of drive-aways, so far as I know.

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9—Our factory has not made an allowance of five cents for drive-aways although it has saved thousands of dollars in blocking material and labor charges. They have made in return a fixed charge of so much per car for getting cars ready for drive-away. In other words, they have added on an additional profit for themselves.

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10—We are charged for decking for each car as shipped at a fixed rate. No charge of this kind is made on drive-aways. Of course, no allowance is made but none would be coming if the charge is actual cost.

—

11—We have never received any credits from our factories in lieu of loading expense on drive-aways. Two of our factories furnish a liberal supply of gasoline and have the motors completely filled with oil. The third factory makes a small drive-away charge. I believe that cars made ready for drive-aways have to be a little more completely equipped and inspected than for shipping, and it has been my thought that the cost of loading saved in drive-aways was pretty well absorbed by the additional work necessary to get cars ready to drive them away.

—

There is one fine thing about the answers to this question. That is the unanimity of opinion, and the short, sharp method of expression. Some of these answers fairly cut. The manufacturer can hardly be in doubt as to the impression left on the distributers' minds by this incident.

Bureau of Standards Annual Report Shows Extent of Automotive Research

Growing importance of the Bureau's activities to the automotive industry made apparent. Work includes research on carbureter and vaporization problems, materials of construction, storage batteries, spark plugs, etc. Much progress made in improving methods for testing lubricants.

IN the annual report of the Bureau of Standards, recently issed there is given an outline of the research work on problems connected with the design and operation of internal combustion engines which the Bureau has completed or has in contemplation. The variety of work done of an automotive character shows the growing importance of this Government bureau to the automotive industry.

According to Dr. Stratton, specifications for starting and lighting batteries have been prepared, at the request of the Motor Transport Corps. The effects of various factors on the voltage required to produce a spark at the terminals of various types of spark plugs under operating conditions have been determined. The results of this work are of special importance in providing for reliable ignition on engines operating at high altitudes with a supercharger.

A special research was undertaken to determine definitely the cause of occasional failures of ignition in aircraft engines apparently due to faulty spark plugs. The results were to demonstrate conclusively that early ignition of the cylinder charge due to overheated spark plug terminal was the cause. Types of construction which tend to aggravate or to prevent this effect were determined. The cylinder pressures resulting from such preignition were also shown to be some three times normal pressures and to constitute an enormous accidental overload on the engine parts.

The Bureau of Standards makes it clear that its researches into antifreeze solutions for automobile radiators are necessarily incomplete, but so far none of the materials submitted warrants the recommendation of solutions other than alcohol and water.

The laboratory for research on carbureter problems has been used for tests of a number of carbureters, including the following: White Co., Browne, Mitler, German Zenith (from German motor truck) U. & J.

A mathematical analysis of the laws of flow involved in one method of compensating for the effects of change in air density at altitude has been completed. Similar analyses of other methods are required.

The fuel economy and power of an internal combustion engine depend upon the condition of the mixture as regards temperature, vaporization of fuel, degree of mixing, etc. An investigation of this problem has been in progress.

Essential to this investigation is a knowledge of the vapor pressures and vapor volumes of the customary fuels. Apparatus for measuring these quantities has been in use for some time and results have been obtained on a number of fuels.

The carburetion research has been undertaken mainly at the instance of the Air Service and of the National Advisory Committee for Aeronautics, but some features of it are of equal interest to the manufacturers and users of all types of automotive appliances.

The Motor Transport Corps has requested the Bureau to study the quality of the materials used in the construction of a large number of German motor trucks.

At the request of a maker of 6-throw automobile crank shafts the process of manufacture was studied with the idea of eliminating certain difficulties which had been encountered.

During the year physicial tests were made on 1,193 samples of oils and greases. This very large increase in work, as compared with previous years, was principally, if not entirely, due to the great number of samples received from the War Department.

The development of a lubrication laboratory with special reference to study of lubrication problems in automotive engines was begun in 1918, hence much of the time has been devoted so far to the development of apparatus and methods.

A series of tests were run in a typical aeronautic engine to determine, if possible, any difference in lubricating value of oils from different classes of crudes. The results showed no significant differences between properly refined oils from different sources, provided the oils are chosen with equal care to meet the conditions of operation.

A series of routine laboratory tests was run on samples of all trade-marked oils sold on the market and which could be secured by the Bureau. The results will serve as a guide to purchasers of oil and it is hoped will be of much value when published in the near future.

A new method of distillation has been perfected for the analysis of lubrication oils, which has proved to be of great value. By the use of superheated steam at very low pressures, in a special still, it is possible to fractionate ordinary lubricating oils and determine their composition with, in most cases, a negligible amount of decomposition. This process gives promise of important applications in the refining of oils.

Other problems which have been undertaken are (*a*) the relative effects on different classes of oils of dilution by fuels escaping into the crankcases of engines, (*b*) the extent to which fuel vapors are dissolved in different classes of oils. No significant differences between oils in these respects were found.

The tendency of oils to form so-called carbon deposits in engine cylinders has been investigated to some extent during the year. Further investigation of the oxidation test and the demulsibility test developed by the Bureau has been made in this connection.

Tests of 25 commercial brands of automobile oils were carried out in co-operation with one of the large automobile manufacturers. A number of special types of automobile oils were also tested for the inventions section of the War Department.

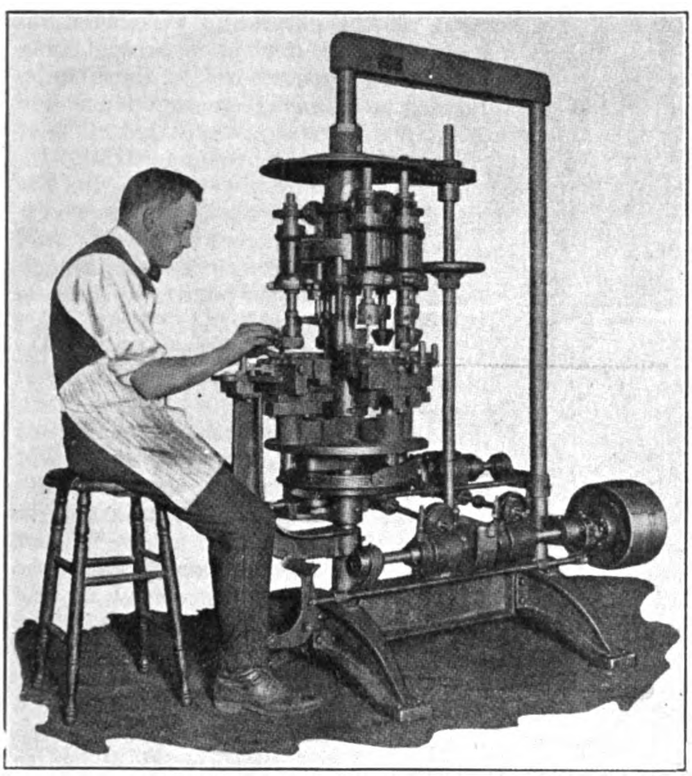
Owing to an unavoidable delay in the delivery of dynamometer equipment no progress was made in the investigation of power losses in tires. The apparatus which is now available will be used in a series of tests to be made in co-operation with the Motor Transport Corps and the Society of Automotive Engineers. A study will be made of different types of tires and of tire fillers under definite conditions of speed, load on tire, and power transmitted. The results of this research will be of particular interest to tire manufacturers in view of the necessity for reducing to a minimum the energy dissipated in tires, which often causes a rise of temperature sufficient to produce serious injury.

The Bureau has co-operated with the American Metric Association in recommending and promoting an international standardization of tire sizes. The importance of such standardization was brought out very clearly during the war, when it was found necessary to change the wheels on some of our motor cars in order to permit the use of tires manufactured abroad.

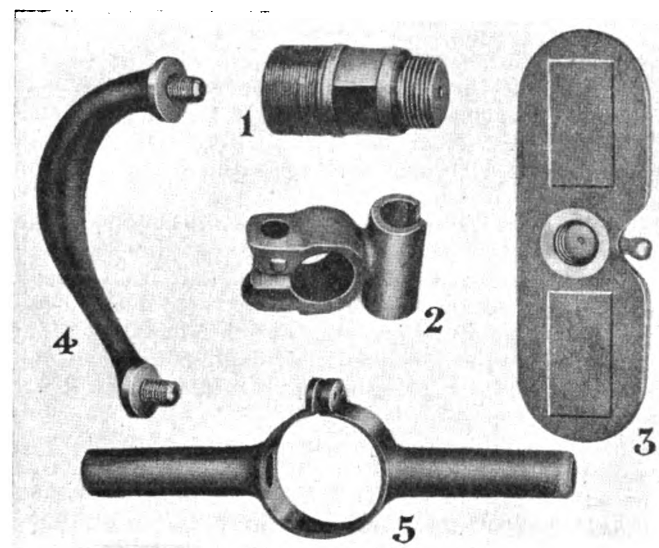
The Bureau has co-operated with the Air Service of the War Department in the development of specifications for leak-proof gasoline tanks and rubber shock absorbers, and in the production of a satisfactory rubberized silk fabric for diaphrams used in connection with autographic instruments.

A Vertical Automatic Chucking Machine

A VERTICAL automatic chucking machine with four duplex automatic chucking vises and three pairs of working spindles is being built by the Long Henkel Mfg. Co. The machine, known as Type B, is best adapted to work requiring (*a*) turning to size, (*b*) drilling or boring, (*c*) threading or tapping. It is claimed for this machine that it produces more work than other machines suitable for similar operations. The chucking vises automatically



Long Henkel vertical automatic chucking machine



Samples of work done by the chucking machine. Operations include turning, facing, drilling, threading and tapping. 1—Pump nipple. 2—Battery terminal. 3—Pump base. 4—Door handle. 5—Pump handle

eject the finished article, and after the operator puts the unfinished article in place, the vises again close automatically, thus relieving the operator of everything but the mere handling of the castings and observation of the work. The machine has positive drive and is equipped with ball bearings. All work is in full view of the operator.

The machine is not limited to simple operations. Multiple operations can in many cases be performed with the same setting, as, for instance, drilling different sized holes, tapping with different sized taps and various other operations limited only by the number of spindles that can be used. A magazine feed can be applied when the machine is used for threading or tapping bolts or nuts.

Individual Personality in Industrial Relationships

(*Continued from page* 171)

3. In still other cases, the whole structure of industrial relationships is built up from the beginning simply on a basis of fairness, honesty, and ordinary business goodwill between management and men. In such cases individual personality plays a small part.

Under any circumstances, however, the personality of the man who is to be the connecting link between management and men must have a personality that is attractive to the majority of the workmen. He must be able to sell himself to them. If he is not able to do this, he is not the man for the job, regardless of his other qualifications.

Personality may as well be recognized at the outset as a potent factor in the success or failure of an industrial relations policy. It does not do to discount it. On the other hand, it must not be depended upon to do the entire work. Other practical factors must be back of it.

And above all, sincere pleasing personality must never be confused with the "glad-hand." The former is a real diamond; the latter paste—and not even a very good imitation.

It Costs Less to Hold a Customer Than to Get a New One

Here is an unusual analysis which shows the importance to the manufacturer of the factory service manager and his policy. The general manager of a motor car factory asserts in this article that the service department has obligations and can be of great value to the factory.

By George C. Hubbs*

IF it were true in the early days of the horseless carriage that service men were obliged to think in terms of mechanics, it is equally true to-day that the highest grade service men are those who think in terms of personality.

This change of thought has been made possible by the tremendous strides which motor car engineers have made in car design and construction, and it has been made necessary by the fact that to-day, with over 8,000,000 cars in the hands of owners, there are probably from ten to twelve million drivers to be dealt with, each one presenting a more or less different and difficult problem in personality.

Perhaps it would not be putting it too strongly to say that the handling and repairing of the temperaments of owners or drivers has become quite as much of an art, and quite as necessary a part of a service man's equipment, as is the skill required to repair their cars.

If this is true, then a service manager of a motor car manufacturer finds himself occupying the new and exacting rôle of service educator to the trade with respect to matters of conduct, diplomacy and honorable dealing.

Inasmuch as the owner-clientele of most dealers is very much larger than the number of new purchasers in any one year, it is perfectly obvious that upon the service manager rests the major responsibility for re-orders, for no fact is better known in this business than this: That the probability that a motor car owner will rebuy the same make of car is almost exactly proportionate to the character of service received from the dealers' service departments.

No manufacturer can dodge the responsibility for doing this educational work—nor should he want to. Certainly if he is going to fix the general sales policies for his dealers (and every manufacturer properly considers this his prerogative), then he should also participate in the larger and more difficult task of establishing a uniform standard of service conduct in the service departments of his dealers.

It has always seemed to me that sales and service policies should have their source with the manufacturer, and that the manufacturer is in reality responsible for the satisfactory or unsatisfactory experience which the individual owner may have with the manufacturer's dealers wherever the owner may have occasion to need sales or service help.

I am disposed to go so far as to say that in my opinion the manufacturer's service manager is responsible for both the efficiency and the behavior of every service employee in a dealer's establishment.

Such supervision is distinctly a protecting measure in the interest of the manufacturer's future business, and as such is well worth all the effort and expense it involves. Entirely aside from its effect upon current business, no manufacturer can hope to create those indefinable, but invaluable, assets known as confidence and prestige, unless he fortifies himself against that class of service men who seem to think that brusqueness and incivility are evidences of super-competency. In the hands of such men, a manufacturer's good name—established through great pains—is in real jeopardy. And if so, then it is his clear obligation to forestall such danger by giving his service manager the utmost latitude in prosecuting his educational campaigns.

I have spent a good many hours talking with service men about the necessity of being gentlemen (and amiable ones) before they were mechanics.

This, I am fully aware, requires an immense amount of work, inasmuch as many mechanics are more competent to deal with the weaknesses of machines than with the weaknesses of men. Machines are at least amenable to reasonable treatment, which is more than can be said of some humans. **Nevertheless, these humans are the manufacturer's customers and it is the duty of the manufacturer to guarantee to them at least fair and courteous treatment.**

It should also be borne in mind that, in addition to the fact that the manufacturer receives ample compensation in reorders and prestige from well-cared-for owners, the information which properly organized service brings to the engineering department would, of itself, more than pay for the cost of intensive service supervision, which introduces the service manager in two additional rôles—that of assistant sales manager and of assistant chief engineer. (And it takes a broad-minded sales manager and an open-minded chief engineer to fully appreciate the possible value to both of them of a highly efficient service manager.)

The real fact is, the service manager is the only executive of a motor car company whose value to the organization increases in almost exact ratio to the number of cars in the field, but this usefulness can be measurably added to by maximum co-operation on the part of the sales and engineering staffs. The service department is (or should be) emphatically **the best business insurance policy any manufacturer can have.**

*General Manager Grant Motor Car Co. Paper read at meeting of Factory Service Managers' Division of N. A. C. C.

Whether the repeat orders for a car run to 25 or 75 per cent of any year's output is a matter of distinctly major importance; and it must be undeniable that the service manager, by his thoroughness, or lack of it—by his vision of himself as a mere "trouble-shooter" or as an educator—is in a position to determine this percentage more certainly than can the combined efforts of the sales and advertising departments.

Furthermore (and it is not unimportant), it costs less to hold a customer than it does to get one. Also, the influence of a friendly owner is more helpful than the comments of a dissatisfied ex-owner.

The future of the motor car industry now lies largely with those who already own cars, so that the competition of the future will more and more concern itself with comparative service, that is, until such a time as faulty human beings can build cars without incorporating in them their own frailties, and thereby make service managers unnecessary. If the truth must be told, cars are good in proportion to their ability to keep away from service departments, but so long as they are neither fault-proof nor fool-proof, the character of service their owners receive will continue to determine how generously any particular make will be purchased.

It seems to me that inasmuch as the value one receives for any given expenditure is, to the buyer, more important than the expenditure itself, it is very certain that the really efficient, educator type of service manager is going to play an increasingly important part in the motor car business of the future.

Relation of Size and Power to Airplane Speed

By A. Ludlow Clayden

THE results of the Pulitzer Trophy air contest at Mitchel Field teach a lesson which was learned long ago in automobile engineering that enormous engine power is not the main factor in obtaining speed.

The Verville Packard, which covered the course of about 132 miles in 44 min. 29 sec., has an engine of 2225 cu. in. and at the speed it was revolving must have developed not less than 550 hp. Yet the Thomas-Morse was only 2 min. 38 sec. slower though its Wright engine is of but 1125 cu. in. and developed not more than 330 hp.

Apart from the engine powers it should also be remembered that the Verville plane was designed with speed as the main object, while the Thomas-Morse is a standard army plane fixed up for maximum speed.

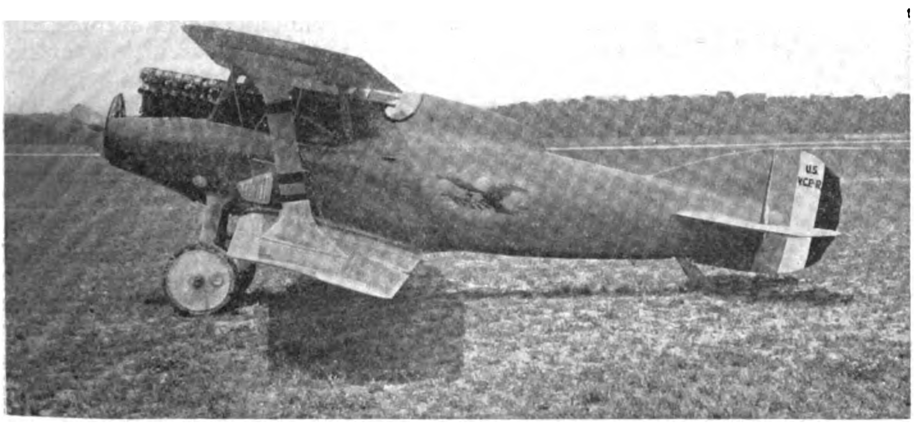
Even more interesting comparatively is the showing of the little Vought with only 718 cu. in. developing not more than 200 hp. in its Hispano-Suiza power plant. Its time was 11 min. 11 sec. longer than that of the winner or 25 per cent slower, with an engine less than one-third the size. Also the Vought ship is even less suitable for high speed than the Thomas-Morse.

Therefore, it seems reasonable to expect that by building as good a speed ship as the Verville Packard on a smaller scale, the performance of this plane might easily be equalled; just as automobile engineers found it actually easier to get high racing speeds from the 183 cu. in. engines than from the earlier 450 cu. in. engines.

In 1918 there was a prevalent opinion in France that the maximum speed combined with controlability would be found to require from 250 to 300 hp. That a larger engine, requiring a heavier, larger plane, would be less lively and so little faster that the extra speed would only count in running away. Hence the French concentration upon the 300 hp. Hispano and the British anxiety to develop the A. B. C.

So far aviation engineering has shown that there is a great lack of co-operation between engine and plane designers. For instance, when it is a case of using maximum power for speed or climb, nearly all planes are shown to have inadequate water and oil radiators.

For utter speed we have as the limiting load the weight and bulk of one man. Since there is only one resistance to consider, that of the atmosphere, it seems reasonable to expect that the most compact plane with the least bulky engine would be the easiest ideal for which to strive. And when we have it the small fast plane will be much more useful than the big fellow.



The Verville Packard biplane which won the Pulitzer trophy

Nickel Plating Aluminum

A PROCESS for nickelling aluminum is described in *Annales de Chimie Analytique* as follows: The aluminum is immersed for two minutes in a cold solution of ammonia and potassium cyanide. The metal is then well washed and brushed with milk of lime until the surface acquires an even, brilliant white tint. Then the washing and brushing are repeated with water, so as to get rid of all traces of lime, and the metal is immersed in an acid bath of manganese and iron chloride. A metallic coating of iron or manganese, which serves as the "mordant," as it were, to fix the nickel to the aluminum, forms upon the aluminum. After two to three minutes' immersion in the acid bath, the metal is rinsed with water and put in the nickelling bath, which consists of nickel sulphate. The anodes are plates of laminated nickel. The electric pressure used should lie between 2.5 and 3 volts, otherwise a non-adherent deposit would be obtained. The current density should be from 0.065 to 0.1 amp. per square inch (9.3-14 amperes per square foot). The treatment for moderate-sized objects lasts 1 to 1½ hr., and is followed by washing in boiling water and drying by compressed air.

A Review of the Present Labor Situation

The open shop movement is gaining momentum, the fear of unemployment has increased individual efficiency, and Americanization work has diminished. Interest in labor problems has diminished, visibility of discord governs attention to the matter. No permanent advance can be expected as long as this attitude toward the problems continues.

By Harry Tipper

AN examination of the conditions which prevailed in industry during 1920 indicates great changes in the visible symptoms of labor unrest, great changes in the economic position in various fields and a slowing down in the demand for increased wages, shorter hours and other matters which have been included always in the consideration of the labor union whenever opportunity afforded it a chance.

In the United States, the year has witnessed a decrease in the power of the American Federation of Labor, due to the differences existing within its own ranks as to the policies which should be pursued, and at the same time a decrease in the solidarity of other labor organizations very largely due to the economic condition and the amount of unemployment.

The latter part of the year also witnessed a very definite movement for the extension of the open shop, a movement which is apparently gaining strength in various industries and which may have some significance in connection with the whole industrial question as time goes on. Wages have been reduced in many industries, and in most cases where these reductions have occurred they have been more drastic than the reduction in the cost of living to the same workers.

Workers in the manufacturing industries have been obliged to take reduction on the position and the price which the manufacturer could secure, whereas the reduction in their cost of living represents only those reductions which the retailer has been obliged to make, and there has not been established as yet a parity between the reduction made by the manufacturers and the prices to the consumer.

With the increased efficiency and the increased unemployment, there has been a very considerable reduction in the labor turnover which in the early part of the year was very high.

For the moment in this country, the visible labor troubles are less in number and materially less in importance. Where the organizations of labor are very strong and complete in their control of the labor employed by an industry, the difference is not so marked. In some of these cases, in fact, wages are still being slightly increased and efficiency has not been increased materially. The situation, however, indicates that the advantage is once more on the side of the manufacturer in most lines of industry and that the fear of losing the job, which is always in the background, is playing an important part in the attitude of the worker of to-day.

The depression which exists in Europe has not had the same effect, at any rate to the same extent, because the political and economic problems are so involved that while there is a great deal of unemployment and suffering, the labor organizations are still intimately concerned with the political programs and their attitude is governed to a large extent by the political necessities with which they are concerned. There is no indication that the unrest in Europe has diminished materially, and there is no present evidence which should justify an expectation of this kind in the near future.

This country is placed in a so much more advantageous position economically, that the severe unemployment is not sufficient to cause the unrest which obtains in Europe, and the political situation does not enter into the industrial question to the same degree because there are no affiliations between industrial organizations and political parties.

From the manufacturers' standpoint the present condition offers at least a relief from the constant problem which he was facing in connection with labor matters until the early part of last year, and it offers also an interval of relief of which he can take advantage in building his organization along lines which will make it possible for him to evade some of the labor trouble in the future.

There is a tendency in some quarters to over emphasize the change in the situation and imagine that it has a permanent significance, just as there was a tendency to explain the previous condition by reference to the war. The reasons which are at the bottom of the lack of organization in this country among the workers are important elements in the consideration of any plans for the establishment of prominent bases of operating efficiency. The number of races involved in the working population of this country and the difference in their traditional, political and social inheritance and their understanding, makes it difficult for them to come together in any well-ordered organization and makes it just as difficult for the employer to bring them together in any well-determined unity.

The infusion of further new labor by immigration will not solve this problem, although it may provide a larger supply, and therefore, retain the advantage on the side of the manufacturer for some time. In effect, however, it will add to the complexity of the situation and increase the difficulties which already exist in arriving at any well-ordered plan of operating efficiency based upon some unity of progress.

While we are considerably removed from the European situation and our conditions are very different from those obtaining in Europe, we will not be able to escape the influence exerted by the political movements and economic developments over there, and in respect of some of our working races, these influences will be quite definite and important.

The Americanization work which was developed with great vigor by many industries during the war and after the Armistice, has suffered in interest during the last six months, and is not the subject of discussion to anything like the same extent. This is somewhat unfortunate as the development of a reasonable understanding of our political and social structure is of primary importance in arriving at some unity, with so many different races involved.

> **It is apparent that the attention which was being given to the whole question of human relations in industry has diminished considerably in the last few months. It is now confined largely to those who have made a conscious study of the matter and are interested in it as a primary necessity, and these number only a small proportion of the people who were interested some time ago.**
>
> **So long as the manufacturers proceed with their study of the matter and their attempts to provide a reasonable basis for its future consideration, the amount of public interest is not very important. It is referred to only because it is an indication of the interest taken in industrial circles and because it shows a general lessening of interest and not merely a decrease in the public attention to it.**

The lessened interests of the manufacturers is also shown by the diminution in new experiments to the point where they are hardly worth recording and the lessened interest in some of the experiments already started even in the establishments where the work has begun.

This whole situation in 1920 is an example of the way in which the visibility of discord governs our attention to the matter itself. In the early part of the year there was great activity in the discussion of human relations, a great deal of attention was paid to the experiments being conducted, the discussions which occurred and to the plans which were being developed.

> **In the latter part of the year this interest died down because the visible symptoms of the problem decreased until they were practically out of sight. No great permanent advance can be made so long as the interest in the question is governed by these visible considerations.**
>
> **Experiments are undertaken too lightly in times of labor stress and dropped too willingly when the visible difficulty has passed away for the moment.**

They are not based upon a sufficient examination in the first place, and they are not based upon sufficient conviction of their value to put them through the second period.

Fortunately, this is not true in all cases. Leaders in various industrial fields are still engaged in working this problem out by the gradual development of reasonable plans. The value of these plans will be more definitely established when they have survived the period of business depression and labor surplus in the same way that many of them survived the period of business activity and labor scarcity.

Office Manuals

AMONG the many minor factors which go toward making office personnel work effective the office manual serves a distinct purpose. Its value is chiefly as a means of immediate and systematic information for the incoming employee, but its effect is widely beneficial. Such a manual is often more effective in the office than in the shop, because the type of employee to which it goes in the former case is more likely to be really interested in the material it presents.

The object of publishing an office manual is practically the same everywhere. One firm states it in this way: "The purpose of this manual is to acquaint employees with the rules, regulations and policies of the company, and to serve as a practical working guide for new employees as well as a reference, to which experienced employees can turn when in doubt."

The longer a new employee takes to become familiar with the routine and workings of a new office, the more his hiring and breaking in is costing the firm. A well-made office manual will probably do more to make new employees feel at home quickly—especially in a large organization—than any other single factor. Such a publication will pay.

To be effective, however, it should be carefully written and edited. The preparation of such a manual is a job that need be done only once, and care should be taken in its preparation for it is worth doing well.

It should contain (1) office rules and regulations; (2) information about the equipment and facilities of the organization that every employee should know; (3) a brief sketch of the history of the company, and (4), possibly an organization chart followed by a brief explanation of how the various departments function in relation to one another.

The New York office of the New Jersey Zinc Company issues an office manual which illustrates many points of good practice. This manual is published in pamphlet form and contains eight pages, including the cover. It explains briefly the facts concerning lost and found articles, cleanliness about the building, the profit sharing plan of the company, the pension plan, the library, the house organ, the cafeteria, the girls' rest room, the first aid room, the regular holidays granted, vacations, the system of periodic revision of individual salary rates, the promotion-from-within policy, the bulletin boards, personal telephone calls, methods of obtaining supplies from the stock room, fire drills and fire regulations.

It also states briefly the general office rules which apply to all employees. These include office hours, time record, absences, overtime compensation, etc.

Many of the best manuals include, beside such facts as those mentioned, a short history of the company. This is an excellent thing to include. It should be a recital of pertinent facts, rather than a glorification of achievements. It is desirable, however, to point out through the history any consistent ideals which really have characterized the growth of the organization. It is never advisable, however, to manufacture such ideals for the purpose of the history.

Of the many ways devised by personnel men for tying up the new employee to the organization, probably no method involving so little effort and expense is so effective as the orderly and interesting facts contained in a well-edited and constructive office manual.

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Important Factors in Fuel Economy

IF any engineer is disposed to question the practical effect of compression ratio, gear ratio, valve timing or fuel vaporizing means, on fuel economy, we recommend that he give careful study to the paper by A. L. Nelson presented at the annual S. A. E. meeting, which we print in this issue. In fact, we think there must be something wrong with any automotive engineer who can't find food for thought in this article. Perhaps it is true that there is little that is startlingly new in the paper, but the evidence produced proves that engineers in general are either ignorant as to the improvements in economy which have been demonstrated to be possible or have failed to apply their knowledge of the subject in such manner as to produce the desired result. More power to Mr. Nelson in his effort to get engineers to take a broader view of the fuel problem! May they also apply the lessons he has taught—be they new or old—and not forget that there are also other simple means of materially improving fuel economy which are not new but which have yet to see any extensive practical application.

We predict that support of engineering research into possible methods of bettering fuel economy of modern automobiles will pay handsomely in future and believe the intelligent and progressive manufacturer should and will support it. He should give the engineer a freer hand in this matter than he has been allowed in the past.

Double Piston in Automotive Diesel Engines

IT is a noteworthy fact that in nearly all attempts abroad to adapt the Diesel engine to automotive purposes the double piston type of engine is selected. This type of construction was also used to some extent in the early years of automobile manufacture for engines working on the Otto cycle. The one make that comes to mind most readily is the Gobron-Brillie, which was manufactured in France for a great many years. But two other French pioneers, Koch and Krebs, also built engines on this principle. The object aimed at in these early engines was improved balance. With two pistons moving in opposite directions at the same speed, in the same cylinder the tendency of the reciprocating parts to cause vibration is eliminated.

Since the time when these early French motors were in vogue the double piston engine has received scant consideration from automobile engineers; it is naturally of somewhat complicated and unwieldy design, and in automobile practice balance of the reciprocating parts has been accomplished by increasing the number of cylinders to six or more. But when the Diesel cycle is to be used it is not practical to increase the number of cylinders in this way, for the reason that the smaller the cylinders the greater the difficulty of injecting fuel in the exact proportion needed. Indications now are that if the Diesel engine is ever used for automotive purposes it will be in the single cylinder form, and this being so, the use of the double piston design goes a long way in solving the balancing problem that comes up with every automotive engine.

Improved balance and reduced difficulty of fuel injection are, however, not the only advantages of the double piston design. The form of the combustion chamber during the early part of the power stroke is much more favorable than in the ordinary single piston type. This is especially important in a Diesel engine, where, on account of the high compression used, the compression space is exceedingly flat and has a large surface area relative to its volume. This means great loss to the cooling water through the cylinder jacket. The gain can easily be visualized by imagining the double-piston cylinder cut into two, the piston in each cylinder having the same stroke as the individual piston in the double piston cylinder. The flame-swept surface will then be increased by the area of the two cylinder heads. That this results in much greater cooling loss is clear.

Can We Double Mileage Per Gallon of Fuel?

IF we are to conserve our petroleum resources it is not only necessary to use the fuel in engines which are inherently efficient, but to see that the fuel furnished to the engine is mixed with the requisite proportion of air and so vaporized that complete combustion can take place in the extremely short time interval allowed. Extensive tests made by the Bureau of Mines show that **over 25 per cent of the fuel fed to the engine goes out with the exhaust in the average case.** To get better economy by preventing in some way the use of over-rich mixtures is indeed a great service problem worthy of study by the very best engineering talent, but this is only a part of the fuel problem.

By far the most important part is to use an engine which is itself inherently efficient. The constant volume or so-called Otto engine now in common use on all automotive vehicles is a highly efficient type, **providing it is designed with a sufficiently high compression pressure and is used most of the time at or near full load or in such manner that the compression is not lowered by throttling.** Unfortunately these two conditions are not complied with in average practice, but they are not impossible of realization. They have not been realized because it has proved easier to date to sacrifice them and waste fuel than to remedy them with consequent increase in economy.

This then is the problem which every engineer should study if he would make the automotive vehicle of the future truly efficient in fuel utilization. Efforts to eliminate the knock and thus make possible the use of higher compression with consequent increase in efficiency are commendable. But this alone will not suffice so long as we persist in using the throttle to limit the compression, for with other factors remaining the same, it is the compression pressure that actually obtains during the greater proportion of the time of operation that determines the efficiency.

How then can throttling be avoided in an engine which must quickly meet wide variations in load? It is possible to accomplish this in several ways. **One of these, which appears to be very promising and does not involve any very extensive change in the design of engines now used, has been tried by at lea t one prominent manufacturer in this country, and has resulted in more than doubling the mileage obtained from a given quantity of fuel.** It consists in providing two inlet valves per cylinder. Through one of these only pure air is admitted, and this supply is never throttled. In consequence the full compression pressure is maintained regardless of load. The air entering the other valve is drawn through a carbureter arranged to furnish a rich mixture containing fuel in sufficient quantity to carry the load. This mixture is diluted in the cylinder by admixture with the air which entered through the first valve, but at least a portion of it is retained in a pocket which forms a part of the clearance space. The spark plug is located in this pocket and is consequently always in contact with a readily combustible mixture at the time of ignition. At full load the quantity of fuel admitted is sufficient to unite with all the oxygen taken in through both valves, but at all lighter loads there is present an excess of oxygen which tends to promote complete combustion. The charge is, however, never too lean to burn, due perhaps to a partial stratification. Similar results have been obtained by using but one inlet valve per cylinder and carbureting only part of the air; also by the use of a properly designed fuel injection system.

Accomplishing the desired result will present difficulties which only persistent effort will overcome, but success will more than justify the means employed. **It is certainly worth while to make a real effort in the direction indicated when tests already made have shown that more than double the mileage attained with a car and engine of conventional design can be attained by the simple change outlined.**

Improvement in manifolds, vaporizing devices and carbureters should continue, **but the time has come when some more radical improvement is necessary.** We have pointed out one way in which a long step forward can be made. There are, no doubt, many other ways in which similar results are attainable. **The progressive engineer will welcome an opportunity to tackle the problem. He should receive whole-hearted support from the manufacturer.**

Buying Move Starts in New York

Many Sales Reported in After-Show Week

Entire December Business Exceeded in Some Instances—Used Cars in Demand

NEW YORK, Jan. 24—The week following the New York Show has brought an inspiring revival in automobile sales, wholesale and retail. A canvass of a majority of the distributers and factory branches shows that cars have been moving in much better volume than in November and December and in a number of places retail sales of the past week, nearly all traceable to the show, have exceeded in volume deliveries for the entire month of December.

Distributers and factory branch managers generally are agreed that dealers in the territory have a new lease of life. There were a good many show visitors from the territory, particularly from the suburban towns of New York, New Jersey and Connecticut, and the names of "foreign" prospects, promptly delivered to dealers in the outside towns, have already yielded an encouraging number of sales. Outside dealers who have been into New York or have written in since the show say that the ice has been broken and their towns are showing unmistakable signs of a steady, though gradual return of buying.

In the retail end there has been a noticeable revival in the metropolis itself. There are more people in the salesrooms than at any time since October, some have bought during the week and others are definitely in the market for March or April delivery. Sales this week have naturally been in most cases for February delivery to save the owner from obtaining a 1920 license, which expires at the end of this month.

Reports Six Sales in Week

As an instance of the "pick-up" in sales, one car in the $2500-$3000 class had six sales this week, more than in all of December, and one in the low-priced class had six a day the first four days following the show. All along the lines there have been some sales and both in personal contacts of salesmen and through mail efforts there has been an encouraging response to work on prospects listed at the show.

All along the row, in addition to actual sales and perhaps more important, there is a better feeling among dealers and salesmen. Nobody is looking for business equalling the 1920 volume but everybody is confident that a reasonable business is attainable and everybody is cheerfully working to get his share.

Truck sales have picked up slowly ever since the first of January. Business is far from normal but it is surely improving.

There are more used car inquiries than there were before the holidays and dealers have been able to take in used cars at more favorable prices than prevailed the last of last year. This is always the case as spring approaches and the hankering for a new car becomes stronger and dealers are finding encouragement in the reappearance of this condition.

The New York Show, never a big selling show, has done a lot for the trade this year and even the most conservative distributers are paying it a tribute.

Shows Curing Slump, Reeves Tells Dealers

MILWAUKEE, Jan. 22—Speaking before the Wisconsin automotive dealers at their dinner here, Alfred Reeves, general manager of the National Automobile Chamber of Commerce, announced that the New York automobile show moved the industry off dead center and sent it forward on its way toward a normal spring sales season.

Reeves said the trade could not expect to soon duplicate the extraordinary business of last spring, but with the increasing need for transportation, the motor car and truck business should be almost normal during the spring, following which sales would depend largely on the general business situation.

An industry that does more than two billion dollars wholesale and is the second largest manufacturing industry in the country naturally had to take time to slow down and will take some little time to get into its stride again, Reeves said. Some of the biggest banking houses in the country, just getting into the automobile business, declare it is now on a settled basis, declared Reeves. This includes J. P. Morgan & Co., and the Du Ponts.

Flint Raises $5,000,000 to Back Durant Motors

FLINT, MICH., Jan. 24—Citizens of Flint have subscribed an amount aggregating $5,000,000 for investment in Durant Motors, Inc., which will locate its first plant in this city. Flint regards W. C. Durant as its "favorite son" and is willing to back his new enterprise with cash. An offer has also been made to Durant of 40 acres of land.

MURRAY SUCCEEDS CURRAN

DETROIT, Jan. 24—W. J. Murray has been elected president of the Curran-Detroit Radiator Co., to succeed E. T. Curran. C. S. Reid is now vice-president; H. H. Rowe, treasurer and general manager, and H. F. Lacey, secretary. J. A. Kring and H. I. Phillips have been elected directors.

Chicago Prepared for Greatest Show

Thousands of Dealers Booked to Attend Big Convention and Exhibit

CHICAGO, Jan. 24—Chicago is ready for the twenty-first annual automobile show which will be held from Jan. 29 to Feb. 5 and which will play as important a role in the revival of business in the automobile industry as that held at New York several weeks before. Enthusiasm is being manifested outside strictly dealer circles and beyond the confines of automobile row for local merchants, theaters and restaurants have not escaped hearing of the effect of the New York show on conditions in that city.

Dealers will flock here just as they flocked to New York though perhaps in greater numbers for Chicago is more centrally located and more easily accessible to the Middle and Far West and Easterners, as a rule, rather like the idea of coming here. At any rate, reservations at the hotels in the city, large and small, indicate that nearly every inch of space available has been taken.

There will be plenty going on all the time from the afternoon the doors of the show at the Coliseum, First Regiment Armory and the New Drake Hotel, where the salon will be held, are thrown open. The truth of the matter is that business in connection with the show will start the preceding night, Jan. 28, with a dinner given at the New Drake by the Chicago Automobile Trade Association.

Graham and Kroh to Speak

Distributer members of the association have invited their Chicago sub-dealers and also their dealers from the Chicago territory together with salesmen and factory executives. George M. Graham, vice-president of the Pierce-Arrow Motor Car Co., and A. R. Kroh, who has become known in automotive circles not only through his previous active participation but through his country wide talks on the motorization of the farm, will be principal speakers. Louis A. Peil, president of the association, will be toastmaster and there will be a prominent New York banker to discuss the financial end of the industry.

From Jan. 31 to Feb. 1 the fourth annual convention of the National Automobile Dealers Association will be held at the Hotel La Salle, the third annual trade frolic to be held in connection with it.

On Feb. 1 the annual dinner and election of officers of the Old Timers Club

(Continued on page 191)

Ford and Banks Spar on Financing

Both Sides Veil Progress of Deal

Manufacturer May Offer Securities Direct to Public—Size of Loan Sought Unknown

NEW YORK, Jan. 25—Wall Street and the financial circles adjacent thereto have been greatly excited for the past few days about the financing of Henry Ford. They admit he needs to be financed and they have evolved a dozen or fifteen ways of doing it. According to Wall Street negotiations are closed every afternoon only to be opened the next morning. It is stated to-day that various banks admit that the deal is virtually completed only to have the banks deny it to-morrow. Meanwhile the person who naturally would be most interested is standing pat and saying nothing.

So much has been heard in the past week about the dire need of Ford for funds and about his frantic appeals to the banks for assistance that the impression is gaining ground that the barrage of reports and rumors has been sent up more or less as a smoke screen.

One solitary fact stands out. That is, that Ford undoubtedly will find it necessary to do some financing in the near future. His representatives do not deny that he is short of cash and that large sums must be raised to meet taxes, trade acceptances, and other obligations falling due soon.

There is very good reason to doubt, however, that Ford will play "Daniel in the Lion's Den" for the banks. He never has had any love for bankers, and bankers have reciprocated his feeling for them. It can be regarded as certain that if he negotiates a large loan it will be on his own terms rather than theirs. If he cannot make arrangements reasonably satisfactory to himself, the chances are that he will attempt to sell securities direct to the public, and it is known he believes such an offering would be successful. Some banks are inclined to agree with him. If Ford does ask the public for funds it is now considered likely that he will offer bonds rather than stock. These bonds would offer an attractive return.

Estimates Range to $100,000,000

Wall Street estimates of Ford's needs, range all the way from $25,000,000 to $100,000,000. It is not probable that even Ford himself knows what the figure will be. It is understood that his current obligations, aside from merchandise accounts and Federal taxes, are less than $25,000,000 and represent trade acceptances due in March. In addition to this a large sum will be needed to put his factory into operation again. His Federal taxes are estimated at from $30,000,000 to $40,000,000.

Ford has neither confirmed nor denied reports that he was negotiating with New York bankers, and it is probable there have been discussions in regard to a large loan. It is equally probable, and in fact practically certain, that Ford has declined to agree to the demands of the banks, which are understood to have insisted on an arrangement which would have given them practical control of the company's finances and left Ford in control only of the manufacturing end.

Seeks "Friendly" Institutions

It can be said positively that if Ford does arrange a large bank loan, it will be with institutions which are relatively friendly to him and not with those which are eager to get him into their power. One of the banks friendly to Ford, and with which he has done much business, is the Liberty National of New York, classed as a Morgan institution. Joseph A. Bower, a vice-president of the Liberty National and formerly a banker in Detroit, spent virtually all of last week in Detroit and is understood to have been offered the position of treasurer of the Ford company. He declined to accept, however. Bower refused to-day to discuss the Ford situation beyond stating that the Detroit manufacturer might not find it necessary to borrow any money at all.

The reports that Ford was in the market for funds have been made the texts of sermons on finance preached to him by financial papers. It is probable that these editorial discussions have been inspired by powerful financial groups. The substance of them has been that Ford should have stuck to the manufacture of automobiles and not purchased railroads, coal mines, iron mines and timber lands. He also has been taken severely to task for the attacks upon the Jews made by the Dearborn *Independent*, owned by him!

FORDSON TRACTOR CUT

DETROIT, Jan. 26—The price of the Fordson tractor was reduced to-day to $625, the new price to be effective at once. This is a reduction of $165.

Dr. Samuel S. Marquis, head of the sociological department of the Ford Motor Co., has offered his resignation. It has been mutually agreed, he said, that no action was to be taken on it for the present. He declined to discuss his reasons.

Wills Distribution to Start in March

Final Work on First Production Starts—Molybdenum Steel Features Construction

MARYSVILLE, MICH., Jan. 22—The first cars from the production line of C. H. Wills & Co., will be completed within a few days. The car is to be known as the Wills Sainte Claire.

While the actual price has not been announced, it is known that it will sell for approximately $3,000, or about $1 a pound. Complete technical details on the car will not be available until it is in the hands of the dealers, which is expected to be sometime in March. It incorporates, however, an eight-cylinder, 60 deg. V type engine mounted on a chassis of 121 in. wheelbase, and equipped with 32 x 4½ in. cord tires. Probably the most outstanding feature of the car is the extensive use of molybdenum steel which is employed in all parts of wear and stress. It is stated that by the use of this alloying substance it has been possible to produce steel of 185,000 lb. per sq. in. tensile strength. This has been affected by the use of chrome-nickel molybdenum alloys. The highly stressed motor parts such as the crankshaft, connecting rods, etc., are all of molybdenum steel, as well as the chassis wearing parts, even to the springs.

Engine Wills Product Throughout

The eight-cylinder engine has a bore and stroke of 3¼ by 4 in. It develops approximately 70 hp. and gives the car a speed range on high gear of from 2 to 70 miles per hr., or better. The engine is a Wills product throughout being the only overhead camshaft, eight-cylinder engine in use on this side of the water. The camshafts which are mounted above the blocks on each side of the engine are driven by spiral bevel gear shafts from the crankshaft, the drive being taken up the front end of the block by the spiral bevel gears and then to the camshaft, which extends overhead with the cams integral, driving the valves which open downward into the cylinders direct. The use of the eight-cylinder engine with a short, sturdy crankshaft and with a 60 deg. angle, permits an exceptionally fine opportunity for balance, and the result is that no period is discernible in driving the car.

The Detroit representative of AUTOMOTIVE INDUSTRIES had the privilege of driving the car over the roads around Marysville and found it to have exceptional accelerative ability throughout the entire speed range. The light weight of

(*Continued on page 194*)

Bay State Factories on Low Schedules

Return to General Operation Progresses Slowly — Wage Scales Revised Slightly

SPRINGFIELD, MASS., Jan. 24—Automotive trade conditions in Worcester and Springfield show several encouraging signs, although there is no marked change for the better.

The Norton company has announced a 10 per cent cut in salaries, effective Feb. 1. Wages have not been cut up to the present time, but working hours have been reduced considerably. Every effort is being made to hold experienced workmen, and something like 50 per cent of the normal number of workmen is still employed.

The Worcester Pressed Steel Co. is operating at 20 per cent normal. Wages have not been cut, but readjustments are being made in the case of certain classes of unskilled workmen.

The open shop movement is being vigorously supported by employers in this section and several union strikes outside of the automotive industry are now in progress as a result of wage reductions.

Gilbert & Barker in Springfield furnish an encouraging variation from the general depression in most manufacturing plants. This firm, which normally employs about 1600 workers, has laid off only a few hundred men. It is continuing manufacture at nearly 85 per cent of normal. Neither day rates nor piece rates have been cut and there is no immediate intention of such action.

The new Westinghouse Electric & Mfg. Co. plant at East Springfield, is in operation on a greatly curtailed schedule and no additional men are being hired at this time.

A slight cut in piece-work rates has been made at the Hendee Mfg. Co., makers of the Indian motorcycle. Operations are continuing at about 40 per cent of normal both on the heavy machines and on the scott model. This is a union shop, but no serious difficulties were experienced when it was found necessary to make wage reductions in view of present conditions.

Throughout this section a general opinion prevails that business has started very slowly on the up-grade, and that a gradual return to normal will be experienced from now on. There is no indication, however, of any sudden increase in manufacturing activity.

Motorcycle Schedule Set at 55,000 for 1921

SPRINGFIELD, MASS., Jan. 24—Motorcycle production for 1921 will probably drop slightly below the 1920 level, according to the best estimate now available. The Hendee Mfg. Co. schedule at present calls for some 15,000 to 18,000 machines this year, while the Harley-Davidson schedule has been reduced to about 18,000. During 1920 both of these concerns made over 20,000 machines, and their plans for the coming year give an excellent indication of the trend of production, since these two, together with the Excelsior organization, produce the vast majority of motorcycles now made in this country.

In 1920 about 70,000 motorcycles were prduced in the United States, while present indications point to a production of about 55,000 for the present year. Brightening of general business, conditions, of course, would serve to raise this estimate again.

Goodrich Creates Fund for Contingent Losses

NEW YORK, Jan. 24—Directors of the B. F. Goodrich Co. have voted to set aside out of the surplus a reserve of $10,000,000 to provide for all possible contingent losses on raw material commitments for future delivery. A dividend of 3½ per cent has been declared on the preferred stock, half of which is payable April 1 and the other half July 1. Action in regard to the May dividend on common stock will be taken at a meeting in April. A statement by the directors says:

"Audit of the accounts for the calendar year 1920 has not been completed, but the general result indicates that earnings for the year will be very largely consumed in writing down the inventory of raw materials on hand at a fair market value. Net sales for the year amounted to approximately $150,000,000."

ReVere Motors Solvent Assets Triple Debts

INDIANAPOLIS, Jan. 22—A finding of solvency in the bankruptcy proceedings instituted against the ReVere Motor Car Corp., of Logansport, three weeks ago, has been made in Federal Court by Harry C. Sheridan of Frankfort, special master. The decision has been expected ever since the hearing last week, when Sheridan indicated he was convinced of the solvency of the concern. The finding points out that expert accountants had testified that the assets of the company on Nov. 30, 1920, were $1,157,328.59 and liabilities only $354,659.90, and that no attempt to question or contradict the figures had been made. The proceedings were brought by three Chicago concerns.

DUPLEX ADDS TWO DIRECTORS

LANSING, MICH., Jan. 21—The Duplex Truck Co. has increased the number of its directors and the new members elected are Bert S. Gier and Charles W. Nichols. President H. M. Lee stated that the sales department has received more inquiries and orders since Jan. 1 than during the entire period of the slump in the automobile business.

AIR FIELD APPROPRIATION ASKED

HARTFORD, CONN., Jan. 24—The Hartford Municipal Aviation Commission has asked the city for an appropriation of $12,500 to provide a landing field for aviators who wish to stop in the city.

Garages Continue High Wage Scales

Concerted Reductions Thought Delayed by Unusual Amount of Repair Work

NEW YORK, Jan. 24—Though there has been no concerted action on the part of garage men to reduce wages of mechanics to a rate approximately that existent before the war, or any specified rate, there is a widespread movement throughout the industry to cut down on wages boosted to unnatural scales by the exigencies of the war-time situation.

New rates of compensation are based entirely upon the conditions existing in the individual communities in which they are applied. In many cases only scattered shop owners in cities like Boston, Philadelphia, New York and others, which number hundreds of garages, have cut wages, but they have suffered no dearth of mechanics, and their work apparently has not been less efficient.

Detroit is perhaps the only city in which concerted action has been taken by an association of owners, the Detroit Automobile Dealers Association having promulgated an entirely new scale of wages in which all concur, and the mechanics have seen the advisability of accepting. Where higher rates have been sought by mechanics in the past few months, owners have acted in concert in opposing them and have been successful. Unions were principally responsible for this activity, notably in New York, Kansas City, and several cities in the West.

Cities which report no concerted wage reduction activity are Boston, Philadelphia, New Orleans, Cincinnati, Sacramento, Cal., New London, Conn., Rock Island, Ill., and Cedar Rapids, Iowa. In all of these there have been individual instances of reductions and general cuts are believed to be, as in Philadelphia, only a matter of time.

A notable reason, perhaps, for the failure of a concerted reduction move to materialize to this time is the unusual amount of repair work being offered to garages, ascribed to open weather conditions, and also to the belief that many owners will make their old cars carry them over for another season or two.

FOUNDRY DIRECTORS RE-ELECTED

BELDING, MICH., Jan. 22—The Belding Foundry Co. has re-elected the present board of directors which consists of Henry J. Hartman of Grand Rapids, J. C. Jenkins of Big Rapids, A. B. Johnson, Albin Johnson and William F. Sandell of Belding. It was announced to the stockholders that the business during the past year had been very satisfactory and that the outlook for this year is good. There is no doubt that with the gradual improvement of general conditions throughout the country that the company will get more business and perhaps make this its biggest year, officials said.

Canada Plans Split on Excise Refund

Manufacturers to Share Dealer Burden on Unsold Cars—General Business Better

OTTAWA, ONT., Jan. 22—The buyers' strike, so far as the Canadian motor trade is concerned, is rapidly breaking down. Many dealers and distributers report more actual sales during the past three weeks than during the preceding three or four months. The feeling is general that the corner has been turned and pessimism has been deposed by optimism.

A week ago Friday, a joint committee of Canadian dealers and manufacturers conferred at Ottawa with Sir Henry Drayton, Minister of Finance, in support of the request made by the deputation of dealers from all over the Dominion, which had urged him to use his good offices to induce the Government to rebate to the dealers the excise tax (15 per cent ad valorem on cars retailing under $3000 and 20 per cent on cars retailing at $3000 and over paid on unsold cars in stock at the time of the repeal of the excise tax.

The Minister made clear his sympathy for the Trade but pointed out difficulties with which he was faced. No precedent for the requested refund would make it necessary to have an Act of Parliament passed during the forthcoming session of the Legislature to sanction it. Lack of funds would make the reimposition of the tax in part necessary to raise the moneys wherewith to make the refund. Other trades and industries similarly circumstanced would also demand refunds and so forth.

The manufacturers' representatives then tentatively agreed that provided the Minister of Finance would agree not to impose further taxes on motor vehicles they would rebate the dealers and set prices that over a period of a year would extinguish the refunds. Owing to the sales resistance factor, it was later agreed at a meeting of the manufacturers in Toronto that an increase in car prices would be very ill advised at this time, particularly as the public, in all probability, would learn of the reason for the increase and would therefore, to a considerable extent, continue the sales siege until the absorption of the loss in question permitted price reductions. A continuance of sales resistance would be extremely harmful, it was agreed.

Would Maintain Present Prices

The proposal was then made that the manufacturers meet the dealers half-way by absorbing fifty per cent of the loss with which they (the dealers) were faced, without increasing the price on their cars. It was hoped originally that all the Canadian manufacturers would concertedly adopt this expedient. Possibly all will but certainly not concertedly for to-day the General Motors of Canada, Ltd., McLaughlin, Chevrolet and Oldsmobile, and the Willys-Overland, Ltd., have advised their dealers that they have decided on the 50-50 plan.

It is believed the other car manufacturers will soon follow suit or possibly announce independent plans. The Ford Co. of Canada, Ltd., in a telegram to the Toronto Automobile Trade Association, stated that action, if any, would be deferred till the end of the month, at which time the Ford dealers' convention will be held.

Former Navy Planes Find Canadian Buyers

NEW YORK, Jan. 24—The Aeromarine Engineering & Sales Co. which recently acquired surplus aircraft and engines from the Navy Department, announces that the Canadian Government recently purchased ten Navy flying boats which are to be utilized in forest patrol and in connection with the Canadian northwest mounted police. It also announces that negotiations are pending which will result in the establishment by next July of an aerial transportation and freight line between Edmonton and Great Slave Lake and Fort Norman in the McKenzie River basin.

This is the region in which there has recently been such activity in connection with the discovery of oil and the plan is to transport prospectors over the 800 or 900 mile route by air. The aerial transsportation line which is to utilize the Aeromarine navy flying boats, following the course of the McKenzie River and nearby lakes, will carry passengers over this route in twenty-four hours, whereas by pack and canoe, the time required is from six weeks to two months.

Under its arrangement with the Navy, the Aeromarine company will be able to sell flying boats on the installment plan instead of for spot cash. The purpose of this plan is to encourage civilian flying and thereby facilitate the training of an aeronautical reserve. The price of these boats has been fixed at $6,160.

SEEK $500,000 FOR IMMEL

COLUMBUS, Jan. 22—At a meeting of the stockholders of the Immel Co., manufacturers of automobile bodies, which is in the hands of Robert H. Schryver, receiver, a committee was named to solicit funds to raise the receivership. H. S. Gilmore was named chairman of the committee. It is planned to raise $500,000 of which $400,000 will be necessary to raise the receivership leaving $100,000 for working capital. In the meantime work at the plant is practically ended although there are about 40 closed bodies to be completed before the plant is entirely closed down.

SPARTON TANKS ENJOINED

NEW YORK, Jan. 24—The United States Court of Appeals his upheld the decision that the manufacture of Sparton vacuum tanks by the Sparks-Withington Co. is an infringement of the Stewart-Warner patents and has enjoined the further manufacture of Sparton vacuum tanks.

Protests Unheeded, Truck Sales Go On

Coast Dealers Aroused Over Failure to Prevent Dumping of War Vehicles

LOS ANGELES, Jan. 22—Motor truck dealers here are feeling keenly the effect on business of the arrival and sale of seventy-five trucks brought from Europe. Protest has been made against this sort of competition to the National Automobile Chamber of Commerce, National Automobile Dealers Association, congressional representatives and others but there has been no suggestion of relief. "It's too bad" and "It ought not to be allowed," are expressions received but further than that nothing has developed at this time.

A meeting of the truck dealers of the city has been called for Thursday night at which time some plan of action may be decided upon. It is understood that the seventy-five trucks already received will be followed by more and that is the thorn that is sticking the hardest, as representatives of all but one truck line are wondering when the end will be. The one exception is the Transport truck dealer who is acting as sales agent for the imported trucks. This dealer has issued the advertising over his signature and is advocating the sale of the trucks at "about one-half the list price."

Speaking for the other truck dealers as well as himself, one dealer said to-day: "It would seem there is some way to control a proposition of this kind but the way is undiscovered. Where is our so-called protective tariff? These trucks originally were American-made but they are not American property now and are being sold in direct competition with our trucks that have to pay no end of special taxes? Handled as they are, it is not even necessary that the owner have a dealer's license. We understand additional shipments now are en route.

"There are enough American-made trucks now in Europe to become a serious menace to the entire market in this country if all are brought over here. What sense was there in American manufacturers insisting that the war trucks and automobiles originally shipped to Europe be left there and sold away below their real value, if now they are to be brought back here as privately owned and be put on the market? The truck business to-day is bad enough without having such a situation to deal with."

TO BUILD PETROLEUM ENGINE

CHICAGO, Jan. 21—The Petroleum Motors Corp., organized about eighteen months ago to develop an opposed piston type, heavy duty truck and tractor engine to operate on low grade fuels, has completed its experimental work and has reorganized for $1,250,000 par value $10 per share to go into the manufacturing of these engines, and will soon start production on a small scale.

Wilson Advocates Air Mail Operation

President Concurs in Report of National Advisory Committee —Bill Before Senate

WASHINGTON, Jan. 24—Concurrence of President Wilson was appended to the report of the National Advisory Committee for Aeronautics, recommending continuance of the air mail service, which was transmitted to Congress today. The report declared that the air mail service was a necessary means for the development of the civil aircraft activities of the nation.

The practicability of heavier-than-air planes for civil as well as military uses has been demonstrated by the air mail service, the report asserted, and adds that though the value might not be apparent in terms of dollars and cents it would be easily seen should the nation be called upon again to mobilize its air forces.

The report was signed by Joseph S. Ames, chairman of the executive committee of the National Advisory Committee, which is composed of representatives of the Army and Navy and several prominent civilians.

The Post Office Appropriation bill, from which the House cut $1,250,000 intended for the air mail service, is now before the Senate Post Office Committee. Unless the Senate makes provision for the service, no funds will be available for it after June 30.

Madden to Push Probe of Larsen Purchases

WASHINGTON, Jan. 24—Congressman Madden of Illinois, announced today that he intended to press for action on his resolution introduced in Congress last week requiring the Post Office, War and Navy Departments to report details regarding the purchase of German airplanes. It is claimed that the purchases were unauthorized and a violation of treaty obligations. The destruction of three metal planes and the loss of life is said to have inspired the inquiry.

According to the Congressman, the planes used by the Post Office Department were purchased through an agency controlled by John Larsen. These eight machines cost the Government $12,500 each, while the War Department purchased three at a cost of $100,000. The War Department planes had additional equipment. The Navy Department paid out the same amount for three monoplanes.

Zeppelin Branch Here Declared Possibility

NEW YORK, Jan. 24—Since the visit to America last summer of representatives of the Zeppelin interests, there have appeared from time to time in the public press many contradictory reports as to the future plans of this company. Apropos of this an item which appeared in the German "Flug-Welt" of Nov. 24, 1920, will be of interest.

According to this report, certain commercial steps were discussed and negotiations initiated with regard to the delivery of a ship. However, no contract was made and nothing conclusive resulted from these preliminaries. In point of fact, according to "Flug-Welt," the Zeppelin plant is still inoperative by reason of treaty regulations, and the use of the company's commercial ships has also been forbidden awaiting certain discussions of the Air Commission. Meanwhile, of course, the company is cut off from international competition.

"The transfer of the Zeppelin plant to the United States is clearly impossible," says "Flug-Welt," "it is, however, not impossible that a branch may be started in that country in the future."

Harvester Price Probe Urged Upon Congress

WASHINGTON, Jan. 24—A resolution asking for investigation of complaints that the International Harvester Co. has announced its intention of increasing the price of some of its farm machinery products was introduced in the House to-day by Representative Jones, Democrat, of Texas. The House Interstate Commerce Committee is directed by the resolution to make an inquiry and if prices have been raised to find out why.

Company Welcomes Inquiry

CHICAGO, Jan. 24—The following statement was made by officials of the International Harvester Co.:

"While we have no detailed information about the resolution, we will welcome any inquiry along the lines, being satisfied that the only result will be to convince the public of the fairness of our prices.

"Our prices are now and always have been based solely on the cost of production. Our current prices are practically the same as for the last ten months. There have been some slight increases on some machines and reductions on others, with the result that, considering our line as a whole, the price level for 1921 is substantially the same as for 1920."

WOULD CHANGE TRUCK DESIGN

WASHINGTON, Jan. 24—Suggestions have been advanced to automotive engineers by Earl B. Smith, senior assistant testing engineer, Bureau of Public Roads, for changes in the design of motor trucks which would distribute the load more nearly equally between the front and rear axles so that the load on the rear wheels would be lessened. This recommendation is made in an effort to reduce the cost of highway repairs.

MAXWELL-CHALMERS ADDS MEN

DETROIT, Jan. 24—Maxwell-Chalmers Corp. has added 450 workers to the operating staff during the past week and will make further additions this week.

Depression Defers Standard Parts Plan

Committee Votes to Continue Receivership When Stock Subscription Falls Short

CLEVELAND, Jan. 24—The receivership of the Standard Parts Co. will be continued for the present owing to the failure of stockholders to raise sufficient funds through the subscription of new stock, to place the company back upon firm financial footing. This decision was made unanimously at a meeting of the reorganization committee Friday at the Cleveland Trust Co.

Failure of the re-establishment of the company to go through as planned is ascribed to the financial depression which made it impossible for many of the stockholders to take their portions of the new stock.

The report to the creditors of the reorganization committee, consisting of F. H. Goff, chairman; George A. Coulton, John Sherwin, E. E. Walker, H. C. Robinson, Cyrus H. Eaton, Leon F. Payne, H. W. Chapin and H. L. Thompson, follows:

"On Oct. 26 your committee advised you that the committees representing the preferred and common stockholders of the Standard Parts Co. had agreed upon a plan whereby reorganization of the company would be effected through the sale of new issues of preferred stock in the amount of approximately $6,000,000, arrangements to be made with certain banks for lines of credit of $4,000,000.

"At that time your committee believed that stockholders would be able to take new issues of preferred stock.

"Owing to the financial depression and the difficulty of securing money, many of the stockholders were unable to take the pro rata share of stock which it was contemplated they should take of the new issues, and the reorganization committee has been unable to secure sufficient subscriptions or to complete the plan.

"For the above reasons it is the opinion of your committee that the company should continue under the receivership under closer co-operation with your committee.

"From time to time this committee will report the progress made by the receivership, and if times become more propitious and a new plan for reorganization is submitted by the reorganization committee, this committee will consider the same and advise you concerning it."

STAR TIRE ALLEGED BANKRUPT

AKRON, Jan. 22—A petition in involuntary bankruptcy has been filed against the Star Tire & Battery Co., Steubenville, O., on the petition of three creditors whose claims aggregate $4,161.90. The creditors are the Goodyear Tire & Rubber Co., Kokomo Rubber Co., and the Gulf Refining Co.

Chicago Prepared for Greatest Show

National Tire Dealers' Association to Be Organized—N. A. C. C. and S. A. E. to Meet

(*Continued from page* 186)

will be held in the Florentine room of the Congress Hotel. This organization, composed exclusively of veterans in the automobile industry was initiated at the New York show a year ago by one of the old timers. The organization will be perfected at the meeting next month. The nominating committee has selected for president, Albert Champion, president of the Champion Ignition Co. of Flint.

Show week, Jan. 31, to be precise, will see the inauguration of a national tire dealers and vulcanizers association which will bring together all the individual tire dealers organizations throughout the country. The meeting will be held in the Morrison Hotel under the auspices of the Chicago Tire Dealers Association, and will continue over Feb. 1 and 2 and Feb. 3, if necessary.

The directors of the National Automobile Chamber of Commerce will hold a meeting on Feb. 2 and on the same evening the annual dinner of the Society of Automotive Engineers will be held at the Morrison.

On Feb. 1, at the Congress, the Motor Truck Manufacturers Association will hold their annual meeting and on the following day at the Morrison will be held a meeting and dinner of the Chicago Truck and Tractor Association.

For three days, Feb. 2 to 4, the Automotive Electric Service Association will meet at the La Salle.

Cleveland Exhibit Gets Flying Start

CLEVELAND, Jan. 23—Saturday's attendance in spite of rain was 20 per cent above the opening last year and a Sunday crowd which exceeded all Sunday records, gave the Cleveland Automobile Show a flying start. The management and the dealers were frankly surprised at the outpouring with the admission raised from 50 to 75 cents, and accepted it as an indication that volume buying is about to return.

The show opened in a heavy downpour which only partly cleared away in the evening, but people came just the same. Actual paid admissions at the gate were 2076, as compared with 1954 last year, and the grand total of attendance, including complimentary and reduced price tickets sold to dealers for distribution was 6000, as against 5000 in 1920. Sunday was clear and cold, and the crowds thronged the aisles until 11 p. m., numbering about 50 per cent above that of Sunday last year.

There were a number of sales Saturday. Then the big rally this noon, attended by dealers from all over Ohio, put additional inspiration into the trade to make this one of the best shows of this city of successful dealer expositions.

All of the Cleveland manufacturers are represented by complete exhibits of their products. Factory representatives are paying close attention to buying indications with a view to forming a production policy for the first part of the year. There are few cars stocked at the factories and manufacturers are desirous of meeting demands with immediate deliveries.

Exhibit Seven Vehicles at Electrical Show

NEW YORK, Jan. 24—Manufacturers of five electric commercial trucks and two electric passenger cars will exhibit at the electric automobile show which opens Saturday at the showroom of the New York Edison Co., this city. In addition there will be exhibits by manufacturers of batteries, charging apparatus and accessories.

Trucks assigned space are Commercial, Lansden, Oneida, Walker and Ward. The passenger cars are Berg and Rauch & Lang. Battery makers exhibiting are Edison, Electric, General Lead and Philadelphia. Apparatus and accessories, Anderson Mfg. Co., Auto Electric Devices Corp., Allen Bradley Co., Cutler-Hammer Mfg. Co., General Electric Co. and Westinghouse Electric & Mfg. Co.

There will be no admission charge to the show and the space to exhibitors has been granted without charge. In the week starting Feb. 7 there will be an exhibit of industrial trucks.

Automotive Stocks Show Market Gains

CLEVELAND, Jan. 25—Transactions on the Cleveland Stock Exchange indicate that the automobile industry in this district is picking up. Shares of practically all automobile manufacturing establishments in this city have sold up from one to five points in the last week. Grant Motor common has come up from 1¾ to 3¾ points. Peerless has risen three points; Standard Parts three points, and other stocks have shown strength.

Recent strength in automobile shares was brought about by the belief that the automobile shows in New York, Chicago, Cleveland and in other cities would show the trend of automobile demands. No one expects a mad scramble of buying, but there is a strong belief the next month or two will bring about steadily increasing orders. Foreign demand for cars also is expected to be above normal.

PHELPS IN RECEIVERSHIP

COLUMBUS, Jan. 24—Upon the application of Louis N. Reif, a holder of a note for $3000 against the company, Judge Duncan has named J. H. Weisenback and Thomas W. Pickard receivers for the Phelps Mfg. Co., a manufacturer of wire wheels for automobiles. The company had a capacity of about 100 sets of wire wheels daily. Pickard reports that operations are being continued under orders of the court.

Dealer Sues Davis for Contract Breach

Damages of $4,357.88 Asked As Extra Commission Due On Sales for Year

INDIANAPOLIS, Jan. 22—Suit for $9,357.88 for alleged breach of contract was filed against the George W. Davis Motor Car Co. of Richmond by Spencer G. Kuhn of Cincinnati, in Federal Court, here.

The complaint charges that Kuhn and Amos E. Chevraux, comprising the A. & K. Automobile Co. of Cincinnati, held a contract for the exclusive sale of the Davis car in Hamilton County. By the contract they were to be allowed a discount of 27½ per cent from the list price of the cars, with an additional allowance of 2½ per cent in the event fifty cars were purchased during the life of the contract.

On June 23, 1920, one week before the expiration of the contract, the A. & K. Co. is said to have ordered seven Davis cars, which would have completed the quota of fifty; but the Davis company refused to ship the automobiles, and to pay the extra commission of 2½ per cent, amounting to $4,334.75 on the forty-three cars already purchased.

It is also charged that the Davis company violated the contract by increasing prices without the notice required and by shipping defective cars.

Court Issues Order to Sell Van Briggle

INDIANAPOLIS, Jan. 22—Upon the report of Mahlon Bash, representing the reorganized directors of the Van Briggle Motor Device Co. of this city that the directors were unable to raise sufficient funds to continue the business in operation, Judge Harry O. Chamberlain of the Marion Circuit Court has issued an order directing that the plant and all assets of the company be sold for the benefit of creditors.

The report showed that the reorganization of the company on a sound basis was impossible and that the directors could see no reason for attempting to carry on the business further.

William R. Hirst, receiver of the company, was ordered to remove his office from the plant to cheaper quarters in the downtown district. Creditors of the company will be given six weeks in which to file claims.

Several weeks ago the receiver filed suit against L. H. Van Briggle, president of the company, alleging that he had obtained more than $240,000 from the company through fraudulent means.

DUESENBERG SUES ON WAR WORK

NEW YORK, Jan. 24—The Duesenberg Motors Corp., one of the Willys subsidiaries, has sued the Government to recover $1,201,851 on contracts for the manufacture of Liberty motors.

British Companies on Firmer Standing

Balance Sheets of Older Concerns Indicate General Weathering of Depression Period

LONDON, Jan. 5 (*Special Correspondence*)—It is both reassuring and significant amid the undeniably adverse state of the trade that the older British companies look like weathering the financial storm. Now that the balance sheets of some of these businesses are coming through, the reports show both a profit earned in a notably disappointing and vexatious year—vexatious because of the hold up of output at the beginning caused by labor troubles, and the sudden cessation of demand and increasing financial tightness which occurred toward the close.

The Rovers Co.'s profit is a good average, so, also, is the first report of the S. T. D. group—the fusion of the Sunbeam, Darracq and Talbot companies—which group also owns the chief motor trade leaf-spring business, that of Jones, Woodhead & Co. of Leeds, and also the truck and other products business of the W. & G. du Cros Co. The net profits of the S. T. D. group are given as £325,000 (nom. $1,625,000 pre-war rate) and the cash assets as £560,000 (nom. $2,800,000 pre-war rate), this item representing 15 per cent of the total assets.

Both the Sunbeam and Darracq outputs were approaching normal, but the Talbot was much below normal, and a new light "four" Talbot model, prepared for the 1920 season, is still in abeyance, though the first samples had been well tested before the 1919 Olympia show. This model has not been dealt with in the press, and here it need only be noted that it seems to be just the sort of chassis for a mass production job likely to sell well here. Probably the fact that the times are inauspicious for such a model explains its being held back. On a 10,000 output yearly the selling value—in normal times, but allowing a continuance of the present wage rates—should be £200 ($1,000) or with a standard body and full equipment at not exceeding £300 ($1,500).

Government Work Still on Hand

Napier and Rolls-Royce have done well financially, but as both had Government work on hand it would be difficult to appraise the worth of their general trading.

The Humber company, one of the oldest and most popular British companies, has declared a net profit on the year of £104,218 (nom. $521,090 pre-war rate), though the net balance, including the sum brought forward from 1919, is a net profit of £215,793 (nom. $1,078,965 pre-war rate). This company, besides labor troubles, had the further set-back of a big fire which burnt the larger portion of the body-shop, and as much of the hold-up of motor output in general was due to the shortage of bodies, it can be understood what this loss meant to the company.

The Humber company, like Sunbeam, Rover and Talbot, and one or two others, resumed manufacture *of their pre-war models, making detail improvements where economically based and justifiable, so that the lesson of their common prosperity is not far to seek.* As regards the Humber result, it should be noted that it includes profits from the company's cycle and motorcycle departments, in both of which it holds a great name and has the advantage of a splendid tradition.

As regards some other established British motor companies, their returns can only be conjectured, and in some cases the accounts are involved with Government orders.

It should also be noted that the present price of the scrip and stocks of some, if not most, British motor companies does not reflect the accepted asset value of the businesses, as can be easily seen by noting the yield as from recent dividends.

Metropolitan Securities Forms Canadian Branch

MONTREAL, Jan. 21—Canada-Metropolitan Securities Corp. has been organized with a capital stock of $1,250,000, divided into $500,000 of 8 per cent cumulative shares and $750,000 common shares, both of the par value of $10. The special function of the new organization is automobile financing, and it is a link in the chain of the "Metropolitan plan" in the United States. The Confederation Investment Corp., Ltd., is the fiscal agent of the new company. The officers and directors are William F. O'Connor, Ottawa, president; Alexander Michaud, Montreal, vice-president; Major Daniel Owen, Ottawa, secretary-treasurer; R. S. Weir, K. C. Frank, W. Knowlton, T. H. L. Saunderson, Montreal, and H. W. Ritter, Cleveland, directors. The Ritter Commercial Trust of Cleveland, guarantees the preferred dividend for ten years and undertakes direction of the management for the same period, and at the end of the period offer to repurchase any preferred stock which may be offered at par.

FULTON BUYS WELLAND PLANT

WELLAND, ONT., Jan. 22—Instead of St. Catherines as was at first planned, the location of Fulton Motors, Ltd., is Welland and the company will establish a plant here having recently closed an option for the purchase of the land, building and plant of the Canadian Automatic Transportation Co.

AUSTRALIA BARS ALL "BOSCH"

NEW YORK, Jan. 21—Mark Sheldon commissioner of the commonwealth of Australia, announces that a proclamation gazetted Dec. 30 prohibits the importation into Australia of all goods bearing the word "Bosch."

England Shows Gain in Tire Shipments

Imports of Cars, Chassis and Parts to November 30 Reach $110,092,775

LONDON, Jan. 5 (*Special Correspondence*)—Britain imported in November 1350 cars and 561 chassis, as against 704 and 238 respectively in November, 1919. The total number of imported cars and chassis for the eleven months of the year was 31,916 *cars and* 11,838 *chassis, as compared with* 3064 *and* 1379 *respectively for the eleven months of* 1919.

The value of the month's imported chassis parts was $3,204,595, against $462,935 in November, 1919. For the eleven months the combined value was $38,603,520, as compared with $13,377,845 for the like period in 1919. The combined value for the eleven months of the cars, chassis and parts imports was *the enormous sum of* $110,092,775, *as against* $19,912,780 *for the like period and combined totals in* 1919.

November's import value of tires was $2,111,405, as compared with $1,108,935 for November, 1919; the eleven months' totals being respectively, in 1920, $25,789,925, and in 1919, $9,063,135.

These figures, though taken at the pre-war rates of exchange—a fact, of course, responsible for a difference in the gross value calculated at the present unfavorable state of the British pound sterling—very sufficiently show the enormous volume and value of the motor and tire import trade with Britain. Of this combined trade the United States has about eight-tenths, if not more, and the total is increasing.

British exports of cars in November were 814 and of chassis 296, as compared with 198 and 84 respectively in November, 1919. *The eleven months totals were* 4720 *cars and* 2835 *chassis, as compared with* 1296 *and* 569 *respectively for the like period in* 1919. The month's value of exported parts was $920,735, as compared with $644,850 in November, 1919. The eleven months' total value of parts exported was $9,029,230, as against $4,861,095 for 1919. For the eleven months the combined total values of exported cars, chassis and parts were $37,177,560, as compared with $11,548,745 for the like period of 1919.

$400,000 Gain Over November, '19

The value of the British tire exports in November was $2,409,680, as compared with $2,083,420 in November, 1919, the respective eleven months' totals being $30,415,610 in 1920, and $19,307,990 in 1919.

Britains most notable export advance, it will be seen, is in tires, the value of which for the eleven months is as 30 to 19, whilst the increased value of exported vehicle chassis and parts is as 37 to 11.3.

War Truck Surplus Requested for Roads

Congress Gets Bill Endorsed by National Association of State Highway Officials

WASHINGTON, Jan. 25—Congressman Frank Reavis of Nebraska has drafted a bill which, if passed, would force the War Department to turn over to the Bureau of Public Roads all surplus motor trucks, tractors, and mobile shop units. The proposed legislation has the support of the National Association of State Highway Officials who feared that the proposal of Congressman Anthony of Kansas to sell on the open market thousands of army trucks and other automotive equipment would be carried out.

Figures have been placed on file with the Chairman of the Select Investigating Committee of the House, purporting to show that $108,000,000 worth of tractors, trucks and automotive equipment is in possession of the War Department. A large part of this equipment, it is claimed, is surplus and should be transferred to the Bureau of Public Roads where it is urgently needed. Congressman Reavis is advised that there are many tractors and trucks at camps along the Mexican border which are serviceable but not in use.

According to the Select Investigating Committee of the House, the War Department has informed the Bureau of Public Roads that this equipment is not available for their use. It is asserted that the War Department further claimed that manufacturers had protective clauses in contracts which prevented the transfer for other than war purposes.

The Reavis measure would require the States taking this surplus material to pay 20 per cent of the original contract price. With allowances for mileage and other items the cost would be comparatively low. The highway officials intend to push this bill at this session though it is doubtful whether they will obtain any action.

ARMLEDER SUED FOR ROYALTY

CINCINNATI, Jan. 25—Charles Flederman, of Cincinnati, is suing in Common Pleas Court for a judgment of $14,000 against the Otto Armleder Co., motor truck manufacturer. Flederman says that in 1913 he contracted with the company for its use of an automobile patent issued to him and that he was to receive $7 for each car manufactured during the life of the patent, as a royalty. He says the company discontinued the royalty when he left its employ in 1915, and that it has used 2000 of the appliances since that time, for which he demands a judgment of $14,000. The company denies all charges.

TO REVIVE BRIARCLIFF RACE

NEW YORK, Jan. 26—The Briarcliff Race will be revived this year and while no actual date has been set, it is understood that the event will take place in May. The race is under the sanction of the Motor Club which has been absorbed by the Automobile Dealers Association and E. S. Partridge has been appointed Chairman of the Race Committee. The race will be open to stock cars only and it is expected that this revival of a classic will stir up a good deal of interest as racing has practically come to a standstill in the East since the abandonment of Sheepshead Bay Speedway.

Committee Endorses $100,000,000 for Roads

WASHINGTON, Jan. 24—A bill authorizing the appropriation of $100,000,000 for Federal aid in the construction of post roads and other highways was reported out to-day by the House Committee on Good Roads. It further provides for an additional sum of $3,000,000 for national forest roads and trails.

The proposed legislation would allow reduction in the ratio of States where the percentage of total public land area exceeds 10 per cent of the total area of all the lands in the State. This proviso is especially used in Western States.

Would Build D. A. R. Highway

WASHINGTON, Jan. 25—Congressman Zihlman of Maryland introduced a bill to-day providing for a national ocean-to-ocean highway over the pioneer trails to be known as the Daughters of the American Revolution Old Trails Act. It provides that the Government should pay half the cost of constructing and repairing the roads and that no tolls can be levied.

Texas Car Association Is Alleged Bankrupt

FORT WORTH, TEX., Jan. 26—Involuntary petitions in bankruptcy were filed here to-day against the Texas Motor Car Association by Reed & Glasser, consulting engineers of Indianapolis; Maremount Mfg. Co., and Cluley Automobile Supply Co. of Chicago, alleging an indebtedness of $4,251.06.

The petition says the Motor Car Association, which went into the hands of receivers last October, committed an act of bankruptcy in making such application.

Willys-Overland Cuts Surplus Cars to 7000

TOLEDO, Jan. 24—Surplus car stocks of the Willys-Overland company have been reduced from 12,000 to 7000 in the past six weeks, factory officials declare. It is expected that the remaining 7000 cars will be practically cleared out by Feb. 1.

President John N. Willys looks to a substantial buying movement about March 1. With this realized and the factory operating on a near normal scale, the present inventories of raw material will be worked off in three or four months, it is declared.

Goodyear Financing Nears Final Stage

Negotiators Report Satisfactory Progress Toward Working Plan —Seiberling Not Resigned

NEW YORK, Jan. 27—Negotiations for the reorganization and refinancing of the Goodyear Tire & Rubber Co. are continuing without interruption, but no official statement is obtainable concerning them except that "satisfactory progress" is being made. Something definite may be evolved by the last of this week. Bankers interested assert that a receivership now is improbable. It seems likely a plan will be worked out for mortgage bonds to take care of the secured creditors, which means the banks.

Merchandise creditors are not satisfied with the proposition made to them which calls for a certain amount of their claims in cash and the remainder in bonds or stock. They want cash and notes, on the theory that notes can be discounted. The merchandise claims amount to approximately $70,000,000. It is understood, however, that the various interests involved are getting closer together and that an ultimate agreement is considerably more likely than it was a week ago.

F. A. Seiberling, president of the company, has been in New York for several days, sitting in at the conferences, and he emphatically denies that he has resigned or contemplates doing so. He insists that the story of his retirement, either forced or voluntary, has been inspired by a banking house which is disgruntled because he would not meet its terms, which were tantamount to giving it complete control of the company. It is probable, however, that if the refinancing plan goes through, a representative of the bankers will be placed in charge of the company's finances.

May Limit Fund to $25,000,000

Plans which the bankers are working on are said to contemplate the raising of not more than $25,000,000 new money, and possibly not more than $20,000,000. in place of the $30,000,000 previously mentioned. The distribution of this fund has not been settled upon, but it was said yesterday that it was not likely any of it would go to merchandise creditors.

The latter are being grouped into two classes. Those who have claims against the Goodyear Tire and Rubber Company for goods delivered, and those whose claims rest on contracts. It was understood that the former would be asked to accept new securities for their claims, and that the latter would be able to liquidate the goods they have on hand for delivery and receive new securities for whatever readjustment is necessary. These securities. it was hoped, would be available for collateral purposes, so that creditors may be able to borrow on them.

Wills Distribution to Start in March

Five Body Models in First of Line—Production for Year Estimated at 6500

(*Continued from page* 187)
the car which, with body and all accessories, barely exceeds 3000 lb., coupled with the high torque engine, gives a very creditable performance.

The car is being made at present in five body models, these being the five passenger touring, roadster, coupé, sedan and town car. The touring and roadster models will be put through first, the roadster being ivory with Sainte Claire blue fenders. The color is named after the blue of the fresh water lakes, which is also incorporated in the symbolic nameplate or trade mark on the car. This is a wild northern goose winging its way over the pine clad shores of the lake region. The touring car is dark blue throughout, the fenders and running gear having the same color as the body. All of the cars are equipped with disk wheels of a special design as standard equipment and no options are being offered on this. The wheels are special design with a convex rather than a concave disk. The wheels and bodies are at the present being made by the Budd company and the trimming is done at the Marysville factory.

In lines, the car presents a rather low appearance, the front view being rather square due to the rectangular radiator, with a very slightly raised center. Mechanically the car presents a number of very unusual features. For instance, the three-bladed, cast aluminum fan is designed to cut-out at high speed so as not to absorb an undue amount of engine power. The headlights, which are unusually powerful, are small and are equipped with magnetic tilting control from the steering column, the tilt is affected by rotating a hard rubber milled piece just below the horn button. The tail lights are double, one being a bright light which is automatically thrown in when the car is put in reverse to give a brilliant back light for driving backwards at night. There is also a lamp on the side of the car which illuminates a circle to the left of the car, making it possible to kill the glare of the headlights or to provide an illuminated area for working on tires, etc., at night.

Leading Distributers Named

The merchandising plan for the product, which has been worked out for the present, embraces a production of between 6000 and 6500 for 1921. Dealers have already been appointed for the New England, New York, Philadelphia, California and Chicago territories. A dealer for the Detroit territory will be appointed within the next 90 days. Deliveries to the dealers will be made during the last half of February. The New England dealer is the Fay-Allen Co.; the New York dealer E. B. Jackson, who recently resigned as sales executive for the Willys-Overland Co. The Philadelphia dealer is F. W. Foss; the Chicago dealer, Dayton Keith, and the California dealer, the Western Motors Co.

C. H. Wills & Co. was incorporated July 6, 1920, as a Delaware corporation. The officers of the company are C. Harold Wills, president; John R. Lee, vice-president; Kirkland B. Alexander, vice-president; Charles Morgana, vice-president; Frank P. Book, treasurer; Ferris D. Stone, secretary; George S. Anderson, assistant secretary and assistant treasurer. The financial matters of the company have been handled through the National Shawmut bank, Kidder, Peabody & Co., and F. S. Mosley & Co., all of Boston, Mass.

To Keep Stock From Market

No stock has been placed on the market or is it anticipated that any will be. The first unit of the factory has been completed and the heat treating plant is under erection at the present time. These two have a combined floor space of 221,400 sq. ft. The concrete foundations for the second factory unit have been laid and it will be completed after production has reached more than 75 per day, which is the capacity of the first plant. Production will start during February at the rate of 10 per day.

Maxwell Suit Filed to Aid Merger Plan

NEW YORK, Jan. 24—The creditors' suit recently begun in Federal district court in Detroit by the Jenks & Muirs Mfg. Co. against the Maxwell Motor Co. Inc., was filed for the purpose of carrying out the reorganization plan for the Maxwell and Chalmers companies through the transfer of the assets of the present company to the new corporation, it is learned from Maxwell attorneys.

The court is asked for an injunction restraining creditors from interfering during the pendency of the suit for the establishment of claims of creditors and assets. If the petition is granted, as it is confidently expected it will be, there will be no necessity for equity receivership proceedings preliminary to the reorganization and consolidation of the new companies which now are backed by ample working capital.

BOWSER OFFICERS CHANGE

FORT WAYNE, IND., Jan. 22—S. B. Bechtel, vice-president and general manager of S. F. Bowser & Co., Inc., manufacturers of gasoline and oil storage systems of this city, has announced several important changes in the executive positions of the company.

W. G. Zahrt, who has been treasurer and assistant general manager, has been named as vice-president and assistant general manager. The treasurership thus vacated has been filled by the appointment of D. G. Milligan, assistant treasurer. J. R. Matlack, who has been executive assistant, has been advanced to the position of assistant to the general manager. R. L. Heaton has been named as assistant to the general manager.

Turcat-Méry Goes Into Liquidation

Failure Surprises French Industry—Ballot to Make Special Sporting Car

PARIS, Jan. 15 (*Special Correspondence*)—One of the oldest of the French automobile companies, for it was established in 1899, the Turcat-Méry of Marseilles, has gone into judicial liquidation. The original capital of the company was 525,000 francs. At the beginning of 1920 the capital stood at 1,050,000 francs, but during the year it was increased to 2,100,000 francs. In June of last year new stock was issued and the capital increased to 3,000,000 francs. At the same time 2,000,000 francs worth of 6 per cent bonds were issued, and three months later another 1,000,000 francs worth of similar bonds were put out.

This failure comes as a surprise, for Turcat-Méry was looked upon as a very sound organization. The volume of business was not big, the output never exceeding 800 cars per year, but the firm enjoyed a good reputation. Leon Turcat, managing director of the company, is treasurer of the Paris automobile show committee.

The Ballot company is involved in the failure of the Turcat-Méry concern, for the cars of the latter company were all fitted with Ballot engines, and big quantities had been delivered before the liquidation went into effect. Ballot is also affected by the liquidation of Sizaire-Naudin, another old established automobile company, and by the financial difficulties of the Sigma company. This latter concern, which made use of Ballot engines and transmissions, has not gone into liquidation, but is in such financial difficulties that practically all production is stopped. Ballot has reduced his normal staff of 1200 to 100 men. It is stated on good authority that Ballot will shortly produce a special sporting, semi-racing type car of 122 cu. in. piston displacement. This firm being one of the biggest producers of engines for car assemblers, there is no intention of producing complete cars on a big scale, but activities will be confined to the special semi-racing type.

Berliet to Make Rail Truck

Berliet is negotiating with the French Government for the delivery of important quantities of narrow track locomotives fitted with gasoline motors. The truck motor will be used. This firm is trying to relieve its present financial position by the sale of all surplus stocks of raw material.

The Zenith Carbureter Co., after having cut down its staff at Lyons factory from 1200 to 900 men, announces that it expects to be at work with a full force within three or four weeks. The firm has produced a new carbureter, a small number of which have been delivered for experimental purposes.

Cuban Ports Tied Up, Exporters Warned

Mexico Best Latin-American Field Now for Cars, Says Southern Shipper

NEW ORLEANS, Jan. 21—Warning to manufacturers and exporters of automotive vehicles of all kinds, as well as to all American exporters of other manufactured products, to "go slow" on shipments to Cuba; to get payment for their shipments while the shipments are still in the United States, and to ship only by established steamer lines, rather than by "tramps," was issued today by L. J. Folse, Jr., of New Orleans, president of the Marine Forwarding and Shipping Co., a leading factor in Latin-American trade from all the Gulf ports, and a prominent official of the New Orleans Association of Commerce.

"Latin-America, with the unusual development of good roads as transportation aids now being done by many of the governments there, is becoming one of the best fields for the automobile, truck and tractor manufacturer and exporter, but if that manufacturer and exporter is not to meet with loss and often failure in those fields, he must study them carefully," said Folse.

"At the present time, Mexico is the best field for American exports of all kinds, including passenger cars, trucks and tractors, while only a few hundred miles to the east lies Cuba, probably the most dangerous and the worst field for all kinds of exports.

"Shipments of automobiles, trucks and tractors, along with other exports from the United States and other countries, are being refused by Cuban consignees and allowed to lie unprotected in lighters or on unroofed wharves, since the congestion in all the ports precludes movement of shipments to warehouses or to other protected places. This congestion is true of the outside ports as well as of Havana, and the Cuban importers, refusing to take out their consignments, naturally are not helping in this freight movement.

Should Avoid Tramp Lines

"Automobile exporters especially should be extremely careful, in making shipments to Cuba, to ship only by established steamer lines, which have terminal and warehouse facilities at Cuban ports, in which such shipments can be left in safety from thieves, and protection from the elements, until received by the consignee.

"Conditions in Porto Rico, on the other hand, are excellent. Money is more plentiful than it has been for some time, and there is no port congestion.

"It is in Mexico, however, that conditions, both financial and commercial, are the best for the automobile exporter of all the Latin-American countries. The paper money issued by the various revolutionary government has been virtually all absorbed, and gold and silver coins are in circulation, putting the country on what is practically a metallic basis, with the coinage intrinsically worth more than its nominal value. There is no congestion at the ports and labor troubles, which threatened for a while, have been eliminated. An unusually extensive policy of good-road building has just been inaugurated by the federal government."

S. A. E. Tractor Meeting Set for February 10

NEW YORK, Jan. 27—The annual tractor meeting of the S. A. E. will be held Feb. 10 in Columbus, Ohio, during the week of the National Tractor Show there. The program of the convention is as follows:

Technical Sessions, Hotel New Southern, 10 A. M. and 2 P. M.
E. A. Johnston, Chairman
John Mainland—Report of Committee on Pulley Widths and Speeds.
O. W. Sjognen—Nebraska State University, Tractor Test Results.
E. A. Johnston—Trend of Tractor Design.
D. L. Arnold—Report on Investigation of Plowing Speeds.
Columbus Dinner, Hotel Deshler, 7 P. M.
Fred Glover, Toastmaster.
SPEAKERS
W. H. Stackhouse, President, National Implement & Vehicle Association.
L. J. Taber, Master of Ohio State Grange.
J. B. Davidson, Secretary American Society of Agricultural Engineers.

Iowa Car Maintenance Exceeds Corn Value

DAVENPORT, IOWA, Jan. 22—Value of Iowa's 1920 corn crop, the greatest in the State's history, was $20,000,000 less than the cost of Iowa's automobiles for the same period, according to estimate prepared by L. A. Andrews of Ottumwa, president of the State Bankers' Association. Automobile registry fees alone, he pointed out, will amount to more than receipts from 270,000 acres of timothy seed and 134,000 acres of clover seed, and the total of spring wheat standing on 400,000 acres will lack $1,500,000 of registering State automobiles.

Last year 437,265 cars paid the State $7,414,548.98 in registry fees and dealers paid an additional $92,653.10 for their numbers. Upkeep of these cars ran to $260,000,000. The corn crop was valued at $222,686,000.

HOLT EMPLOYEES AGREE TO CUT

PEORIA, ILL., Jan. 22—Employees of the Holt Mfg. Co., after conference with officials, have agreed to accept a cut of 15 per cent in wages in thirty days. Wage scales at the time of closing the plant will continue during the month.

Manager M. M. Baker in announcing results of the conference said: "The men promise a 25 per cent increase in productivity and on our part we agree not to suggest any further wage reductions for a period of six months."

Big Future Trade Likely in Siberia

Promoter Would Have American Interests Send Representative to Study Territory

SEATTLE, Jan. 21—While there is to-day no possibility of doing any business because of the almost worthless level to which the ruble has descended and on account of the unsettled political conditions, American manufacturers of automobiles and tractors should join in sending a representative to Siberia at this time if they are to share in the tremendous trade that will develop when the big "opening up" occurs. This was the declaration of Waldemar Toritch, former president of the once powerful Timbermen's Association of Siberia and now connected with several enterprises in Siberia, who is on a brief visit to this country. Toritch left Vladivostok about six weeks ago.

British, French and other European manufacturers have trade investigators of a high caliber on the ground, and have had for some time, said Toritch. These representatives are laying the foundation for obtaining a generous share of the orders when it is possible to accept them. On the other hand, the visitor declared that American manufacturers appear to be entirely overlooking the urgency of being represented in Siberia now, despite the fact that no business is immediately forthcoming.

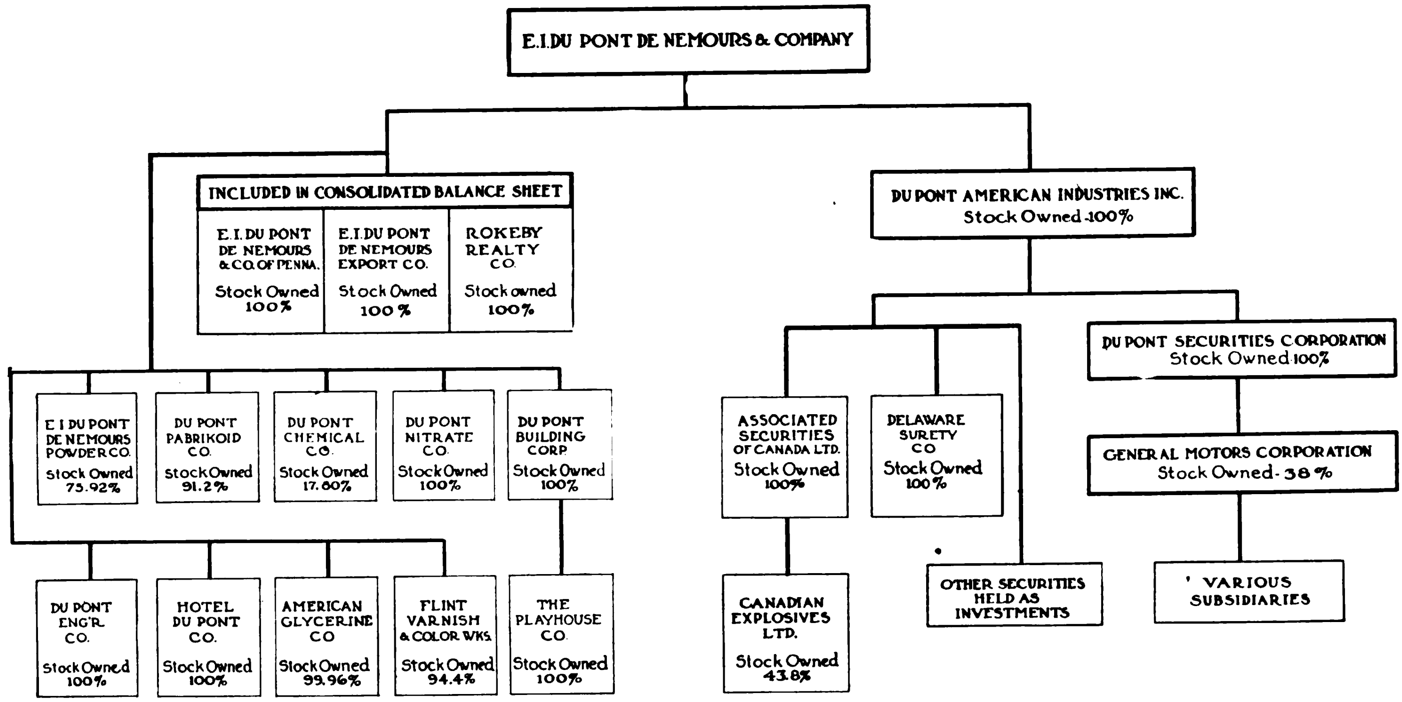
Because of the deteriorated state in which the railroads are in, there will be an enormous demand for automobiles of all classes in Siberia when trade can be resumed, said Toritch, and the Europeans are actively preparing to act as the suppliers.

Toritch has witnessed with marked interest the increasing use to which tractors are being put in the great lumbering industry of the western part of the United States, and believes that when the development of the timbering industry of Siberia is undertaken tractors will be in great demand. Toritch declared that the forest stands in four of the leading provinces in eastern Siberia covers 156,377,725 acres. At the present time Siberia is not consuming 1 per cent of its standing timber. There is not now a single mile of logging railroad in Siberia, said Toritch, so that forests situated over sixteen or seventeen miles from the water are absolutely untouched.

WOULD BUY CHILLICOTHE PLANT

CHILLICOTHE, OHIO, Jan. 24—Stockholders of the Chillicothe Rubber Co. have been asked to consider a proposition made by the Ultimate Tire & Rubber Co., Cleveland to take over the plant here. The Cleveland company, capitalized at $2,000,000, has sold a large part of its stock but has no plant of its own at present. Another meeting of the Chillicothe stockholders will be held late this month to vote on the question.

Main Holdings of E. I. du Pont de Nemours & Co.



This chart shows the main ramifications of the DuPont interests where the various members of the family have banded together but it does not indicate in any way the investments of the various members of the family as individuals. These investments run far into the millions and make the men who now control the General Motors Corp. one of the strongest groups of financiers in the world

Eisemann Consolidation With Recording Pends

DAYTON, OHIO, Jan. 24—Negotiations for the consolidation of the Recording & Computing Co. of this city and the Eisemann Magneto Corp. of Brooklyn under the name of the Ohmer Corp. have not yet been completed according to Will I. Ohmer, president of the Recording Co. The plants of the company here were used for war work and when hostilities ceased, they decided to go into the production of automotive parts. One of the most important of these will be magnetos. Other devices will be a combination magneto and generator for trucks, a starting motor and a generator. Considerable difficulty has been experienced in obtaining castings and machinery.

The Eisemann magneto is used as standard equipment by more than 125 automotive companies. It also manufactures other devices for motor vehicles. The company has no factory of its own but occupies under lease 100,000 sq. ft. in one of the Bush Terminal buildings in Brooklyn. It has service stations all over the United States, Cuba, South America, the Philippines and Hawaii.

SINGER LIABILITIES $103,998

NEW YORK, Jan. 21—Schedules in bankruptcy filed by the Singer Motor Co. of Mount Vernon disclose liabilities of $103,998, of which $42,066 are secured claims. The assets are listed as $114,460, book value. The assets are divided as follows:

Stock, $42,621; chassis held as security for loans, $11,973; apparatus, $17,596; furniture and fixtures $2,184; stocks, at par, $2,600; deposits, $35,284, and accounts, $2,199. Among secured creditors are Columbia Trust Co., $20,000, and Clinch Valley Coal & Iron Co., $19,556. Among those unsecured are Mount Vernon Trust Co., $8,000; Pacific Bank, $6,926, and Westinghouse Electric & Mfg. Co., $4,871.

Continental Motors Shows Higher Earnings

DETROIT, Jan. 21—The net profits of the Continental Motors Corp. during the fiscal year ending Oct. 31, 1920, were $3,567,504 compared with $3,425,725 in 1919. Including the surplus, the balance was $7,395,202 compared with $4,981,335 the year before. After deducting dividends, the net surplus was $6,345,309 as against $3,827,698 the year before. The total sales were 15½ per cent in excess of the previous year. The orders on the book at close of the fiscal year totalled $53,584,220 or 64 per cent more that at the end of the previous year.

SAGINAW PRODUCTS PICK UP

SAGINAW, MICH., Jan. 22—The various plants which make up the Saginaw Products Co. and are a part of the General Motors Corp., are gradually although slowly resuming operations. In a statement by General Manager George H. Hannum, he said there are about 400 men, 25 per cent of the normal number, now working at the motor plant; 100 or about 20 per cent, at the malleable plant; about 10 per cent of normal force at the foundry, while the Jacox or steering gear plant is likely not to reopen until Feb. 1, or even the middle of the month.

To Show New Renault at New York Branch

NEW YORK, Jan. 25—G. Baldenweck, general manager for Renault automobiles in America, announces that he will have on exhibition at New York showrooms next week a 10 hp. Renault car.

This car was recently referred to in a cable from Paris to AUTOMOTIVE INDUSTRIES as containing some features of the American Ford. Baldenweck says that this is not correct, also that the statement that the model has been withdrawn and a 12 hp. substituted, was an error. In this connection, Baldenweck writes:

"Referring to your article which was published Nov. 4 on the subject of Renault cars, I am directed by our factory in Billancourt, France, to advise you that our 10 hp. car is not, by any means or design, either a copy of the Ford automobile or a copy of any other car. It was completed and delivered in France a short while ago and there are now over 5000 of these cars in circulation, not only in France but in foreign countries, and this is our best proof that the car in question is giving all the satisfaction expected to motorists.

"Further, instead of upholding the manufacture and production of this car, we are proceeding normally to its construction and we have the approval of our customers, who have sent us numerous orders, not only direct to our plant, but through our various agencies."

It may be interesting to know that there is on exhibition at the New York show rooms the first Renault model built by the company.

No Barrier Found to Tire Sale Here

A. E. F. Stocks Now Offered to American Dealers—Surplus Totals 360,000

NEW YORK, Jan. 26.—The lack of legal provisions forbidding the re-importation into this country of surplus army tire stocks in France, probably means, according to General Manager Viles of the Rubber Association of America, that all of these tires intended for army use abroad soon will be landed in America and offered for sale to American buyers.

Cable despatches have indicated that there were approximately 200,000 pneumatic tires and 160,000 solids, and a presumably large supply of inner tubes. Of this number, Viles said, all but about 55,000 pneumatics and 80,000 solids had been bought by representatives of American jobbing syndicates to a recent date and the remainder have probably been purchased by now.

Thousands have been sold already to American tire dealers by the jobbing syndicate, operating in New York and Newark, N. J. The tires are of five standard American makes. Though they are unused, they are not new in the sense that they have been manufactured several years and consequently have suffered deterioration through aging. Manufacturers have declared their intention to deny the usual adjustment privileges.

Manufacturers do not anticipate any particular slump in the market owing to the absorption of this supply, but there has been considerable annoyance expressed that there has been no legal barriers to prevent this surplus being sold here.

INLAND ACQUIRES SHURNUFF

ST. LOUIS, Jan. 22—The Inland Machine Works has absorbed the Shurnuff Mfg. Co. and will continue the manufacture of its products which include a spark plug, combination manifold, grease retainer, runningboard support and a heater. Former prices will be continued. Sales are made only through bona fide jobbers.

Stockholders of the Shurnuff company are now stockholders in the Inland works, and two directors of the former company are now directors on the Inland. One of these is John F. Shuford, well known to the jobbing trade.

AMERICAN METAL TO BUILD

MILWAUKEE, Jan. 24—In view of substantial improvement in the demand for its products, and more favorable conditions in building construction and equipment markets, the American Metal Products Co. has decided to proceed immediately with the erection of a new foundry and machine shop in West Milwaukee. The work was projected about six months ago but held in obeyance until now. The main shop will be 80 x 225 ft., and equipped with new electric furnaces for manufacturing Ampco bronze bars, rounds, castings, etc., under patented processes. Officers of the company are: President, George F. Staal, city engineer of Milwaukee; vice-president, W. J. Eberle; secretary-treasurer and general manager, Carl J. Zaiser.

Blekre in Production on High Grade Tire

ST. PAUL, MINN., Jan. 26—Production has been started in the new plant here of the Blekre Tire & Rubber Co., organized with a capitalization of $4,500,000 to manufacture high grade cord and fabric tires and tubes. The plant has a capacity of 2000 tires a day and will employ 250 operatives. The company will devote itself entirely to high grade product and will not enter the medium grade field.

The formation of the company is the outcome of the growth of a small tire jobbing business started by E. O. Blekre, three years ago in Sioux City, Iowa. Through the expansion of this business the Blekre Tire & Rubber Co. was formed to manufacture and market its own product and St. Paul was selected as the manufacturing site.

Officers of the company are E. O. Blekre, president; S. E. Blekre, vice-president and treasurer; G. W. Wells, secretary; S. A. Rheinstrom, vice-president and general sales manager; G. O. Ludcke, advertising manager, and W. E. Greer, superintendent.

ERDMAN-GUIDER GETS GOING

SAGINAW, MICH., Jan. 22—Erdman-Guider Co., which operates a large body making plant here and another in Detroit, is preparing to increase its production, due to the satisfactory business transacted at the show by some of its customers. The company employs normally about 350 men, the local plant giving employment to more than half. The company specializes on closed bodies and its total production capacity is about 5000 for its two plants.

COTTON STATES RUBBER FORMED

ATLANTA, Jan. 24—With a capitalization of $500,000 and authority to increase to $2,000,000, the Cotton States Rubber Mfg. Co. has been incorporated here by J. B. Anchors, R. W. Ragin and G. J. Reuter. The company states in its petition for a charter that it will manufacture automobile tires and tubes.

WILSON FOUNDRY TO RE-OPEN

PONTIAC, MICH., Jan. 24—The Wilson Foundry & Machine Co. expects to resume operations not later than the first week in February, according to the statement of the vice-president and general manager D. R. Wilson. Inasmuch as this concern is one of the units of the Willys-Overland Co., it probably means an early increase in activities at the Willys-Overland in Toledo.

METAL MARKETS

SOME of the smaller interests among the independent steel producers are sounding consumers with a view to ascertaining whether price concessions would lead to the placing of orders without delay. Steel men, large and small, are unwilling to cut prices if their doing so results merely in lowered quotations without increasing buying activity. Sales managers are, therefore, exhausting their resources of diplomacy to make certain that tonnages are actually ready to be ordered before they compete actively for the business and, in a market condition like the present one, competition revolves almost solely around the price. A cut of $3 a ton under the general market was secured in this way on a tonnage of sheets bought by the Standard Oil Co. a few days ago. In the case of the smaller steel finishing plants the human element enters strongly into their anxiety for sufficient orders to keep their plants at a fair rate of operation. In a large plant it is relatively easy, even in a period of quasi-idleness, to keep the vital parts of the organization intact, whereas the burden of "overhead," in keeping skilled overseers, superintendents and foremen on the payroll, when the wheels are not turning, is considerable in the case of small plants. Some of the automobile sheet mills in the Ohio valley, however, are "sitting tight" in the matter of prices for another reason. These are the sheet makers who depend upon others for their supply of bar stock. They contend that, if they have to pay $47 for sheet bars, they must get twice as much for finished sheets, or a base price of 4.75c. instead of the prevailing quotation of 4.35c. So they are seeking to bring all possible pressure to bear on sheet bar mills to lower their prices. Odd lots of furnace coke are reported to have been sold in the last few days at as low as $4.50, which marks another recession of 50c. This should serve to expedite further re-adjustment in the pig iron market, which remains in much the same position as last week, offers of No. 2 foundry at $30, valley, continuing with occasional reports of odd tonnage sales at below that level.

Pig Iron—Automotive plants continue to operate largely on old reserves, and furnaces have been asked to hold off a few weeks more before resuming shipments on suspended tonnages.

Steel—Cold-rolled strip steel plants operate largely on old orders on which suspensions had been requested. No marked quickening in activity is looked for until automotive consumption increases. Although reductions on structural and boiler rivets have been announced, quotations on rivets used in the automotive industries remain nominally unaltered, but the market for rivets, as well as bolts and nuts, may be characterized as very easy.

Aluminum—The sole American producer's spot quotation for 50-ton lots of 98 to 99 per cent virgin ingots is now 28c., and for No. 12 alloy 27.30c. These prices denote an average reduction of ¼c. a lb. There are reports in the "outside" market that some automotive interests, apprehensive of an advance in import duties, have taken on some of the imported metal that was offered at 22½c.

Copper—In spite of curtailed production and some hand to mouth buying, the heavy surplus is being added to daily. In other words, there is still more copper produced than consumed. Hence the market's weakness.

Brass—The leading interest has reduced, effective January 20, its extras on a number of products 25 per cent. The War Department will re-offer 47,751,838 lb. of cartridge case brass, having canceled an award of this material recently made.

FINANCIAL NOTES

Martin-Parry Corp. has declared the regular quarterly dividend of 50 cents a share, payable March 1. Net income of the company for the ten months ended Oct. 31, 1920, was $378,000 after all charges, including Federal taxes. The company has current assets of $1,672,000, of which about $126,000 is cash in bank. Current liabilities are about $10,000. There are no outstanding notes and all inventories have been written down to present market values.

McCord Mfg. Co., Inc., reports 1920 sales as $15,257,672 and net earnings before Federal taxes, but after inventory adjustments, above $802,000. The great bulk of the inventory stands as sold material, therefore writing down will be very small. Operations were two-thirds of normal in November, but only 40 per cent in December.

Standard Die Casting Co. of Milwaukee has been incorporated with a capital stock of $100,000 to engage in the manufacture of dies, die castings and similar articles. The owners are the principal stockholders and officers of the Charles Jurack Pattern Works.

Lumen Bearing Co. will increase its capitalization from $200,000 to $500,000, of which $100,000 will be issued to stockholders as a stock dividend of 50 per cent. The balance of the new issue is to be used to take care of expanding business.

Lee Rubber & Tire Co. reports earnings for 1920 before deducting $225,000 dividends were about $510,000, without taking into account inventory write-off. On Dec. 31 the company owed banks $400,000 and had over $300,000 cash in banks.

Sterling Motor Truck Co. of Milwaukee, manufacturer of Sterling trucks, has increased its authorized capitalization from $250,000 to $1,000,000. Arthur C. Wollensak is chief engineer.

Charleston Steam Tractor & Truck Mfg. Co. has filed notice of an application to change its name to the Automoto Mfg Co., and to increase its capitalization from $1,000,000 to $2,000,000.

King Motor Car Co. has about $1,500,000 net assets with no bonded indebtedness, no notes out, and only a few small bills unpaid, according to General Manager Weber.

Kelly-Springfield Tire Co. has declared a quarterly dividend of $2 a share on the 8 per cent preferred stock of the company, payable Feb. 15.

Miller Rubber Co. gross sales in 1920 were $32,891,670.22; an increase of $5,775,081.89 over 1919, or 21 per cent.

Federal Motor Truck Co. has passed its monthly dividend.

Hamilton Motors Add Two New Truck Models

GRAND HAVEN, MICH., Jan. 22—Two new models are announced by the Hamilton Motors Co., a 1-ton speed truck and a 3½-ton truck. The 3½-ton model is very similar in design to the 1½ and 2½-ton Apex trucks, the only difference being in the dimensions of parts. It comprises a Buda 4½ x 6-in. engine, a Fuller 4-speed transmission amidships, a Torbensen rear axle with external service and internal emergency brake, a Shuler front axle, Blood Bros. universal joints and propeller shaft, G. & O. radiator, Stromberg carbureter, Eisemann magneto, Auto-Lite generator and Lavine steering gear.

The frame is of 7-in. rolled channel steel, ¼ in. thick and with 2¾-in. flange, and is suspended on half-elliptic springs. The wheelbase is 160 in., the front tread 65 in. and the rear tread 67 in. Wheels are of the wood artillery type, 36 x 5 in. front and 36 x 10 in. rear. The loading space is 168 x 72 in. The standard equipment includes a driver's seat, electric generator, electric head lamp, front fenders, tool box, tools, jack and Alemite grease outfit. The truck will develop a speed of 22 m.p.h., it is claimed.

On the 1-ton speed model, a Lycoming 3½ x 5 .in. engine is used, together with a Borg & Beck clutch, Muncey transmission, Torbensen axles, Lavine steering gear, G. & O. radiator, Stewart vacuum feed, Stromberg carbureter and Auto-Lite starting and lighting equipment. The frame of this model consists of 4-in. rolled channels, and is supported by half-elliptic springs both front and rear. The wheelbase is 130 in. and the tread the standard 56 in.

The 3½-ton model lists at $3,975 and the speed model at $1,695, both for chassis with seat.

Commonwealth Directors Re-elected to Positions

NEW YORK, Jan. 24—Directors of the Commonwealth Finance Corp. were reelected by large majorities at the annual meeting of stockholders. This is regarded as a vindication of the management of the company in the face of an attempt by one faction of the stockholders to have the present management ousted. It is considered probable that the temporary receivership, against which the company was granted a stay, soon will be lifted. After their election the directors elected the following officers: President, Henry D. Tudor; vice-presidents, Charles C. Dickson, Charles W. Thomas and Theodore L. Weed; secretary and treasurer, N. A. Merritt. The directors include the officers and Harry L. Burrage, George McAneny and Karl Goldsmith. The board is the same except that Weed takes the place formerly held by Ormsby McHarg, who instituted the legal proceedings resulting in the receivership and who preferred charges of malfeasance against the present management.

POWELSOHN DEBTS REDUCED

ROCHESTER, Jan. 24—Stockholders of the Powelsohn Foundry & Machine Co., Inc., manufacturers of automobile valves, pistons and wrist pins are apprised of the financial condition of the firm in a report just filed by the committee appointed at a meeting of creditors. According to figures submitted, the accounts payable on Oct. 1 were $38,953.29, and notes payable totaled $36,006.71. On Nov. 1 the accounts payable totaled $17,813.67 and the notes payable, $18,857.57.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Jan. 27—The stock market last week was irregular, with a downward tendency the latter part of the week after withdrawal of professional support. The bond market, on the other hand, gave indications of continued strength. There was a general advance, with some high grade bonds gaining as much as four or five points. Liberties and tractions were the most active issues. The new $30,000,000 8 per cent Belgian Loan was quoted last week on a "when issued" basis at a full point above par. Continued improvement in bond prices, which is generally expected to result from easier money, may be checked by further flotation of high-coupon-rate foreign issues, of which there are said to be a number in prospect. The foreign exchange market was the most prominent of the speculative markets.

The removal in Canada last week of the embargo on the importation of foreign held securities is significant, in that foreign held Canadian securities may form the medium of payment for Canadian exports, thus serving in a measure to divert Canadian trade from the United States to Great Britain, where Canadian securities are extensively held.

The recall of funds by interior banks and the continued withdrawal of Government funds were probably responsible to a great degree for the hardening of money rates last week. This is reflected in the large rediscounts and the decline in reserves of the New York Federal Reserve Bank. Call money, which had ruled at 6 per cent earlier in the week, rose to 7 per cent for renewals on Thursday and has since continued at that figure. The time money market was quiet with a 6 per cent rate quoted for all maturities up to six months. This rate compared with 6 per cent for maturities up to five months and 5½ to 6 per cent for six months' paper the week before.

A decline in the reserve position of the New York Federal Reserve Bank was partly a result of an increase in reserves held for private banks and of withdrawals by interior institutions. Gold reserves declined $37,495,000, and total cash reserves declined $36,001,000. Total bills on hand increased $50,372,000, and total earning assets increased $37,734,000. Federal Reserve notes in circulation declined $7,096,000.

The Federal Reserve banks as a whole continued the recent marked improvement in reserve position. Federal Reserve notes in circulation declined $44,181,000. The actual circulation at $3,115,310,000 was $289,600,000 less than it was only four weeks ago. Total gold reserves increased $10,315,000. As a result, the ratio of gold reserves to Federal Reserve notes in circulation, after allocating 35 per cent against net deposits, increased from 54.8 per cent to 55.6 per cent. While total earning assets declined $27,016,000, net deposits increased $33,061,000.

MEN OF THE INDUSTRY

Fred L. Good has assumed new duties as general sales manager of the Ogren Motor Car Co., Milwaukee, manufacturing the Ogren. Good retires as sales manager of the Wisconsin Automobile Sales Co., state distributer of the Jordan, after two years' service. He has been connected with the automotive industries for twenty years, having been associated in engineering capacities with Ford and Cadillac.

W. D. Crouch, formerly in charge of sales for Robertshaw temperature controllers in industrial plants, has been made general sales manager of both the domestic and industrial departments. The headquarters of the sales manager of the industrial department have been moved from New York to Youngwood and consolidated with those of the domestic department. John A. Robertshaw has been appointed New York representative and will have charge of Eastern interests.

C. C. Clay, for the past year sales manager of the Samson Tractor Co., Janesville, Wis., has retired to resume his previous connections with the Chevrolet Motor Co. of Atlanta. He is succeeded at Janesville by Hugh M. Craig, with the title of acting general sales manager, pending a permanent appointment. Craig has been assistant to Clay, and he is a nephew of J. A. Craig, president and general manager of the Samson company.

David Rosenbach, formerly president of the Motor Equipment Co., which recently discontinued business, has been appointed general field secretary of the Automotive Equipment Association. He was a jobber for five years, sales manager for the Rayfield carbureter for many years, and for four years was president of the Overland Sales Co.

C. R. Lester has resigned as general service manager of the Packard Motor Car Co., taking effect Jan. 17. Lester has occupied this important position for a number of years and has been largely instrumental in building up the system and personnel of the Packard service organization. He is one of the pioneers in the automobile business.

Hiram Walker has been appointed chief engineer of the Chandler Motor Car Co. Walker has been with Chandler for several years and his many friends will be pleased to learn of his promotion. He succeeds J. V. Whitbeck, who will now devote all his time to the Cleveland Automobile Co., he being president of that company.

Edmund T. Boland, formerly works manager of the Kissel Motor Car Co., Hartford, Wis., and more recently in charge of operations of the Clintonville (Wis.) Tractor Co., has become associated in a similar capacity with the Theodore Armleder Co., Cincinnati, manufacturer of Armleder motor trucks.

John N. Mowery has been made general manager of the Worcester Pressed Steel Co. He has had a wide manufacturing experience, having formerly been plant engineer with the Chester Shipbuilding Corp. and more lately connected with the McDougall-Duluth organization.

F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, delivered two lectures this week to the seniors of the University of Michigan, who are taking the course in transport engineering.

Hugh R. Corse has been made sales engineer of the Lumen Bearing Co. For the past six years he has been general sales manager of the Titanium Bronze Co., and previous to that had been manager of the Lumen office in Detroit.

Robert M. Eames has been appointed general sales manager of the Bryant Electric Co. to fill the vacancy caused by the resignation of Frank V. Burton. Eames has been active in the sales organization of the Bryant company for fifteen years.

Ernest N. Culver, who during the last three years has been division manager of the Willys-Overland Co. in charge of the southern division with headquarters at Atlanta, has been promoted assistant sales manager.

J. G. Meibrod, during the past four years foreman in direct charge of the Titanium Bronze Co. foundry, has made connections with the Hills-McCanna Co., Chicago, and assumed charge of its foundry Jan. 24.

H. M. Daniels, who has just returned from eighteen months abroad in the interest of the Four Wheel Drive Automobile Co., Clintonville, Wis., has been appointed manager of the New York branch of the company.

A. S. Hetzell has been appointed general sales manager of the Knox Tire & Rubber Co., Mt. Vernon, Ohio. Hetzell was formerly connected with the Diamond Rubber Co. and latterly with the Republic Rubber Co.

R. I. Pierce has resigned as supervisor of production and materials of the Gramm-Bernstein Motor Truck Co., effective Feb. 1. Pierce will join the sales organization of the Holland Furnace Co., Lima, Ohio.

S. Y. Tidd has been elected president of the New Tread Tire Co. of Columbiana, Ohio; C. R. Calvin, secretary and treasurer, and Eric P. Altenburg, vice-president and general manager.

Charles Froesch has resigned as chief engineer of the S. W. Merritt Co., New York, to become associated with William E. Kemp, New York, carburetion specialist.

Paul Fitzpatrick, vice-president of the General Motors Acceptance Corp., has returned from a trip abroad.

E. B. McKay has been elected vice-president and general manager of the Inland Rubber Co., Chicago.

W. C. Anderson Resigns as Ford Representative

DETROIT, Jan. 26—Warren C. Anderson, director of the five Ford Motor Co. corporations in Europe and chief representative of the American company, with offices in London and Paris, resigned to-day. Both Edsel Ford and Henry Ford were in conference with Eastern bankers, so the resignation was not tendered personally but laid on the desk of Edsel Ford, president. No reason was given for the resignation.

Huron Truck Prepares for Improved Business

BAD AXE, MICH., Jan. 22—The annual meeting of the directors of the Huron Truck Co. resulted in the re-election of the present officers and directors. The officers are: President, F. W. Kinde; vice-president, W. R. Lyons; secretary, C. C. Henny; treasurer, Fred M. Cross. The board of directors consists of these officers and former Governor A. E. Sleeper, George L. Whitney, John G. Clark, Fred M. Cross and John Ryan.

INDUSTRIAL NOTES

Arrow Pump Co. has been organized with headquarters at 1438 Washington Boulevard, Detroit, to manufacture a full line of small pumps for automobile, marine and tractor engines. The company is headed by F. M. Cobb, for several years president and general manager of the Fulflo Pump Co. Other officers of the same company are associated with him in the new enterprise. The capacities of the pumps to be made at present range from 4 quarts to 25 gallons a minute.

Detroit Consolidated Sales Co., Inc., has been formed in Detroit to handle the sale of Universal Tool Co. products to the wholesale trade in Minnesota, Iowa, Missouri, Arkansas, Louisiana and all states east. Officers of the company, most of whom were formerly connected with sales end of the Universal company, are E. H. Herman, president; C. H. Hinckley, vice-president; J. F. Nebrick, treasurer, and C. C. Weisblum, secretary.

General Electric Co. has bought the lamp and wire plants of the Independent Lamp & Wire Co., and it is thought the latter company will go out of business. One-third of the Independent company stock was owned by the General Motors Corp., which took about 10 per cent of its lamp output.

General Motors Corp. has bought an entire city block in Saginaw almost adjacent to the Jacox plant, which is a General Motors unit and which makes steering gears. While for the time being it is not expected that anything will be done to the new property, the site will eventually be used for the erection of a large addition to the Jacox plant.

Roller-Smith Co. has appointed the J. E. Dilworth Co., Memphis, as its representative in western Tennessee, eastern Arkansas and northern Mississippi. The electrical department of the Dilworth company is in charge of E. M. Greeson, formerly associated with Fairbanks, Morse and Sanborn Electric Co.

Seymour Laboratories Units, Inc., has been adopted as the new corporate style of the W. E. Seymour Mfg. Co. of Milwaukee. Walter E. Seymour is head of the company which is incorporated with a capital of $250,000 to manufacture piston rings and other automotive parts and specialties.

Service Motor Truck Co. of Wabash, Ind., has notified the Commercial Intelligence Branch of the Department of Trade and Commerce that it has purchased fifty acres of ground in London, Ont., and expects to build workshops for the manufacture of motor trucks in the spring.

Universal Tool Co., Inc., has moved its sales, service and executive offices from Detroit to the new factory at Garwood, N. J.

Ward La France Truck Corp. has established a direct factory branch in Chicago in charge of former Sales Manager G. E. De Long.

Four Drive Tractor Co., Big Rapids, Mich., has passed into the control of Dr. G. H. Lynch and John E. Bergelin.

MILES BUYS NEW BUILDINGS

CHICAGO, Jan. 21—The Miles Piston Ring Co., manufacturer of piston rings for about fifteen automobile companies, has acquired property on the South side of this city improved with a one and two story building. The Gill Piston Ring Co. has recently completed an addition to its plant here and has plans for further additions next year.

Calendar

SHOWS

Jan. 29-Feb. 4 — **Chicago, National Passenger Car Show, Coliseum, Auspices of N.A.C.C.**

Jan. 31-Feb. 5—London, Ont., National Automobile Show of Western Canada, London Chamber of Commerce, Armories, T. C. Kirby, Mgr.

Feb. 5-12—**Minneapolis, Annual Automobile Show, Minneapolis Automobile Trade Ass'n.**

Feb. 7-12—Columbus, National Tractor Show, Columbus Tractor & Implement Club, Ohio State Fair Grounds.

Feb. 7-12—St. Louis, Annual Automobile Show, St. Louis Automobile M'f'rs & Dealers' Ass'n, Robt. E. Lee, Mgr.

Feb. 12-19—Hartford, Conn., Annual Automobile Show, Hartford Automobile Dealers Ass'n, Armory, Arthur Fifoot, Mgr.

Feb. 12-19—Kansas City, Annual Automobile Show, Kansas City Motor Car Dealers' Ass'n.

Feb. 14-19—Winnipeg, Western Canada Automotive Equipment Show.

Feb. 18-28—San Bernardino, Cal., National Orange Show, Fred M. Renfro, Mgr.

Feb. 19-26—San Francisco, Fifth Annual Pacific Automobile Show, Exposition Auditorium, George Mahlgreen, Mgr.

Feb. 21-26—Louisville, Annual Automobile Show, Louisville Automobile Dealers Ass'n, First Regiment Armory, C. L. Alderson, Secy'.

Feb. 21-26—Salt Lake City, Annual Automobile Show, Intermountain Automotive Trades Ass'n, W. D. Rishal, Mgr.

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Atlanta, Annual Automobile Show, Atlanta Automobile Dealers' Ass'n, Auditorium, Virgil Shepard, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 5-12—Atlantic City, Annual Automobile Show, Automobile Trade Association of Atlantic City, Million Dollar Pier, A. H. Generatzky, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

Mar. 14-19—Washington, Annual Automobile Show, Washington Automobile Dealers' Ass'n, Rudolph Jose, Chmn.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April— Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Feb. 7—**Delhi, India, Delhi Motor Show.**

Mar. 23-28—**Witwatersrand Agricultural Show including machinery and motors sections.**

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

October—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

CONVENTIONS

Feb. 2-4—**Chicago, First Annual Meeting, Automotive Electric Service Assn. Hotel La Salle.**

May 4-7 — **Cleveland, National Foreign Trade Council.**

Oct. 12-14, 1921—**Chicago, Twenty-Eighth Annual Convention National Implement & Vehicle Ass'n.**

Roads Bureau to Show Practicability of Tests

WASHINGTON, Jan. 24—For the second time in its history, the Federal Bureau of Public Roads will make an elaborate exhibit outside the National capital when it stages a demonstration of its work at the American Good Roads Congress to be held at the Coliseum in Chicago, Feb. 9 to 12 next. The bureau is preparing to ship considerable equipment to Chicago and several of the bureau officials will occupy prominent places on the program.

Features of the government exhibit will be actual demonstrations by the Division of Tests in the conduct of the impact tests that the bureau is using to determine the ability of different soils to sustain roads and to measure the amount of wear on road surfaces caused by heavy traffic. Owing to the fact that moisture in the underlying soil is the principal cause of road failures, the actual subgrade tests and investigations which will also be conducted by the bureau at Chicago, showing how the movement of water in different soils can be controlled and road failures reduced, will be a big feature. The bureau will also conduct tests of road-building materials.

OHIO DISMISSES HIGHWAY HEAD

COLUMBUS, Jan. 24—Major General George W. Goethals, builder of the Panama Canal and formerly Quartermaster-General of the Army, spent a day in Columbus conferring over the reorganization of the Ohio Highway Commission. Considerable attention is being given to the reorganization of the Ohio Highway Commission and the first step in that direction was the dismissal of A. R. Taylor, highway commissioner and the naming of T. S. Brindle, chief engineer in the department, acting commissioner until the reorganization plan is decided upon.

Credit Men's Bureau Aids Car Financing

NEW YORK, Jan. 22—The Auto Financing Credit Men's Association, Inc., organized in New York a year ago to protect members and to assist dealers in improving the quality of their time payments risks, now has twenty-five members in the New York territory and seventeen in Chicago, who did $256,597,891 of business in 1920. The association has been working quietly for the past year, maintaining a paid secretary and exchanging information regarding accounts to prevent duplication of loans on a single security. At the same time it has been sending out periodic letters to dealers who are clients of its members, giving general information about credit risks. The membership includes some of the largest acceptance corporations, including two controlled by automobile interests.

WINDSHIELD PATENT UPHELD

NEW YORK, Jan. 24—Federal Judge Hand has granted to Theodore B. Nisbet, John O. Hofbauer and Anton Valerius a perpetual injunction restraining the Perkins Tonneau Windshield Co., Inc., from the manufacture or sale of windshields embracing the claims in a patent granted to Hofbauer in 1912. The court has appointed a commissioner to assess the damages due the plaintiffs under the infringement which the court recognizes.

Congress Drops Fund for Horsepower Study

WASHINGTON, Jan. 22—Engineering research into the problems of standardization of horsepower of motor trucks and tractors, as contemplated by the Bureau of Roads in co-operation with automotive manufacturers, will be abandoned unless the Senate Appropriations Committee restores the item for $100,000 which the House Committee struck from the Agricultural Appropriation Bill. Other reductions in the appropriations for this Federal agency will undoubtedly force them to revise their extensive plans for scientific inquiries into motive power and highways.

Truck and tractor manufacturers had requested the Bureau of Roads to undertake these investigations among farmers and other users of automotive farm equipment. The inquiry was intended to cover the construction, capacity, use and operation of farm implements, farm machinery, motor trucks, tractors and motive power for farm purposes. Only a portion of this fund would have been devoted exclusively for inquiries in this field as the research was to have been extended to other phases of rural engineering problems.

NEW YORK GETS DEVICE BILL

ALBANY, Jan. 24—Asemblyman Martin has introduced in the Legislature a bill which would require every motor vehicle to be equipped with automatic lights showing by color or other means whether it is moving or stationary. The bill would require use of words or lettering by day to show whether or not the car is in motion. It is significant the requirements fit a patented device.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

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Optimism and Returning Business in Evidence at Chicago

Many car manufacturers give releases to parts makers. Forecast of 1921 production is 60 per cent. of 1920 figure. Early attendance at show exceeds previous records. Manufacturers and dealers discuss policies. Sales and prospects very encouraging.

By J. Edward Schipper

CHICAGO, Feb. 1.

IT would be impossible for even a conservative observer to leave the Chicago Automobile Show, which is being held at the Coliseum this week, without becoming imbued with the spirit of sane optimism which prevails among the attending manufacturers, parts and material makers and dealers. These men came here with the hope of getting business and practically all are reporting more than they expected. This spirit is reflected throughout the entire gamut of show incidents. The attendance is larger than at any previous Chicago show, running, as this is written, fully 10 per cent ahead of that of a year ago.

The sales on the floor have exceeded the most optimistic predictions and while, during the early part of the week, the larger part of the sales are the result of campaign work, conducted before the show opened, there are a considerable number of new sales. One assembled car maker in the $2500 class reports eight sales on the floor during the first three days, three being to persons not on the prospect lists.

To properly appreciate the satisfaction with which the business being done at the show is regarded through the trade, it is necessary to realize what it was hoped to accomplish at this show. Never has the difference between the New York and Chicago shows in this regard been brought out as strikingly as this year. Most manufacturers and others left the New York show no wiser than they went. Parts makers, as a rule, were unable to get schedules from the manufacturers and very few of the car manufacturers were able to get sufficient information from their distributing organizations to formulate a policy for the year. At the close of the New York show all eyes were turned toward Chicago, with the feeling that the show there would enable a closer estimate of the year's business.

As a consequence everybody is here. The material manufacturers are represented more strongly than ever before. Foundry, forge shops and mill men are here, as well as car distributers and makers. They came to feel the pulse of the industry, as well as to obtain actual orders. The result is that, because all branches of the industry are in attendance, it is possible to get a more tangible view of the manufacturing situation for the next three months than has been possible since the present phase of business conditions was entered.

With the exception of perhaps five of the large man-

ufacturers, who have internal conditions in the way of re-organization of finances and personnel to face or who, because of a previous period of forced production, have an unusually large stock of cars in distributers' hands, the car manufacturing schedule for the next three months will average 60 per cent of that for the same period in 1920. Releases to parts manufacturers have started and are being given on this basis. It is almost impossible to make any definite predictions because of the position of three or four of the largest producers. But gathering together all the bits of information available, a production estimate of 1,300,000 for 1921, looks conservative. While the selling wave began to spread early in January, there is no question that it has been accelerated by the Chicago show.

The enthusiasm of dealers who came here in a keenly critical frame of mind to get a line on business conditions tells the story far better than it can be put into words. A shortage of cars in the spring has been predicted and talked of by over-optimistic dealers for the past two months, but it is doubtful whether there will be any general shortage. At the same time it is very likely that certain makers who have been especially conservative in their manufacturing policy during the dull period, will confront a delayed delivery condition.

The supply of unsold cars in the country has been over, rather than underestimated. The rumor crop which has been exceptionally good during the past three months, has been responsible for exaggerated estimates of the numbers of cars on hand. One of the greatest benefits of the show is that it enables the dealers from various parts of the country to compare notes and get these stories out of their systems. It is true that four or five manufacturers have overstocked dealers but beyond this there is not much slack to take up during the time required to get into production. It requires a considerable period for a factory of any size to get back to a considerable production basis. If there is one month's normal production—or two months' present production—surplus in the country, all of it will be required to fill the gap between the present and the time the new crop of finished cars is coming through with the desired regularity.

This year the Chicago show has exceeded its record in several respects. It is always a business show, but this year there has been a spirit of determination in every branch of the industry represented here. Constructive work has been done because everyone came here determined to get business no matter how hard it was necessary to fight for it. There has been a feeling all through the industry that the ice had to be broken on the firing line; that renewed business must begin in the dealers' salesrooms. Even parts manufacturers have openly expressed the idea that it is their duty to see that the proper vigor and fighting spirit is being displayed in the salesrooms of the companies using their products. The parts makers have been brought into closer contact with the actual selling of cars than ever before by the recent practice of cancelling contracts.

The parts makers reason that if the manufacturer is going to cancel orders because sales are slow and his cars are not moving, it is no more than reasonable that he assure himself that the manufacturer is putting forth the proper effort all along the line, particularly in the selection of his dealers and their methods.

The keen interest of the dealers themselves in the future of the industry and of their own business was evidenced in the annual meeting Monday and Tuesday of the National Automobile Dealers Association, at which the relations between the dealers and factories was the principal subject of discussion. Strong feeling regarding cancellation clauses in dealer contracts and arbitrary methods by factories has existed for some time and has been detrimental to business. The N. A. D. A., after discussing the subject, sent a communication to the National Automobile Chamber of Commerce asking that the manufacturers appoint a committee to meet with a committee of the dealers for the purpose of discussing trade practices and eliminating anything detrimental to the development of the industry. Robert J. Schmunk, vice-president and sales manager of Peerless, opened the discussion which was supplemented by a letter from C. W. Nash. Both stated that some of the industry's past practices are detrimental to business and should be corrected.

A point which must not be overlooked is the tremendous effect on general business conditions which will inevitably result from the acceleration of this great industry, which does a business of over two billion dollars a year. In fact, the general resumption in the automobile and parts plants alone will materially affect sales in the industrial territories. It is illuminating to consider the number of persons who are able to buy cars because they are in the business of making cars or parts. Sales in Michigan, Indiana and Ohio are expected to immediately result from the reopening of production.

The activities which are generally on the program for Chicago show week are in full swing. The salon at the Drake Hotel, with fourteen makers showing 43 cars, has been well attended. Despite the fact that the special bodies on these cars and the chassis shown are among the highest priced in this country and Europe, a highly satisfactory volume of business has been done.

Judged from an engineering and manufacturing standpoint, it may be said that no new cars appeared at the Chicago show. The three cars shown which are new to the general public are all assembled products incorporating units with which the industry is familiar. These new cars are the Winther Six put out by the manufacturers of the Winther truck, the Ambassador, which is a product of Shaw of Yellow Taxi fame, and the third is the Sterling Knight, of which the initial product is being exhibited at the salon and for which there are as yet no factory or manufacturing plans. The car is the design of engineer Sterling, formerly of the B. F. Stearns Co.

If the New York show had been moved bodily to the Coliseum in Chicago it would hardly have presented more similarity. In fact a great percentage of the exhibits were shipped directly to the Coliseum and Armory after the New York show. All three of the new cars are at the hotel exhibits. The Ambassador and the Sterling make up part of the salon which is being held at the new Drake Hotel and the Winther is shown at the Sherman. In connection with the salon, six of the leading body manufacturers, Fleetwood, Rubay, Graff, Smith-Springfield, Kimball and Willoughby are exhibiting their products on foreign chassis or on American chassis of the higher price class.

The new Ambassador is a high-priced product incorporating the Weidely twelve-cylinder overhead valve engine. This unit, which has been on the market for some time and which was formerly used by an Indianapolis car manufacturer, has its cylinders cast in blocks of three. It has a bore and stroke of 2⅞ by 5 in. and develops 82 b.hp. at 2700 r.p.m. The unit powerplant construction is used with a Brown-Lipe multiple-disk clutch and an aluminum gearset of the same make fitted with Timken roller bearings.

The axles are Timken, the rear being of the floating type. The drive to the rear axle is through a hollow propeller shaft and two Thermoid universals. Other

parts include a split-nut steering gear, 8-in. channel frame with four cross members and a rear cross plate, and chrome vanadium semi-elliptic springs. The rear springs are 58½ in. long. The wheelbase is 136 in. The electrical equipment includes Westinghouse starting and lighting motors and the new Philbrin ignition system. The car is fitted with 32 by 4½-in. tires on the roadster and four-passenger cars and with 33 by 5-in. tires on the closed models.

The Winther Six is manufactured in the plant which is also devoted to the manufacture of Winther trucks. This car is being put out by the Winther Motor Sales Corp. and is also an assembled job. It utilizes the Herschell-Spillman engine, with a bore and stroke of 3¼ by 5 in. This unit is credited with 60 hp. at 2200 r.p.m. It is a block-cast design and in the Winther car is utilized in unit powerplant form, including Warner clutch and gearset. The gear ratios in the box are 1.64 to 1 in second, 3.24 to 1 in low, and 4.05 to 1 in reverse. The reduction in the rear axle is 4 5/11 to 1.

The rear axle is a three-quarter floating, ball and roller bearing type, with spiral bevel gears. The rear wheels are carried on ball bearings and the differential on taper rollers. The propeller shaft is hollow with metal universals at each end. The drive is Hotchkiss. A feature of the universals is the magazine oiling system which operates through centrifugal force, necessitating a filling but once in 5000 miles, according to the claims of the manufacturers.

Westinghouse electrical equipment is used for starting, lighting and ignition. The generator is mounted on the right side of the engine and the drive is taken through the waterpump shaft. The battery is a Willard of 127 amp.-hr. capacity. The battery mounting, which is under the front seat, is swung from the chassis and is independent of the body. Gasoline feed is by Stewart vacuum system to a Stromberg carbureter. The car is fitted with Velvet recoil snubbers as stock equipment. Other equipment includes a motor-driven tire pump, cowl ventilator, Motometer and a Klaxon horn. The car is being put out with a touring body and the latter is equipped with a De Luxe winter top as special or extra equipment when so ordered. The wheelbase is 120 in. and regular equipment includes 33 by 4-in. cord tires.

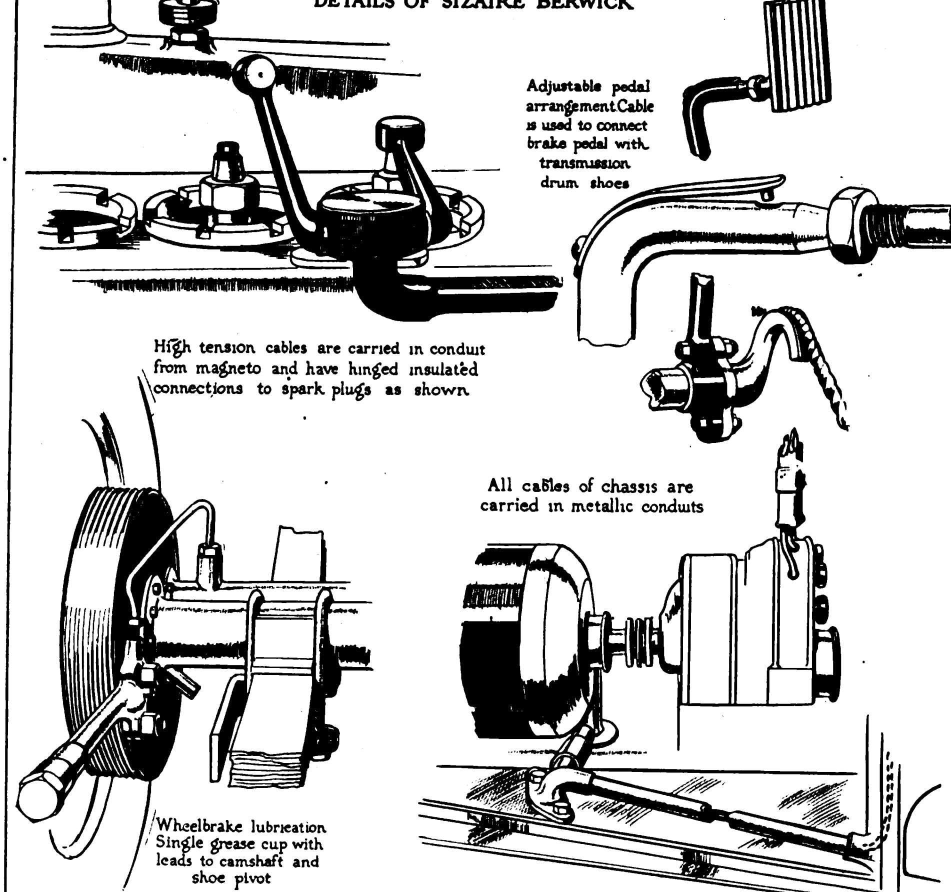
Detail Refinements Characterize Sizaire Berwick Chassis

By M. W. Bourdon

THE Sizaire Berwick chassis designed by French brains and made in London differs but little from the chassis shown at Olympia in 1919. The plant in which this car is built is one of the most up-to-date in equipment in England and planned for production as well as any and better than most.

The latest chassis displays the same elaborate attention to details which characterized previous models. All wiring is inclosed in metal conduits, and even hinged insulated connections for the spark plugs are provided. The fittings on the instrument board have translucent dials with an electric light behind them. The cast aluminum dashboard is surmounted by a horizontal vacuum feed tank of 1.8 gal. capacity and other similar refinements are provided.

DETAILS OF SIZAIRE BERWICK



The four-cylinder 3¾ x 6 5/16 in. L head engine now has a pump for water circulation driven from the camshaft by a transverse shaft and located at the center of the crankcase on the right, the camshaft being on the left. The clutch is of the disk type and the amidships gearset with four speeds and right-hand control is suspended at three points from brackets attached to a subframe. From the ribbed drum of the internal expanding transmission brake the drive passes through an open tubular propeller shaft with ball-bearing star joints at each end to the spiral bevel final drive with a ratio of 4 to 1. A feature of the universal joints is that they are automatically lubricated, one from the gearset and the other from the rear axle casing.

The back axle is of the semi-floating type with self-aligning ball bearings on the ends of the tapered extensions of the axle center. The rear semi-elliptic springs take torque and drive and are arranged immediately under the side frame members. Internal expanding brakes are used on the rear wheels, which are wire spoked.

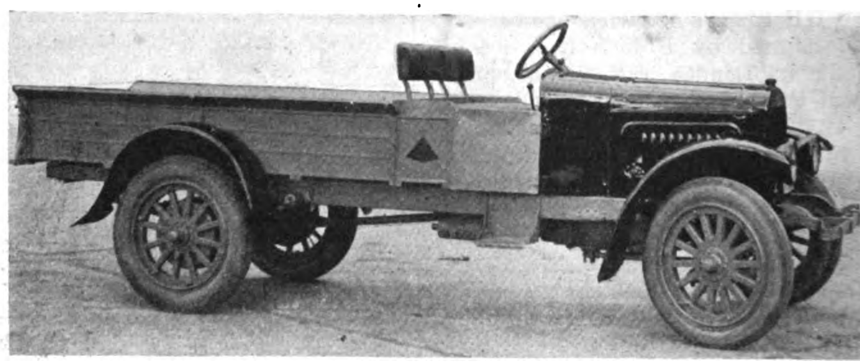
Three Point Chassis Mounting Feature of New Speed Truck

Transverse front spring with pivot joint connection to frame renders truck especially suitable for farm use or on rough roads. Midwest engine with two-bearing crankshaft and full electrical equipment is rigidly mounted on two forward points but has flexible connection with frame at rear supports. Rigid frame designed to prevent weaving of bodies.

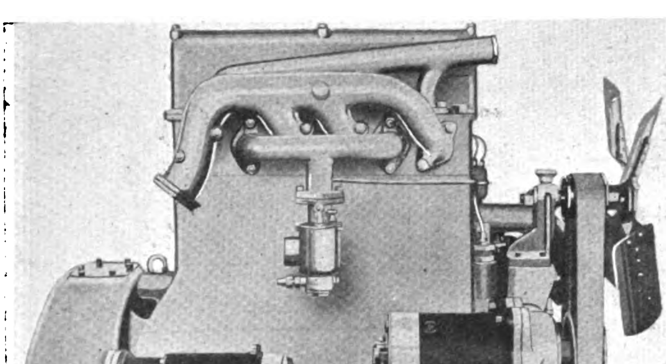
THE outstanding feature of the ¾-1 ton speed truck of the Service Motor Truck Co. is the three point mounting of the chassis. The truck is evidently intended for farm use to a certain extent. In such service the trucks often have to leave the highway, they must be built so as to be able to readily accommodate themselves to very uneven ground or be subjected to very severe strain. In the Service truck the plan of arranging the front spring transversely, generally followed in farm tractor practice, is adopted. There is a pivot joint between the spring and the frame at the middle, and the axle is steadied by radius rods attached by a ball joint beneath the transmission.

Flexibility is not confined to the running gear, but is aimed at also in the support of the unit powerplant. The latter comprises a Midwest four-cylinder 3⅝ x 5 in. engine, developing 40 hp. at 1800 r.p.m., a Brown-Lipe dry plate clutch and transmission. Power is transmitted through a metal universal joint, a tubular propeller shaft, and a fabric universal joint to a model 1000 Eaton spiral bevel gear drive axle.

The engine is one of the new products of the Midwest Engine Co., and has many of the same features of construction employed in their larger type of engine. The four cylinders are cast in a block and are integral with the upper half of the crankcase. The oil pan is of pressed steel. The removable cylinder head permits machining of the entire combustion chamber and enables clean coring of the water passages. Alloy steel valves, 1 17/32 in. at the throat, are used. The valve lift is 11/32 in. The rocker-arm construction is identical with that of the larger type Midwest engine. The push rods are surrounded by breather tubes, which insures oil vapor lubrication of the rocker-arms. A tappet platform is bolted to the upper half of the crankcase.



Service ¾-1 ton speed truck

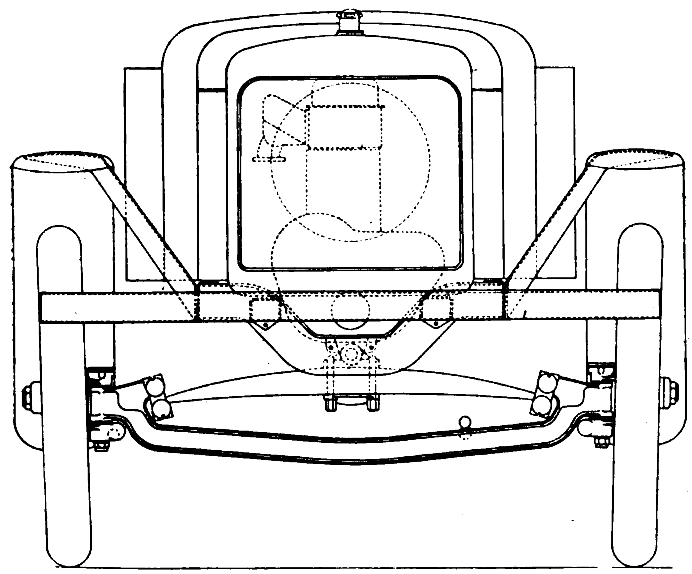


Midwest 3½ x 5 in. truck engine with full electric equipment

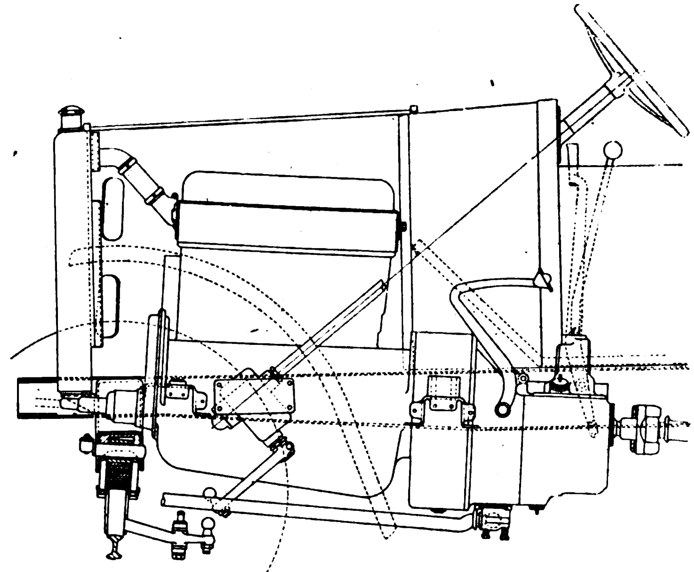
Cast iron pistons 4½ in. long are used. They are provided with grooves to accommodate three rings above the piston bosses. The piston pin bearing, which is 1⅛ in. wide and 15/16 in. long, is located in the piston. Connecting rods are of the usual I section, 10½ in. long, and are made of S.A.E. No. 1040 steel. These rods are belled out at the crankshaft end and the flange is carried to the center of the bearing. This construction is employed to keep the bearing round and prevent distortion when the cap is drawn up tight. Connecting rod bearings measure 2½ x 2½ in. and the bearing cap is held on by two ½ in. nickel steel bolts.

This model differs from the larger Midwest engines in that it has a two-bearing, counter-balanced crankshaft. Counter-weights are bolted to the shaft with nickel steel bolts, riveted over, and dowelled bushings where the counter-weights come in contact with the shaft. The front crankshaft bearing is 2½ by 2¾ in. and the rear crankshaft bearing, 2½ x 3 5/16 in.

The same force feed system of lubrication is employed on this model as on the larger type. The geared oil pump is of the self-priming type and has a capacity of 1 7/10 gal. per min. at 1000 r.p.m. Oil is drawn from the lower



Front elevation of chassis



Elevation of forward part of chassis, showing trunnion support of frame and location of radius rods

pan, which has a capacity of 2¼ gal. A plunger controlled by the vacuum of the manifold regulates the oil flow in relation to the actual load on the engine. This allows ample lubrication for full load and prevents excess oiling at light or medium loads.

Cooling is effected by a radiator with a continuous fin and tube type core. The pressed steel radiator shell is mounted on leather pads to absorb vibration. Water is circulated by a pump having a capacity of 18 gal. per min. at 1000 r.p.m. and the air is drawn through the radiator by an 18 in. fan, driven by a 2 in. flat belt. The Remy system of battery ignition is employed, together with a Remy generator and starting motor and an Exide truck battery. A Stromberg carbureter with hot air stove attachment and choker controlled from the instrument board is used. Gasoline is carried in a 12 gal. tank in the cowl.

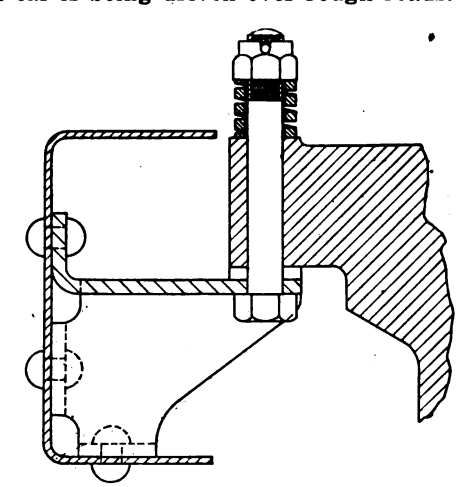
Power is transmitted through a single drive plate clutch and a Brown-Lipe Model 30 transmission. The clutch housing is of cast iron. The method of adjusting this clutch is somewhat different from that employed on other Brown-Lipe clutches. A nut of malleable iron, which moves mild steel plugs in and out, is provided. These plugs change the relative position of the toggle levers, which are hardened forgings, and they, in turn, regulate the pressure on the pressure plate. The pressure plate is cast iron and the driven disks are pressed steel, ground on both sides. The clutch facings are of moulded Raybestos, 10 x ⅛ in. The clutch shaft is of low carbon, 3½ per cent nickel steel, and of 1½ in. diameter. Whereas radial and thrust bearings are used in most Brown-Lipe clutches, this clutch is provided with a straight thrust bearing. The transmission is provided with speedometer drive at the rear.

A 2½ in. tubular propeller shaft is used, with a Merchant & Evans universal joint at the front and a No. 2206 Goodrich fabric joint at the rear. The latter provides a cushioning member between axle and transmission.

The front axle is of the reverse Elliott type, drop forged of alloy steel, heat treated. This axle is specially designed to accommodate the front cross spring. The axle center is 2½ in. deep, 1⅝ in. wide and has a ⅜ in. web. The front spindles are 1½ in. in diameter and are fitted with taper roller bearings. The rear axle is designed for the Hotchkiss drive but can be equipped with radius rods if desired. Optional gear ratios are 5⅛, 5⅝ and 6 1/7:1.

Cam actuated internal brakes act upon brake drums 15¾ in. in diameter. The width of the brake shoes is 1¾ in. Both brakes are placed inside the frame to avoid interference with skid chains. The lug at the rear of the brake bands is provided with a slot which permits the brake band to center itself when the brakes are applied. This results in more even wear on the band.

The steering gear is of the worm and sector type and is of Service design and manufacture. A small metal stamping covers the joint between knuckle pin and steering head and aids in excluding dirt. Left hand drive and center control are provided, the gear shift and emergency brake levers being mounted on the transmission. The spark and throttle are controlled by levers under the steering wheel and the throttle is also under the control of a foot accelerator. The pedal of the accelerator is so designed as to eliminate continual opening and closing of the throttle when the car is being driven over rough roads.



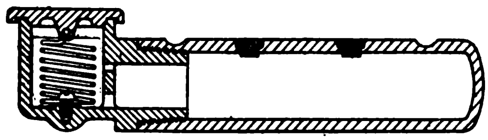
Flexible rear engine support

The frame is made of pressed steel, the channel section being 5⅞ x 3 x ⅛ in. between dash and rear spring front hanger, tapering to 3¾ x 2 in. at the rear end and 3⅞ x 2 in. at the front end. The length of the frame back of the driver's seat is 101.5 in., the width 30¾ in. at the front and 37 3/16 in. at the rear.

The front cross spring is 38 in. long, 2½ in. wide and has nine leaves of a total thickness of 2 21/32 in. The spring eyes are bronze bushed for 1¼ in. shackle bolts. This spring is shackled at both ends of the front axle and is trunnioned at the center. The shackle bolt, which is

drawn from low carbon steel, is screwed to a die cast oil cap with the cover held in place by a spring. Two pieces of felt about 3/8 in. in diameter transfer the oil from the reservoir to the bearing surfaces.

The use of the front cross spring makes it necessary to provide radius rods. One end of the radius rod has a ball joint at the bottom of the transmission, the socket of the ball joint being held in place by four bolts. The front end of the radius rods has a taper fit in the front axle. The use of this type of front spring suspension makes necessary the use of four-point suspension for the engine, but permits the use of a very rigid frame, which is particularly desirable. Four-point suspension always gives rise to the question of how the engine can be bolted down tight. The two bolts holding the rear legs of this engine are bolted down against the tension of heavy coil springs, which allow a certain amount of flexibility and insure keeping the legs tight at all times. It is said that considerable trouble (with bodies in particular) has been caused by the use of a flexible type of frame, and this type of suspension, which permits the use of rigid frame construction, is intended to obviate this trouble. The rear springs are of the conventional type, semi-elliptic, 50 x 2½ in.



Section of shackle bolts and oil reservoir

This truck is regularly equipped with 34 x 4½ in. pneumatic tires in front and 35 x 5 in. in the rear. The standard gear ratio is 5⅝ to 1 and permits of a speed as high as 40 m.p.h. The truck chassis, provided with a cushion but no seat, is to sell for $1,840, f.o.b. at factory. Two standard bodies, one open and one closed, can be purchased, the weights being about 600 lb. for the open body and 700 lb. for the closed.

Winch Attachment for Tractors

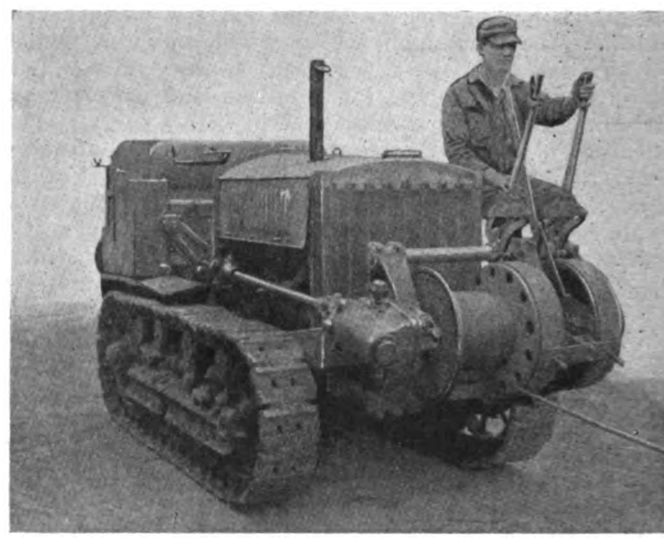
THE range of utility of the 5 ton and 10 ton caterpillar tractor manufactured by the Holt Manufacturing Co. has been increased by providing for use on the tractors a winch attachment as shown in the accompanying cut.

Caterpillar type tractors are extensively used in the logging industry as well as in the oil fields. The winch attachment facilitates skidding logs out of relatively inaccessible places, and is useful in pulling and running back tubing and rods used in oil wells.

The Holt winch is operated independently of the driving mechanism of the tractor. The drive is from the rear of the transmission-case by propeller-shaft and gear-train to internal gear planetary and final bevel gears. A clutch of ample size to permit slipping indefinitely is provided. The standard pulling speed of the 5 ton winch is 108 and 252 ft. per min. on low and high gear respectively, and the corresponding pulls are 10,400 and 4450 lbs. Maximum reverse speed is 583 ft. on low and 1360 ft. on high gear. Other speeds are obtained by slipping the clutch. Two other sets of gear ratios are provided at option.

The winding drum is 8 in. diameter and 13 in. between flanges, and has a capacity of 1300 ft. of ½ in., 850 ft. of ⅝ in., or 590 ft. of ¾ in. cable.

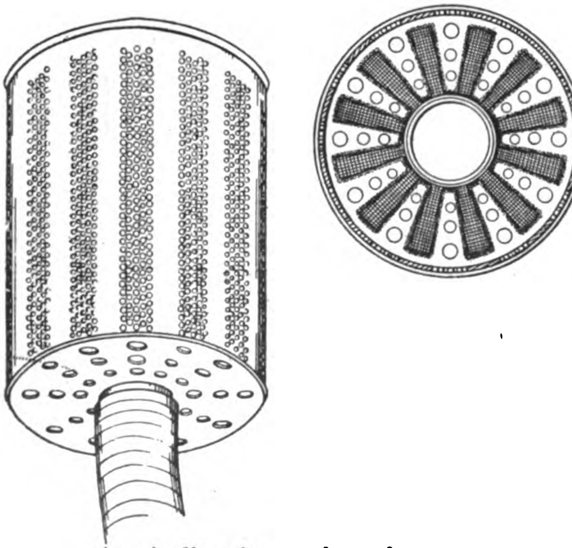
All shafts and gears are nickel or carbon steel, the gears being case hardened. Ball or roller bearings are used throughout and the gears and moving parts are enclosed.



Winch attachment applied to Holt tractor

A Self-Cleaning Air Filter

AN air cleaner in which felt is used as a filtering medium has recently been placed on the market by the Staynew Filter Co. As will be seen from the accompanying cut the device consists of a cylindrical, perforated shell, into which is fitted an elongated spider formed of wire screen and covered with felt. The central portion of the spider communicates with a central tube, through which the clean air entering the carbureter flows. The felt-covered surface spider is said to have an area of over 500 sq. in. The area of the inlet holes being large, the entering velocity of the air is low and consequently the larger particles of dust are allowed to settle out before the air passes through the felt. It is claimed that the air entering the cleaner does not strike directly upon the filtering material and that the dust which collects on the surface of the felt is shaken off by the vibration of the vehicle on which the cleaner is used. The dust shaken loose drops out of the shell through holes in the base.



An air filter for trucks and tractors

Instrument for Measuring Engine Clearance Volumes

Makes use of principle which provides that a simultaneous decrease of known amount in two volumes will produce the same pressure change only when both volumes are equal and the leakage is the same.

By S. W. Sparrow*

A FEW years ago, when the gasoline engine with vertical cylinders was the well-nigh universal type, a description of apparatus to measure clearance volume would have aroused little interest. In the highest part of such cylinders there was usually located either a valve or a spark plug through the opening for which liquid could be poured. The volume of liquid required to fill completely the combustion space with the piston at the upper dead center served as the clearance measurement. To be sure, it was a rather messy procedure requiring considerable time to remove the liquid when check readings were desired, but otherwise was fairly satisfactory. With the advent of the V-type engine, the problem ceased to be simple. Frequently it was almost impossible to make this measurement with the engine mounted for test, as all openings were then below the highest point in the cylinder.

In the summer of 1919, Major Norman of the English Royal Aircraft Establishment at Farnborough suggested making this measurement by a process which consisted essentially of simultaneously changing both a known and an unknown volume of gas by a known amount and then calculating the magnitude of the unknown from the resulting difference in pressure between the two. To Dr. Dickinson, who was in Europe studying aviation development, the idea made instant appeal, and on his return to the Bureau of Standards he started the construction of an instrument based on this principle.

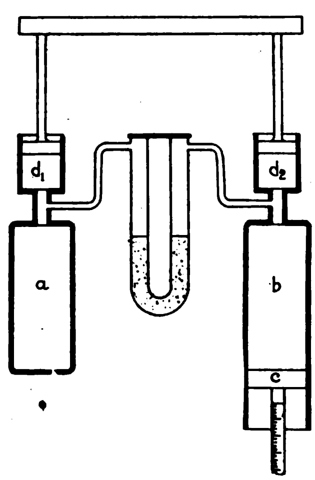


Fig. 1—Diagram illustrating principle of apparatus

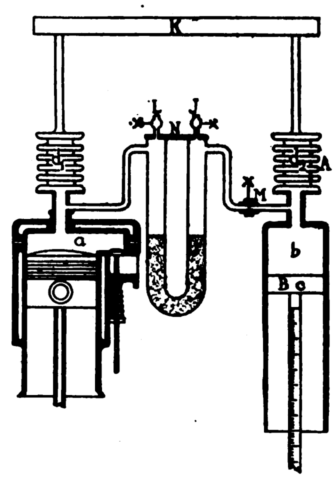


Fig. 2—Diagram of actual instrument illustrated in the photograph

The principle of the apparatus is shown in Fig. 1. If the volumes *a* and *b* are both decreased the same amount by the movement of the pistons, there will be a pressure increase in each cylinder, the greater increase occurring in the smaller volume. The pressure difference will be indicated by the difference in liquid level in the U tube connecting the two cylinders. In practice, volume *a*, the clearance volume, is always unknown, while in the other, volume *b*, can be altered by moving piston *c* in or out of the measuring cylinder and its magnitude read from the scale on the piston stem. This calibrated volume is changed until the movement of the two companion pistons produces the same pressure increase in both cylinders as indicated by the liquid in the U tube remaining level. Both volumes are then equal. The above statements hold true only if both cylinders are airtight or if both leak at the same rate. Since the engine cylinder is never strictly tight, an adjustable opening is provided to permit an equal rate of leakage from the comparison cylinder. For clearness, the simultaneous volume changes are described as taking place in the clearance and measuring volumes, whereas actually there are auxiliary volumes d_1 and d_2, connected with these in which the actual change is made, so that it is (clearance volume + auxiliary volume d_1) and (measuring volume + auxiliary volume d_2) that are changed. The addition of these auxiliary volumes simplifies the apparatus for making the volume changes, and inasmuch as both are equal, does not alter the relations described above.

The actual instrument is shown in diagram in Fig. 2, in section in Fig. 3, and in the photograph, Fig. 4. For producing the changes in volumes, the pistons, shown in the diagram, have been replaced by the cylindrical copper bellows, *A*. Changes in the comparison volume are produced by turning hand wheel *C*, the motion being transmitted to the piston *B* through a gear and rack. A vernier and graduated scale on the piston stem permit the direct reading of volumes up to 48 cubic inches in steps of one-tenth of a cubic inch. Should it ever be necessary to measure larger volumes, an auxiliary cylinder can be connected to Tee *D*, now closed by a pipe plug. The measurement would then be made as before, except that to the reading on the piston stem should be added the volume of the auxiliary cylinder. Tank *E* is a check volume of 7 cu. in., used only for calibration purposes. When the tubing is renewed, fitting *F* is screwed into the tank, screw *G* loosened, and vernier *H* adjusted to read exactly 7.

Measuring clearance volumes consists of three distinct steps:

1. Measuring the rate of leakage from the engine cylinder.
2. Making the rate of leakage from the comparison volume equal to that from the engine cylinder.

*Automotive Power Plants Section, Bureau of Standards. Condensed from N. A. C. A. Technical Note No. 27.

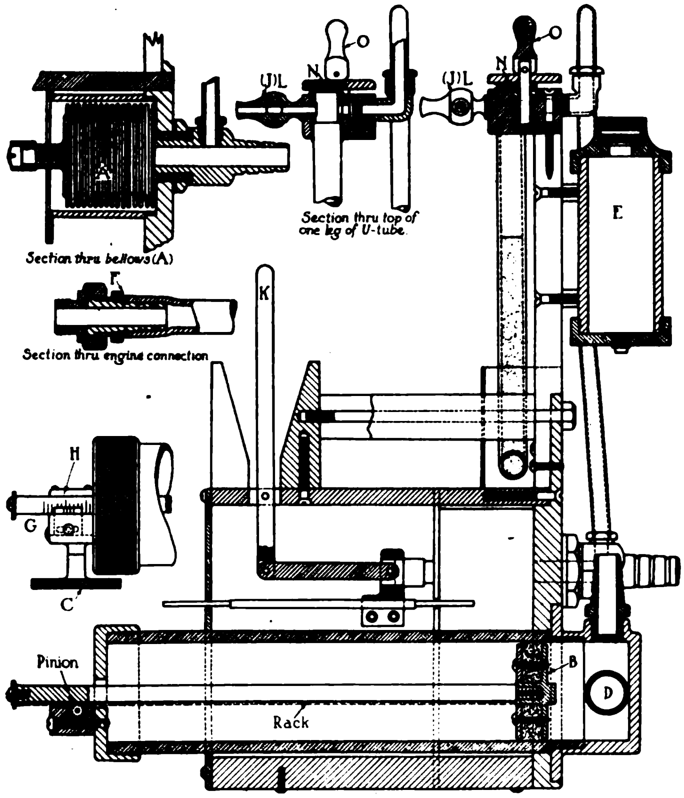


Fig. 3—Sectional view of instrument, showing details of construction

3. Equalizing the comparison volume with the clearance volume.

In measuring the rate of leakage from the engine cylinder, after having latched cover plate *N*, needle valve *J* is opened, leaving the right side of the U tube open to the atmosphere. Lever *K* is then pulled back until a considerable pressure difference is produced. The leakage rate is estimated by noting the approximate time required for the pressure to decrease a definite amount. Valve *L* is next opened and *J* closed, one side of the U tube now being open to the atmosphere and the other connected to the comparison volume. Valve *M* is then adjusted until the leakage rate is approximately the same as that from the engine cylinder.

In equalizing the volumes, valves *J* and *L* are both closed, the left leg of the U tube then being connected to the engine cylinder and the right leg to the measuring cylinder. When changing the volumes by means of lever *K*, it is most convenient to watch but one leg of the tube. If the left leg be the one chosen and the initial movement of the liquid is downward, it indicates the pressure in the engine cylinder to be the greater and its volume to be the smaller. After relieving the pressure on both sides by raising cover plate *N*, the volume in the measuring cylinder should be decreased. The cover plate is again lowered and secured tightly with latch O and the process repeated. The correct volume is that with which there is no change in liquid level noted at the first application of the pressure.

It will frequently be found that with the volumes well equalized, after the pressure has been maintained for a second or two, the deflection of the liquid in the U tube will increase, showing that the leakage rates have not been perfectly balanced. A few trials will readily convince the operator that it is the initial movement that should be considered in adjusting the comparison volume, and that extreme care in balancing leakage is unnecessary. The explanation will be evident from a consideration of the effect of a difference as large as 10 per cent in the leakage rate from the two volumes. For this purpose, let the rate be assumed as 0.03 cu. in. per second, a rather high value for the small pressure increase produced with this instrument. With the above assumption, a measurement taken at the end of one second will be in error by the difference in the amounts that have leaked from the two volumes, namely, 0.03—0.9 (0.03) = 0.003 cu. in. The sensitivity of the instrument, however, is about 1 per cent, a difference between the comparison volume and the measured volume of this amount being required to produce a readable deflection on the manometer. The 0.003 cu. in. error will therefore be too small to be noticed in measuring volumes of the magnitude of engine clearance spaces. The initial manometer deflection observed can therefore be attributed entirely to the difference in the magnitude of the two volumes.

In using this apparatus, care must be taken to prevent temperature changes in either volume, as a change of 3 deg. C. will change the deflection a noticeable amount, and hence vitiate the result. Obviously, such measurements should never be attempted immediately after operating the engine, before it has cooled to normal temperature.

To attempt precise measurements of a clearance volume without first carefully setting the piston at dead center would be utter folly. Markings on flywheel or propeller hub make this a matter of comparative ease in the majority of cases. In the absence of such markings, the clearance measuring apparatus may be connected as was done for measuring leakage with valve *J* open and *L* closed. This merely enables the U tube on the instrument to be used to measure the difference between the pressure in the cylinder and the atmosphere. Moving the piston toward upper dead center produces pressure; moving it away, suction. In the Liberty "12" one degree motion of the crank from dead center can be detected with this instrument.

THE engineer of a large automotive engine manufacturer states that his company is concentrating all its efforts in fuel study on improving vaporization by applying the hot-spot principle, believing it to be the most logical method adaptable to present-day types of engines.

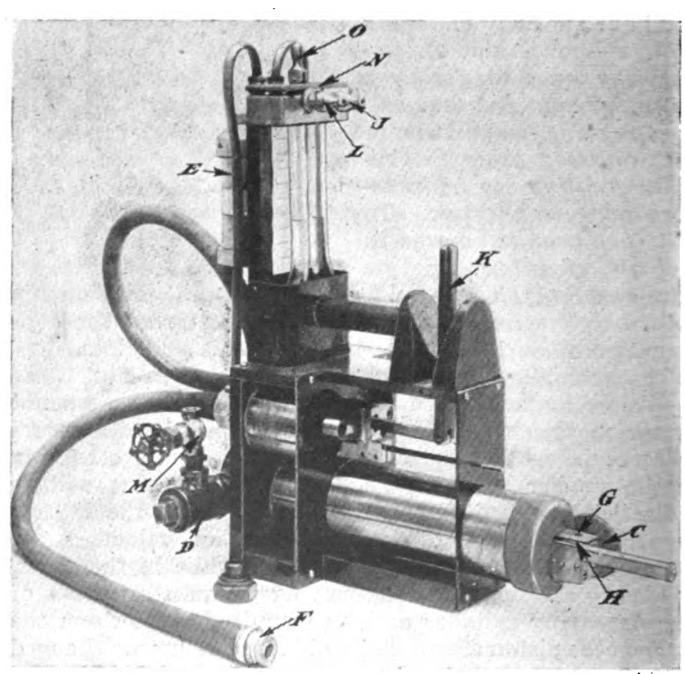


Fig. 4—Instrument developed by the Bureau of Standards for measuring clearance volumes

Two Recent French Pursuit and Racing Planes

Borel machines are both biplanes and use 300 hp. Hispano-Suiza engines. The pursuit machine has good streamline nose, clear vision, and carries radiators under fuselage. Fuel tanks can be instantly released in case of fire. Racing plane first seen in Gordon-Bennett trials.

By John Jay Ide

THE Société Anonyme des Aéroplanes Borel has recently produced a pursuit type airplane which can be used either as a one or a two-seater. It is noteworthy for the good streamline form of the nose, a relatively short fuselage, a stabilizer adjustable on the ground, long narrow ailerons on the lower wing only and wings staggered forward.

There are two bays in the biplane wing structure cross-braced by streamline wire. The lower plane has no dihedral but the upper plane has a dihedral of 2 deg. The angle of incidence of both planes is 2° 30′. The forward stagger is 15 in. The leading edges of the wings are covered with three-ply and the trailing edges are composed of steel wires. Both interplane struts and wing spars are of spruce. The factor of safety of the cellule is 7 for normal loading and 3.5 for top loading.

The balanced ailerons are operated by duralumin tubes, the control wires of which are doubled. The comfort of the pilot was considered in making adjustable not only the height of the seat but also the position of the rudder bar with reference to the seat. A stream of hot water taken from the carbureter heater runs through the rudder bar.

The upper plane is at the height of the pilot's eyes and the straight line from the pilot's eyes to the leading edge of the lower plane is at an angle of 18 deg. with the vertical. The vision straight forward is excellent due to the absence of a nose radiator. Cut out portions of the lower wing permit the pilot to see vertically downward. Cooling is by two Lamblin radiators placed under the fuselage. The latter is designed for a factor of safety of 5.5. The longerons are of ash and spruce connected by spruce struts and cross braced with piano wire.

The landing gear struts are of reinforced streamline tubing; the axles are also streamlined. A pivoted ash skid is attached to the stern of the fuselage.

The 300 hp. Hispano-Suiza engine rests on walnut bearers with leather between the bearers and the engine. The two bearers are held in place by metal braces. There are large inspection doors for the carbureter, magnetos, Odier self-starter and plugs.

The two tanks which can be released instantly in case of fire hold sufficient fuel for 2½ hr. flight at full speed at ground level. There is a gravity tank in the upper wing.

The radiators installed under the fuselage are quickly demountable. A filter is placed in the water circulation system. The gravity water tank is in the leading edge of the cabane joining the fuselage and the upper wing.

There are two Vickers machine guns with 1600 cartridges firing forward and two Lewis guns aft, mounted on a ring. The installation of a gun firing downward has been provided for, it being necessary merely to remove a three-ply cover. When the aeroplane is used as a single seater the ring mount is turned and clamped so that the two Lewis guns fire over the upper plane and propeller parallel to the longitudinal axis of the machine.

Provision has been made for two cameras behind the pilot's seat. Parachutes are placed in a case behind the gunner.

The service ceiling is 25.900 ft. and the absolute ceiling 27,100 ft.

Borel pursuit airplane (300-hp. Hispano-Suiza engine) can be used either as single or two seater

The new Borel racing airplane made its first appearance at the French elimination races for the Gordon Bennett Cup last September. Although possessed of very great speed it did not qualify as it was overturned and somewhat damaged in making a landing.

The biplane cellule is noteworthy for the small chord (36 in.) of the planes. The supporting area is increased by a small plane covering the axle of the landing gear. The single strut on each side of the fuselage is forked.

Streamline wiring is used, the attachments at the lower ends of the wires being hidden in the wing.

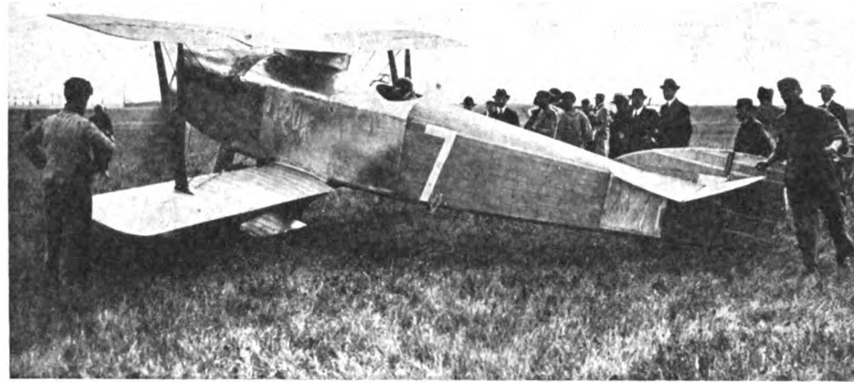
There are ailerons on the upper wing only. Their area is very great relative to

the area of the wing. The fin is of very small size but the rudder is quite large (16 x 32 in.).

The wing area is 140 sq. ft. and the total weight 1936 lbs. The load per sq. ft. is 13.8 lbs. and per hp. 6.4 lbs.

A 300-hp. Hispano-Suiza engine is used cooled by two Lamblin radiators.

The general specifications of the Borel pursuit machine are as follows:



Borel racing airplane (300-hp. Hispano-Suiza engine) used in Gordon Bennett cup elimination race

Span	37.4 ft.
Length	23.3 ft.
Height	8.7 ft.
Chord	5.2 ft.
Wing area	355 sq. ft.
Area of elevator	16.5 sq. ft.
Area of stabilizer	18.8 sq. ft.
Area of rudder	9.7 sq. ft.
Area of fin	5.4 sq. ft.
Weight, empty	1798 lbs.
Useful load (2 seater)	1095 lbs.
Total weight	2893 lbs.
Load per sq. ft.	8.1 lbs.
Load per hp.	9.6 lbs.
Engine	300 hp. Hispano-Suiza

The official performances as a two-seater are:

Feet	Time of Climb	Speed (m.p.h.)
3,280	2 min. 47 sec.	....
6,560	6 min. 0 sec.	143.6
9,840	9 min. 34 sec.	139.8
13,220	13 min. 49 sec.	134.9
16,440	19 min. 31 sec.	128.6
19,680	26 min. 53 sec.	120.6
21,320	33 min. 33 sec.	115.6

The De Pischoff "Avionette"

By John Jay Ide

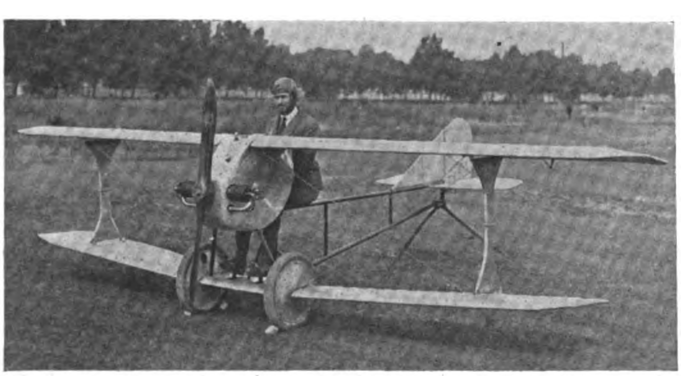
THE De Pischoff "Avionette" is the smallest serious flying machine in France, if not in the world. To prove that it is not a mere toy one has only to point to its performances at the recent Buc Aviation Meet, where among other achievements it climbed to a height of over 2500 ft.

The "Avionette" is a biplane with tail booms and wing structure entirely of metal. The axle of the landing gear is mounted on the front spar of the lower wing, which is only 8 in. from the ground. The interplane struts are of the I type and the fuselage is replaced by a couple of booms carrying the customary tail surfaces. The ailerons are on the upper wing only.

The engine is a 16-hp. two-cylinder horizontally opposed Clerget-Blin. Immediately behind it sits the pilot, of whose anatomy it must be admitted a considerable portion is exposed.

By folding the wings and hinging the tail the dimensions of the machine can be considerably reduced for storage purposes.

The characteristics of the "Avionette" are:



The De Pischoff Avionette

Span	17 ft.
Length	11.5 ft.
Height	4.2 ft.
Wheel track	2.6 ft.
Wing area	81 sq. ft.
Weight, empty	225 lb.
Useful load	176 lb.
Total weight	401 lb.
Speed	59 m.p.h.
Duration	2 hr.
Getting-off run	130-160 ft.
Landing run	65-80 ft.
Factor of safety	5

To Assemble American Parts in Spain

A COMPANY called the Sociedad Española de Automóviles Landa has been organized in Madrid, and has put on the market a four-cylinder car, which is considered to embody all the features necessary to capture the Spanish market. Spain does not at present possess the elements indispensable for the practical construction of cars in all stages, and the Landa company does not actually manufacture the constituent parts of its cars in Spain, but has devoted its whole energy and capital to the organization of a model finishing and assembling establishment.

The Landa chassis are built in Spain with American material, but they are claimed to unite all the good qualities of the most modern type of car. The motor has 3⅞ x 5-in. cylinders. It is said only to consume 12 litres of fuel per 100 kiloms. (5.08 gal. per 100 miles), and to give the car a speed approaching 100 kiloms. per hour. The cars are fitted with the Zenith carbureters and the Westinghouse electrical equipment. A number of chassis are now being built by the company, while the materials for 200 more are on the way, and it is hoped ultimately to turn out 1000 cars yearly.

Researches on Alcohol as a Fuel for Internal Combustion Engines

The object of investigator was to secure basic data on the vapor pressure, ignition temperature, movement of flame through explosive mixtures and the detonation of the vapor of alcohol, gasoline, benzol and various mixtures of two of these fuels. The results are worthy of careful study by those interested in combustion and related phenomena.

By Harold B. Dixon*

THE object of these researches was to obtain data for comparing alcohol with gasoline and other hydrocarbons as a fuel for motor and other small engines, and to determine how far the properties of alcohol are modified by admixture with other volatile liquids. I undertook to make experiments on the burning of alcohol and other vapors on the same lines that had been followed with permanent gases—especially on the ignition of the mixtures and on the movements of the flame in explosions. The work is by no means finished, and I propose to continue and present a more complete report later on.

One further word of introduction must be said. It has been argued—and probably most people agree with the reasons urged—(1) that if the increasing use of motor engines is to be maintained, some fuel must be found to reinforce the world's supply of gasoline; and (2) that of the possible fuels "in sight" which have the desired physical properties, ethyl alcohol alone seems capable of being produced in quantity sufficient to meet the demands of the future. In assenting to these conclusions, there is no question of sounding any alarmist note against the use and efficiency of gasoline, which the world will continue to demand in increasing quantities. We are merely recognizing the fact that the deposits of mineral oil are limited and cannot be reproduced, while the potential supply of alcohol is only limited by our power to produce fermentable sugar through the sun's energy. There is the question of husbanding the world's resources of gasoline, and if power alcohol will help to that end—as I believe it will—it is our duty and our advantage to give it fair trial.

Germany, with characteristic prescience, began more than twenty years ago to foster the use of alcohol, which (with certain additions) has been her standard motor fuel since 1904.

The Vapor-Pressures of Alcohol and of Alcohol Mixtures

On comparing alcohol with other liquid fuels, we find certain properties which affect its use, such as its small vapor pressure at low temperatures, its high latent heat of vaporization, its attraction for and its miscibility with water. For instance, air bubbling through liquid alcohol does not form an explosive mixture, for the vapor carried by the air is too small; but air bubbled through pentane or hexane, through benzol or through ether in each case forms a combustible mixture with too much vapor in it to explode. Alcohol must be heated to give off enough vapor to form an explosive mixture with air; the other mixtures must be diluted with more air to bring them within the explosion limits. Hence the difficulty with an ordinary gasoline engine starting cold with alcohol. There are several ways of surmounting or avoiding the difficulty. If the engine is designed to burn alcohol—using a long stroke and a high compression—the cylinder may be flooded (either directly or through the throttle valve) with a little liquid alcohol in the form of spray, which is warmed by compressing the air in the cylinder. Crossley Bros. are running one of their 4¼-in. x 6-in. 5 hp. single-cylinder engines arranged to give a compression ratio of rather over 8 to 1. With either method of flooding there is no difficulty in starting cold with ordinary industrial alcohol. Running at full load and 500 r.p.m., the engine was remarkably silent. The spray from the exhaust, thrown out while the condenser was cool, was found to be slightly acid, though no evil effects of acid could be found on the exhaust or throttle valve, or on the cast iron piston, after a fortnight's running.

Those who wish to avoid the starting difficulty will look to some mixture of alcohol with other liquid which will readily form an explosive gas with air in the cold. As a guide in making such mixtures, the vapor-pressures of pure alcohol, pure pentane, pure hexane and of various mixtures have been determined, with the results shown in the appended table. It is remarkable that, while the vapor-pressures of pentane, hexane, and ether are lowered by admixture with alcohol (as is usual with miscible liquids), the vapor-pressure of the benzol mixture is above that of either of its constituents. When cold air is bubbled through a 20 per cent benzol-80 per cent alcohol mixture the resulting stream of vapor and air is highly explosive. This mixture has been tested in automotive engines, and no difficulty has been found in starting up cold. With the single-cylinder kerosene engine of Crossley Bros. the volume of liquid fuel consumed per b.-hp. was about 3 per cent less with the 20 per cent benzol mixture than with industrial alcohol alone.

Vapor Pressures of Liquid Fuels in Mm. of Mercury.

Temp. C.	Temp. F.	Ether.	Natalite. Ether 45. Alc. 55%	20% Et. 80% Al.	Alcohol.	20% Hex. 80% Al.	Hexane.	20% Ben 80% Al.	Benzo
0	32	180	165	73	14	30	44	37	28
10	50	280	250	105	22	46	76	56	45
20	68	433	380	162	42	80	121	90	75
30	86	637	547	247	79	141	184	142	120
40	104	..	..	350	135	219	276	215	180
50	122	..	..	500	217	328	400	325	263

*Professor of chemistry in the University of Manchester. This paper was presented before the Imperial Motor Transport Council.

The difference shown by the benzol-alcohol mixture is no doubt due to the small attraction between the two liquids. The addition of water to the mixture diminishes the attraction, and a dilution is soon reached when the liquid separates into two layers, the denser watery liquid below containing less benzol and the lighter liquid above containing more benzol than the original mixture. Also as the temperature falls the solubility of benzol in alcohol diminishes. The higher the percentage of alcohol in the mixture the more water is required to separate the mixture into two liquid layers.

Similar experiments made with alcohol-hexane mixtures showed that the addition of water caused a separation at lower temperatures than with the corresponding alcohol-benzol mixtures. For instance, with equal volumes of alcohol and hexane, it requires the addition of only 7 per cent of water to separate the liquids at 63 deg. Fahr., whereas the same water added to equal volumes of alcohol and benzol required the whole to be cooled below the freezing point (29 deg Fahr.) before producing separation. For these reasons I have mainly worked with alcohol mixtures containing between 20 and 30 per cent by volume of benzol.

Owing to the heat of evaporation of liquid alcohol being greater than that of gasoline or benzol it is important to warm the intake when using alcohol mixtures. This can be conveniently done by passing all or a part of the exhaust gases round the intake.

The Ignition Temperatures of Alcohol and Other Vapors

Two methods were used for the determination of the ignition temperature of alcohol vapor, and in each case comparison experiments were made with other vapors. Both methods had previously been used for determining the ignition temperatures of permanent gases, and the chief alterations required in the apparatus were means of keeping the stored mixtures, the connecting tubes, and the ignition vessel itself above the condensation point of the vapors, and the substitution by glass, silica, or metal joints of all rubber connections which would have been acted on by the vapors.

Ignition by Heating at Atmospheric Pressure

In the first method, the vapor and the air or oxygen were heated separately by passing them upward through two concentric tubes fitted into a long electric furnace, the temperature of which could be slowly raised and accurately measured. The vapor passing up the narrow inner tube issued at a jet with a sufficient stream to carry the combustible gas rapidly away from the solid silica surrounding the orifice, but not so quickly as to cause the resultant mixture of combustible vapor, containing oxygen or air, to come into contact with the heated wall of the large outer tube before the flame appeared.

The catalytic effect of a heated solid on the ignition of the permanent gases had been already noticed. All combustible gases and vapors when heated with oxygen undergo a "pre-flame combustion," which at the ignition point becomes rapid enough to heat up the gases automatically until the flame appears. Solids affect this pre-flame combustion in two ways: They increase the rate of combination, thereby generally lowering the ignition temperature, but when the flow of combustible gas is very slow the solid may start the pre-flame combustion, but, by conducting away the heat, may prevent the automatic heating-up—so that no flame appears though the orifice of the tube is visibly red-hot. It was necessary to determine by experiment when the rate of flow through the jet and when variations in the diameter of the outer tube ceased to affect the ignition temperatures.

In the case of the vapors now experimented with, the pre-flame combustion is much more marked than with such gases as hydrogen and cyanogen. All the vapors underwent pre-flame combustion as they mixed with the oxygen and passed along the wall of the outer tube, so that the gases would often burst into flame near the upper end of the furnace, and fire back some seconds after the vapor had issued from the jet. This contact action with the wall was particularly noticeable with ether. To overcome this difficulty, two methods were tried: (1) by increasing the air-stream to render the mixture non-inflammable (by dilution) before it reached the wall; (2) by making the flow of vapor from the jet intermittent and timing the inflammation. A combination of these methods was finally adopted; a wider outer tube was used, to increase the relative quantity of air, and the flow of vapor could be started at any moment. When the vapor ignited within a half-second of its issue from the orifice, the temperature of the tube was taken as the ignition temperature.

The ignition temperatures of alcohol vapor coming into contact with oxygen or air heated to the same temperature were fairly definite; those of pentane vapor moderately so. It is noticeable that pentane ignited at nearly the same temperature, whether the vapor came into contact with pure oxygen or air, whereas alcohol ignited at lower temperatures in oxygen. Ether presented a quite abnormal property; when all contact with solids was avoided ether fired below 240 deg. C. (464 deg. Fahr.) in oxygen, but had to be heated to nearly 580 deg. C. (1076 deg. Fahr.) before it would inflame immediately in air. When ether vapor and air are allowed to flow along a tube and are in contact with the heated walls, the mixture gradually heats up, and the ignition temperature, as measured by the temperature of the tube, is quite indefinite.

Ignition Temperature of Vapors Heated Prior to Admixture with Air or Oxygen Heated to Same Temperature

	With Oxygen		With Air	
	Cent.	Fahr.	Cent.	Fahr.
Alcohol	510 to 515	950 to 959	595 to 600	1103 to 1112
Pentane	550	1022	560 to 570	1040 to 1058
Ether	235 to 240	455 to 464	560 to 580	1040 to 1076

The second method of determining the ignition temperatures of alcohol and other vapors was to compress mixtures of the vapor with air or oxygen in a steel cylinder by means of a falling weight driving in an air-tight piston. This method had been carried out successfully with many of the permanent gases, and can be used for the vapors of volatile liquids, providing the reservoir containing the mixtures and the cylinder itself are maintained at a sufficiently high temperature. In most of the experiments the cylinder was kept at 50 deg. C. (122 deg. Fahr.) by a water jacket, in which the hot water was well stirred. In some experiments a temperature of 140 to 158 deg. Fahr. was used, and in a few 212 deg. Fahr.

The rise of temperature produced in the mass of the gas by the sudden compression is nearly independent of the wall surface, which, of course, cools by contact the layer of gas next to it, and, so far as it acts, lowers the pressure. There is no evidence that the steel surface promotes combustion by contact action; indeed, since the temperatures of ignition calculated by the adiabatic law were practically constant, whether the cylinder was at 122 deg. Fahr. or over 176 deg. Fahr. at the moment of compression, such action, if any, must be negligible.

A greater difficulty arises in calculating the ignition temperatures from the observed compressions necessary to fire the mixtures, since the recorded measurements of the specific heats of these vapors vary considerably. However, the latest determinations made by Thibaut give values for the ratios of the specific heats which appear probable. We have accordingly taken the round figure 1.05 for the mean ratio of the specific heats for ether between 50 deg. and 350 deg. C. (122 to 662 deg. Fahr.). From the velocity of sound in pentane vapor at 50 deg. C. we have taken the mean ratio between 50 deg.-500 deg. C. (122 and 932 deg. Fahr.) at 1.065.

The temperatures of ignition calculated from the compressions must be regarded as only approximations. What is more important, especially for the engine designer, is the fact that this method gives with a near approach to accuracy the actual volume change necessary to fire the particular mixture by adiabatic compression, starting from any known temperature. The calculated ignition temperatures will probably be varied as our theoretical knowledge of vapors improves; but the compression volumes determined are independent of theory.

The ignition compressions were measured by a system of trial and approximation. For each mixture the compressions were gradually increased until the mixture exploded; in another series the compressions were gradually reduced until the mixture did not explode. Then experiments were made in the neighborhood of these two points, and a mean compression taken between the nearest exploding and non-exploding trial. In some cases the compressions "overlapped" — a non-explosive mixture being fired by a slightly less compression in a second trial. In such cases I have inclined to the lower value as the safer to give. Of all the vapors and mixtures tried, the vapor of pure benzol mixed with air seemed to have the most indefinite ignition temperature. I have given in the appended table the lowest compression limit observed.

The ignition temperatures by adiabatic compression for alcohol with oxygen and with air are what we should expect from the results at atmospheric pressure. At the high pressure the ignition temperatures are lower. With pentane the results show a similar agreement, but with ether the results are discordant. The ignition temperatures in the heated tube at atmospheric pressure were much lower with oxygen, and much higher with air than the temperature found by compression. The latter were very consistent and definite.

The Movements of Flame Through Explosive Mixtures

The mode in which the flame spreads throughout an explosive mixture of gases and the rapidity of chemical combustion taking place in the flame depend not only on the nature of the gas mixture, but on the method of firing. When an explosive mixture is lit by a flame or a hot wire near the open end of a tube the flame travels through the mixture slowly at first, then more quickly and jerkily. Fired near the closed end of a tube, the same gas will propagate a flame with greatly increased velocity. When the gas mixture is fired by a spark the travel of the flame depends on both the intensity and the position of the spark. When the spark is passed close to a surface the flame starts slowly; when the spark is at a short distance from one end the sound wave starting **backward** from the spark, and traveling faster than the flame, reaches the near end, and is reflected back — passing through the flame, and hurrying it up. Similarly if the tube is short the sound wave starting **forward** from the spark may reach the far end of the tube before the flame, and being reflected back passes through the advancing flame—checking its advance, but causing more rapid combination where the sound wave passes. These reflected

Firing by Compression

Volumes.			Alcohol with Oxygen and Nitrogen.			
Alcohol	O_2.	N_2.	Ratio of Spec. Heats	Compression Ratio $\frac{V_1}{V_2}=C$	Ignition Temp. C.	F.
1	2	..	1.200	34.6 at 60° C.	405	761
1	3	..	1.225	21.8 at 50° C.	375	707
1	5	..	1.260	14.8 "	380	716
1	10	..	1.307	11.5 "	410	770
1	15	..	1.33	11.3 "	445	833
1	3	2	1.26	20.4 "	435	815
1	3	7	1.307	18.2 "	515	959
1	3	12	1.33	17.0 "	550	1022

Ether	O_2	N_2	Ether with Oxygen and Nitrogen			
					C.	F.
1	6	..	1.206	18.6 at 50° C.	315	599
1	10	..	1.25	11.3 "	320	608
1	15	..	1.283	8.7 "	325	617
1	21	..	1.308	7.4 "	325	617
1	30	..	1.33	6.5 "	325	617
1	6	4	1.25	10.9 "	315	599
1	6	9	1.283	8.24 "	315	599
1	6	15	1.308	7.14 "	320	608
1	6	24	1.33	6.37 "	320	608

Pentane, with Oxygen and Nitrogen.

Volumes.			Ratio of Spec. Heats	Compression Ratio.		Ignition Temp.	
Pentane.	O_2	N_2		At 50° C.	At 100° C.	C.	F.
1	8	..	1.253	23.5	13.4	445	833
1 (Iso)	8	..	1.253	23.5	13.4	445	833
1	12	..	1.285	17.5	10.5	455	833
1	16	..	1.306	14.7	9.1	460	860
1	24	..	1.331	11.8	7.7	460	860
1	32	..	1.345	10.9	7.2	465	869
1	40	..	1.355	10.3	7.0	470	878
1	8	8	1.306	17.6	11.1	505	941
1	8	16	1.331	14.5	9.4	510	950
1	8	24	1.345	12.8	8.5	505	941
1	8	32	1,355	12.1	8.1	510	950

Hexane, with Oxygen and Nitrogen.

Hexane.	O_2	N_2					
1	9½	38	1.358	11.4	7.6	500	932

Alcohol-Benzol Mixtures.

Volumes.			Ratio of Spec. Heats	Compression Ratio.		Ignition Temp.	
Alcohol.	Benzol	Air.		At 50° C.	At 100° C.	C.	F.
1.0	.0	15	1.33	17	11	550	1022
.8	.2	19.5	1.34	15.5	10.1	547	1016
.6	.4	24	1.345	14.8	9.75	545	1013
.4	.6	28.5	1.35	13.4	8.9	530	986
.2	.8	33	1.353	12.0	8.0	504	940
.0	1.0	37.5	1.355	10.2	6.8	464	867

Alcohol-Ether Mixtures.

Alcohol.	Ether.	Air.	Ratio of Spec. Heats	Compression Ratio. At 50°	At 100°.	Ignition Temp. C.	F.
1.0	.0	15	1.33	17	11.0	550	1022
.9	.1	10.5	1.33	15.6	10.1	525	977
.8	.2	18	1.33	14.2	9.1	500	932
.75	.25	18.75	1.33	10.6	6.8	430	806
.7	.3	19.5	1.33	9.2	5.9	395	743
.6	.4	21	1.33	8.2	5.3	370	689
.5	.5	22.5	1.33	7.33	4.7	350	662
.0	1.0	30	1.33	6.35	4.1	320	608

waves, due to sound, are more intense than the original flame, and they become more intense by the combustion they promote. It may thus happen that the explosion only becomes brilliant after the flame has completely traversed the mass of combustible gas. In this brilliant flame which can be analyzed photographically on a rapidly moving film, the sound waves can be seen crossing and recrossing the tube from end to end. The flame traversed by these intense waves may be (and usually is) so much more luminous than the original flame that the latter may escape detection altogether. Von Oettingen, a pupil of Bunsen, who first photographed these waves, declared that the explosion wave itself was completely invisible, and one only saw bits of glass and dust detached and heated up by the non-luminous explosion. My photographs have proved that the explosion wave is not set up at once, but that the flame starts slowly, and gradually increases in velocity and intensity, especially when sound waves are reflected through it. At a certain point in its course the explosion wave may be started; this point is marked by several distinct characteristics. The speed of the flame increases. It is no longer varying, but constant, and it continues at a constant velocity as far as the gas mixture extends. As it travels faster than sound in the upburnt gas it can send no pressure wave in front of it. At the moment when the explosion wave is started forward a well marked wave —which I have called the retonation wave—is sent backward through the burning gases and a dark region is left between the two bright waves. When the explosion wave strikes the end of the tube it sends back a reflection wave, which is easily photographed as it passes backward through the heated gas—in many cases undergoing secondary combustion—for example, the burning of carbon monoxide formed in the explosion wave.

If the tube is of such a length that the explosion wave has not been set up by the time the flame reaches the end of the tube, a reflected wave comes back across the flame. This promotes combustion, which may become very intense at the first or second reflection; it does not set up a true detonation, and the flame lasts much longer than if the explosion wave had been started. But the flame may reach the end of the tube at the precise moment when the explosion wave starts. In this case the wave of retonation comes back with the reflection wave superposed on it —with the result that it is scarcely distinguishable from the explosion wave itself. This is the extreme instance where a reflected wave differs wholly in velocity and intensity from the impinging wave. The chemical reactions appear to be as rapidly completed in this wave as in the true explosion wave. It is evident that in the original flame the combustion is slow, and Bunsen's statement that the spread of the flame "is synchronous with complete combustion" is quite erroneous.

The size and shape of the explosion vessel are important elements in determining the nature of the flame, and so is the position of the spark.

Unfortunately the initial flame in alcohol is hard to photograph, and it is especially difficult when the vapor is mixed with air. After many trials we have succeeded in getting photographs on which the initial flames can be traced and a comparison made between alcohol and other vapors under similar conditions, but the images are too faint to make prints or lantern slides from.

A careful comparison of the photographs yields an unexpected result: The alcohol flame **starts faster** than the hexane, pentane, and ether flames, which keep close together, while the benzol flame is left far behind. But though the alcohol flame is quick off the mark it cannot increase the pace as the others do. Hexane catches it in less than seven ten-thousandths of a second, ether and pentane a moment later.

There is a general opinion that if the charge is fired in any part of the combustion chamber of an engine by "spontaneous ignition," that is, by compression before any flame reaches it, this portion of the charge necessarily detonates. Nernst has given his authority to this view. Now, it is possible to photograph on a rapidly moving film, and analyze the flames produced by the rapid compression of gas mixtures. It has been found in all cases of firing by adiabatic compression that the flame starts comparatively gently, and does not set up detonation immediately. Indeed, many gas mixtures, fired by compression, do not set up the explosion wave, but continue to burn quietly while they push out the piston. Such flames, in spite of the rapid compression, are singularly free from the sound waves that are so strongly marked when the gases are fired by a spark. Of course, an explosion wave is more readily set up in a hot compressed gas than in a similar uncompressed gas, but compression does not necessarily set up the explosion wave. In this connection I should like to give a word of warning against any conical pocket or recess in the combustion chamber—for example, in the sparking plug; for it is much easier to produce firing by compression when the gas is driven toward the small end of a cone. If it be found necessary to quicken the initial flame, two sparks might be employed at such a distance apart that the sound waves started from each should cross and intensify the other flame.

The Detonation of Alcohol and Other Vapors

The detonation of a gas mixture, as of a high explosive, is due to the passage of an extremely rapid shock or wave through the substance, the intensity of the shock being continually renewed by the chemical reactions it produces as the shock passes from molecule to molecule. The explosion wave, discovered by Berthelot, and observed almost at the same time independently by Le Chatelier and myself was explained by Berthelot as due to molecular impacts causing a disk of flame to move forward with the mean velocity of the molecules themselves while they still retain all the heat due to the chemical change. The explosion wave is therefore a definite physico-chemical constant depending only on the nature of the burning substance, and calculable when the chemical change and the heat evolved are known. Although certain factors in Berthelot's formula have been shown to be erroneous, his fundamental idea connecting the rate of the flame with the velocity of the reacting molecules has been retained. It is now seen that in the explosion the mass of reacting gas moves bodily forward, comes to rest and swings back again. According to Prof. Jouguet, the explosion wave travels forward with the velocity of sound in the forward moving gas, which is itself moving with nearly the same velocity, and therefore the actual rate of the explosion wave is equal to the sum of these two velocities, or twice that of sound in the burning gas. Fortunately this conclusion is easy to verify with the camera. A sound wave can be dispatched through the burning gases behind the explosion wave, and its movement can be photographed—if it is not too close to the intensely bright explosion wave. Such a sound wave travels nearly as fast as the explosion wave it is following—the difference in rate being due to the gas, in which it is propagated, having already lost a little of its forward velocity.

The close approximation between the measured velocities of the explosion wave and those calculated from M. Jouguet's formula show, I think, that the chemical combination must be very rapid in the wave, whereas in the region of ordinary explosion the flame traverses the vessel, leaving a large percentage of slowly burning gas behind it. In the explosion wave the collisions of molecules are so violent that most of them cause chemical change where

this is possible, and the flame is usually short lived and intense. In ordinary explosions only a small proportion of the molecular collisions are chemically fruitful, and the flame continues to burn long and quietly.

Now, the explosion wave or detonation has the effect of a hammer blow on the walls of the vessel; hence the use of high explosives in which the explosion wave is set up by a detonator. Detonation must be avoided in the internal-combustion engine; hence it is necessary to determine the conditions under which it can be set up in alcohol and other vapors. All the vapors tried will detonate when they are mixed with oxygen and fired in a long tube. When mixed with air under atmospheric pressure alcohol and ether just propagate the explosion wave, while pentane and benzol are just beyond the limit. But though these vapors will not detonate with air under atmospheric pressure, it is evident that an increase in pressure such as is used in an automobile engine would bring them within the range of detonation.

As might have been predicted from previous work on cyanogen, ethylene, and acetylene, it was found that alcohol, ether, pentane, and benzol all gave faster rates of detonation when mixed with oxygen insufficient for complete combustion. This is explained in part by the formation of carbon monoxide, either directly or indirectly, in the wave front, while the formation of carbon dioxide is only possible where the flame is cooler—behind the wave front; and possibly by the separation of free hydrogen. In the explosion of benzol with insufficient oxygen large quantities of finely divided carbon were deposited, some of the molecules probably breaking up by impact in the wave front into free carbon and hydrogen. There appears to be no striking difference between the four fuels in the rates of the explosion wave either when the vapors were fired with pure oxygen or when the explosions were damped down with nitrogen. The ether mixtures gave slightly the fastest rates, alcohol the slowest, under similar conditions.

The accuracy with which the rate of the explosion wave can be measured has suggested its use in determining the temperatures reached in explosions and the specific heats of the gases concerned. The rate has also been used for determining the nature and the order of the chemical changes taking place in explosions—for example, for showing by what steps the carbon in hydrocarbons is burnt.

Conclusion

In the course of these researches it has been made clear that alcohol possesses most of the properties required in a motor-fuel. As compared with gasoline, its lower calorific value is almost compensated for by the greater compression at which it can be used—and this property (of high ignition temperature under compression) is hardly altered by admixture with 20 per cent of benzol, or of gasoline itself. Such a mixture readily starts in the cold, and has been shown to run very smoothly, and without knocking in an engine.

I have not touched on the question of denaturing, but I would urge that the less methyl alcohol employed the better for the liquid as a fuel. By cutting down the wood spirit the strength of the explosion is increased, and it should not be necessary to maintain the present high proportion since the nauseous taste of crude wood spirit is largely due, not to the methyl alcohol itself, but to a small quantity of a less volatile constituent.

I think there would be some advantage if one or two standard alcohol mixtures were authorized, one of which could be used in existing engines with only slight adjustments. Engineers would soon work out the most efficient designs for burning a standard power alcohol.

If alcohol mixtures can be used for ordinary motor transport, saving 70 to 80 per cent of other fuel, by so much will our limited resources of petrol and benzol be husbanded for the special services in which they cannot be replaced.

Civil Aviation in England

DURING the six months between April 1 and Sept. 1 a total of 689,600 machine miles were flown by British civil aviators, a large increase over the mileage of the preceding half-year. The number of passengers carried has also increased, the figure for the period named being 32,345. The number of departures and arrivals to and from England and the Continent has increased from 734 to 2445.

This large development in civil aviation has naturally brought with it many improvements in service and facilities. Landing fields have increased in number and have been improved in quality. Regulations regarding pilots have been revised, and extensive research in regard to power plants has been carried on. Much of this information is of interest to those interested in American aviation and is contained in the recent Half-Yearly Report on the Progress of Civil Aviation, presented by the British Air Ministry.

Interesting investigations have also been carried out to minimize the effects of mist and fog by mechanical dispersal, to secure the illumination of landing grounds, and to produce mechanical apparatus to cause machines to flatten out automatically before touching the ground. Methods have also been investigated for obtaining instruments to indicate accurately to the pilot his position in relation to the airdrome, and his height above the ground.

The Department of Research has been paying special attention to the development of new types of power plant. If these experiments are successful, it will be possible to use a fuel of a higher flash point, thus increasing both safety and cheapness.

Several new designs of aircraft with facilities for making adjustments to the engines during the flight are being made, and a satisfactory engine starter for use on the ground is now available.

The report states that a wireless direction finder apparatus, which had been installed at Croydon, proved to be of great value. It enables aircraft to correct their course in thick weather. The equipment of aircraft with wireless telephones is becoming more common, as it has been found to be of great assistance to navigation.

Names of towns and railway junctions around London are being so marked that they can be seen from the air, and electric landing lights for indicating the direction of landing are being installed at the Croydon Airdrome.

The Air Ministry has given assistance to insurance companies to establish aviation insurance on a sound basis. Lloyds have issued a civil aircraft record, the first publication of its kind in any country.

ACCORDING to the Department of Statistics of India, 1041 motor cars were imported into British India during September, 1920, and of them no fewer than 723 cars were consigned from the United States, only 247 being received from the United Kingdom. During the six months, April to September, 1920, the number of motor cars imported was 7498, valued at 308 lakhs of rupees, Bombay imported 2775 cars, Bengal 2694, Madras 908, Sind 590 and Burma 531.

Twenty-two More Tractors Undergo Nebraska Tests

Nearly all require some adjustments during tests. While difficulties are mostly of a minor nature, the need for intelligent instructions to users and adequate provision for service are again evidenced. Nearly all firms given to extravagant statements in advertising matter.

TWENTY-TWO more tractors have satisfactorily completed the official test required under the Nebraska State Law before the tractor can be marketed in the State. A summary of the results of the test is given in the accompanying table, this supplementing the previous reports which appeared in the issues of AUTOMOTIVE INDUSTRIES for Sept. 2 and Dec. 30, 1920.

In the summaries of the tests already printed little has been said concerning the matter of adjustments and repairs, although the official reports devote some space to listing items of this nature that proved necessary or were considered desirable by the manufacturers during the test. An analysis of this portion of the report shows that very few tractors were able to complete the test, or the preliminary run for limbering up which preceded the test, without some change, adjustment, repair or replacement. Of the twenty-two tractors tested in accordance with reports summarized herewith no less than ten required adjustment or re-grinding of the valves before the tests were completed. Seven were in trouble due to over-heating or required some change or adjustment in the cooling system. Of these several experienced some trouble with the fan or fan belt, and others with parts of the water pump or circulating system. Eight tractors had spark plug trouble, or considered it desirable to replace or clean plugs during the test. Some tractors blew out as many as five plugs in the endurance test.

Cleaning or some adjustment or change in the air-cleaner or carbureter system was required on seven tractors. Five required adjustments to the clutch, chiefly to prevent slipping, while four had difficulty in lubrication of individual bearings or with some part of the engine lubrication system. Unsatisfactory lubrication caused the burning out or scoring of bearings on two tractors, and one required adjustment of the connecting-rod bearings.

The ignition system on four machines required repair, adjustment or replacement during the test. Three machines had piston ring trouble, and found it desirable to replace or repair rings. In three other machines the gearing gave some difficulty, in one case a key which had fallen out requiring replacement. The governor was the cause of trouble on three machines and two others had trouble with the fuel supply system, one from a leaking tank, and the other from a clogged gasoline pipe. In one case the cylinder heads of the engine cracked and were replaced. In several cases the cylinder heads were removed for inspection purposes and required new gaskets when the head was replaced.

While in all cases covered by reports here summarized the repairs and adjustments required were not considered sufficient to disqualify the tractor, the results make it plain that the tractor user must expect to make adjustments, replacements or repairs to the machine in normal use, and should therefore make it a point to know the machine and be prepared to keep it in operable condition.

Furthermore, it is apparent (if further evidence is needed) that the manufacturer who expects his machine to give satisfaction to the user must insist upon the distributer or dealer preparing for and giving prompt and intelligent service.

This service should start by seeing to it that the purchaser is fully instructed in the operation and care of the machine at the time of or prior to its delivery.

Prof. Oscar W. Sjorgren, chairman of the Agricultural Engineering Department, of the University of Nebraska, who had general supervision of the tests, recently presented a paper before the American Society of Agricultural Engineers in which the following particulars were given:

Of the 68 tractors which appeared for test 39 went through without any changes, while 29 made changes as follows: Eleven have changed or will be required to change their rating, 6 increased the rated engine speed, 11 changed some item of equipment and 3 withdrew after the preliminary test. Of the 11 which changed equipment, 2 also changed their rating. One of those which withdrew later made a re-application, reappeared and finished the test. These results indicate the necessity for a method of intelligently testing and rating tractors. These tractors have all been tested under conditions as nearly uniform as it is possible to secure, by a competent and unbiased force of men.

It is interesting to note how few of the large number of tractors tested conformed to the recommended standards of the S. A. E. and the A. S. A. E. The standards as to horsepower ratings read as follows: "The drawbar rating shall be 80 per cent of the horsepower that the tractor is guaranteed to develop at the drawbar continuously for 2 hours, the tractors being in good condition and properly operated at rated engine speed. The belt horsepower rating shall be 80 per cent of the horsepower the engine is guaranteed to deliver at the belt pulling continuously for two hours, the tractor being in good condition and properly operated at rated engine speed."

Of the 65 tractors tested only one was rated at between 60 and 70 per cent of the maximum power it proved capable of developing, 10 were rated at between 70.1 and 80 per cent maximum power, 21 between 80.1 and 90 per cent, 23 between 90.1 and 100, and 7 above 100 per cent of the maximum power they proved capable of developing at the belt.

Three tractors were not rated. Thus it is seen that only 11 machines fall within the set standard, while 51

Details of Tractor Tests Officially Conducted Under Nebraska State Law

No. of Test	Name and Model of Tractor	Belt Tests: Test at Rated b. hp. (2 hr.) hp.	r.p.m.	Hp-hr per gal.	Varying Load Test, maximum hp.	r.p.m.	Varying Load Test, minimum hp.	r.p.m.	Maximum b. hp. Test (1 hr.) hp.	r.p.m.	Hp-hr per gal.	Half Load Test hp.	r.p.m.	Hp-hr per gal.	Drawbar Tests: Rated Drawbar Load (10 hrs.) lb.	m.p.h.	Hp-hr per gal.	Maximum Drawbar Load lb.	m.p.h.	Oil* Gal. per hr.
20	Emerson-Brantingham	20.27	906	8.45	20.66	905	5.17	935	25.90	915	7.29	10.43	943	6.00	2037	2.86	5.73	3022	2.18	3.25-30
28	Beeman G	2.40	1036	5.43	2.37	1019	0.17	1093	2.37	1023	5.60	1.20	1033	4.72	187	2.17	3.78	186	1.56	.875-40
48	Twin City 40-65	65.96	534	8.38	65.96	534	2.01	752	65.53	530	8.32	33.48	542	6.00	7736	2.00	5.73	10,820	1.72	15.25-28
51	Lauson 15-30	30.14	960	8.19	33.63	958	1.01	1008	32.46	980	7.23	15.66	990	6.59	2512	2.64	4.89	5191	1.91	4.50-31
52	Flour City 40-70	70.81	558	7.57	71.03	566	2.64	857	72.52	563	7.54	35.25	555	7.41	6869	2.33	5.52	8404	2.37	11.50-38
53	Allwork 14-28	28.41	915	6.75	28.31	910	1.53	967	28.86	915	5.83	16.06	1015	6.68	2133	2.68	3.33	3950	1.87	9 -35
54	Allis-Chalmers 6-12	12.08	1011	7.11	12.09	1013	1.22	1214	12.37	1008	7.05	6.34	1054	5.95	1046	2.28	3.99	1142	2.06	-2 -29
55	Allis-Chalmers 18-30	30.58	839	9.30	30.86	846	1.75	1000	33.41	842	7.24	17.87	973	7.75	2704	2.85	5.93	3500	2.18	7 -33
56	Monarch 18-30	30.55	952	8.43	32.22	983	1.31	1056	31.40	957	7.97	15.28	959	6.83	3443	2.10	5.18	5852	1.32	3.12-31
57	Avery 5-10	10.11	1246	5.45	10.16	1256	0.71	1309	11.14	1228	5.99	5.20	1258	6.68	914	2.46	3.27	1116	1.82	1 -30
58	Avery 18-36	36.70	812	6.31	36.78	817	1.56	837	44.50	812	6.50	18.70	827	5.73	3202	2.41	3.45	4590	2.25	6 -30
59	Holt 25-40	30.24	1070	7.94	30.98	1068	1.58	1186	35.52	1066	8.11	15.51	1100	5.31	3336	2.98	6.39	5558	1.36	7.75-35
60	Bates Steel Mule, Model D, 15-22	22.66	1110	7.12	22.89	1088	0.94	1212	24.84	1116	6.61	11.72	1147	6.20	2566	2.48	5.46	2996	2.59	4.75-29
61	Holt 40-60	55.25	763	7.16	56.11	760	2.03	900	57.21	772	6.41	31.67	872	5.71	4963	3.23	4.91	9756	1.63	9 -33
62	Indiana 5-10	10.20	1024	8.52	10.52	1001	0.53	1127	11.34	1023	5.13	5.36	1083	6.39	849	2.21	3.71	1189	1.79	2 -28
63	Townsend 15-30	28.35	526	9.38	27.43	510	1.96	582	29.51	533	7.58	15.17	563	8.66	2559	2.24	4.73	2681	2.50	2 -30
64	Uncle Sam 20-30	30.75	1025	4.85	30.00	1009	4.10	1099	32.20	1041	5.02	15.17	1053	5.78	2954	2.79	3.83	3264	2.57	4.50-34
65	Toro 6-10	10.56	1208	8.48	10.63	1197	0.80	1326	13.31	1219	7.70	5.54	1265	5.03	893	2.66	4.31	1310	2.84	1.50-30
66	Square Turn 18-35	30.35	854	6.39	31.20	844	1.24	1020	32.19	848	6.02	17.44	975	5.64	2904	2.47	3.91	3090	2.85	5 -39
67	Twin City 20-35	35.22	905	8.39	35.40	911	1.03	908	46.88	905	7.81	18.73	953	5.34	2509	2.91	4.55	5730	2.23	8.50-32
68	Bates Steel Mule, 15-22	22.20	1112	7.39	22.50	1101	0.76	1118	29.78	1108	8.30	11.13	1112	5.71	2558	2.37	6.07	3100	2.81	4.50-32
69	Port Huron 12-25	25.14	893	5.43	25.20	905	1.13	1069	28.46	895	6.69	13.56	959	6.81	2320	2.32	3.74	4144	1.85	9.25-32

*In engine only. The reports give kind of oil and amount used in transmission.

machines carry a rating higher than permitted by the standard.

On the drawbar work it was found that in all but two instances no difficulty was had in securing the rated drawbar horsepower if the rated belt horsepower was developed. The maximum drawbar horsepower was not obtained through any extended period, but the rated load was carried for ten hours.

In these tests 7 tractors were rated at between 50 and 60 per cent of the maximum drawbar horsepower they proved capable of developing, 12 between 60.1 and 70 per cent, 25 between 70.1 and 80 per cent, 9 between 80.1 and 90 per cent, 5 between 90.1 and 100 per cent and 2 above 100 per cent of the maximum drawbar horsepower they proved capable of developing. Five tractors had no drawbar ratings.

Thus it is seen that 45 tractors fall within the standards set for the drawbar rating as compared to only 7 falling in this class on the belt tests. Seventeen carry a rating higher than the standard, 2 of these being rated at more than they can actually develop.

Belt Speed

A very great variation exists in the belt speeds employed by different tractors as indicated by the following:

	Tractors
Less than 2000 ft. per min.	2
2000 to 2199 ft. per min.	5
2200 to 2399 ft. per min.	2
2400 to 2599 ft. per min.	6
2600 to 2799 ft. per min.	13
2800 to 2999 ft. per min.	6
3000 to 3199 ft. per min.	7
3200 to 3399 ft. per min.	9
3400 to 3599 ft. per min.	7
3600 to 3799 ft. per min.	1
3800 to 3999 ft. per min.	3
Above 4000 ft. per min.	3

The following comments concerning advertising matter put out by the various manufacturers who build the machines, tests of which are summarized herewith are contained in the official reports and indicate that many of the builders are given to the use of exaggerations or claims not substantiated by satisfactory evidence:

Test No. 20—Emerson-Brantingham 12-20. In the advertising literature submitted with the application for test of this tractor, we find some statements and claims that cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable.

Test No. 28—Beeman Model G. Remarks same as for Test No. 20.

Test No. 48—Twin City 40-65. In the advertising literature submitted with the application for test of this tractor, we find some claims and statements which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these claims or statements are unreasonable or excessive except the following:

"This 65 hp. engine is perfectly governed."

Test No. 51—Lauson 15-30. In the advertising literature submitted with the application for test of this tractor, we find some claims and statements which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable except the following:

"Whether running idle or on the full load, the Lauson burns *all* the kerosene."

"The Lauson burns every particle of kerosene. This close regulation makes every drop of fuel count and *there is positively no waste.*"

Test No. 52—Flour City 40-70. In the advertising literature submitted with the application for test of this tractor, we find some statements and claims which cannot be directly compared with the results of this test. It is our opinion that none of these are unreasonable or excessive except the following:

"There seems to be no load too great for it to pull."

"The gears are made—and they are *unequalled* for substantiability and long life."

Test No. 53—Allwork 14-28. Remarks same as for Test No. 20.

Test No. 54—Allis-Chalmers 6-12. In the advertising literature submitted with the application for test of this tractor we find some statements and claims which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable except the following:

"To-day it stands forth—as the most efficient small power unit available."

"There is no loss of power, no deadweight, no lost motion in the Allis-Chalmers general purpose tractor."

Test No. 55—Allis-Chalmers 18-30. Remarks same as for Test No. 20.

Test No. 56—Monarch 18-30. In the advertising literature submitted with the application for test of this tractor, we find some claims and statements which cannot be directly compared with the results of this test as reported above. It is our opinion that these are not excessive or unreasonable, except the following:

"The Monarch will go *anywhere*."

Test No. 57—Avery Single Row Cultivator 5-10. In the advertising literature submitted with the application for test of this tractor, we find some claims and statements which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable except the following:

"The Avery Motor Cultivator is the only real successful cultivator on the market to-day, as it leads the field in power, durability, simplicity, etc., over *any* cultivator built."

Test No. 58—Avery 18-36. In the advertising literature submitted with the application for test of this tractor, we find some claims and statements which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable except the following:

"Avery tractors have motors with patented gasifiers that turn kerosene or distillate into gas and burn it all."

"———Avery—is the—most efficient belt and drawbar transmission system built."

"———Avery—is the most 'direct drive' transmission system built."

"——a larger percentage of the power developed by the motor in Avery tractor is delivered to the belt wheel and to the drawbar than in any other tractor built."

"——Avery opposed motors are superior to any tractor motor built."

"The opposed type of motor—is much better adapted for use in tractor work."

"The fuel system used on the Avery tractors from the 8-16 hp. to the 40-80 hp. size burns kerosene, distillate or any other low grade fuel more successfully than it has been ever done before."

"—Avery tractors are the simplest tractors built."

"Averys are the best all-around drawbar and belt tractors built."

Test No. 59—Holt T-11. Starting the "limbering up" run, the tractor was operated in mud. It pulled about three-fourths of its rated load the entire twelve hours.

Test No. 60—Bates Steel Mule, Model D, 15-22. During the "limbering up" run, the tractor was operated in mud for about 8 hours, pulling about three-quarter load.

In the advertising literature submitted with the application for test of this tractor, we find some statements and claims which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable except the following:

"The Bates Steel Mule is the most efficient tractor in America to-day, barring none."

"The Bates Steel Mule will always work equally well in dry or wet soil, good or bad condition."

"The Bates Steel Mule is a *perfect* field machine."

Test No. 61—Holt Model T-16, 40-60. This tractor was operated in mud during the last eight hours of the "limbering up" run, pulling about three-fourths of its rated load.

Test No. 62—Indiana 5-10. In the advertising literature submitted with the application for test of this tractor, we find some statements and claims which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable except the following:

"The Indiana is the nearest perfect power plant for the farm use."

"No other tractor can anywhere near approach the amount of work which can be performed by an Indiana in a whole season on the farm——."

"Mechanically the Indiana is right."

Test No. 63—Townsend 15-30. In the advertising literature submitted with the application for test of this tractor, we find some statements and claims which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable except the following:

"The Townsend transmission is as near frictionless—All power is delivered at the drawbar, etc.——."

"That it will stand the hardest use without falter or need of repair or attention."

"Townsend patented carbureter is one of the most economical and thorough burners of kerosene possible to obtain. There is a remarkable *freedom from carbon or smoke*, etc."

Test No. 64—Uncle Sam 20-30. Remarks same as for Test No. 20.

Test No. 65—Toro 6-10. Remarks same as for Test No. 20.

Test No. 66—Square Turn 18-35. In the first tractor submitted for test, the motor was found defective, and the company was allowed to substitute another tractor.

During the rated drawbar test one-half of track was sprinkled but tractor was hard to control with one wheel on slightly damp soil, so sprinkling was discontinued.

In the advertising literature submitted with application for test of this tractor, we find some statements and claims which cannot be directly compared with the results of this test as reported above. It is our opinion that none of these are excessive or unreasonable except the following:

"In the Square Turn we use the well-known Climax engine. Because of its superior design—it has earned the reputation of being practically 'trouble-proof.'"

"First you have—but turning three 14-inch furrows 10 inches deep under practically all soil conditions."

"It will always transmit the power of the motor *without loss* and without slippage."

Test No. 67—Twin City 20-35. Remarks same as for Test No. 20.

Test No. 68—Bates Steel Mule 15-22. Remarks same as for Test No. 60.

Test No. 69—Port Huron 12-25. Remarks same as for Test No. 20.

Ford Tractors in Germany

IN connection with the report that the Ford Company was in negotiation with the firm of Ehrich & Graetz, Berlin, for the establishment in Germany of works for the production of farm tractors, the *Berliner Zeitung* learns from the latter firm that the report is correct. It appears that the motors will be imported from America, but that the other parts of the tractors will be produced in Germany according to Ford specifications. The complete tractors will then be assembled in German factories built or bought by the Ford Company. For the time being only tractors will be manufactured, but the eventual production of motor cars also is contemplated. During the first year only ten or twenty tractors will be turned out daily, but it is hoped to increase this number considerably in two years time.

ONE of the five fellowships in Highway Engineering and Highway Transport recently awarded by the University of Michigan went to Chia T. Yeh, a Chinese engineer who has been taking the special highway course at Ann Arbor. If Yeh returns to China and exerts the influence this fellowship should give him, it should increase the prospective sale of many motor vehicles there.

A Revolving Air-Cooled Engine

Has cylinder axes parallel to axis of rotation and utilizes wobbling-plate principle. Is of four cycle type but has planetary gear so arranged that engine makes one revolution for two revolutions of plate, thus combining high piston speed with low rotative speed. Single sleeve valve of cast iron is employed in each of five aluminum cylinders.

THE wobbling plate is an old mechanism that was probably first used in steam engines with a view to doing away with the crankshaft, which is considered an inefficient device by some inventors. The argument against the crankshaft is that at the moment of greatest pressure in the cylinder it affords no effective torque arm, so that it is impossible to get a tangential effort on the shaft. We now realize that this objection to the crankshaft is based on a misconception.

But while the wobbling plate may not be inherently superior to the crankshaft for transforming reciprocating into rotary motion, it makes possible a type of engine which can be easily air-cooled and which, on account of the absence of a flywheel, can be built very light. Several gasoline engines of this type, intended for automobile service, have been built in the past. In 1912 M. Canton Unne of France constructed such an engine which was extensively featured in the trade press at the time. In this the motion of the wobbling disk was transmitted through a pair of bevel gears. In this country during the early period of the war the Macomber car, which had an engine of this type, was advertised extensively.

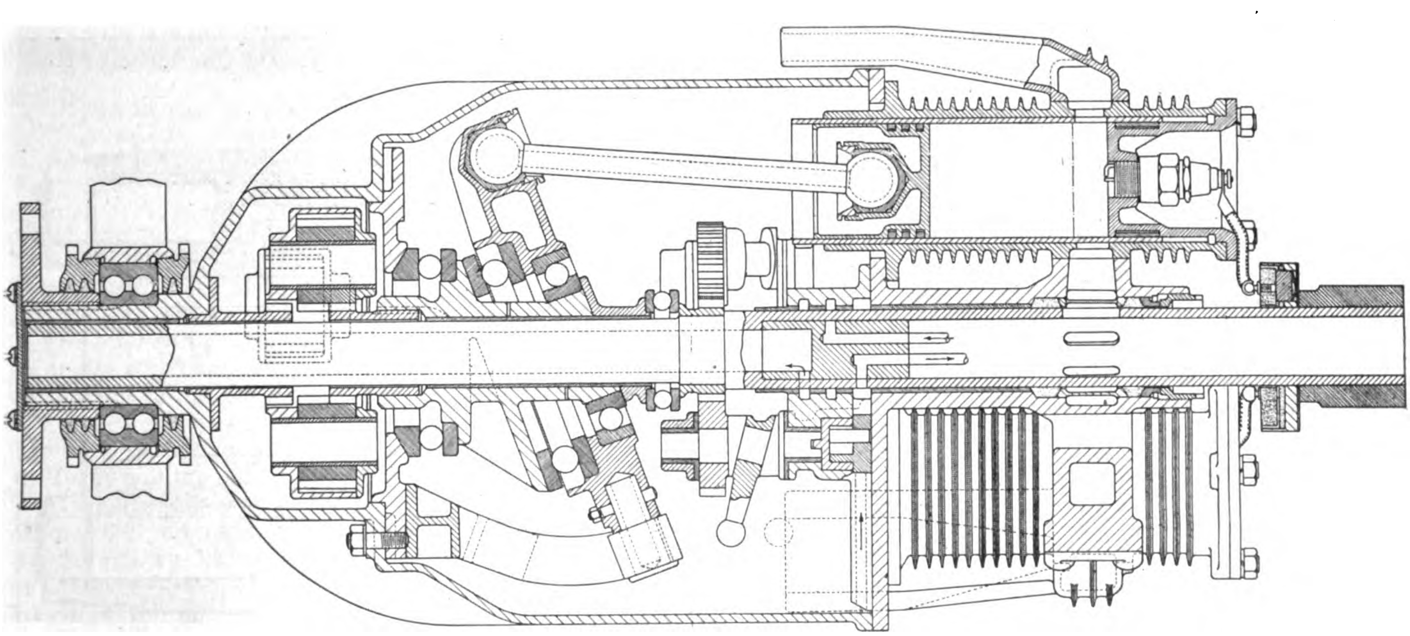
Judged by our present practice, a wabbling disk type is an engine of quite radical design, but it is clear that, in certain forms at least, it offers important advantages. Since the whole engine revolves, no separate flywheel is required. Still, if a moderate number of cylinders is used, the distance of the cylinder axes from the axis of rotation can be kept small, so there need be no excessive strains due to centrifugal force.

Owing to the rotary motion of the cylinders, they can readily be air cooled without fans or blowers, though, as in radial rotating engines, the leading and trailing sides are probably cooled somewhat unequally.

A new design of wobble plate engine has been evolved by the Nedoma-Najder Motor Syndicate and is illustrated by the sectional view herewith. This apparently represents a considerable advance over previous designs. By a special arrangement of the wobbling disk, its rate of wobbling is doubled, so that, although the cylinders operate on the four-stroke principle, there is one explosion in each cylinder for each revolution of the engine. This is an original feature and evidently makes it possible to combine high piston speed with a moderate speed of revolution, both of which are desirable, the first, because it results in high power per unit of displacement and in the high thermal efficiency and the second, because it reduces the strain due to centrifugal force on the engine structure.

Poppet valves are not very suitable for use in a revolving engine, owing to the effect of centrifugal force on their operation. In the engine here described a single sleeve type of valve is employed which has a combined rocking and reciprocating motion.

Referring to the accompanying sectional view, the whole engine is supported on a stationary hollow shaft, the forward end of which is held rigidly on a cross member of the frame. Combustible charge enters this hollow shaft at forward end and flows through ports in wall into a passage leading to the cylinder inlet ports, the opening and closing of which are controlled by the single sleeve valve.



Nedoma-Najder revolving air-cooled wobbling plate engine

The five cylinders, which have a bore of 2¾ and a stroke of 3⅜ in., are cast of aluminum with the cooling ribs integral. Into the outer ends of these cylinders are fitted cylinder heads of a form similar to those used in Knight engines, there being an annular space between the cylinder head and the cylinder wall into which the sleeve extends. The spark plugs are located centrally in the cylinder heads. The valve sleeves are made of cast iron and the pistons within them of aluminum. The connecting rods are tubular, with spherical heads, which are fitted respectively into the piston and into sockets of the wobbling disk. The wobbling disk is held against rotary motion relative to the cylinders by a guide secured to the engine housing and extending through a slot of the disk. The disk is supported on two ball bearings mounted upon a hub surrounding the stationary shaft. At the left-hand end of the engine there is a sort of differential gear of the spur type, one member of which is rigidly secured to the stationary shaft. This gear assembly causes the hub to revolve in the opposite direction to that of the engine frame at the same speed. It is this mechanism which causes the disk to wobble at twice the rate at which the engine revolves.

The valve sleeves are actuated by a set of five gears, supported in bearings carried on the engine frame. These gears mesh with a central gear on the stationary supporting shaft and, as the engine housing revolves, the five gears are caused to roll on the stationary gear. These five gears are mounted on shafts which are cut with inclined circular grooves, whereby a compound motion is given to lever arms, which connect by links to the valve sleeves. Three of these valve gear shafts are used to operate oil pumps, of which two serve to drain the engine case of oil, while the third forces the oil to all the bearing surfaces. The oil is contained in an outside reservoir which may be provided with cooling ribs, if desired. It passes between this reservoir and the engine through tubes extending through the hollow shaft.

The engine here shown is expected to develop 40 hp. at 1400 r.p.m. and to weigh 160 lb. Its firing order is 1, 4, 2, 5, 3. The power is taken off by means of the flange at the left-hand end which is keyed to a hub on the engine housing. Inclined flanges are cast onto the engine housing to facilitate cooling. The whole engine will be enclosed in a sheet metal stationary housing and the exhaust from the five cylinders takes place directly into this housing. The housing is supported by the channel type frame.

Spring Shackles Require Lateral Rigidity

SPRING shackles should be made quite rigid in a lateral direction as they are subjected to severe stresses when the car is driven around a corner at considerable speed, and particularly when it strikes an obstruction while skidding. F. Strickland in an article in *Engineering* points out that in one respect it is advisable to make the shackles long, as this reduces their angular motion on the pins and consequently the wear, but the requirement of lateral rigidity limits the length. He shows three constructions of varying degrees of rigidity.

Fig. 1 shows the simplest form of spring shackle. This was used on one make of vehicle in war service and proved the reverse of durable, but has the merit of being very cheap to make and therefore to renew. It will be seen that it fails completely to fulfill the condition of lateral rigidity. The result therefore is that the pins rapidly get loose in the shackles and the latter then cut into the pins, while the holes wear oval. The shackles as well as the pins have then to be scrapped.

It is possible that this type of shackle could be made satisfactory if constructed as shown in Fig. 2, as considerable lateral rigidity could be obtained while all parts would still be cheap to make.

The more usual form of shackle is shown in Fig. 3. The difficulty here is that each pin has to be a push fit in the eyes, and unless this is very accurate the pin gets "alive" in the eye and rapidly wears the hole oval, in which case both shackle and pin must be scrapped.

The satisfactory working of this type of shackle depends very largely on the proportions and workmanship. If the size of the parts is ample and the work good the shackle may be very durable, but if, to save weight, the parts are made small there is considerable wear. The pins should in all cases be case-hardened and ground.

IN a recent Bureau of Standards circular (No. 89) by C. E. Waters it is pointed out that the term carbon as applied to the incrustation in internal combustion engine cylinders is a misnomer, because the deposits consist largely of asphaltic matter.

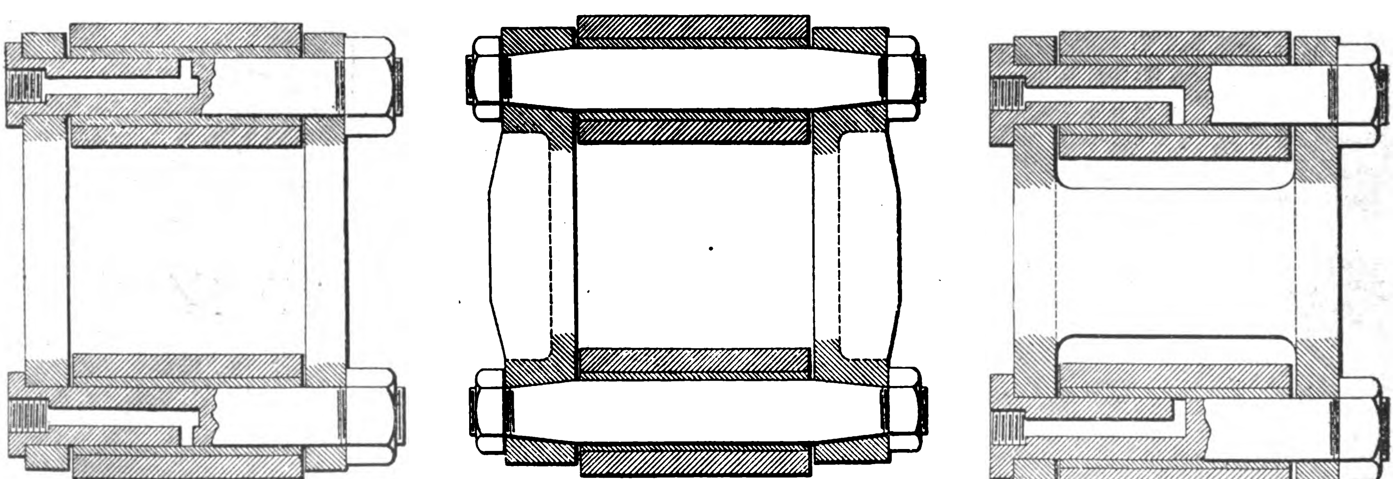


Fig. 1 *Fig.* 2 *Fig.* 3

Sectional views of spring shackles of various construction

The Manufacture of Magneto Magnets

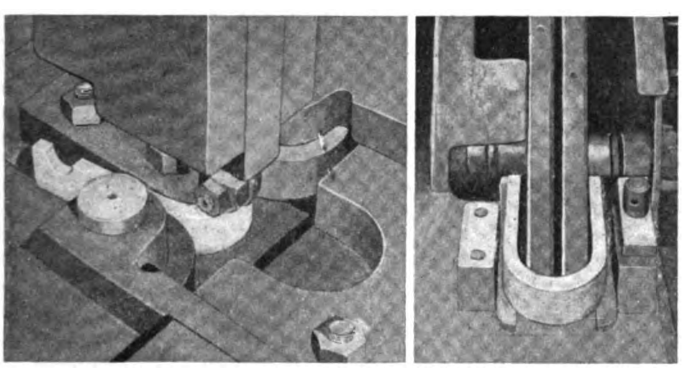
Production of U-shaped magnets from bar stock in large quantity is feature of Splitdorf plant. Forming, grinding, heat treating and testing operations systematized and under careful inspection. Magnetic strength of each piece measured in order to maintain standard.

By P. M. Heldt

ONE of the advantages of specialized manufacture is that equipment can be installed for economical production far beyond the possibilities where a great variety of products are turned out. However, economy of production is not the only advantage of such highly developed equipment, as accuracy of product and uniformity of quality are also secured as a rule.

The above remarks are motivated by a recent visit to the plant of the Splitdorf Electrical Co. The company manufactures its own steel magnets from bar steel and has developed a manufacturing process which is both economical and efficient.

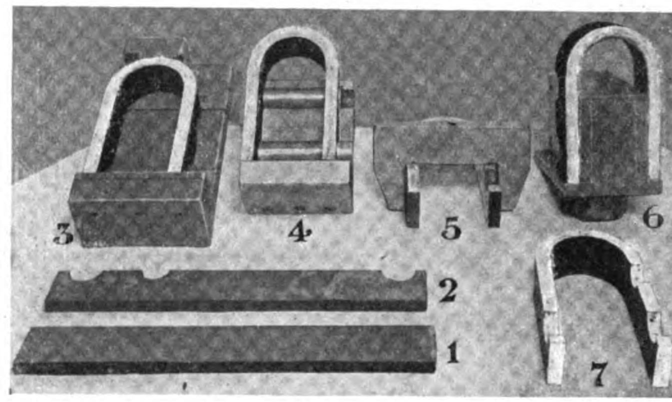
The magnet steel is received in the form of bars, which are sheared off to the proper length. These lengths of steel bar are next heated in a furnace to the working temperature. The passage through the furnace is continuous. Next the bars are put into a press in which half circles are punched out for the openings through which the rotor shaft extends. From this press the bars are transferred to a bulldozer, where they are bent up into U shape in a single operation. Both the punching and bending up into U form are accomplished during a single heat.



Left—Close up view of magnet just after being pressed in magnet forming machine. Right—Magnet set in grinding machine. (This apparatus grinds the inside of each leg of the magnets)

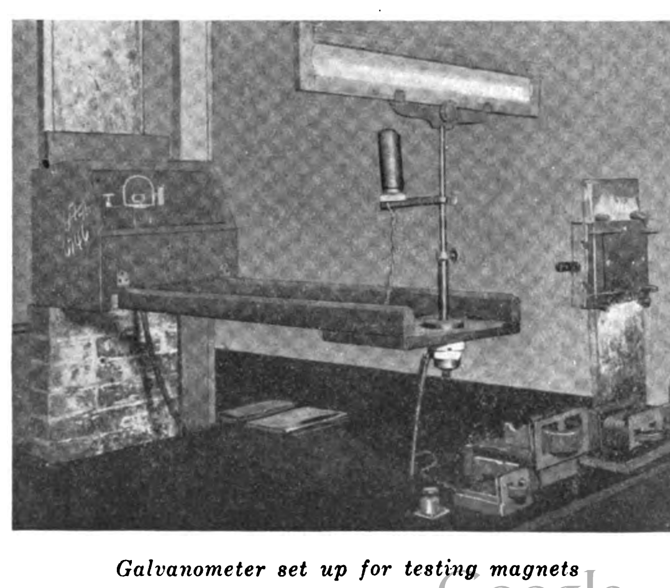
For quenching and hardening, the bars are pre-heated in another furnace, and during this operation they are held in tongues to protect them against warpage. The magnets are quenched by hand individually, the workman swinging them to and fro in the quenching bath, so as to insure uniform cooling and uniform hardness.

After coming out of the oil bath, the magnets are cleansed of oil in sawdust. Next, they are subjected to a preliminary bumping test, in order to show up any possible cracks or other imperfections. This consists in knocking the magnets together two and two. In another operation in the punch, following the bumping test, the legs of the magnets are bent in a little in order to provide stock for grinding on the inside. This gives the surface to which the bearing holder is fitted, this latter forming a part of the magnetic circuit.

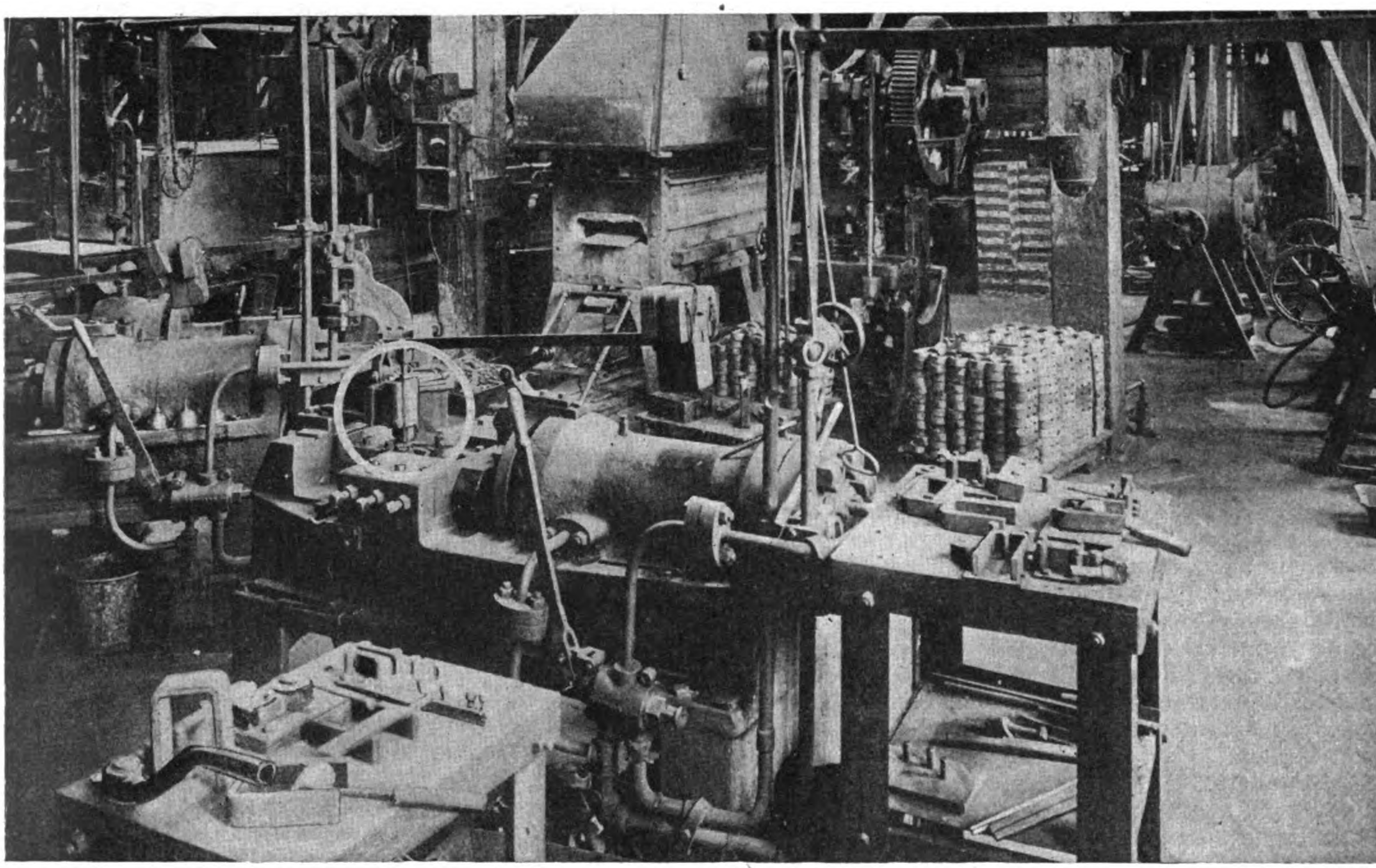


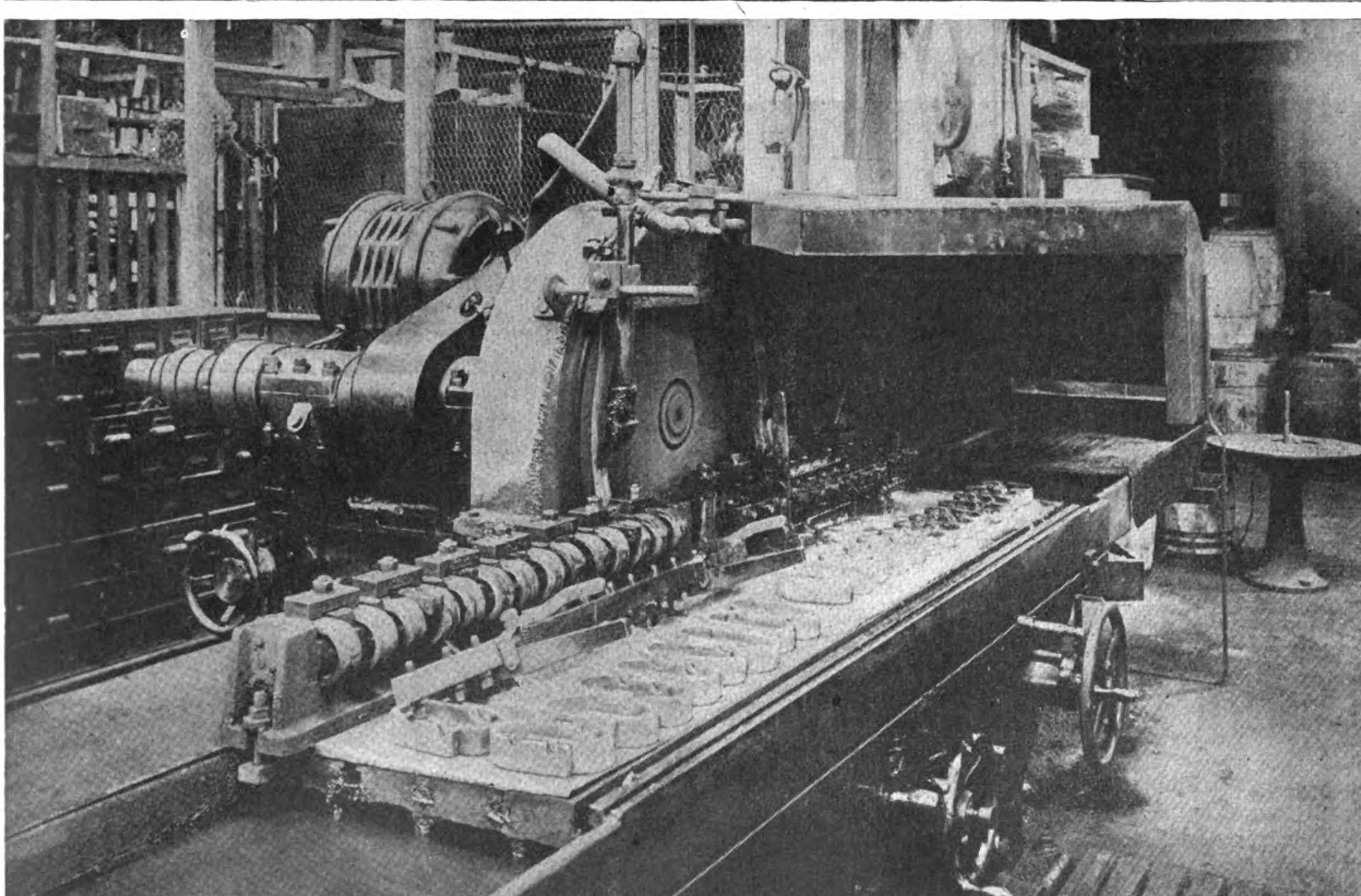
1—Plain bars of steel from which magnet is formed. 2—Semi-circular holes punched, to allow projection of rotor. 3—Magnet formed in gage for height. 4—Magnet formed in gage for hole size. 5—Magnet formed in gage for distance between outside of poles. 6—Magnet formed in gage for distance between inside of poles. 7—Finished magnet

Next comes the rough grinding of the outside of the magnet. First one side of the U is ground off, to get a surface to work from; then the other side, and finally the ends of the legs are ground off square. This completes the mechanical operations on the magnet.



Galvanometer set up for testing magnets





Upper—Forming machine and hardening department. A magnet just formed is seen within the circle marked on the forming machine in the foreground. Lower—Machine used for grinding off ends of magnets. This is a surface grinder and has a capacity of 2500 magnets per day

Magnetizing is accomplished on each magnet individually, the horseshoe being placed in a double coil magnetizing device, which is provided with an armature at one end. When the magnet is in position a switch is closed momentarily.

After the magnetizing process, each magnet is subjected to a test to show its magnetic strength, and any magnet not showing at least 20,000 magnetic lines is either remagnetized or rejected. The test is made by means of an induction coil connected to a ballistic galvanometer. The coil is wound on a rectangular frame, so arranged that the magnet can be inserted and quickly withdrawn. The withdrawal of the magnet causes the coil to be cut by the entire flux of the magnet, with the result that an electric impulse is induced in the coil, which is directly proportional to the total number of lines of force, and independent of the speed of withdrawal. This electric impulse passes through the coil of the ballistic galvanometer, the movable system of which is comparatively heavy, so that its period of swing is much greater than the duration of the electric impulse following the withdrawal of the magnet.

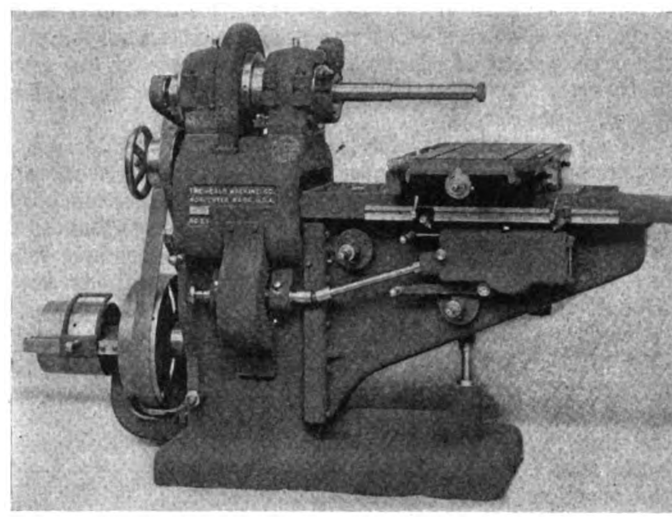
The galvanometer is of the mirror type, and is provided with a scale at some distance in front of it. Behind the scale is arranged a light, in such a manner that a beam from the light falls on the mirror and is reflected onto the scale. Owing to the slow rate of swing of the movable system, the maximum reflection can be easily read off. The scale is graduated directly in thousands of lines of force.

Simplified Cylinder Grinding Machine

A DEMAND for a simpler and smaller cylinder grinding machine has been met by the Heald Machine Co. by bringing out a new design in which the speed boxes and other expensive units are omitted, the drive being from a single shaft at the rear of the machine. The machine is self-contained and does not require a countershaft.

The machine embodies many of the features of earlier types. In addition to simplifying it and bringing down the price, the Heald company has increased the width of the knee and main table, so that when grinding six-cylinder blocks there is no undue overhang on either side when grinding the bores at the ends. Another change consists in an increase in the distance between the center line of the grinding spindle and the top of the cross slide table. On earlier machines this distance ranges between 4¼ and 7½ in. but on the new one it ranges between 7 and 9½ in. This makes it very convenient when grinding very large castings.

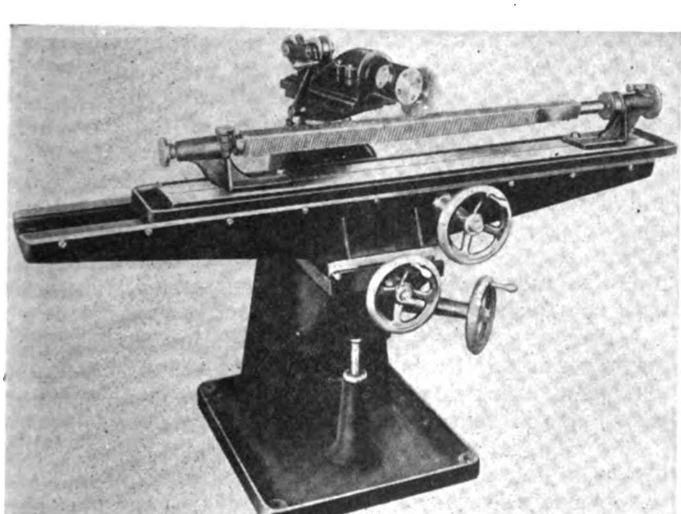
The eccentric and spindle arrangement is the same as heretofore. An arm, which grinds holes 2⅜ in. and larger in diameter by 11 in. long, is furnished as regular equipment with this machine. It also grinds holes 3 in. in diameter and larger 18 in. long. Other size arms can be substituted if the work requires it. The machine is designed specially to meet the requirements of shops doing a variety of work.



The Heald simplified type of cylinder grinder

A Grinder for Broaches

A GRINDER specially designed for sharpening broaches is being marketed by the J. N. Lapointe Co. It consists of a solid column supporting a vertically adjustable knee. This knee carries a table having both cross and longitudinal hand feed. The grinder has a head and a foot-stock which can be removed when it is desired to clamp square broaches and keyway cutter bars. The head-stock comprises an index mechanism for use when grinding spline broaches, and a live center which is belt-driven from an auxiliary countershaft. A three-story cone pulley on both the main and the auxiliary countershaft gives three possible speeds to the live center spindle on the grinder table. The table is large enough to grind broaches 64 in. long and 8 in. in diameter.



The Lapointe broach grinder

The grinding wheel is carried on a spindle supported by a swivel-head which makes it possible to both grind the rake angle on the back of the broach teeth and to undercut the faces. The head swings on the column of the machine to any horizontal angle, and so permits the grinding of teeth machined at any angle to the axis of the broach, as well as the grinding of teeth at the customary 90 deg. to the axis. The grinding wheel spindle is belt-driven from the main countershaft. A pair of idler pulleys change the direction of this belt for any angle of the grinding wheel spindle. The whole swivel head mechanism is moved forward by a hand lever to bring the grinding wheel up to the tooth surface to be ground.

Training Men for Tractor Service Work

Service is an extremely important part of tractor merchandising. Lack of proper service has hindered tractor development on more than one occasion. The present article describes the methods used by one manufacturer in training service men for his dealer and distributer organizations.

By Norman G. Shidle

EFFECTIVE service is an important feature in the merchandising of tractors: some authorities believe it to be the most important. It is of mutual benefit to the manufacturer, the dealer, and the user that proper service be available when the need for it arises. And in the development of effective service facilities by the manufacturer lies the possibility for a greatly widened and improved tractor market.

In an effort to develop men capable of rendering the proper service, some tractor manufacturers have installed training schools for dealer and distributer service men. Through such a school it is possible, not only to make the service man thoroughly familiar with the product itself, but also to "sell" him on the ideals and methods of the manufacturing organization. As a result, the manufacturer gets a closer relationship with his dealers and at the same time insures service to the user along the lines best suited to a promotion of good will for the product.

An excellent school has been developed along these lines at the Midwest Engine Company in connection with the Utilitor tractor. The course is conducted under the auspices of the factory service department of the Utilitor Division. It lasts for nine days, each class comprising about ten men. During the course, the students are made thoroughly familiar with the various technical details of the Utilitor, are instructed in the best methods of making repairs, spend a number of hours in practical work both in shop work and on a farm adjacent to the factory school.

APPLICATION FOR MEMBERSHIP

UTILITOR CENTRAL SERVICE SCHOOL

No.............

NAME AGE NATIONALITY

MARRIED No. OF DEPENDENTS CHURCH

STATE NATURE OF EXPERIENCE DURING PAST THREE YEARS

EDUCATION 8TH GRADE HIGH SCHOOL COLLEGE SPECIAL COURSES

DISTRIBUTOR DEALER SERVICE MECHANIC SALESMAN OWNER

EMPLOYER'S NAME ADDRESS

APPLICANT'S CITY ADDRESS TELEPHONE DATE WISHES TO ENTER

MIDWEST ENGINE COMPANY

Utilitor Sales Division Service Department

Application for membership in service training course

While service on a very small machine such as the Utilitor does not involve as many complexities as would arise in connection with larger units, a story of this course is specially valuable because it is possible to get an entire picture of the school and the various training activities.

The course is particularly adaptable to description in a short article, since it involves all the factors in a small way which might be necessary in larger scope in training men for work on a large machine.

Most of the men who take this course are already familiar with the fundamentals of gas engine design and operation, most of them being dealer or distributer service men. The course is so designed, however, that salesmen and prospective salesmen, or men entirely unfamiliar with the technical phases of the tractor may also be included.

The school is in charge of a director who devotes his entire time to this work. It is supervised, however, by S. V. Harding, Service Director of the Utilitor Division. A description of the work in detail will indicate the thoroughness with which the ground is covered, taking into consideration the short duration of the course.

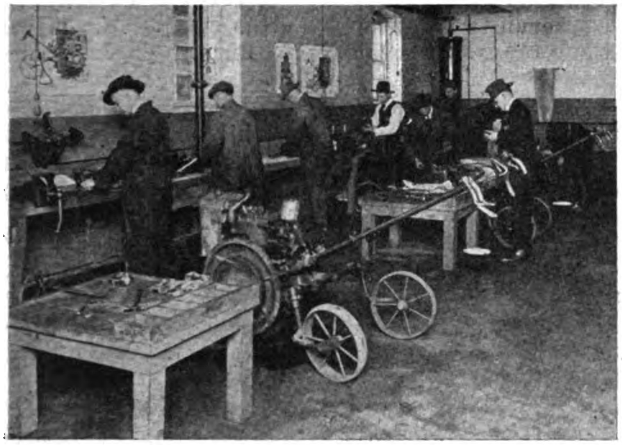
On the first day, after the new students have been enrolled, a general lecture on Utilitor service is presented. This brief talk introduces the men to the service ideals and aims of the company and forms a basis upon which the rest of the course is built up. The following paragraph from the first lecture indicates the kind of foundation that is laid:

"In addition to this education (of the user as regards his service obligations), the manufacturer group must maintain adequate supplies of spare parts at points easily accessible to Utilitor users, and it must have at hand men trained and qualified in the care, operation and repair of this product, whose services may be brought to the assistance of the Utilitors operating in the user's hands."

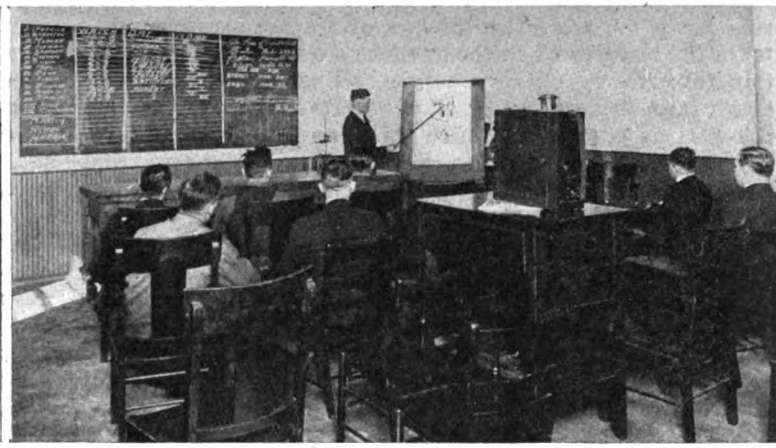
Following this lecture, is an illustrated talk on the principles of the gas engine. This talk traces rapidly the history of the combustion engine from its inception to the present state of refinement, and describes simply and briefly the fundamental principles of gas engine operation. The talk is illustrated by colored charts which present the material so clearly that it can be understood even by one comparatively unfamiliar with the functioning of gas engines.

A general survey of the plant is then made, the students being conducted through the various manufacturing departments and being instructed in a general way as regards the different operations.

The final part of the first day's work is taken up with disassembling the Utilitor, so that each student may learn the names and functions of each of the various parts. First, the instructor gives a talk on disassembly, taking



View in shop section of service school



The classroom of the service school

the machine apart to illustrate his various points. The students are encouraged to ask questions when any point is not clear, so that when this short lecture is finished, they should be capable of properly disassembling a machine themselves.

Following the lecture, each student is given a tractor and is expected to properly disassemble it. This he does entirely alone, the instructor, however, being present to answer questions and make explanations.

The second day begins with a lecture on Utilitor parts, illustrated in the same manner as was the lecture on gas engine principles. Following this talk, the students again go into the shop to actually do sub-assembly work. In this way they become familiar with the details of the various parts and become proficient, through actual experience, in assembling them.

The particular type of clutch used on this tractor is next discussed, first in a lecture and later in the shop. The students, after being taught the theoretical principles of the clutch are required to assemble and disassemble it. In every case, a clutch is given to each student so that he must do all the work on every unit himself.

The ignition and fuel system comes in for attention on the third day. The lecture on ignition which starts the day takes up the basic principles of ignition and explains the ignition system thoroughly in simplified terms. This lecture is followed by several hours of shop work on the ignition system.

The historical as well as the technical phases of the fuel system are explained to the students, the idea being to give them a broader knowledge and a more intelligent interest in the material things with which they are working each day. The parts and principles of the carbureter are discussed, questions are answered, and the entire matter made clear to every man. The last periods of this day are spent in reassembly of the entire machine. Each student again has a machine to himself and is required to assemble it from beginning to end.

Instruction is given in the proper methods of uncrating a machine at the beginning of the fourth day. It is possible for the dealer to uncrate the machine in such a way that the crate may be used over again. Improper methods, however, destroy the crate so that it is not fit for further use. For this reason an entire period is devoted to this phase of the work. After the lecture the students again go into the shop. The work done in the shop from this time on is likely to vary somewhat with the individual. Some men will grasp certain phases of the work more readily than others. In the shop work, each man works along the lines in which he is least proficient, so that he may have a clear and comprehensive grasp of all phases of the work when he has finished the course.

The lecture on hitches which follows, explains the various methods of hitching the Utilitor to the different farm implements. The students then spend several hours in making such hitches until each one becomes proficient.

A lecture on "trouble shooting" starts the work of the fifth day. In this lecture it is pointed out that three things are needed in order that an explosion may occur:

1. Pressure
2. Combustible mixture
3. Ignition

The students are then taught how to trace various troubles to a lack of one of these three essentials. Each man is given an engine which has been put out of order in some way. He must then locate the trouble and set it to rights. Several hours are spent in this work.

The "trouble shooting" work is followed by a lecture on the various power applications of this particular tractor. The men are taught the various ways in which the Utilitor can be used as a power plant. More practical work in "trouble shooting" follows this lecture.

The sixth and seventh days are spent "down on the farm." An experimental farm of about 17 acres is located within walking distance of the factory. Here the agricultural features of the hitches are demonstrated; the type of hitch best designed for a specific type of work is explained, etc. The students then make the various hitches, see the tractor used for various types of work, and operate it themselves under various conditions. Much of this day is spent in instruction talks and demonstrations by the instructor. The seventh day is a day of actual field work by the students. This day brings out the things that the student does not know and an opportunity is given him to clear up the cloudy spots in his knowledge.

The first period of the eighth day is an open conference with the director of the farm service department. A lecture is then given to show the best method of making a field demonstration, and of pointing out the outstanding features of the machine. A conference period follows during which the students may talk individually with the instructors concerning various phases of the work, and may go into the shop and work on some part of the tractor with which they are not yet thoroughly familiar.

Every student is taught how to run a motion picture machine. This firm has obtained excellent results through the use of motion pictures in advertising its product, and wishes at least one man in every dealer's and distributor's organization to be familiar with the operation of the picture machine.

The last period of this day is filled with a talk about spare parts, the necessity for a dealer's keeping on hand an adequate supply, the system of distribution used by

this company, and other phases of tractor service work.

On the last day of the course, the students make another trip through the factory assembly line. This time they are in a position to know all the parts and to understand the various operations which they see. It is, in a sense, a lecture tour during which the men ask questions and find out many new points which were not intelligible to them on their first trip at the beginning of the course.

A detailed lecture concerning the proper equipment necessary for a tractor service shop is given. The special tools necessary are named and described. When the student is through with this lecture he is able to go back home, start a service shop and intelligently order all the tools and equipment he will need to keep it operating efficiently.

The class is taken for a trip through the stock room. The man in charge of the stock room explains the stock-keeping system to them, points out the difficulties with which he meets, and thus makes them aware of the inevitable causes for delay which sometimes arise. This is not in the nature of excuses, but simply another method of getting the dealer's organization to understand the problems of the factory. The result has been a marked increase in the spirit of co-operation.

A final lecture by the service director, summing up the course and presenting the ideals and knowledge which the company hopes it has given the men, winds up the course. After this lecture informal conferences are held in which the students can ask and have answered any questions which may have come up and which they wish answered before returning home.

The results thus far obtained from this short intensive course have been excellent. It has resulted in a number of advantages to the company. Among the chief of these might be mentioned:

1. A better and more thorough knowledge of the product among dealer's service men.

2. A knowledge among these men of the best service practice for this particular product and a resulting betterment of the service rendered to users.

3. A raising of the ideals of service among the men who actually render that service to the user; a broadening of the vision and ideals of these men.

4. A better understanding by the dealer's organization of the factory problems, and vice versa. This makes for a smooth working organization throughout.

5. A personal acquaintanceship between the factory service manager and the various dealer service men. This is made possible by pleasant and close association during the ten days of the course. It is not only a personal pleasure for all concerned, but a distinct advantage to the efficient working of the service organization. It is an advantage that is abstract rather than material, but it is through that intangible human element that the best organizations are effected and the greatest tasks accomplished.

Several interesting points are brought out by this course from the standpoint of instruction methods. The instruction is given to more than one type of man, although a single type predominates. In order of the number which take the course, the following groups are comprised among the students in general:

1. Mechanics; men who are good artisans, but who have had little experience in listening to lectures or in taking notes. Men who are likely to grasp mechanical details rapidly and theoretical details slowly.

2. Salesmen; men being trained to sell the tractor; whose chief experience is selling; who are likely to grasp principles quickly and a technical practice less readily.

3. Executives of distributers' organizations; men likely to have the same characteristics as the second group mentioned, with the good points more highly accentuated.

To make the course adaptable to each of the classes, every subject is treated in simple form to begin with. It does not hurt those who are familiar with technical practice to renew their knowledge of fundamentals, and it enables the others to grasp the subsequent instruction. Then too, the latter part of the course, though definitely planned as to periods, allows considerable scope in the exact shop work to be done, so that the particular needs of each type of man can be adequately accommodated.

Insofar as possible the lectures are given early in the day; the first period is always a lecture. Thus the minds of the men are caught when they are fresh, and when they can most readily adapt themselves to the unusual ordeal of keeping the body still but the mind active.

When a man applies to enter the course, he is required to fill out the "Application for Membership" card shown in the accompanying illustration. When the man is a dealer or distributer employee, the director of the service school sends a letter, near the beginning of the course, to the man's employer, noting the arrival of the man and the prospects which he seems to have for successfully completing the study. In some cases, it may be obvious at once that the man does not have the requisite qualifications. Then the employer is notified in a frank and cordial manner. The man is allowed to take the course, but the employer then knows beforehand that he is unlikely to receive the maximum value from the training.

At the completion of the course, an examination is given. Those who pass it successfully are given a certificate of graduation. The service director then writes to the employer of the man another letter, reporting upon the work of the student during the course.

The school is conducted in three large rooms, one of them a shop, one an office, and one a classroom. These rooms are provided with the models, charts, classroom chairs, and other equipment necessary to provide the best facilities for such a course. The expense of conducting the course, providing equipment, instructors, etc., is borne by the company. The personal expenses of the student are borne by his employer.

To illustrate the thoroughness of the training, considering the very brief period devoted to it, a few sample questions from the final examinations are presented.

1. What is meant by ignition, how is it accomplished? What is preignition?
2. What becomes of the heat generated during power and compression stroke?
3. What is correct method of lubrication of magneto? Why should cylinder oil never be used?
4. What factors can be at fault to prevent the low tension current from completing its circuit?
5. Outline the Utilitor plan of distribution.
6. Explain thoroughly the Midwest service policy.
7. Name all publications in which you have seen national advertising of the Midwest Utilitor.
8. What function does the Utilitor clutch perform? What type of clutch is used? Has Utilitor separate set of transmission gears?

While these questions would not cause an engineer to think very long, it is evident that if a man is able to answer a majority of them correctly after a nine days training course, those nine days have been spent in very profitable effort.

This training plan is further carried out by requiring each distributer to maintain a similar course of training, conducted on a less elaborate scale, for his dealers. The dealers are also required to provide training for their own men as occasion requires. Thus the work of the central school is supplemented by two duplications. The main course, however, is always open to men from both dealer and distributer organizations, and draws many of its students from the first as well as the second.

Dealers Resentful Because of Expense on New Cars

This installment of our document on the relations of the manufacturer and dealers is confined to the dealers' opinions on assembly and inspection. As nine of the thirteen replies tell of heavy expenses, you can understand why the dealer is not cheerful on this subject.

By Clyde Jennings

MR. MANUFACTURER, have your cars been costing your distributers and dealers from $50 to $150 to put them in shape to be handed over to the customer?

No, this is not a foolish question. A lot of cars have been costing the dealers and distributers this amount and evidence at hand is that in many cases the factory has not in any way reimbursed the dealer for this expense.

In only four of the thirteen cases we will cite has the factory met this issue fairly. The four, you will note from a reading of the evidence, are dealers who handle only one car. Some of the others, you will note, handle more than one line.

A pretty bad situation, I grant you, and it is no wonder that some dealers and distributers are perfectly willing to change their lines.

It is one of the limitations of research that the results are never entirely up to date. We can obtain positive information only on what has happened and then, usually, only when it has happened long enough before to become a settled incident. It was for this reason that in a previous article we passed on to you a referendum on incidents that were ancient history. It would be very interesting to know to what extent the conditions reported in these replies have been corrected—now that the manufacturers have more time to give to details.

It is no secret that each manufacturer, as he reads these answers, is going to reflect in his mind that he is not the man referred to. But are you sure? How long has it been since you read the dealer complaint correspondence? It is to be hoped that all manufacturers who read these answers will read them with a perfect open mind and not influence himself as to his attitude.

Here is the question asked the dealers to get these replies:

Numerous reports indicate that poor assembly by factories has cost in many cases as high as $50 per car to put in suitable shape for customers and that the factories have not reimbursed dealer for poor factory work. Is this true?

THIS is the third of a series of manufacturer-dealer articles. These articles are intended to call to the attention of the manufacturer some of the conditions existing in the dealer field. They are not written for dealers.

We believe that it is time for better selling of automobiles.

We believe that errors can be corrected only when it is known that the errors exist.

We believe that much of the information in these articles will be real news to many manufacturers.

We believe that it is important that he should know these things.

There will be more of these articles—one of especial interest on the manufacturer-dealer contract.

Now we have taken the liberty of grading these replies from worst to best in a general way. Read these carefully, they are worth attention!

1—Our cars, particularly one model, have given us no end of trouble, and the service on this particular model has averaged us about $150 a car. Our factory has not as much as replaced parts. They would simply state that the parts were worn and not defective, and we had to replace these parts free for service policy. Our dealer organization, which cost us thousands of dollars to create, is in a most disorganized condition because of the trouble which this particular model has given, and being short of mechanics, we have simply been unable to give the dealer the help and co-operation which he should have, which burden should be on the factory's shoulders and not on ours.

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2—The manufacturer ought to be ashamed of himself for delivering cars to the distributer and dealer which were only half assembled. The average cost to us for every small model Four that we have had delivered to us this year has cost us $60 per car to put it in a salable condition. I have distributer friends who tell me that it cost them $120 per car to put them in salable condition, and when we mention this fact to the manufacturers they say that their policy is that they absolutely will not reimburse any dealer for labor. This applies also to labor for replacing defective parts.

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I am glad to say that the worst is past, but there are still some reports that are very embarrassing to legitimate manufacturers. Here are a few that will cause any thoughtful man to ask if there is any such correspondence in his office:

3—Poor assembly by the factories costing as high as $50, yes, even more, has been chronic with most manufacturers as well as the manufacturers with whom we do business. There is no question about this, and this is still continuing today, and the "buck" is passed to

the distributer and the dealer in each instance. There is no labor allowance given for rebuilding these cars and putting them in satisfactory condition for the customers. This obviously is very unfair. Factories will replace parts, but the transportation on these parts must be paid by the customer, and the labor charges for installing the same, even though the cars have seen little or no service. **This matter should be remedied, and the factories under their guarantee should take care of this item to build up a reputation for themselves and also allow the distributers and dealers to make money. This is one of the worst features of the business.**

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4—It is quite true the majority of factories have given their cars very poor inspection, indeed, with the result that poor assembly has occurred in many cases. I believe that when you quote $50 per car as the cost to the dealer for taking care of this poor assembly, you are putting it very low. I know of a number of cases where the amount far exceeds that sum. In some cases the factories have taken care of this bill, but have not done so in the majority of instances.

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5—The poor assembly of cars by factories, undoubtedly, has cost the dealers considerable money to put cars in suitable shape for deliveries, and not a single case of reimbursement has come to my knowledge.

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6—This is a fact. Not only have the assemblies been poor, but we have had instances of equipment being short when it was self-evident that the cars were loaded that way. We have had to buy two or three clocks, and so forth. We have had to tear down several engines because of tight pistons. The factory is absolutely arbitrarily taking a position that it cannot err nor can any of its employees; therefore, if they do not, of their own accord, send us a Back Order, we have to pay the bill.

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7—My last records show that it cost me about $75 per car to put the Blank in condition for customers, and we were never reimbursed one cent by the factory for labor. In addition to this, we have to pay express both ways on parts returned, but in most cases the parts were furnished free by the factory.

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8—The assembly work in the aggregate has been poor. The inspection, as a rule, has been a joke, and it is acknowledged that most dealers before starting on their drive-aways inspect their cars before taking a chance on the road. However, our factories have made good any defect and have allowed us the credit to cover on the parts and, in some cases, the labor also was included in our credit.

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9—It has been the custom ever since I have been in the business (11 years) for distributers to put the cars in condition to run at their own expense, and there has been very little change in the situation during the past several years.

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Granted that you are a conscientious manufacturer, and that you have survived thus far, I am glad to say that there is better news coming. Very likely you had begun to think that you were in mighty bad company. But there are **some automotive manufacturers who have a right regard for the morals of business.** It is a great pleasure to pass these bits of testimony on to you:

10—We have had more or less difficulty from the condition referred to. No doubt, factories have been laboring under a very serious condition from a labor standpoint. We have had a great many cars come in that have been taken into the shop before we could deliver them. In some cases on our Blank cars, we have had to spend as much as $50 to condition them for delivery. We have found that these cases, however, are isolated, and in such cases we have taken the matter up with the factory, and in nearly all instances received entire satisfaction. We believe we are particularly fortunate in being connected with factories that have a very fair policy.

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11—Poor assembly has not been a serious matter with us. Cars have been coming through comparatively O. K.

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12—Our factories have co-operated with us to the last degree, in my estimation, in relation to anything that could be traced to poor factory work or poor assembly, as you put it. Two of our factories, on several occasions, reimbursed us for labor when it could be proven that the job was improperly done at the factory.

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13—The Blank people prefer to shut down in preference to sending out badly assembled cars. We have experienced practically none of this, but have experienced delay in getting cars and waiting until they were properly assembled. We know, as a matter of fact, that lots of distributers and dealers have been put to the expense of a lot more than $50 a car to get their automobiles into commercial condition, and that the manufacturer has not reimbursed the dealer.

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Just a word more in closing. It is to be hoped that manufacturers will not remember the last four testimonials and forget the others. Also it is to be hoped that they will not remember only the first two.

Our business is a great, big, fine business, and we have the foundation for a bigger and finer business, but some things that are happening in this structure are not entirely helpful. We must tear out the defective material put in during the last few years of stress and replace it with honest intentions, well carried out.

The strongest bond the manufacturer should weave should be that with the dealer. YOU cannot hope for success unless your dealers are for you and with you, heart and soul.

We are not yet through with this manufacturer-dealer situation.

THE trade mark law of 1920 has materially softened the harsh and apparently unreasonable conditions of the Trade Mark Act of 1905, under which so many trade marks constantly used in this country could not be legally protected. The old law did not permit of the legal registration of a trade mark that was descriptive or geographical. Such a trade mark might be adopted and used in this country and respected because of the popularity given it by advertising, but as it was not legally registered in this country any one could steal it for use in another country. Under the new law, such trade marks can be registered. An automobile, truck or tractor may now be registered under a trade mark that is descriptive or indicative of the city or State in which the vehicle is made. The greatest advantage of this law is that when a trade mark is so registered in this country, it cannot be as easily stolen in a foreign country as under the act of 1905. But to devise a trade mark that will be attractive and command respect in all countries is quite another matter and here is where the trade mark experts can well serve a firm that is going into the world trade field.

Some Interesting Bits of Information on Foreign Trade

No one has compiled a comprehensive directory on Foreign Trade and probably no one source of information will supply your needs. It is only by carefully compiling all bits of information that fit your case that you can study your export problem with the care and interest it warrants.

THE annual meeting of the National Foreign Trade Council, which will be held in Cleveland May 4 to 7 inclusive, should be of especial interest to automotive manufacturers this year. Surely no one will question the fact that the export trade has been an important factor during the past year, and there is every reason to believe that it will be even a more important factor in the years to come.

Export trade has peculiarities. A man versed in domestic trade is not always entirely equipped for export selling. There are many crooks and turns that must be learned and mastered. Experience is very slow in export trade, chiefly because the turnover is slow. It requires a long time to learn whether or not you have offended a customer. So, if you are in haste to get into foreign trade, it is best to learn by the experience of others. The meetings of the Foreign Trade Council serve that purpose.

Batteries Abroad

AN interesting development in foreign trading is the increased attention being given export trade by the storage battery companies. Several of these companies are establishing export agencies in many countries where sufficient American cars have been sold to warrant this attention. It is even more significant that these companies are establishing export agencies only where the agency will provide adequate service facilities.

The battery companies intimate that they have not received full support from the car manufacturers. The car exporter, it appears from the data in the possession of the battery exporters, has not realized fully the importance of primary information that should accompany cars shipped abroad. In some cases cars have been exported with wet batteries, instead of the special dry battery that is manufactured for export trade. As a result, when this car is turned over to the owner four months after it has left the factory, the battery is impotent. This is quite a serious defect in a country where the battery is so little understood as in most of the countries to which cars are exported. It not only is a blow at the battery maker, but what must be considered more important, is a blow at the confidence in the car and, generally speaking, to American cars as a whole.

Optional Equipment

IT is interesting to note that some very careful merchandisers of cars are going into the export business with a considerable understanding of the problems before them. Among the cars exhibited in New York during show week was a Marmon, which was designed especially for export trade. This car was at the Marmon dealer show room. The most marked feature of the car was that it was a right hand drive, but there were other optional features, designed to meet the wants of the public in the various countries of the world where the export division of the Marmon sales department may place the car.

Optional equipment is quite necessary for a successful foreign business. The need of right hand drives and magnetos is very well known. The matter of colors is also quite important. In only a few countries in the world is the buying public content to ride every day and on all occasions in the funereal appearing cars that predominate in the United States.

Car Census in Sweden

AN error in an article about Sweden as a market for automobiles, which was published in AUTOMOTIVE INDUSTRIES Dec. 2, has brought to us a number of letters, which go to show how seriously an error in AUTOMOTIVE INDUSTRIES is regarded, and which bring to us considerable information. These letters come from The Scandinavian-American Trading Co. of New York, Fiat Societa Anonima-Torino, Turin, Italy, and Capt. John Neren, editor *Motor*, Stockholm.

These letters all call attention that the figure of 70,000 is entirely too high for the number of automobiles in Sweden. This figure was printed as coming from the French Chamber of Commerce in Sweden. It is probable that in transmission of this information a typographical error made 7000 grow to 70,000.

The difficulty in reading this article by the correspondents was that the figure of 7000 is not high enough, and the mistake was not obvious. These letters inform us that on June 1 there was a census of motor cars in Sweden and that the number reached 8506. The Scandinavian-American Trading Co., which represents The White Co. in Sweden, adds that recent information indicates that the Jan. 1 registration will show between 13,000 and 13,500 cars and trucks in that country. This great increase is due to the heavy importations during 1920.

The details of the June 1, 1920, census were:

	Country	Stockholm
Cars and trucks	8,506	2,137
Motorcycles	9,059	1,015

Another bit of information in these communications is that the import duty on automobiles into Sweden is 15 per cent of the value c.i.f. at Swedish port, consequently this is inclusive also of the freight and insurance, railroad and boxing charges, and not as stated in the translated article.

Defense of American Car

AMERICAN car manufacturers who export to Australia have a firm friend, the editor of *The Australian Motorist*. This comment is brought out by an article which appeared in the Dec. 1 issue of that publication.

The comment was based upon a criticism of the Adelaide show, written by an anonymous correspondent. The editor apologizes for printing such a communication, but he interlards between the paragraphs of this criticism his own view of the points made by the critic.

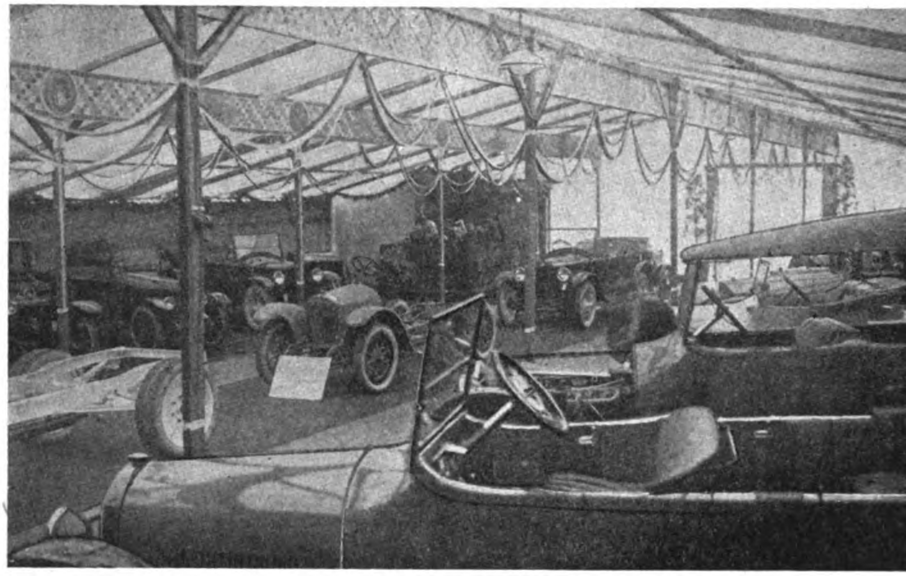
The critic is one of those persons who can be classed as pro-British. He apparently believes that Australians should not buy cars until the British manufacturers are ready to supply them. He let his antipathy for American cars carry him past the facts, for his statement that the show was financed by Americans and displayed more American cars than British are met with a mere statement of fact. We will reprint one paragraph of the criticism of the editor's reply as a type of the controversy.

The critic wrote:

"The British side of the show, though so limited in numbers, came in for a good share of attention, and undoubtedly the agents will be able to report business by the end of the week, in spite of the big difference between the cost of British and American cars. That the British car will hold its own again, and in the near future too, can be guaranteed. The British manufacturers have not recovered from the effect of the war yet, and may not do so for another season or more, but taking into consideration the many advantages America had while British interests were fighting the wars of the rest of the world, it is a marvel that we could even make a show at all."

The editor replied:

"When the British manufacturer gives Australians motor vehicles which come within the scope of the purchasing power of the Australians then British builders will get all the trade. The reason that fewer British cars are being purchased than American is due to the following: (1) A mail contractor with small capital cannot purchase a motor car for £1250, but he can finance one at between £300 and £650. (2) The farmer with heavy demands on his bank for agricultural machinery, fertilizers, and perhaps seed, when the drought catches him, cannot be expected to lay out over £1000 in a luxurious mechanical road vehicle if one costing a little more than half that sum will do the work satisfactorily. A Rolls-Royce limousine loaded with fencing wire on an outback sheep run would be an absurd situation. The British car has always held its own in its class. The British never have catered for the purchasers of purely utility cars. The policy of the British builder has always been to construct a high-grade piece of mechanism, costing more, which has found a great market in the wealthy old countries of Europe and Asia, and even America; and also to the full extent of the purchasing power in Australia. No one questions the ability of the British manufacturer to hold his own in his own class. We did not see during the war any rush on new makes of American cars in Australia. The motor traders in Australia had two alternatives—sell what they could get or close up their businesses, sack all hands, and destroy a great industry. No British or American capital is invested in the Australian motor industry. All the hard cash and hard labor in developing the trade and putting British cars on the market were all Australian. Before the war it was difficult to get prompt delivery of British goods. We don't agree that it 'is a marvel that we can make a show at all.' It is two years since the armistice was signed, and if our correspondent will examine British Board of Trade figures he will find that in most British industries pre-war figures have been exceeded. Only in the motor trade are there signs of delay in recapturing pre-war export trade, and this is due to the absorption of output in the home market."



Some importers of American cars work on big plans. This photograph indicates the extent of a "private exhibition of American cars," staged in Copenhagen by K. W. Christensen, agent there for Buick and Hupmobile cars and Denby and Clydesdale trucks. Forty vehicles were exhibited and there was music and everything to make a show attractive

Postage on Export Mail

MANY companies which have a central mailing department to handle all outgoing correspondence have found difficulty in getting the right stamps placed upon their foreign letters. In the rush of handling a large amount of mail, a foreign letter generally is included in a bunch destined for domestic points and the result is that a two-cent stamp is placed on the communication going to the Argentine or perhaps Italy. The result, of course, is generally unfortunate. The firm receiving the letter not only has to pay the missing postage and any penalties that may have accrued, but also obtains a very poor impression of the manner in which the offending company handles its foreign business.

One way of combating such mistakes is to have the word "foreign" or the letter "F" written or stamped in the upper right hand corner of the envelope where the stamp is to be placed. When the envelope is addressed, the word or letter is written either on the typewriter or pencil or a rubber stamp may be provided for this purpose. Then, when the letter goes to the mailing department to be stamped, the worker's eye is caught at once with the mark where the stamp is being placed. Thus warned, the proper stamp is affixed and the evidence of this bit of efficiency disappears with the certainty that the receiver of the letter will be unable to exclaim that "another American company has shown carelessness."

A RECENT report of the National Association of Corporation Training states that out of 117 companies from whom information was asked, 36 were making more or less extensive use of rating scales in employment and personnel work. Some twelve companies used such scales to apply to all positions; seven used them for executives only; five for salesmen; five for foremen; two for agents; three for telephone operators, and one for all employees on a salary basis.

The FORUM

Transmission Brakes

Editor AUTOMOTIVE INDUSTRIES:—It is not very often that I find myself opposed to the views expressed in an A. I. editorial, but I cannot help feeling that the recent comment on transmission brakes missed a few points of some importance.

It is my conviction that the best service brake is a transmission brake, when all things are considered, and this is not based on old European prejudice; I hope that I have very little of that left in my make up.

Taking the advantages of the service transmission brake as they appeal to the user: First, there is its great power with small exertion; second, there is extreme ease of adjustment, and third, there is much easier replacement when relining becomes necessary.

Against these unquestioned good points there are three conventional objections: That the brake is dangerously powerful, that it over-stresses the universal joints and that it puts excessive loads on the bevels in the rear axle.

Now, as a matter of fact, it is high speed rather than high unit pressure which is bad for universals, and as for the driving gear pressures, a properly designed brake does not give deceleration greatly in excess of the acceleration on low gear while the total length of time during which a transmission brake would be "hard on" never exceeds a few seconds per hour of driving.

As to the absolute power, this is a question of design. Most transmission brakes, whether American or European, are not particularly well thought out, just as most rear wheel brakes are not of the engineering quality to be expected from that of the rest of the car to which they are attached. Brake design generally has been neglected very much indeed, and has been assumed to be easy, whereas it is really not easy at all.

Many transmission brakes have been made too powerful, because, owing to the compactness of everything, very slight pedal movement is sufficient to set the brake. This can be compensated for by proper proportioning of the various levers or by the introduction of a spring link, positively limiting the pressure that can be applied to a predetermined maximum.

Incidentally the hand-operated transmission brake is far more liable to be too powerful and is far more likely to do damage owing to the facts that the leverage is very great and that the ratchet locks the brake. One of the greatest charms of a good transmission brake is its delicacy of "feel" to the foot, especially when braking on very slippery roads.

While I am altogether in accord with your editorial in its condemnation of the conventional external rear wheel brake it has a point or two in its favor which ought in fairness to be mentioned. First, if both brakes are to be rear wheel brakes, then the double expanding brakes are a little heavier. Also some brake linings are apt to glaze if not occasionally fed with abrasive material. My experience has been that linings with much brass wire are very liable to glaze if perfectly inclosed. Another drawback is that to reline an internal brake costs more than to do the same job on an external one, owing to the necessity for removing the wheels. This last argument, for whatever it is worth, must also be put in favor of making the transmission brake the service brake, if it is used at all, since a transmission brake is easier to remove and reline than any *pair* of rear wheel brakes.

There is little doubt that ideal braking is obtained from brakes on all four wheels. Properly linked, such brakes will never cause skidding and will be more powerful than even the best of transmission brakes, but the mechanical difficulties are considerable.

In the hands of the average owner or repairman the rear wheel brakes on most cars soon get a little irregular in action. The equalizing gear gums up and is never oiled and so forth. In most front wheel brakes the operating system is such that oiling and *intelligent* adjustment are essential, and the user is calling out for less parts to look after. A transmission service brake does simplify maintenance and gives better braking than the conventional system. It is also cheaper by a long shot than four wheel brakes. So, while the ideal system may have a vogue on costly chassis, everything points to the transmission brake as being the best choice for the medium priced machine. A. LUDLOW CLAYDEN.

Some Suggestions to Manufacturers

Editor AUTOMOTIVE INDUSTRIES:

Why don't more car makers install the invaluable gas saving shutters on the radiators?

Why don't they give a man who drives his own car and takes long trips in the summer, or any other time, some protection against the petty thieves who infest garages by putting locks on all door pockets?

Why don't they also protect Mr. Owner from the "smart" garage man who lifts the hood and "adjusts" the carbureter because the car won't start immediately on a cold morning, said protection to consist of good locks on the hood at a cost of $2 or $3?

Why don't they put the horn where there is some chance of a truck driver hearing it, that is, under the left headlight, so that the sound will be thrown forward without interference, and deflected to the right?

Why don't they try out some of the several hundred devices that will cause the headlights to turn with the car so that the road is always lighted even on sharp curves, at least as far as the driver can see around the "bend"? A device of this kind should, in my opinion, be non-operative in the day time, by the turning of a screw, and when in operation only the lamp on the outside of the curve should turn inward on the curve. H. C. MORRIS.

Washington, D. C.

A Book on Carburetion

WE have recently received copy of the second edition of a book entitled Carburetion in Theory and Practice by Robert W. A. Brewer, Crosby, Lockwood & Son, Publishers. New matter contained in this volume includes appendices summarizing data from papers by Professors O. C. Berry and C. E. Lucke and G. H. Baillie.

Wages and Working Hours Are Different Problems

Recent reports indicate that some manufacturers are coupling demands for wage decreases with demands for longer working hours. Fatigue cannot be swept away by fear of losing a job. Proper working hours depend upon sound investigations and analyses. They comprise an entirely different problem than that of wages and should be treated separately.

By Harry Tipper

IN the information which has been received lately concerning the notices by employers as to reduction in wages, it is interesting to note that in a number of these cases the demand is made not only for a reduction in the wages, but for an increase in the number of working hours from eight to ten, from eight to nine and from eight to twelve. This would indicate that, in the minds of many manufacturers, the present is a good time to try to bring back the conditions which existed before the war. It also indicates that in those cases the reason for the cut in wages is not entirely a case of labor surplus in their particular establishment.

There are two elements to be considered in the question of hours apart from the demand of the labor union or the worker, and entirely apart from the custom which has been established in connection with an industry.

On much of the work which is done in various lines of industry, the investigation of the medical profession and the engineers working with them have established a definite relation between the fatigue and the number of hours in each day, so that the production is not actually maintained day after day on an increased scale in proportion to the number of extra hours worked.

The question of fatigue has been occupying the attention of some of the engineers and some of the industrial medical men, but the factors which enter into this fatigue have not been established thoroughly and the results are not entirely conclusive. However, it has been observed that there is a very definite limit to the number of hours which can be worked economically on any given class of work, and these limits vary according to the condition and character of the work.

There is, of course, a considerable variance in the actual fatigue established in the individual case and it is necessary to secure an average from a number of cases in order to determine the general conditions governing that kind of work.

Previous custom is not of much importance in this respect, as the earlier investigation did not deal with the human side particularly, and the knowledge of the human frame had not reached the point where we could determine fatigue with any reasonable exactness or know anything about the factors which enter into it. The bibliography of production is very barren of information on this subject, and it is necessary to go to the medical library to get the best work which has been done upon this matter.

Nevertheless, sufficient has been accomplished to show that the fatigue established by the working period bears a direct relation to the length of the period, and when it is accumulated to a certain degree, it has a tendency to carry over so that the efficiency is not as great at the start of the following day. This, of course, is particularly true in the highly repetitive, monotonous work which requires concentrated effort of mind and hand upon a few rapid operations, but it is true of all classes of work, although the length of the required period varies.

The extension of a half hour in the working period is sufficient to accelerate the production drop very rapidly in the extended period, and it is a question whether the production increase secured in the period of extension is sufficient to justify the operation being continued that length of time.

These manufacturers who are demanding a return to the ten and twelve-hour day without having considered the matter apparently any further than their desire to establish pre-war conditions, are forgetting the fact that the cost of production is a relation between the cost per hour and the production during the same period.

The idleness of machinery frequently costs a great deal more than the idleness of men, and it is better to close down the establishment rather than to run the machinery at a production which is not sufficient to pay the interest charges on the machinery operation.

This is not an absurd picture, as investigations have shown in past years similar conditions existing in industries where long hours have prevailed, without regard to the character of the work and the extent of the fatigue established during the working period.

Sufficient attention has not been paid to the investigation of production curves and the effect upon these of a small decrease or increase in the working period itself. And practically no investigation has been made as to the effect of a long working period, day in or day out, upon the attitude of the worker, his incentive, and the demand for the establishment of a minimum pace. The object, of course, of all operations in industry is to establish the minimum cost per piece in production, and this object is not always to be determined by a calculation of the rate, the hours of work and the average work per hour. There is too much difference in the capacity of the man and the amount of work he is supposed to do

under conditions which do not tend to bring out the full potential power.

It is not so long ago that several industries changing from nine to eight hours found production per man to be the same for the shorter day, and it is interesting to note, that with the new arrangement between the British coal miners and the government, although the hours have been materially shortened, the miners are showing the increase which will justify the wage increase.

It may be that industry will find that a greater number of shifts at maximum capacity with the same machinery will permit of a better production ratio cost than the present method. At any rate, the subject of the hours of labor economically of most value is too much a matter of investigation, analysis and consideration of the medical and industrial factors involved to make it a matter of argument with the workers because the manufacturer happens to have the advantage for the moment.

The question of wage reductions is one thing; if the cost of the articles themselves will not justify the wages that are being paid, it is necessary that those wages should be reduced. The question of hours is an entirely different matter. This is not merely a matter of extending the amount of production. It might be of no value to the manufacturer who paid hourly wages. The only advantage will be in the case of the manufacturer who pays by the day and who hopes to secure a sufficient amount of extra production in the hour or two hours demanded, to pay for the running of the plant during the extra period.

The circumstances under which these demands have been made do not indicate that the manufacturers' investigations have clearly demonstrated the length of working period which would be economically sound for his factory, and it is unlikely that any such investigations have been made as they are unusual and most factories have not attempted to examine the question from this standpoint.

Fatigue is not something which cannot be overcome by fear of the job and it is not swept away simply because the conditions are to the advantage of the employer. It is definitely related to the effort in character and extent, and the length of the period through which that effort must be made. It is just as definite in its consequences, and while it depends to some extent upon mental factors, the result is physical and finds its expression in a decrease or limitation of production.

It is not a question of labor politics or the demands of labor, but it is a question entirely of sound economics and the best economy to the manufacturer. The reason it has had so little attention is that the average manufacturer has not studied the investigations which have been made and the average engineer has not had the opportunity to go into it as it affects the production of the plant.

These changes which are suggested in various localities in accordance with information received, may or may not be justified, but their wisdom is not indicated by the circumstances and it is a mistake to tie up a demand for longer hours with a wage reduction at the present moment. The two things should be treated as different matters and approached in different ways.

Touching Bottom in Seeking a Basis for Wage Payments

WITH numerous factory representatives gathered in one place, it was possible during the New York show to ascertain with some degree of accuracy the general action being taken concerning wages in the industry.

An examination of reports from twenty-two representative automobile concerns, published in a recent number of AUTOMOTIVE INDUSTRIES, shows that eleven of these firms have reduced wages and that eleven of them have not reduced wages up to the present time.

The wisdom of reducing or failing to reduce wages just at this time cannot be finally determined as yet. The real test of the judgment displayed will come later when production is normal and good workmen are in demand. It will be very interesting to the student of industrial affairs to note the production and labor turnover results obtained by the different firms at that time, and in the light of those facts to interpret the wisdom of cutting or failing to cut wages at this time.

There is no disputing the fact, of course, that wages will inevitably fall with the cost of living, but there is some question as to whether they should follow or precede a definite change in that respect. Food and lodging are the two largest items of expense in most families, and while the former has dropped somewhat, there has been no change for the better in the latter. And with rent costing many one-fourth to one-third of earnings, it must be counted as a large factor in living expense.

Wages took a tremendous jump during and after the war, but so did the cost of living, and wages followed the cost of living up—they did not precede it. Moreover, in discussing the present wage situation, it is not feasible to lay undue emphasis upon the percentage of rise in wages since 1914. Before the percentage of rise means anything, it must be established that the relation between wages and the cost of living was a just one in 1914. Undoubtedly it was not in very many cases.

If a certain class of workman was receiving in 1914 much less than was just, he cannot in fairness be expected to justify a decrease now because he has experienced a rise of 100 per cent since 1914. It is manifestly absurd to argue the question of fair wages upon the basis of how much wages have increased since before the war, because it is by no means established that the wage basis at that time was fair.

The difficulty with wage arguments and adjustments lies in the fact that they are placed upon an unsound and unscientific basis. Never in the history of industry have wages been determined upon a fundamentally sound basis; and they never can be until the various factors, human as well as mechanical, which are involved are more thoroughly studied, investigated and understood.

"Until we are willing to take production service as a basis of reward and to analyze that service so that it can be determined in its individual relations," wrote Harry Tipper recently, "wage systems must continue to be arbitrary and in themselves ineffectual in inducing the worker to put forth his full effort in production, incapable of removing the conflict which exists at all times, and insufficient to provide a reasonable measure of justice for all workers.

"Of all the systems for general wage payments being used at the present time the ones which are predicated upon the relation between the individual and the quantity and quality of his production, are the most effective in their general application."

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W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

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Why Not a Competitive Fuel Economy Test?

THERE are indications that a well-organized road test in which suitable prizes would be awarded for the cars that make the greatest mileage per gallon of fuel would attract many entrants and wide engineering as well as popular interest. Such a test would, of course, have to be run under carefully drawn rules which would take into consideration the size and load of the car, and would, to be of greatest value, have to be run under careful supervision to prevent freak methods of driving which no one would consider following in the normal use of a car.

Some manufacturers, especially those who build cars with air-cooled engines, consider that they are in a class by themselves when it comes to getting maximum fuel economy, but there seems to be little doubt but that a well-designed water-cooled car of equal weight could equal if not surpass the performance of the air-cooled car, for it should be able to operate with higher compression ratio, and perhaps a better load factor than the other type, while with proper control of water temperature the cylinder walls need not be unduly cool.

However this may be, under intelligent rules there is opportunity for a competition that would prove instructive, and, we believe, thoroughly worth while. Such tests at least bring out possibilities or establish marks at which to aim in commercial practice. Whatever their advertising value might be it would be of small moment as compared to the engineering stimulus that should result.

We shall be glad to hear from engineers as well as manufacturers who would be interested in or lend their support to such a competition. Comments as to the rules which should govern an event of this character will also be welcomed.

The Chicago Show

THE increased buying which the opening day of the Chicago automobile show made evident is but a concrete expression of improved sales conditions that began evidencing themselves soon after Jan. 1 and are continuing. In former years the increased wave of buying set in motion by the show continued into the spring and summer selling season with increased momentum but there should be careful watching of the show stimulation this year. In two cities, Los Angeles and New Orleans, the show stimulation failed to continue as formerly. Following the New York show, the Gotham dealers have experienced increased sales and manufacturers will do well to follow closely each week the influence of the Chicago show. It yet remains to be definitely established whether or not the wave of sales due to the shows will grow into an appreciably increased volume of business. It should not be taken as an established fact that such will necessarily follow.

The show circuit so far—and reports from distributers from the country—establish the fact that there are two classes of interested visitors:

> FIRST, those that have money but are carefully conserving it and are intelligently studying general conditions. SECOND, those that are temporarily embarrassed due to lack of employment or shrinkage of resources and looking for future information.

It is the lower-priced cars that are most affected by the lack of buying capital. It is in this class that reduced production will be noticed during this year.

Among distributers there are wide differences of opinion regarding price changes. The policy to be pursued is largely individual with different organizations. Several companies, that have made substantial reductions in the past four months and are giving rock bottom values, are not only going steadily on with a manufacturing program but the cars are selling generally. The public seems to be conscious that they are giving good value for the money. Others cannot make price alterations, due to stocks in dealers' hands and heavy inventories. There are sections of the country where the scarcity of money is such that any price reduction would not stimulate

sales because, despite the reduction, the money scarcity would prevent buying.

The Ford situation is creating much discussion and a good deal of confidence is given to the opinion that Ford will have to increase his price or resume production on a 100 per cent basis, and that an increase in Ford price would have a very stabilizing influence on the industry, proving to the doubting Thomases that the bottom has been reached on a number of cars. With so many out of the buying market in the low price field, a resumption of 100 per cent production seems improbable.

The Chicago show is offering the greatest opportunity for studying conditions, but the study will have to be continued for weeks after the show is over. Most manufacturers are going to resume production on one scale or another as a result of the Chicago show and are not placing much importance on such local shows such as those in Minneapolis or Kansas City.

A Factory Service Manager's Task

THE recent meetings of the factory service managers have brought out one point that should make for better service for automobiles in the future. An increasing number of factory service managers are listing for their several service stations the tools that can best be used for repairs on the car with which they are chiefly concerned. In many cases it is necessary for the service manager to design and practically manufacture certain tools so that his car can be serviced at a cost comparable with the service of competing cars. Recently Paul Williams, service manager of the H. H. Franklin Mfg. Co., classified the tools that must be listed as follows:

1—Commercial wrenches (this includes such wrenches as standard open end and pipe wrenches).

2—Specialty tools. These are made by companies making special automobile tool equipment; such as valve grinders, etc.

3—Tools required for the particular make of car the distributer is handling.

If service managers generally would interest themselves to this extent in their service stations, service would begin to look up. It is especially the task of the factory to see that the local service man knows how he can most economically do the work brought to him by the owner.

Thrift Campaigns in Factories

A CAMPAIGN is being carried on to induce manufacturers to institute thrift departments in their factories. In the main, the suggestion is that Liberty Bond campaigns be repeated. It has been suggested to AUTOMOTIVE INDUSTRIES that we endeavor to persuade different automotive factories to enter into a competition to determine which can sell the largest proportion of securities to employees.

But we are not ready to do this. The disappointments of the Liberty Bond campaigns are many. The chief consolation is that it was a patriotic effort. Whatever the results, they were justified by the emergency. The bitter taste is due to the market price of Liberty Bonds since they were sold. Imagine what the impression would be if a campaign was waged in a less worthy cause. Some companies that last winter sold heavily of their own stock to employees on part-payment plans have had a serious time in explaining what has happened, especially when it was necessary to lay off or discharge the purchaser.

But we believe in teaching thrift to workers. It would be a very fine thing if every worker owned some securities, or had other negotiable wealth. You all are familiar with the arguments and there is no use repeating them. We think the idea of inculcating thrift is a splendid one, but we would proceed on low gear.

One man who is prominent in this campaign has stated his reasons for favoring such a campaign very differently from the usual thrift promoter. He says that industry to-day needs much money and that, because of the surtaxes on incomes, this money is not going to be forthcoming from its usual sources—the monied men and women of the country. Therefore, we must find new sources of wealth. The small saver is next on his list. So he suggests that each manufacturer would only be helping himself by inducing his employees to buy.

Very good. But can you assure yourself to-day of an investment that will remain of sufficient value for you to recommend it to the small and more or less uninformed purchaser? It might be well for manufacturers to teach thrift and to encourage savings, but he should be very careful what securities he recommends. Perhaps the establishment of a thrift office, where individuals will be advised as to possible investments, would be best under the circumstances.

The project is a very commendable one if it is carried forward with sufficient caution.

Bankers Recognize the Automobile as a Necessity

IT is interesting to note the worth while comments of bankers concerning the automotive industry, now that they are taking an active part in the financing of our operations. George C. Roberts, the eminent banker who spoke at the Society of Automotive Engineers' dinner during the annual meeting, discussed the "necessity of automobiles" in one sentence. He said, in effect: "The automobile has proven that it is a necessity because no man who has owned one will now be without a car." Slowly the men who have power in financial circles are putting themselves on record in favorable opinions.

A STRONG appeal is being made by the National Foreign Trade Council to members of Congress not to reduce the appropriations for the promotion of foreign trade. The automotive industry should be sympathetic with this promotion. O. K. Davis, secretary of the National Foreign Trade Council, 1 Hanover Square, New York City, can tell those interested how they can best assist.

1920 Exports Double Former Year

Gain of $154,000,000 Largest in Industry

Trade Balance Immensely Favorable to Country—Returned Vehicles Total $11,511,995

WASHINGTON, Jan. 31—Analysis of statistics prepared by the Bureau of Foreign and Domestic Commerce to-day shows that 1920 was the greatest year in the history of foreign trade in automotive products. Exports of automobiles, trucks and automobile parts more than doubled in value in the twelve months period ending Dec. 31, 1920. Sales of passenger cars on foreign markets increased by $91,555,394, the total value of the 142,508 cars being $165,255,921. The 29,126 trucks shipped abroad last year represented a value of $46,765,781 or an increase of 13,641 trucks in excess of 1919 shipments and an increased value of $11,340,344. Imports of 926 cars were valued at $1,026,518, an increase in quantity of 809 cars and $903,493 in value.

There were but two instances where automotive products declined in volume or value. Shipment of airplane parts fell from $3,249,226 to $554,375, notwithstanding the fact that exports of airplanes doubled in value. Sixty-five planes sold overseas last year were valued at $598,274 as against 44 machines with a declared valuation of $215,300 in the preceding year. A slight drop in the volume of marine gas engines was reported, exports for 1920 amounted to 9616 engines valued at $3,283,341 as compared with 10,485 engines valued at $4,363,538 in 1919.

The official figures make clear the fact that the American automobile manufacturers are effectively cultivating foreign markets for their products and the steady and marked gains in this direction indicate that the domestic depression is but momentary.

Import Business Prosperous

There are unmistakable signs that foreign manufacturers have enjoyed a prosperous trade in this country during the past year. The resumption of automotive manufacturing abroad and the careful cultivation of the American market made but little difference in the consumption of American products. The combined exports of automotive products represent a gain of approximately $154,000,000. Imports of automobile parts other than tires for 1920 amounted to $1,252,250 as compared with $278,003 last year, an increase of $974,243. The total imports of automobile and automotive parts were valued at $1,877,736 or a small percentage of the exports.

The year of 1920 witnessed the return in large volume of American cars and trucks to point of manufacture. The records show that 4959 vehicles with a valuation of $7,921,540 re-entered the country without an assessment of duty. This amount is nearly double the value of cars returned in 1919 when 1656 machines carried a valuation of $3,590,455. The business of returning cars to this country fell off in December, 1920, for there were only 42 automobiles valued at $66,041 returned free as compared with 159 cars valued at $390,780 in the same month in 1919.

J. Allen Smith Heads New Car Corporation

SYRACUSE, Jan. 31—The Nera Car Corp. is under process of organization here. It will be headed by J. Allen Smith who recently resigned as president of the New Process Gear Corp. and the United States Light & Heat Co. and as vice-president of the Willys corporation. He will be associated with Carl Neracher who also has held an important position with the New Process Gear Corp. Smith will be succeeded at the New Process Gear Corp. works by Layton R. Burt of Rochester.

Plans for the Nera car which the new company proposes to construct in this city, have not been announced, but it is understood it will be a vehicle especially designed for commercial work and will be ready for the market some time in the next six months. Neracher is the originator of the vehicle which is not entirely unlike an English invention largely used abroad.

Special virtues claimed for it are its exceptionally light weight and economy of operation. The promoters believe it will supplant many of the lighter delivery trucks now in use. Those who have seen the Nera car say that it is a cross between a motorcycle and an automobile and that it will not weigh more than 200 or 300 lbs. It will be capable of a speed of 30 miles an hour.

STEEL PRICES UNCERTAIN

YOUNGSTOWN, OHIO, Jan. 29—Steel prices and steel plant wage rates are still very much unsettled and uncertain. Officials of the larger independents and of the steel corporation properties are unable to forecast conditions in the valley, although there is no note of pessimism. New business is not in the volume that has been confidently expected, however.

BIG MARKET SEEN IN CHINA

BOSTON, Jan. 31—There is a big field for the sale of motor vehicles in China, according to Prof. Marshall L. Perrin of Boston University who has recently returned from a tour of that country.

Propose to Dump 5000 Trucks Here

Slough Company Finds No Market in England for U. S. Used Army Trucks

LONDON, Jan. 21—(*Special Correspondence*)—The Slough Trading Co., headed by Sir Percival Perry, former Ford manager in England, expects to sell in the United States a very large number of rebuilt army trucks and passenger cars, which were manufactured in the United States, and which were bought up at a ridiculously low price. It is understood that at the beginning of the year the company had on hand 10,000 of these vehicles and it hopes to dispose of approximately 5000 trucks in America. Many of the trucks are Packards and Rikers, but the majority were made in the Peerless factory for the British government during the war.

The Slough company's stock is going very slowly in this country as there is practically no demand at this time. As evidence of this situation, it is current gossip that if a man goes down to Slough with 100 pounds sterling in real money in his pocket, the gates are locked and he is not allowed to go out until he has bought something, and that something is quite likely to be a rebuilt 3-ton truck or a rebuilt passenger car.

The company has sent rebuilt trucks, as samples of what can be done, to all the Colonies and initial shipments have been sent to the United States to test out the market there. The lines which are going to America are those which are not well known over here or in the Colonies. The present premium on the dollar makes American business specially profitable at this time and it will be possible for the Slough company to undersell American makers and even used vehicle dealers in their own market.

Congressmen Getting Protests of Dealers

WASHINGTON, Jan. 31—Careful investigation here discloses that under the present law there is nothing which can be done to prevent the dumping on the American market of army trucks made in America and purchased in England by the Slough Trading Co. at a very low price. As a matter of fact, the British traders are not even compelled to pay import duty for the law provides that goods made in this country can be returned without any tariff charges.

The first shipment of these trucks to the United States was dumped on the

(*Continued on page 246*)

Baker Orders Army Truck Inquiry

Problem of Surplus to Be Determined

Anthony Presents Legislation to Dump Excess Vehicles— Reaves Urges Road Need

WASHINGTON, Jan. 31—Congressman Anthony's persistent efforts to dump 10,000 Army trucks on the market as surplus property and the introduction of measures requiring the transfer of this property to the Bureau of Roads for highway construction brought about a crisis in various branches of the Government to-day which resulted in a formal order from Secretary of War Baker directing the Inspector-General of the Army to conduct a thorough inquiry. There is some question as to the time required in the investigation but it is understood that the incoming Secretary of War will continue and possibly broaden the activities of the Inspector-General to a general inventory in order that the controversy may be definitely settled.

The Army appropriation bill which Congressman Anthony reported out to the House Saturday as chairman of the sub-committee on appropriations, carried legislation which "the committee has found necessary in order to carry out its policy of forcing an economic and efficient administration of the War Department, to freely resort to the use of limitations upon various funds, and in some instances in order to compel the sale of certain unnecessary supplies."

The chairman advised AUTOMOTIVE INDUSTRIES that this proviso was inserted to compel the War Department to declare 10,000 trucks as "surplus" and sell them. He stated that inquiry convinced him that the Bureau of Roads had sufficient trucks and motorized equipment and could not absorb the surplus material of the War Department.

Would Limit Motorized Units

The legislation which the Anthony committee introduced would limit the War Department in issuance of motorized equipment to National Guard organizations, contending that the infantry units should be developed and "minimize the organization of those branches of the guard which require the issue and maintenance of animals and motors and special technical equipment." The grand total of the Army bill providing for the support of the organization is $331,222,612.12 or $63,477,965.08 less than current appropriations and $368,052,890.31 under the departmental estimates.

It is quite possible that this proposed legislation which the Kansas congressman intends to push through the House will be blocked on the ground that it is new legislation and not authorized by law. The attachment of these "riders" to appropriation measures is one of the principal causes of filibusters which delay essential money bills.

The fact that the passage of the Anthony measures would defeat the purposes of the Reavis bill introduced in the House last week indicates that a strong fight will be made to block the "rider." Congressman Reavis introduced a bill at the last session which would require the War Department to transfer surplus motor equipment to the Bureau of Roads but it met with a pocket veto. A similar measure was presented by him last week. National organizations of highway officials are in favor of the Reavis bill which would allow the various States to obtain trucks, tractors and other machinery at small cost. It would also prevent dumping this used equipment on the present overstocked market.

Both Reavis and Anthony claim that this equipment is rotting at camps here and abroad. The Inspector General must submit a report on three charges. He is also directed to inquire into allegations as to disposal of equipment through the sales department of the Surplus Property division.

R. C. Durant Joins New Durant Motors

NEW YORK, Feb. 1—R. C. (Cliff) Durant, son of W. C. Durant, will have charge of the distribution on the Pacific coast of the cars which will be manufactured by Durant Motors, Inc. He will also be in charge of an assembling plant which ultimately will be erected at Oakland.

As soon as his father announced the formation of the company which he will head, the younger Durant resigned as vice-president of the Chevrolet Motor Co. of California. With him will be C. M. Steves who has been Durant's assistant for several years in active charge of the Oakland Chevrolet assembling plant. Both men will give all their time to the new organization.

JEFFERSON PRODUCTION NEAR

JEFFERSON, WIS., Jan. 31—The Jefferson Rubber Co., which is erecting a new tire and rubber goods manufacturing plant at Jefferson, Wis., to be ready for production about Feb. 15, has made a return gift of $15,000 in cash to the Jefferson Realty Co., which provided a bonus of $25,000 four months ago to secure the industry for the city. The new factory is 80 x 300 feet in size and now fully enclosed, so that interior work is under way and some equipment is already being installed.

Limited Production Proposed by Ford

Not More Than 5,000 Men at Work—Few Cars to Be Made in February

DETROIT, Jan. 31—Approximately 5000 men returned to work to-day at the Highland Park plant of the Ford Motor Co. Virtually all of them are engaged in getting the plant ready for production, but the manufacture of cars has not been resumed and it is impossible to learn when it will be. The force will be increased gradually and when production is begun, it will be on the basis of actual sales and it will be some time before anything like a real working force is employed or quantity production started. It is safe to say that comparatively few cars will be made in February.

None of the parts makers who supply Ford have been given opening orders save the Briggs Mfg. Co. which makes coupe bodies. That company has recalled about 1000 men or 40% of its normal force on the strength of instructions from Ford, but it is said the order does not specify the number of bodies Ford will want or when his production will begin.

The parts manufacturers are under the impression that the probable production in the Ford factory for February will not be large enough to warrant them in reopening their plants. The Fisher Body Co. is taking on a few men each day on account of the gradual improvement in business.

The Liberty Starter Co., which makes all the Ford starters except those manufactured in the Ford factory, has not been ordered to resume operations. Officials of the company say they have no surplus and expect to receive instructions to start as soon as Ford production begins.

Formal Statements Withheld

It still is impossible to obtain any authoritative statement covering the Ford situation. Edsel Ford has not been discharged from the hospital where he recently was operated on for appendicitis and so many of the officials of the company have resigned, that those who are left are not taking any chances of unpleasant consequences by discussing the present situation. Nothing definite is known here of the progress of the negotiations for a large loan. It is understood that representatives of the Guaranty Trust Company, The Chase National Bank and the Liberty National Bank, all of New York, are participating in the financial parley. Bankers here are skep-

(*Continued on page* 243)

Many Bankers Attend Chicago Show Meet

Inspiring Addresses Feature Big Dealer Event—Urge Conservatism in Methods

CHICAGO, Feb. 1—Courage and clear headedness were held up as qualities necessary to carry on through the present business situation by speakers at a rousing trade rally with which the Chicago Automobile Trade Association, the National Automobile Chamber of Commerce and the Motor & Accessory Manufacturers Association opened the week's activities. Twelve hundred and twenty-five men, distributers, dealers and salesmen from Illinois and surrounding States, and manufacturers from all parts of the country, attended the dinner, which was alive with enthusiasm and which got everybody set for a week of hard work at the show.

Presided over by Leo A. Peil, president of the Chicago association, the program presented to the big crowd included George M. Graham, vice-president of the Pierce-Arrow Motor Car Co.; H. H. Merrick, president of the Great Lakes Trust Co., and A. R. Kroh, who has spoken at hundreds of farmers' and business men's meetings throughout the country. Significant in the attendance was the presence of a large number of Chicago and Central Western bankers, who rubbed elbows with the automobile men and heard Graham's address on the essential place of the automotive industry in the development of the country.

Graham cited history to prove the stability of the country and to show the soundness of investments in its future. He said that business had been running on too rich a mixture.

Graham defended the sales departments against critics of their methods during the period of easy selling, declaring that they never ceased fighting for business for their companies, no matter how easy orders came.

Merrick bespoke the faith of bankers in the automotive industry and urged upon it courage, conservatism and balance as sure builders of the road to success.

Kroh presented his picture of the benefits to accrue to industry and commerce from the improvement of farm conditions possible through diversification of crops and use of labor and time saving machinery.

Easier Credits Help Ohio Trade Recovery

TOLEDO, Jan. 31—The number of unemployed here is gradually growing smaller because of increased industrial activity in Toledo manufacturing plants. The improved situation and the stimulation given by the automobile show are helping sales of motor cars. Dealers are making some sales for immediate delivery and more for April delivery in the city and though dealers in the outlying territory are taking only a few cars at a time, they are not standing still.

Credit and used cars remain the big obstacles to sales all through the territory, as elsewhere in Ohio. There is no more bank discrimination against the industry but financial houses simply haven't the money to loan on account of their investments in frozen industrial and agricultural inventories. Acceptance corporation rates are so high dealers and customers are protesting. However, the bank situation is better, with factories getting into production again and with farmers, on the eve of the planting season, letting go some of the crops that they were holding for higher prices.

United States Leads in Trailer Industry

WASHINGTON, Jan. 31—American consuls in all parts of the world have reported to the State Department on the possible market for motor truck trailers manufactured in the United States. These reports show that this country is far in advance of all other countries in the use of this economical aid to highway transportation, notwithstanding England was first to adopt the principle of trailer transportation and there are about a score of trailer manufacturers in Europe, located in England, France, Italy and Germany.

The United States, with about 75 trailer makers and probably 50,000 trailers in use, leads the world in this new industry. Trailers are being exported in limited numbers from this country to many parts of the world, including Canada, the West Indies, some South American countries, England, Scandinavia, West and South Africa, the Philippines and even China.

KALAMAZOO NAMES OFFICERS

KALAMAZOO, MICH., Jan. 31.—The Kalamazoo Motors Corp. at its annual meeting in this city re-elected H. A. Crawford president, and Joseph E. Brown of Kalamazoo to succeed William Johnson of Sioux Falls, S. D., as vice-president. R. M. Gregory and W. B. Milham continue respectively in the offices of secretary and treasurer. Two changes are reported in the board of directors, B. A. Bush and Glenn L. Shipman succeeding Frank H. Milham and A. L. Pratt.

ENGINEERS ESTABLISH PRIZE

NEW YORK, Jan. 31—The American Society of Civil Engineers has accepted the offer of the Engineering News-Record to establish an Arthur M. Wellington prize to be awarded annually for the best paper presented before the society on any phase on the science and art of transportation, whether by land, water or air. The prize is a memorial in honor of the former editor of Engineering News and consists of the income from a fund of $2000.

Metropolitan Sales Doubled in January

Steady Upward Trend Experienced Following Show—Look for Normal Spring

NEW YORK, Jan. 31—January showed a slow, steady upward bending of the sales curve in the Metropolitan district. With motor car sales showing a gain over December of 50 to 100 per cent, territorial distributers are convinced that they have "turned the corner" and that there will be a gradual resumption of buying to a point probably within 50 per cent of last year's abnormal figure.

Nobody is making extravagant claims for spring. They realize that the January sales record contains the New York show impetus, and that the succeeding months will have to stand on their own legs, aided slightly, perhaps by the closing of show prospects.

New York's greatest encouragement is the optimistic reports from the smaller dealers of the territory. Wholesale orders were particularly good following the show and the weekly reports of sales indicate a decided weakening in the buying apathy in the territory. Aggressive selling of the past two months is having its effect.

Truck distributers feel somewhat encouraged, but have experienced very little increased trade. The truck business is described as "spotty" which is taken to indicate that it is reacting to the resumption of business in various industrial lines.

With the settling of the weather and the beginning of building operations, which are expected to open on a fairly large scale, a decided increase in the sale of trucks is expected.

The weather and the resumption of spring business is also a factor in the consideration of spring business by the passenger car dealers. It is felt now pretty generally that the breaking of the mild winter to date by a heavy storm or two may postpone the actual opening of spring buying a week or two, but it is too late in the season to have any effect for a longer period.

WILSON LISTS NEW OFFICERS

PONTIAC, MICH., Jan. 29—There have been several changes among the officers of the Wilson Foundry & Machine Co. for which reason a list of officers and directors to date has just been issued. The officers are: President, Charles B. Wilson; vice-president and general manager, D. R. Wilson; secretary, W. E. MacKenzie; treasurer, C. E. Killinger; assistant treasurer, Dave J. Moreland. Directors: Walter C. Chrysler, F. K. Dolbeer, C. B. Wilson, G. R. Spencer, D. R. Wilson, C. E. Killinger and J. E. Kipperley. Officials express confidence as to the future and believe that before the end of February the big plant will again be in big production.

Chain Company Sues to Protect Patent

Infringement of Weed Rights Alleged in Suit Against Philadelphia Companies

WILMINGTON, DEL., Feb. 1—Suit has been started in the United States District Court here by the American Chain Co., Inc., against the United Auto Stores, Inc., of Delaware, and against George J. Campbell for infringement of the Weed chain patent No. 768,495, granted Aug. 23, 1904. Both defendants have their principal places of business in Philadelphia. A motion for preliminary injunction has been set for hearing before Judge Morris on Feb. 14.

It is alleged in the complaint that a chain of the so-called reversible ladder type was manufactured by Campbell so that it closely resembled in construction and general appearance the genuine Weed grip, but containing inferior quality material and workmanship. These chains were sold by the United Auto Stores. Except for the acts of the defendants, it is declared there has been general acquiescence on the part of the public in the rights of the American Chain Co. under the Weed patent.

It is further alleged that the defendants are engaged in unfair competition in that the chain grips made by Campbell and sold by the United Auto Stores are provided with cross-chains having a light coating of copper plating which contrasts with the gray coating of the side chains, giving these chains an appearance decidedly similar to the distinctive dress that has long been given to the Weed grip by the American Chain Co.

Parsons Patent Expired

NEW YORK, Feb. 1—Life of the patent granted Harry Parsons, known technically as No. 723,299, under which the Weed tire chains had been made for seventeen years, expired March 24, 1920. This was controlled by the American Chain Co., which succeeded the Weed Tire Chain Co., and purchased the Weed holdings. The company also owns the Weed patent No. 768,495. The Parsons patent covered a chain put on zig-zag fashion, and the Weed a chain which goes straight across the tire.

GRAND RAPIDS PLANTS RESUME

GRAND RAPIDS, MICH., Jan. 31—The The Hayes-Ionia plant has taken back 500 men and will be back to normal Feb. 15. Three hundred employees will return to the Macey company's plant Monday.

CORRECTION

An error was made in the issue of AUTOMOTIVE INDUSTRIES of Jan. 20 in its account of the decision of the United States Supreme Court sustaining the right of revenue officers to seize any automobile containing contraband liquor regardless of whether the owner had knowledge of the illicit use to which the vehicle was being put. The article stated that the particular car in question was loaned to a friend. This was an error because the car had been sold to J. W. Goldsmith by the Grant company although only $800 had been paid on it and the Grant company retained title as the actual owner. The Grant company had no knowledge whatever of the transportation of liquor in the car but the vehicle was ordered forfeited.

Diamond T Restrains Cut-price Advertising

ST. LOUIS, Jan. 31—A perpetual injunction has been granted in Federal court by Judge Faris to the Diamond T Motor Car Co. of Chicago, restraining Harry Newman, Inc., of this city, from advertising or offering for sale Diamond T trucks at less than their listed price. In the petition for an injunction, it was alleged that the defendants were former distributers of the truck in St. Louis but that their contract was cancelled for good reason and that they were advertising in twenty-five of the larger cities of the country that they would sell Diamond T trucks at a 35 per cent discount without any intention of makng bonafide sales, but with the malicious purpose of injuring the motor car company and for the further purpose of forcing the settlement of a law suit then pending.

Judge Faris appointed a special master to establish damages and in granting the injunction, declared he never had seen a case "that equals the malice involved in this."

BADGER INCREASES CAPACITY

MILWAUKEE, Jan. 31—The Badger Mfg. Corp. of Milwaukee, maker of bumpers, tire carriers, racks, creepers, cutouts, steering wheels, etc., has moved into quarters where 45,000 sq. ft. are available, as against 26,000 sq. ft. in the former plant at 313-315 Milwaukee Street. The new factory is one erected several years and until now occupied by the Harley-Davidson Motor Co. as its automatic screw machine shop. The Badger Corp. was formed in 1917 as the outgrowth of the Auto Parts Mfg. Co., organized in 1914. It is capitalized at $300,000 and is increasing its force from 150 to 200 men. The business of 1920 aggregated nearly $1,000,000, against $601,000 in 1919. Charles H. Hathaway is president; John T. Johnston, vice-president, and Walter V. Isgrig, secretary and treasurer.

OILGEAR TO MAKE PARTS

MILWAUKEE, Jan. 31—A charter has been granted to the Oilgear Co., incorporated under the laws of Wisconsin with $500,000 capital stock, to engage in the manufacture of hydraulic transmissions and devices for the automotive and general industries. The promoters are represented by J. A. Dietrich, Howard T. Foulkes and J. A. Wickham, of the law firm of Quarles, Spence & Quarles.

Interlocking Tire Officials Resign

Complete Re-organization of the Company Is Planned by Stockholders and Creditors

AKRON, Jan. 31—Creditors and stockholders of the Interlocking Cord Tire Co. of Akron and Mogadore will completely reorganize the company and name new officers to replace present directors and four of the main officers who are under criminal indictment for alleged violation of the Ohio "blue sky" law. Announcement to this effect was made following the formal offer of Walter Kline, president; C. E. Foust, secretary; J. W. Rinear, treasurer, and L. W. Rinear, sales manager, to resign as officers of the company in order to permit lifting of the temporary receivership under which the corporation now is operating. Kline and his co-officers made the offer of resignation before Judge Willard Wright in Common Pleas Court to-day.

Kline is indicted for alleged violation of the "blue sky" law and on a charge of obtaining money under false pretenses. Foust and the two Rinears are indicted under the "blue sky" law for alleged assistance in flotation of the corporation's securities without a State license.

Following the offer of resignation, thirty-six creditors of the company, whose claims constitute approximately $75,000, met and agreed tentatively to accept the offer and to proceed at once with the reorganization of the company. F. B. Hood, Arthur Sweeny, Frank Lea and W. B. Smith, who were recently elected to the directorate of the Interlocking Cord Tire Co., but who have not as yet qualified for such official capacity, have also offered to resign, it was announced.

Creditors named a committee consisting of W. H. Flower, chairman, F. J. Bents, L. E. Newman, Otis Prier, R. B. Koontz and P. E. Welton to confer with stockholders on the matter of reorganization. A meeting of stockholders will be called, it was announced, to consider the proposal and ratify the plans and also to select representatives on the new board of directors.

Officers Deny Allegations

Indicted officers of the company have issued sweeping denials of all charges contained in the receivership and the criminal indictments. In a formal statement they charge the receivership and grand jury actions to be the result of an alleged attempt upon the part of a few stockholders to form a conspiracy to "ruin the company," and that the indictments were sought "simply to scare more stockholders into the opposition camp," it being stated by the officials that stockholders originally petitioning for the receivership never at any time represented more than 10 per cent of all shareholders.

Burleson Defends Junker Plane Use

General Efficiency and Economy Factor in Purchase—American Craft Little Used

WASHINGTON, Jan. 29—Responding to a House resolution demanding information relating to purchases of Junker aircraft, Postmaster-General Burleson to-day advised the Congress that Junker planes have demonstrated their efficiency and economy in actual demonstrations.

The Postmaster-General said:

"The Junker airplanes purchased by the Post Office Department represent a forward step in airplane development over the development at that time in this country. Their operation over 30,122 miles gives 5.1 miles per gallon of fuel, as against an average of about 2.5 miles per gallon with the planes and motors in the air mail service. The cost of flying operations with these planes is about 30 per cent less and the cost of maintenance and upkeep about 50 per cent less than is the flying cost and maintenance cost of the Liberty motored De Haviland planes turned over to the Post Office Department by the Army and Navy.

"On the other hand, the cruising radius of the Junker plane is at least 50 per cent more and the possible mail load is nearly two and one-half times as great as that of the surplus war planes with which the air mail is principally operated. Whether the relatively low cost of maintenance of a Junker plane over a De Haviland will continue as the planes see more service is something that is being determined by the daily operation of these planes by the side of the De Havilands.

"When the German planes were put into service by the Post Office Department, after planes of this type had made a number of remarkable long-distance runs for other parties, defects in the fuel installation and in the engine compartment, ventilation and drainage were discovered through planes catching fire in the air.

Construction Defects Corrected

"These defects of construction and engineering were promptly remedied by the Post Office Department, since which time the planes have been operating steadily in the mail service without fire hazard or casualty of any character to the crews operating them. The safeguarding against fire hazard, as the result of the accidents to the Junker planes, has been of great importance to aviation and has resulted in the elimination of fire hazard in other mail ships."

Actually, the Post Office Department bought eight Junker planes, for spare parts to the value of two additional planes were obtained to keep the other six machines operating. The purchases were made direct from the J. L. Aircraft Corp. at a cost of $200,000. It was announced that 215 planes of American make are in possession of the Post Office Department at this time, of which 65 are now in use. The remainder are either in warehouses or being remodeled.

GERMAN PARTS MAKERS UNDERSELL AMERICAN

SPRINGFIELD, MASS., Feb. 1—German competition in the sale of automobile parts has already been felt by American manufacturers. Investigation by the American Bosch Magneto Co. discloses that German manufacturers are offering South American consumers Bosch magnetos and parts at prices with which the American company cannot compete.

Army Air Appropriation Reduced to $19,200,000

WASHINGTON, Jan. 31—The House Committee on Appropriations has disregarded the appeal of Brigadier General Mitchell, assistant chief of the Army Air Service and has recommended the appropriation of only $19,200,000 instead of the $60,000,000 asked, for the development of aviation as a means of military defense.

In his appeal for funds, General Mitchell insisted that the airplane had become superior to the battleship and that a well-balanced military program must include a military aerial force to be effective in the next war. He stated that a sufficiently large force could be formed and equipped in three years at a cost of $45,000,000 which represented no more than the cost of a battle cruiser. He contended that the armored ship is just as helpless as the armored knight was when firearms were brought against him.

PEUGEOT OUT OF 1921 RACING

PARIS, Jan. 21—(*Special Correspondence*)—Peugeot will not take part in any automobile races this season, according to a decision of the Board of Directors of this important French company. This decision comes as a surprise, for not only has Peugeot been a very strong supporter of racing in the past, but it has a set of 183 cu. in. racing machines all ready. This policy removes a possible competitor from the Automobile Club of France Grand Prix for next July, and makes it very unlikely that any Peugeot cars will be sent for the Indianapolis race. General business depression is said to be the reason for Peugeot's withdrawal from racing.

DAIMLER DOUBLES CAPITAL

NEW YORK, Feb. 2—A dispatch from Germany states that the Daimler Motor Company of Stuttgart, which manufactures the Mercedes car has increased its capital stock from 100,000,000 shares to 200,000,000 shares.

Landing Place Lack Halts Air Progress

Development Dependent Upon National Action in Providing Facilities, Says Professor

BOSTON, Jan. 28—Boston has an opportunity of gaining fame as an aviation center. Prof. E. P. Warner of the aeronautics department of Massachusetts Institute of Technology, yesterday told how this city, this State or this country might advance the use of airplanes, and the secret is for the municipality, the State or the country to provide landing places for the ships of the air.

"We are making progress in perfecting the airplane—making it more serviceable and less dangerous—but the whole program of aviation has practically come to a standstill as far as the public making use of it," declared Professor Warner.

"An aerial taxi-cab in London costs approximately the same as an earthbound taxi in Boston. The charge in England for an aerial taxi is 2s 6d, or 44 cents for two persons per mile. This fare is only two and a half times as large as that for an earthbound taxi and it costs approximately the same amount to travel by airplane in England as by taxi-cab in Boston.

"We can do as well with our American planes and costs if the proper support is given to us by the public and the government. The government ought to encourage private enterprise in aviation, for commercial purposes and as sport.

"But private capital is slow to take up aviation probably because of the high cost of landing places. The nearest landing places to Boston are at Lynnfield and Framingham. In Texas and California the towns are granting lots for landing places and those States should go ahead fast in aviation.

"It would be somewhat more difficult for a city or State in New England to buy landing places because property is more expensive and it is harder to develop aviation here and because there are so many trees and so few landing places in case of emergency.

Potential Business Here

"However, the potential business is here. Airplane service between Boston and New York could be established to make the trip in less than three hours. But very little time would be saved by airplane if a person had to land in Framingham at this end and Long Island in New York."

Professor Warner said the actual costs of air travel in Europe have shown a tendency to steady reduction. He asserted that the fare charge on the London-Paris route was originally 20 guineas, but has since been decreased several times, and now stands at 10 guineas ($37) for the one way journey and 18 guineas for the round trip.

Russian Trade Ban Not Insuperable

Border Countries Present Way to Meet Obstacles—Payments Chief Difficulty

WASHINGTON, Jan. 31—Although the export of automotive products to Russia still is technically under the ban of the State Department on the ground that most of these products might be used for military purposes, there are no insuperable obstacles in the way of American trade with the Soviets. This is admitted unofficially at the State and Commerce departments. Whatever trade is done, however, must be through Scandinavia, Poland or some other country bordering on Russia. Direct shipments could not be passed through the custom house, but no obstacles would be placed in the way of shipments to some consignee in one of the bordering states.

As a matter of fact, the chief difficulty confronting an American automotive manufacturer who seeks an outlet for his goods in Russia is making satisfactory arrangements to get payment for the goods. If this can be done, the hardest part of the problem has been solved.

Trading with Russia is very largely a question of ethics. Manufacturers in other countries are doing it and making no bones about it. It is significant of the high sense of honor of American automotive manufacturers that no applications have been made to the State Department for permission to ship to Russia since the ruling in reference to their products was made by the State Department. Even more significant is the fact that neither the State nor the commerce departments has received any report of surreptitious trading.

Russia offers a large potential market for small tractors and the State Department undoubtedly would permit their export. It would be difficult to make a military weapon out of such a machine. It is no secret that a considerable number of Fordsons have been absorbed by Russia.

No Espionage Maintained

The State Department does not maintain an espionage system in the countries bordering Russia to determine whether its regulations in regard to trade with the Muscovites are being violated. It has no funds to pay secret agents and apparently no disposition to interfere. It is stated frankly that there is nothing to prevent the export of cars and trucks from this country into Russia through Denmark or Poland if the shipper has an agent to get the goods across the line and if he is enough of a financier to work out some satisfactory method of payment.

The Danish committee for the resumption of trade with Russia has established at Copenhagen the International Clearing House with a capital of 2,000,000 crowns to foster trade with the Soviets. The All Russian Central Union of Consumers Societies has deposited 2,000,000 rubles in gold in the Danish National Bank as security for the exchange of goods and credits. This is designed as a revolving fund and it is expected that much of the trade will be on a barter basis.

The Soviets are stated to contemplate increasing this fund to 25,000,000 rubles in gold and it is known that they have established other credits for trading purposes in neighboring countries although most of their commerce at present is going through Copenhagen.

Ford British Output Totals 40,500 in 1920

LONDON, Jan. 14 (*Special Correspondence*)—Ford's Manchester works produced 40,500 vehicles last year and employed about 4000 hands. This output is stated to be 20,000 better than ever before.

Moreover, the result has been financially good, ordinary workers at 60 cents the hour getting $35 bonus and higher paid workers, if engaged not later than 1915, $195 bonus. The rest of the staff eligible for a bonus share also will benefit. Further, 50 per cent or half the workers, by virtue of being investors in Ford stock, on which they get 6 per cent interest per $50, will receive an extra 6 per cent.

Saskatchewan Outlines $24,000,000 Road System

SASKATOON, Sask., Jan. 31—Plans for the construction of 1607 miles of paved highways throughout Saskatchewan have been evolved by C. J. Yorath, city commissioner of Saskatoon, and will be laid before the provincial government for consideration. The program of road building, it is estimated, would cost $24,000,000. It provides for a pavement fifteen feet wide on all highways and the gradual recovery of the money expended by a system of toll-gates such as are still in use on turnpikes in certain American States. California's paved automobile highways are suggested as the model.

URUGUAY PLANS HIGHER TARIFF

NEW YORK, Jan. 31—Increased tariffs to protect the local body building industry is proposed for Uruguay, according to a report from Vice Consul Avery at Montevideo. The Minister of Finance, the Consul states, had sent to the Administrative Consul the following proposals for increases: Automobiles of bonded value not exceeding $700 shall pay an import duty of 10 per cent; those above that value shall pay 20 per cent on the value of the chassis, and 25 per cent on the value of the body. All automobiles shall pay "additional duties" which amount to about 14 per cent. Trucks shall pay 5 per cent of their value but are exempt from paying the additional duties.

Fuel Shortage Hurts South African Trade

Government Aid in Meeting Problem Sought—American Cars Gain Popularity

JOHANNESBURG, SOUTH AFRICA, Jan. 3—(*Special Correspondence*)—The petrol question is still exercising the minds of those connected with the motor trade. Supplies have been more generous during the past month but the situation still leaves a great deal to be desired. It seems that while other sections of the commercial community have received consideration from the Government the motor trade has been singularly neglected in this respect. With all due regard to this the motor trade continues to be one of the most flourishing branches of the community.

Houses have in some cases gone as far as to import stocks of fuel entirely independent of the oil companies and the trade generally seeks either a decontrol with a free market or that the control take the form of a percentage on the landed cost. Letters to the daily press have been suggesting the importation of petrol in bulk instead of the method that at present prevails. Facilities for this measure exist at several ports of the Union and this certainly seems a feasible way out of the difficulty. The question of shipping has however to be considered in this connection but in view of the fact that the shipping position here is gradually getting easier this ought not to be an insurmountable difficulty.

Sales of cars have shown a rise over the figures for last month and dealers are optimistic about the car position. The action taken by certain banking institutions from the countries of export in regard to bills drawn and presented by shippers will tend to make the number of cars now coming to South Africa less and less until the usual facilities are resumed. The decreased prices of cars at the factory caused a stir for a short while, but has not made any difference in sales, and the demand for automobiles continues as strong as ever.

Light Weight Car Popular

The Spacke has arrived and bids fair to become a favorite if the inquiries for a car of this class can be quoted as authentic. The English small models that are imported are too high priced to place them within the reach of many, and the Spacke fills a long felt want in the small car class. Dealers have taken trips to Cape Town in order to fix up rights for various parts of the country.

South Africa is gradually marketing accessories of home invention and manufacture. The latest is a special stand for motorcycles. Very favorable comment has been made by those who have witnessed the ease of control of this stand and quantities are in the process of manufacture in order to cope with the demand that has arisen in motorcycling circles.

Fourth Reserve Bank Finds Trade Better

Lower Prices and Easier Credits Help Inaugurate Buying in Cleveland District

CLEVELAND, Jan. 29—The great army of automobile owners who trade in used-cars in purchasing new cars are coming into the market to boom sales, according to the business forecast of the Federal Reserve Bank of the Fourth District. This is a source that is going to send the automobile business soaring ahead of the volume of trade in the average line of business according to reports received at the bank.

These used car owners have for some time been watching readjustment developments that send down the value of their used cars. Now they are getting to the point where they want to buy before the general readjustment process further reduces their second hand valuation. The bank says that there are fewer buyers of low priced cars in the market.

Motor truck manufacturers report increased buying in practically all sections of the country; public utilities are placing orders, and according to one large producer "there is every indication of considerable business from large industries." Makers of passenger cars comment on the fact that sales at the New York show, while not as large as a year ago when the shortage was so great, were quite in keeping with the records of all previous years.

Speaking of general conditions in the Fourth Federal Reserve District, the bank says that the turn of the year has witnessed a decided change in business sentiment. Reports this month are almost a unit in declaring that signs point to improvement in the business situation. Easier credit conditions are reported Lower prices for commodities mean lowered costs of doing business with a consequent release of additional credit. This may not become apparent until many large inventories purchased at top prices have been worked off, but it is a condition that will ultimately develop as a result of the resumption of business.

Tractor Demand Shows Steady Gain in Year

CLEVELAND, Jan. 29—That the tractor has been slower to come into widespread popularity than the truck or passenger car is not due to lack of merit or lack of desire on the part of the farmer, says L. W. Ellis, of this city, who has taken a leading part in advertising the tractor. Putting the tractor on the farm means the substitution of individual power for motor power, a complete new plan of operation for the farmer, and the scrapping of old plans. The farmer has been slower to work out the solution than they have in other lines, and the tractor is not so old as the truck and passenger car.

But it is working out in Ohio. Ohio farmers, for instance, had 8313 tractors in use last year as compared to 4279 in 1919, a gain of nearly 100 per cent in two years. Figures for the United States show that nearly 200,000 tractors were made and sold in 1920, as compared to the 300,000 that were in use up to the end of 1919.

R. T. Hodgkins, sales manager for the Cleveland Tractor Co., says that prospects for 1921 are even better than they were for 1920. He says that his company has sold many more tractors in December 1920 than they did in the corresponding month a year ago, and that dealers have small stocks on hand.

Bower Bearing Yields $90,000 Profit in Year

DETROIT, Jan. 28—The annual statement of the Bower Roller Bearing Co. shows that during the fiscal year ended Dec. 31 the company made a net profit of approximately $90,000. The report of the company states that at the end of the first six months last year profits totaled $122,400 but that during the other half of the year the company lost $34,-993. The sales for the first half of 1920 totaled $769,755 and for the second half of the year they were $320,395, or a total of $1,090,140. During 1919 the business totaled $1,603,205.

The Bower company paid its stockholders $90,000 in dividends during the first six months of 1920, or about $3000 more than the total net profits made during the year.

The company has kept its personnel of skilled workers during the period of depression and is in a position to go ahead increasing its production at any time. The plant has been given a thorough overhauling and is in better shape to take care of business than ever before. Officials declare that they are confident as to the gradual return of activities in the automobile industry.

TOPP-STEWART ADDS DIRECTORS

CLINTONVILLE, WIS., Jan. 31—The Topp-Stewart Tractor Co. of Clintonville, Wis., at its annual meeting, increased the number of its directors from seven to nine, the new members being H. A. Rindt and Theodore Meyer. Officers were re-elected as follows: President, Dr. W. H. Finney; vice-president, H. F. Zarling; secretary, A. C. Cather; treasurer, Levi C. Larson. Active production will be resumed about Feb. 1 at a materially increased scale, which is required mainly by a wholesome enlargement of foreign demand. Domestic orders also are accumulating at a satisfactory rate.

CREDITORS SUE PERFECTION

MILWAUKEE, Jan. 31—The Perfection Engine Co. has been made defendant in involuntary bankruptcy proceedings by the following creditors: North Milwaukee Foundry Co., with a claim of $2,939; Badger-Packard Machinery Co., $125; Detroit Auto Radiator Co., $720.

Diversity of Crops Urged to Help South

Georgia and Alabama Dealers' Associations Foster Movement to Increase Prosperity

ATLANTA, Jan. 31—A movement to encourage a program of diversification of crops on Georgia farms through a campaign that is to be inaugurated and carried on systematically through every county of the state, is to be fostered by the Georgia Automotive Dealers' Association, according to a decision reached at the annual convention held here.

The impetus to the movement was given by A. R. Kroh in an address before the second annual convention of the association. Kroh, who is himself a practical farmer, pointed out that since 1900 more than 10,000,000 farmers have left the rural districts for the cities and as a consequence the cost of living is mounting higher and higher because America consumes more than it produces.

Kroh went thoroughly into the subject of power farming, discussing this phase of the industry from the dealer's standpoint and showing how diversification of crops on Georgia farms would mean an enormous increase in the demand for power farming equipment, principally tractors.

While the movement to bring about a diversified program will be fostered by the automobile association, bankers, merchants and industrial leaders throughout the state will be asked to assist in the work. Plans are being formulated by association officers to arrange a general meeting for the near future and invitations will be extended to business men to attend. It is believed this meeting will probably be held during the week of the automobile show, March 5 to 12. The principal address will be delivered by Kroh, who will explain the whole program of diversification exactly as it is to be encouraged by the automobile association.

A similar movement is already under way in Alabama, fostered by the Alabama Automobile Dealers' Association. An address was delivered by Kroh at the sixth annual convention of the Alabama dealers held at Albany, Ala., Jan. 24. The following day a conference of bankers, business men and merchants was held at Birmingham, where the movement was endorsed and it was decided to carry it out during the coming year under the auspices of the automobile association.

I. M. C. TO REDUCE WAGES

NEW BRUNSWICK, N. J., Jan. 31—The branch factory of the International Motor Co. here posted a notice yesterday of reduction in wages ranging from 10 to 30 per cent, effective immediately. The working force will also be reduced. The wages of a number of the office force in the toolmakers' division will be cut from 85 to 65 cents an hour, and those of laborers from 55 to 35 cents.

W. R. Campbell to Be New Ford Executive

Nomination As Klingensmith Successor Considered Certain —Jewish Attacks Hurt

DETROIT, Feb. 1—While official announcement is lacking, it is stated on authority that W. R. Campbell, secretary and assistant general manager of the Ford Motor Co. of Canada, will succeed F. L. Klingensmith as vice-president and general manager of the Ford Motor Co. Campbell is now at the Highland Park plant and has been there for several days. He is virtually in authority at the big factory.

Klingensmith held the position of treasurer, but it is understood the duties of that office will be given to some one other than Campbell, who will devote his entire attention to active management of the plant, chiefly along production lines. It is reported that important financial matters in future will be handled entirely by Henry Ford, whereas Klingensmith heretofore negotiated practically all the financial deals.

Campbell is thirty-nine years old. He has been with the Ford company of Canada since it was organized in 1904. Prior to that he was with the Queen City Oil Co. His home is at Walkerville, Ont., where the Canadian plant is located. He is said to be of exceptional ability and Henry Ford is said to have had his eyes upon him for a long time.

The Ford organization still is in more or less of a state of chaos. W. C. Anderson, director of operations in Europe with headquarters in London and Paris, tendered his resignation last week and this was followed by that of Louis Block, in charge of the Philadelphia branch.

Resignations Not Explained

In the absence of statements from officials as to the reason for these resignations and the reluctance of both Anderson and Block to discuss them, semi-official statements are to the effect that the anti-Jewish campaign of Henry Ford's newspaper, the Dearborn *Independent*, is responsible. From a man close to Anderson it was learned the foreign chief had been driven to the point of severing relations with the company by reason of a virtual boycott on Ford products in foreign countries as a result of the attack on the Jews. This man said not only were the majority of foreign dealers of Jewish descent, but that the money in Europe was in the control of Jewish bankers. Likewise, probably a majority of the prospective customers for Ford products were of Jewish origin or closely connected with that race.

Business in the foreign countries, it is said, began to slump several months ago at the outset of the campaign and grew worse rapidly until the point was reached where it became apparent the attitude toward the Ford Jewish fight had practically ruined the business of the company on the continent.

Anderson, who is regarded as one of the most competent men in the foreign field, is said to have made repeated entreaties, appeals and finally demands that the Jewish attack cease, but all of his efforts are said to have been unavailing and instead the attacks became even more bitter. The recent resignation of Vice-President Klingensmith, which was in great measure due to the same cause, convinced Anderson, according to his friend, that there was no alternative and he promptly decided to come to America and tender his resignation.

Anderson Record Enviable

Anderson is widely known among automobile men in America and Europe as "Fuzzy" Anderson. He was one of the many bicycle racers who entered the automobile business at its inception. He joined the Ford company as branch manager sixteen years ago and later was put in charge of the Chicago business after several years in St. Louis. Two years ago he was selected, after a survey of the entire Ford organization, as the man best qualified to take charge of the Ford European business. He was sent abroad with full control of production and sales during the reconstruction period, and established a record that automobile men and Ford officials admit was remarkable.

Anderson has been in Detroit several days, and will be here until sometime this week. While he has no plans to announce for the future, he has been in constant association with leading manufacturers, and his friends say it is not unlikely when he leaves Detroit he will go as the foreign representative of one of the newest cars on the market.

No information could be secured regarding the resignation of Block other than statements of friends that he was prompted by the same reasons that forced the resignation of Anderson.

Ford Sued by Gest for Alleged Libel

CHICAGO, Feb. 1—Morris Gest, theatrical producer, has filed a $5,000,000 damage suit against Henry Ford in the Circuit Court of Cook County, alleging libel in statements published on Jan. 22 in the Dearborn *Independent*, Ford's paper, which has been running a series of attacks on the Jews. Gest takes exception to various statements made, but is particularly incensed at the intimation that he has neglected his parents who still live in Odessa. His counsel asserts that his parents are very wealthy and do not need their son's assistance.

PIERCE PROFITS $1,769,914

NEW YORK, Feb. 3—The report of the Pierce-Arrow Motor Car Co. for 1920 shows net profits after charges and Federal taxes of $1,769,914, compared with $2,491,070 the previous year.

Limited Production Proposed by Ford

Not More Than 5,000 Men at Work—Few Cars to Be Made in February

(*Continued from page* 237)

tical as to the success of the conference.

It is intimated that the resumption of operations at this time may have been due in some measure to the psychological effect it might have on the financial world.

The foremen were the first to arrive at the Ford plant to-day and the next employes to go to work included the best element among the married men with dependents. They were put to work cleaning up the plant and getting the machinery into shape. Manufacture of parts will be resumed before production of cars is begun as the surplus of cars on hand when the plant closed has been exhausted.

W. A. Ryan, general sales manager for the Ford Co. asserts that sales have increased rapidly in the last 10 days in most sections of the country. Cars have been moving from districts where agricultural or industrial conditions caused a backward market and sent to territories where dealers were moving them rapidly.

Newspaper reports of renewed industrial activity in Detroit have been very much exaggerated and have been the result of an attempt to make the outside world believe Detroit was coming back rapidly as a great manufacturing center. Most of the dispatches which have appeared in other cities have been a rehash of stories in local papers which seek to minimize the unemployment situation.

It is true that there is a gradual improvement in the industrial outlook here, but it is coming about slowly and only a few men are taken on at any of the factories. Conditions do not differ in any material way from those which prevailed after the resumption of work following the Christmas holidays. There is some production in most of the automobile factories but it is on a greatly reduced scale and it will be increased only as actual orders warrant.

Negotiations Reported Off

NEW YORK, Feb. 2—While financial papers still are printing numerous stories recounting the alleged financial difficulties of Henry Ford, it is impossible to obtain anything tangible here on the progress of negotiations between Ford and New York banks. There is substantial reason to believe that these parleys have been broken off.

Reports from Detroit are to the effect that Ford has ceased his efforts to obtain financial aid in this city because he considered the bankers' demands unreasonable. It also is understood he flatly refused to permit a bankers' committee or a representative of the banks to supervise the operation of his plants. No statement has come from Ford.

Unsold Cars Load British Markets

Thousands of American Vehicles in Heavy Surplus—Trade Fails to Revive

LONDON, Jan. 21—(*Special Correspondence*)—The turn of the year brought no improvement in the automotive trade in England and conditions generally are no better than they were the last three months of 1920. The slight but definite improvement which was expected after Jan. 1 has failed to make itself evident. The trouble seems to be that no one expected the cessation of buying was going to be so definite and dealers therefore took large stocks of cars while the manufacturers, supposing these cars soon would be sold to the public, continued to manufacture at full speed. The result is that there is in the country to-day a stock of vehicles sufficient to last from six to eight months even if the demand rises to the normal level.

It is reported that Ford, who produced at Manchester in 1920 just 40,000 cars, or nearly twice the best record for any previous year, has between 7000 and 8000 cars in the hands of dealers. Willys-Overland has 2600 cars in stock at Manchester. Its December deliveries numbered only 34. Chandler is reported to have 300 cars unsold; Cole 100 and Jordan 40. The great race course at Aintree, which was operated as a shell factory during the war, is said to be piled high with American motor vehicles such as All-American trucks, Traffic trucks, Dixie Flyers, and Moon cars. The stock of Hudsons and Essex on hand is estimated at from 300 to 400.

English makers are no better off than their American competitors. The Angus-Sanderson company, which started out a year ago with a popular 15 h.p. car has gone into liquidation, as has the Bean company. This takes out of the field two of the three quantity production post war jobs. The Cubitt, the third of this group, still is in operation although its makers had no previous experience along mechanical or engineering lines until after the war. It is interesting to note that before the Bean plant was practically closed two months ago it had reached a production basis of 100 a day which is astounding from a British point of view. Credit for this record is given to Production Manager Conroy, who came here from the Willys-Overland plant at Toledo.

Austin Makes Headway

One English maker who is making a little headway is Austin. He has kept his prices down to a reasonable level and stood the losses which he made all last year, believing that in the end a volume of business would be maintained which would bring financial reward. His output is relatively small, however, probably not exceeding 40 or 50 a week.

Brown Succeeds Dunbar as Clydesdale President

CLYDE, OHIO, Feb. 1—Frank D. Brown, a director and chairman of the finance committee of the Provident Bank & Trust Co. of Cincinnati, has been elected president of the Clydesdale Motor Truck Co., succeeding C. R. Dunbar. Brown is now in Florida but is expected to take an active part in the management of the company of which he has been a director. Other officers elected by the company, are: Vice-presidents, C. R. Dunbar, and A. C. Burch; treasurer, W. P. Dodge; assistant treasurer, J. C. L. Krebs, who has been a vice-president; secretary, Homer Metzgar. The board of directors is composed of the officers and J. H. Baynes and Charles H. Bowker of Northampton, Mass.

Gasoline Prices Drop Over Wide Territory

NEW YORK, Feb. 3.—Announcement of reduction in prices of gasoline and crude oil in virtually all the eastern and midwestern territory have been made this week by the various oil companies. This follows other cuts made in the past few weeks. The first reduction thus far made in the New York and New England territory was announced by the Standard Oil Co. of New York, which marked down motor gasoline 1 cent a gallon. The Standard Oil Co. of New Jersey also announced a cut of 1 cent, the second in the past two months.

The Sinclair Refining Co. has reduced gasoline 2 cents a gallon in Cleveland and has made a second cut in a month in Chicago, where the price at filling stations is 25 cents and for tank wagon delivery 23 cents. The same price has been made by the Standard Oil Co. of Indiana for the entire midwest territory.

Crude oil has been reduced to $2.50 a barrel by the Magnolia Petroleum Co. and the Prairie Oil and Gas Co.

Gasoline Reserves Increase

WASHINGTON, Jan. 29—Gasoline reserves are gradually increasing, according to refinery statistics compiled by the Bureau of Mines for November, 1920, which shows an increase of 50 per cent in the daily average output as compared with 1918. Production of gasoline for November increased by 62,000 gal. daily over the October output. Total stocks at refineries Nov. 30 amounted to 354,835,764 gal. as compared with 378,133,185 gal. for the same month last year and 270,072,011 gal. in November, 1918.

Petroleum Stocks Increase

WASHINGTON, Jan. 31—Oil production in the United States in 1920 totaled 443,402,000 bbl., while consumption reached the unprecedented total of 531,186,000 bbl. Despite the excess of consumption over production, the end of the year showed a net increase in petroleum stocks of more than 10,000,000 bbl.

Goodyear to Receive $45,000,000 New Funds

Announcement of Refinancing Details Awaits Adjustment of Merchandise Claims

NEW YORK, Feb. 2—The adjourned meeting of Goodyear Tire & Rubber Co. stockholders, set for yesterday has been again adjourned until Feb. 11 due to delay in satisfactory consummation of refinancing negotiations. Officials of the company state that they hope to announce the full refinancing plans on Feb. 11, and report that satisfactory progress is being made in the negotiations.

It is stated on authority that the negotiations for a permanent loan have been practically concluded and that the only matters now remaining to be adjusted, are with the company's large number of merchandise creditors. Under the refinancing plan the company is to receive approximately $45,000,000 in new money, it is stated. This will permit immediate retirement of the notes for $28,800,000 negotiated by the Goldman-Sachs banking group, which mature Feb. 15.

Consummation of the refinancing will also enable the Goodyear company to increase production, officials state. According to Vice-Presidents G. W. Seiberling and G. M. Stadleman, the company's business for January showed an increase of slightly more than 50 per cent over December. This is taken to indicate a strong upward trend in the tire industry, as an increase of only 25 per cent over December business had been forecast.

Orders for February and March business are coming in so rapidly, according to Mr. Stadleman, that as soon as the refinancing is definitely concluded, the company expects to increase production more than 100 per cent, and will go to fully 18,000 tires daily at the earliest possible date. Estimates now place Goodyear production at between 8000 and 8500 tires daily.

Stadleman is mentioned prominently in industrial and financial circles, as the man who perhaps will succeed to the presidency of the Goodyear company, should there be any change in official personnel in compliance with terms of the refinancing program. It is regarded as not improbable that President F. A. Seiberling, although remaining with the company, will surrender direct control to interests dictated by bankers negotiating the company's loan.

DANIELS FAVORS OIL EMBARGO

WASHINGTON, Feb. 2—Senator Phelan's bill which would authorize the President to embargo petroleum exports has been approved by Secretary of the Navy Daniels. The bill is now before the Senate Naval Committee and it is expected the measure will be reported. Senator Phelan wants immediate action but it is probable appropriation bills will block its early consideration. Exportation of California oil to Japan caused the bill.

Surplus Tire Stocks Show Big Reduction

Heavy Buying May Cause Spring Shortage, Officials Believe—January Sales Heavy

AKRON, Jan. 29—Estimates prepared by rubber manufacturers of Akron indicate that the country will be faced with a tire shortage, possibly by March 1, unless tire production is increased materially at once. Great inroads have been made into the surplus of tires, estimated conservatively at 10,000,000 last September, and actual production of tires now is only one-fourth of consumption, according to estimates prepared by the B. F. Goodrich Co.

Tire production, according to Goodrich estimates, has been at the rate of not more than 8,000,000 tires a year, or about 660,000 a month since last September. Although tire sales are admitted to have slumped, due to the financial depression, business is improving as indicated by the fact that Akron tire factories expect to do more than $50,000,000 worth of business this month.

Based upon the reports of January business booked by Akron tire companies, and upon the estimates of the Goodrich company that 32,000,000 tires are needed this year to equip the 9,295,252 motor vehicles now in use in America, the monthly demand is 2,000,000 tires in excess of actual production.

Goodrich, by restoring its ten-hour factory shifts, has increased tire production materially this month, while a further increase to a basis of 10,000 tires daily will become effective this week. Goodyear, according to the latest available information, has been manufacturing not to exceed 6500 tires daily. Under conditions of the temporary loan of $28,300,000 negotiated with Goldman-Sachs Co., New York, which matures Feb. 15, the Goodyear company is precluded from increasing its payroll.

Plenty of Orders on Hand

It is stated authoritatively by Goodyear officals, however, that with negotiations satisfactorily consummated for permanent refinancing to replace the temporary financing program, it will become necessary to increase production in order to keep production apace with present increasing demand. Goodyear has not less than $15,000,000 worth of business booked for January delivery, while February orders are coming in in an encouraging manner. The increase in production, it is stated, will be accomplished by restoring present factory forces to normal hours, and that additional men will not be employed in the immediate future.

Miller Tire & Rubber Co. is slowing down production somewhat but expects to resume on a basis closely approaching normal, within a few weeks. Miller, which is recognized to be in as sound a financial condition as any rubber company in Akron, has not felt the tire sale slump or business depression as severely as other companies until this month. The lull in production is merely transitory and is enforced so that present surplus of finished product can be absorbed, Miller officials state.

The open winter has been largely responsible for the present improvement noted in the tire situation. "The possibility of a spring tire shortage is greatly increased by the open winter," state Goodrich officials, "and the surplus existing last fall cannot be counted upon to ward off a shortage when the full buying movement starts."

River Rouge Damages Fixed at $470,142

DETROIT, Jan. 29—A jury in Federal court hearing the River Rouge condemnation proceedings through which Henry Ford seeks widening the river channel to permit the passage of heavy freight steamers to and from his blast furnaces, handed down a decision this week awarding a total of $470,142.30 to property owners whose land had been condemned. The warrant is considered a distinct victory for Ford, though the government rather than Ford appeared as plaintiff in the action. However, in view of the fact that Ford was to be the chief beneficiary of the improvement, he agreed to pay all awards and costs of the litigation in the government's behalf and at the outset was compelled to deposit Liberty Bonds and other securities amounting to approximately $4,000,000 to cover costs and damages that might be assessed as a result of suits by property owners.

It has been more than four years since the War Department advised dredging the Rouge river, and immediately after Congress appropriated money to cover the work property owners began filing suits to prevent the condemnation and carried their case through the Circuit Court of Appeals.

The largest single award was made to the Delray Inland Salt Co. which was given $73,244.16, although it only asked $40,000. Other plants were cut down materially in their damage claims. The completion of the River Rouge project is expected by August 1.

FORD WORKS OUT RAIL PLANS

DETROIT, Jan. 28—It has been announced by officials of the Detroit, Toledo & Ironton Railroad, that it is the desire of Henry Ford, who controls the road, that as he is against the idea of working on Sunday, the road will not operate trains on that day. There is no let-up in the plan to put the road on a thoroughly efficient and profitable basis. After the winter months the real big work will begin, although already considerable headway has been made in that direction. For instance, it is stated that a large number of freight cars, formerly used by the road, have been discarded being considered by the experts chosen by Henry Ford as a liability to the road's good operations.

Packard Shuts Down To Balance Stocks

Shortage of Bodies Due to Strikes Upsets Schedules—Western Sales Slump

DETROIT, Jan. 29—Packard Motor Car Co.'s plant closed at noon to-day for an indefinite period to permit of balancing inventories, according to E. F. Roberts, vice president in charge of manufacturing. Plant officials expressed the hope that conditions would permit of resumption of production in ten days but employees were informed that the maximum period of idleness would be thirty days. More than 3000 men in the factory and many of the employees in the offices were included in the suspension order.

A decided slump in the West following buying activity during the week of the New York show and for a few days thereafter is declared to be in the main responsible for the order, though a strike of body finishers at the Packard plant and also at the plants of two independent concerns which are employed chiefly on Packard work, prevented completion of cars and resulted in other departments getting so far ahead of the body plant as to force cessation of production until the body plant could catch up. The strike began three weeks ago when, according to employees, a cut of 44 cents an hour went into effect.

The following statement was made today by Vice President Roberts:

"We are closing today in order to permit balancing our inventories but we hope to resume within the next ten days. At all events the plant will not be closed longer than March 1. Many circumstances have combined to bring about the decision to close, though it is due chiefly to the fact that some of our departments have to run too far ahead of others resulting in greatly unbalanced inventories. Then too there has been a check in the sales mainly in Western territory though there is every indication that that section now is passing through the depression period and in a short time will show signs of reaction and improvement such as has resulted in the East following the recent distinct slump there."

Present Demand Satisfactory

The closing order coming on the heels of reports that Ford would reopen in part Monday was a great surprise though manufacturers were inclined to attribute Packard conditions chiefly to the labor situation in the body plant rather than over-production or lack of demand. Packard has been building about 400 single sixes a month for the last four months. The plant closed for inventory during the holidays but reopened Jan. 3 and had been running steadily since that time. Orders stopping all incoming freight shipments also were sent out today.

Cleveland Puts Over Many Sales at Show

Attendance Records Indicate Wide Public Interest—Factory Representatives Stir Dealers

CLEVELAND, Jan. 29—Cleveland's twentieth automobile show closed to-day with all attendance records broken by fully 30 per cent and with an encouraging report on both wholesale and retail sales. No actual count of orders is ever made here but there are indications that the aggregate will run at least a little way into the hundreds in retail business alone.

The show received wide and dignified attention from the Cleveland newspapers and brought into town prospects from all of northern Ohio. Dealer meetings, several of them addressed by high factory executives, avoided frills and resulted in a quite satisfactory placing of wholesale orders.

With a wide diversification of industries, Cleveland has not suffered in the readjustment as have some centers but the heavy car registration in Ohio, one to every nine of the population, has created a serious used car problem, which had a good deal to do with preventing sales at the show from attaining even more encouraging totals.

The large attendance at the show was in spite of an increase in the admission fee from 50 to 75 cents.

Baltimore Develops Trade

BALTIMORE, Jan. 31—From a buying standpoint, the automobile show which closed Saturday night probably was 50 per cent as good as that of last year. Firms which did an actual business of eight or ten cars in 1920 and 1919 were well satisfied with four or five last week. There appeared to be more interest in the high-priced cars than in the cheaper ones. The attendance was unusually large but it was obvious that many of those who visited the show were merely sightseers.

Milwaukee Sells 300 Cars

MILWAUKEE, Feb. 1—Informal reports of sales at the Milwaukee show indicate that upwards of 300 cars were sold at retail. Since the close of the show dealers report that business has been of satisfactory volume and much in excess of the pre-show period. Unofficial figures of attendance at the exhibit disclose that approximately 48,000 paid admission. Lists of about 2500 prospective buyers were built up from the show visitors. Distributers in the territory say the show was unusually successful in stirring the dealer and sub-dealer trade.

Addresses at the annual dinner of the Wisconsin Automotive Dealers Association were by Alfred Reeves, manager of the National Automobile Chamber of Commerce; David Beecroft, directing editor of the Class Journal Co., and A. R. Kroh, of Goodyear.

TRAVELING SERVICE TRIED IN ENGLAND

LONDON, Jan. 14.—(*Special Correspondence*).—The Associated Equipment Co. (Inc.) of Walthamstow, London, E., whose fame was largely made by Sam Wallace, production engineer there during the war period, and now chief director of the Wallace truck interests, has started a truck service plan which is making good and earning favor by rapid renovations of A. E. C. trucks when in trouble. The company has six traveling repair shop trucks covering the whole of England and Wales. Each is allotted a territory to tour in, and carries a stock of replacement parts and workshop plant. When a breakdown is reported the district repair truck makes for the spot and the job proceeds until finished. Some record times are reported for such jobs as engine overhauls.

Congressmen Getting Protests of Dealers

(*Continued from page* 236)

market at Los Angeles and dealers in that city, with the exception of one who is acting as agent for the Slough company, are protesting vigorously to their representatives in Congress in the hope that something may be done to amend the law. The Congressmen view these appeals with much sympathy and believe an injustice is being done to the American truck industry but there is no action they can take as the law stands now. The suggestion has been made, however, that some amendment be proposed. The appeals of individual dealers are being backed by the representative here of the Los Angeles Chamber of Commerce which has gone on record as opposed to the sale of these trucks.

It is understood other chambers of commerce throughout the country will be asked to take similar action and thus arouse sentiment against the purchase of these trucks. As the situation stands at present, it is largely a moral issue and individuals in the market for motor vehicles must decide for themselves whether to buy these rebuilt army trucks from a British company rather than a used vehicle in the same general condition for a little more money.

New York Agents Named

NEW YORK, Feb. 2 — Roskam-Scott Co., 1869 Broadway, will represent the Slough Trading Co. in New York. E. I. Roskam, head of the company, said arrangements had been made for the handling of a large quantity of parts, reshipped to this country by the Slough company, and that a percentage of the truck total would also be handled here. No arrangement had been made for the shipping of any definite number, he said.

Dealers Contracts to Be Considered

N. A. C. C. Accepts Invitation From N. A. D. A. for Conference on Relations

CHICAGO, Feb. 2—Directors of the National Automobile Chamber of Commerce to-day accepted the invitation of the National Automobile Dealers Association for a joint conference to consider manufacturer and dealer relations, including the question of contracts.

The directors, in a resolution, extended greetings to the dealers association in convention here and referred to the dealers action in inviting the conference as one based on a broad view of the good of the industry.

It is expected that the manufacturers and dealers will appoint their committees in the near future and that the general question of relations between makers and merchandisers of cars and trucks will be taken up.

The traffic committee of the N. A. C. C. reported carload shipments from the factories in January 35 per cent of those in January, 1920.

The Chicago show has gone ahead of that in New York in attendance for the first time in history. The first three days had the largest paid attendance at any national show.

SPRINGFIELD PLANTS ACTIVE

SPRINGFIELD, OHIO, Feb. 2—A. K. Stewart of the Hare's Motors Corp., formerly with the Packard Motor Car Co., has assumed his new duties as manager of the Kelly Springfield Motor Truck Co. Production is gradually increasing at this plant.

All departments at the plant of the Westcott Motor Car Co. resumed operations yesterday on a 50 per cent basis. More men will be added soon, it is announced by General Manager H. G. Root.

REPUBLIC TIRE OUTPUT LOW

YOUNGSTOWN, OHIO, Jan. 29—Operations at the Republic Rubber Co., scheduled to start Jan. 10, were not under way until this week. Cord tire production is on only a small scale. Only the mechanical rubber goods department is working to near full production. The announced eight-hour shift plan has not been put into effect and it is doubtful now whether or not it will be adopted.

MULLINS REDUCES PRODUCTION

SALEM, OHIO, Jan. 29—Production has been almost entirely suspended at the Mullins Body Co., according to officials who assert that they have no definite information as to when work will be resumed. Although a quantity of orders is unfilled, the Mullins company has been notified to withhold shipments.

Efficiency to Bring Wide Use of Trucks

White Sees Greater Trend to Highway Shipping — Time Economy Important

CLEVELAND, Jan. 29—Windsor T. White, president of the White Motor Co., and chairman of the National Motor Truck Committee of the National Automobile Chamber of Commerce, in giving a review of what the motor truck is doing toward transporting freight of the country, says that more than 10,000 regularly established rural motor express lines are in operation and the number is increasing constantly.

The coal situation offers a striking proof of the country's dependency on the motor truck as a means for increasing production, and economical distribution. Of the 4000 coal mines in the country 2000 are without railroad connection. Of the 5000 precious and semi-precious ore mines in the country about 2500 use motor trucks.

At Terre Haute, Ind., coal is being hauled directly from the mines to the consumer. The mines are several miles east of the city and are owned by the coal dealers. Due to the fact that this operation lies within the short haul sphere, the truck was able to cut the delivery time from weeks by railroad to days. The Civic Association of Birmingham, Ala., has contracted with a motor truck corporation to move coal direct from the mines to the consumer at the rate of 200 tons a day.

At such centers as New York, Cincinnati, Minneapolis, Cleveland, St. Louis and Grand Rapids, motor freight terminals have been established. These exercise important influence on transportation and production. In Cincinnati alone 66,000 cars were released for through traffic; shipments that took four days by railroad cars from one part of Cincinnati to another were transferred in four hours by truck.

The conditions of competition for motor transportation at present are different from those which stimulated the rapid increase in the use of trucks during the war. Except for perishable goods, time is the only consideration. The older transportation systems will eventually adjust their facilities to accommodate the traffic for which they are best adapted so that the motor truck must bid for business on the basis of efficiency alone.

OHIO NAMES NEW ENGINEER

YOUNGSTOWN, OHIO, Jan. 29—Ett S. Smith, city service director, becomes State highway engineer Feb. 1, according to announcement from the office of Governor Davis. Smith has been county highway engineer for a number of years until Jan. 1, 1920, when he was named service director. His record has been a distinct improvement of city streets and great advances toward repair of main thoroughfares that have been "sore spots" for several administrations. He is recognized as one of the leading engineers of the State. He has been an owner and operator of passenger cars and commercial vehicles for several years and is known to look with high favor on the motor vehicle and its large benefits to society. It is believed by automobile men that his efforts will be directed toward building roads that will stand up under modern transportation.

Federal Aid Extension Favored by Congress

WASHINGTON, Jan. 31—The Senate Committee on Post Offices and Post Roads and the House Committee on Good Roads have favorably reported bills amending the Federal Aid act simplifying and extending Government assistance to the States in construction of highways.

The measure sponsored by Senator Phipps of Colorado, provides that the present limit of $20,000 per mile which may be contributed by the Federal Government should be increased in those States in which the percentage of participation required of the State is decreased under another section of the bill. While this section would not increase the amount of Federal aid, it would allow public land States to avail themselves of their allotments by appropriating a smaller amount of State funds. The Senator announced to-day that he would call it up for early consideration.

Ohio Court to Rule on Bridge Weight Limit

YOUNGSTOWN, OHIO, Jan. 29.—Decision by Judge Cooper in the suit of Albert Buehrle and others, against the county commissioners, seeking permanent injunction against enforcement by the commissioners of stringent regulations restricting weights of loads carried by motor trucks over bridges on main market highways will be made Feb. 5. The plaintiffs introduced evidence showing that there had been a number of arrests of truck operators charged with violating the weight limitations prescribed by the commissioners, a maximum of eight tons gross and as low as five tons gross, including 17 bridges.

The plaintiffs contend that the statute requirements are twelve tons gross and that the commissioners are required to maintain bridges at that loading. The commissioners contend that an act passed some years before motor vehicles were generally used in transportation gave them the right to restrict bridge loading. This act has as its principal feature a restriction "that not more than 40 head of horses or cattle" shall be on a bridge at one time.

C. W. REID DIES

WASHINGTON, Jan. 31—C. W. Reid, manager of the Transportation Bureau of the Federal Highway Council, is dead here after a brief illness.

METAL MARKETS

IN all departments of the iron and steel markets stress is being laid on the silver lining which the clouds are beginning to disclose. Resumption of operations by automotive plants that have been shut down was naturally preceded and accompanied by some purchases in the iron, steel and non-ferrous metal markets. Every one interprets what buying has taken place to suit his own particular purposes. A large pig iron interest says: "It appears as though at least one buyer has reached the conclusion that the pig iron market has struck bottom and that the present is as good a time as any to buy for the first half. He has backed this opinion to the extent of 3000 tons for prompt shipment to be stored on the yard for future use, and is inquiring for approximately 10,000 tons of another grade for use over the first half." To which the buyer of a fair-sized tonnage of pig iron, when asked if he was the purchaser alluded to in the foregoing, retorted: "I am not backing any such opinion. In fact, I have no opinion whatsoever to back. But my plant needs pig iron for prompt shipment and I am trying to cover part of our wants over the next six months." Similar conditions are encountered in finished steel. Some of the mills have received modest sheet orders from automotive buyers. From the buyer's point of view, the placing of these orders is not to be interpreted as denoting anything else than that he requires the material and, therefore, is willing to pay the seller's price. If the latter has reached the conclusion that this modest buying indicates that buyers have made up their mind that prices will not go lower, such a deduction is utterly unwarranted. In fact, most buyers, and especially those who are now placing orders for small tonnages, are of the belief that there will be a further downward readjustment in prices. But they believe that it will come gradually and that it can be best and easiest brought about by a resumption of buying on a conservative scale, so that competition between the mills will be encouraged, and those which are really anxious to maintain a fair rate of operations will have an incentive to offer inducements for a corresponding backlog of orders.

Pig Iron—In spite of the ado that some Pittsburgh correspondents make about the coming of a $30 valley market, the fact is that they are rehashing ancient history. Published quotations notwithstanding, the market has been a $30 affair ever since Jan. 2. In fact, there have been sales at $1 and $2 below that level, but none on a higher basis.

Steel—The largest Chicago district independent is reported to be cutting sheet prices, but Youngstown district rolling mills claim to be maintaining previous quotations. Only a slight improvement is noted in the interest manifested by automotive parts makers in cold finished steel bar offerings. Further reductions are reported in bolts and nuts from the Middle West.

Ferro-Vanadium—The Vanadium Corp. of America has fixed its 1921 price for ferro-vanadium, open hearth grade, at $5 per pound, contained, base. For low-silicon and low-carbon alloy extras range from $1.50 to $2.

Aluminum—Importers have revised their price views upward and appear unwilling to shade 25c., duty paid, for 98 to 99 per cent virgin ingots. The domestic manufacturer's price remains unaltered.

Tin—Rumors that the Federated Malay States Government had reduced the minimum price for Straits tin caused a break followed by speculative ups and downs.

FINANCIAL NOTES

Packard Motor Car Co. inventories, including finished vehicles, show a total of $16,683,605 as of Nov. 31 last. This compares with $16,063,189 as of Dec. 31, 1919. Between Sept. 1, 1920, when Packard's fiscal year opened, and Nov. 30 there was an inventory reduction of slightly more than $1,000,000. In accounts for the year ended Aug. 31, 1920, the company set aside a reserve of $2,500,000 to offset possible depreciation in inventory values, to be determined from physical inventory as of Dec. 31. Apparently no serious depreciation in value has occurred.

Gillette Motor Products Co. stockholders at a meeting this week voted to increase the capital from $150,000 to $300,000. R. N. Gillette, J. D. Stewart, B. H. Carnahan, B. E. Githens and J. A. Golden were named directors. The plant, which manufactures floor and running boards for automobiles and trucks, resumed operations Monday after a shutdown of three months.

H. H. Franklin Mfg. Co. estimates inventory as of Dec. 31 at $8,160,000, of which $4,140,000 is work in process and $4,020,000 stores inventory. This compares with a total of $6,384,446 as of Dec. 31, 1919. The current inventory shows a big reduction from the peak during the year.

New Castle Rubber Co. schedules in bankruptcy as filed in the United States District Court at Pittsburgh show liabilities of $3,833,567 and assets of $745,021.

Kelly-Springfield Tire Co. has had listed on the New York Stock Exchange $1,250,000 additional common stock, on notice of issuance as a stock dividend.

Eisemann Magneto Corp. paid a regular quarterly dividend of $1.75 a share on the preferred capital stock of the company Feb. 1.

Studebaker Corp. has declared the regular quarterly dividend of 1¾ per cent on preferred and common stocks, payable March 1.

Buckeye Traction Ditcher Co. will increase its capital stock from $300,000 to $1,000,000 to provide for increased operation.

Maxwell to Receive Balance of Claims

DETROIT, Jan. 31—Creditors of the Maxwell Motor Co. holding claims amounting to less than $5,000 have been ordered to present their claims to Special Master William S. Sayres, Jr., on or before Feb. 15 in the suit of Jenks & Muir Mfg. Co. against Maxwell Motor Co. Inc., a friendly action in which the company joins.

The suit was filed according to Special Master Sayres for the purpose of permitting the reorganization plans to proceed without interruption from the smaller creditors who necessarily would be inclined to file suits, attachments, garnishments, etc., and in fact, would enter into a contest to see which would be first to tie up the company's property. All of the claims above $5,000 were deposited with the reorganization committee, and the smaller claims will be given hearings by the Special Master and will be settled in full or on an equitable basis, he said.

While the Jenks & Muir action in no sense involves a receivership, it is in effect the same thing inasmuch as the plant will have to be sold by the Special Master after the hearings, and it is presumed the reorganization committee will be on hand and become buyer of the plant.

Dragon Stock Sales Banned in Illinois

CHICAGO, Jan. 28—In mandamus proceedings brought in the Sangamon county court under the "blue sky" law by the Dragon Motors Corp., a Chicago company, Judge E. S. Smith upheld the action of Secretary of State Louis A. Emmerson in refusing to file the application of the corporation for permission to sell its stock in Illinois.

The company organized to manufacture automobiles had begun an extensive advertising campaign to sell its stock. The value of the assets of the corporation was fixed at $581,000, a figure obtained, according to the attorneys for the company, by an appraisal on the basis of production of the plant, which was not new, less depreciation.

DUPLEX NAMES NEW OFFICERS

BEAVER DAM, WIS., Jan. 31—The Duplex Storage Battery Co., which moved its works from Milwaukee to Beaver Dam, Wis., several months ago, has reorganized its official personnel and management. The new officers are: President, J. W. Deniger, Beaver Dam; vice-president, Herman L. Schickel, Milwaukee; secretary-treasurer, M. A. Jacobs, Beaver Dam; general manager, Peter M. Kettenhofen; factory superintendent, Joseph Mollerus; directors, John V. Zweck, Beaver Dam, and A. H. Luckenbach, Chicago.

KELLY TRUCK ADDS TO FORCE

SPRINGFIELD, OHIO, Jan. 28—Gradually the force at the Kelly-Springfield Motor Truck Co. plant is being increased. Orders are coming in slowly. With the additional facilities provided not long ago the company is in a position to meet any demands of the trade.

GEORGE HALLEY DIES

LONDON, Jan. 14 (*Special Correspondence*)—The death has occurred this week of George Halley, founder of the well known Glasgow company, makers of Halley trucks. His first vehicles were steamers, but more recently the company concentrated wholly on a 6-cylinder truck which is probably the only "six" truck of British make.

TO ACT ON SLOCUM OFFER

NEWARK, N. J., Feb. 2—Creditors and stockholders of the Slocum, Avram & Slocum Laboratories, Inc., have been directed to show cause on Feb. 14 why the receivers should not accept an offer of $161,000 for the property of the company exclusive of land, buildings, equipment and accounts receivable.

BANK CREDITS

NEW YORK, Feb. 3—While the week-end bank statements seemed to warrant the predictions for easier money, the local loan market last week showed a firmness which became pronounced on Monday of this week when call money reached 8 per cent. During the last week call money ruled at 7 per cent, as compared with a range of 6 to 7 per cent the week before. There was little activity in the time money market. Demand was light and the supply of loanable money was not plentiful. The single rate of 6½ per cent was quoted for all maturities up to six months until Monday, when a range of 6½ to 7 per cent was established. A uniform rate of 6 per cent was quoted a week ago. Loans secured by all-industrial collateral were quoted at about ¼ of 1 per cent higher.

The Federal Reserve System as a whole continued the improvement which had been taking place in its reserve position during the month of January. The gold reserves increased $10,368,000, while Federal Reserve notes in circulation declined $24,562,000. Total bills on hand declined $29,446,000 and total earning assets $32,675,000. As a result, the ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against net deposits, increased from 55.6 per cent to 56.5 per cent.

The continued rise in sterling and francs was again the feature of the foreign exchange market. Other European exchanges continued to move up sympathetically. Apparently, an expectation of a favorable outcome to the deliberations of the Allied premiers at the Paris Conference was responsible in a large degree for the activity in the foreign exchange

The stock market was very quiet, with the total turnover for the week at less than 2,700,000 shares. The bond market also was quiet, with indications that the recent rise in prices for high grade securities has received at least a temporary check. This probably is due in part to the flotation of high-coupon-rate foreign securities and the expectation of further similar flotations in the near future. The over-subscription of the Belgium 20-year 8 per cent loan and of the Pennsylvania Railroad 6½s indicates the continued acceptability of such new issues in the investment market.

SEEK GLAMORGAN REFINANCING

SPRINGFIELD, OHIO, Feb. 2—An effort is to be made by stockholders to reorganize and refinance the Glamorgan Tire & Rubber Co., which has plants at Delphos, Oakhill and Byesville. Fifty stockholders met here this afternoon by order of the United States court at Toledo to determine what they desired to do. A new board of directors was elected to serve with Receiver Arnold V. King. It is stated that the assets amount to $611,000 and the liabilities are $650,000, according to the auditor's accounts.

MEN OF THE INDUSTRY

E. A. Taylor, formerly production engineer of the Pierce-Arrow Motor Car Co., has been appointed works manager in charge of production for the Liberty Motor Car Co. Before going with the Pierce-Arrow Co., where he was responsible for plant layout and the installation of progressive assembly as well as criticisms of design from a manufacturing point of view, Taylor was in charge of the manufacturing department of the Cadillac Motor Car Co. for two years and later was in charge of the Maxwell Motor Co.'s plants at Detroit and Dayton. He became general superintendent of the Chalmers plant in 1917 and was in complete charge of important war work in addition to the manufacturing of cars. He joined the Pierce-Arrow organization in 1919.

W. F. Taylor, New York, has been appointed eastern sales director of the Acason Motor Truck Co. Taylor was formerly sales manager for the Federal truck distributer in Philadelphia and later was associated with his brother in handling Signal trucks in New York territory.

D. Minard Shaw has been appointed field representative of the Briscoe Motor Corp. Shaw has been for several years connected with Briscoe distributing interests in the South. He will make his headquarters at Memphis, Tenn.

J. A. Palmer has become sales manager of the Neville More-Room Steering Wheel Co. of Wayne, Mich. He will have charge of sales and advertising. Palmer has been connected with the Burroughs Adding Machine Co.

James N. Gunn, president of the United States Rubber Co., has been elected president of the Lincoln Highway Association, succeeding F. A. Seiberling, president of Goodyear Tire & Rubber Co., who resigned.

Clifford M. Sparks, formerly captain of the University of Michigan football team and who is widely known in athletics, has been placed in charge of sales for the Sparks-Withington Co. at Jackson, Mich.

C. W. Hodges, Galesburg, Mich., has purchased the interest of Henry Lane of Kalamazoo, in the Kalamazoo Chain Co. and the name of the concern has been changed to the Hodges Chain Co. of Galesburg.

Glen D. Hiller, formerly sales manager of the Nelson Motor Truck Co., has been appointed assistant general manager in charge of sales of the Triangle Motor Truck Co., St. Johns, Mich.

Arthur H. Lacey, formerly assistant engineer of the Hall-Scott Motor Car Co. and latterly chief engineer at the Moon Tractor Co., has established a consulting engineering office at Oakland, Cal.

E. G. Edwards, Chicago, for many years associated with George W. Kellogg, founder of the Kellogg Mfg. Co., has been elected to the board of directors of the Wayland Specialty Mfg. Co., Inc.,

R. J. Firestone has been elected a vice-president of the United States Motor Truck Co., Cincinnati. Firestone has been connected with the rubber industry for a number of years.

Louis H. Dusenbury has been named vice president, and Harold W. Schwab, secretary, of Louis Dusenbury & Co., Inc., upholstery manufacturers, New York.

A. N. Pollen of London is at the St. Regis Hotel, New York, investigating the local conditions with a view of bringing the Daimler car to this country.

S. L. Warner has resigned as vice-president and general manager of the National Tire & Rubber Co. to join the Robinson Clay Products Co., Akron.

L. A. Brown, formerly district manager for the United States Rubber Co., has been elected president of the Grand Rapids Tire & Rubber Corp.

Omar Wicklin has been appointed assistant western sales manager of the Moon Motor Car Co. and will make his headquarters at Los Angeles.

George W. Copp Co., Inc., has located a new plant at Long Island City for the building of winter tops and automobile bodies.

A. G. Maney and H. L. Franklin have been elected directors of the H. H. Franklin Mfg. Co. and O. A. Lawton has retired.

Andrew J. Pierce Dies; Had Built New Engine

CHICAGO, Jan. 29—Andrew J. Pierce, builder of the old Pierce motor car which was taken over by the J. I. Case T. M. Co. of Racine, died here yesterday of pneumonia. Mr. Pierce was born in Rochester, N. Y., on Jan. 11, 1859, and after working on a newspaper in that city, became associated through the efforts of the owner who perceived his mechanical bent with a well-known machinist in that city. In 1887 he moved to Racine and became connected with the Racine Hardware Co. in charge of the engine production department making an oil engine.

In 1892 he entered into business for himself, manufacturing a gasoline engine of his own invention which was a long step in advance at that time in power machines and organized the Pierce Engine Mfg. Co. After a few years, he established and built a large plant at Lakeside, a suburb of Racine, and formed the Pierce Motor Co. for the manufacture of the Pierce automobile, this being an out-growth of the engine company.

The Pierce company was sold in 1910 to Case who continued to manufacture the Pierce car for two years. A new engine was then adopted and the Pierce name discontinued.

Mr. Pierce was a mechanical engineer, and a designer and manufacturer of gasoline engines. He has been allowed many United States patents on engines which have been used in launches, automobiles and stationary machinery and at the time of his death, had just perfected and obtained letters patent on a new engine for which he claimed great efficiency.

BARLEY NAMES NEW OFFICERS

KALAMAZOO, MICH., Jan. 31—Reports filed at the annual meeting indicate that the Barley Motor Car Co., makers of the Roamer, enjoyed a very prosperous year during 1920. The election of officers resulted in the naming of A. C. Barley, president; C. G. Barley, Marion, Ind., vice-president; C. E. Stephenson, treasurer, and George B. Hopkins, secretary and assistant to President Barley. Hopkins was also added to the board of directors, which includes the officers and M. A. Barley of Kalamazoo and Howard Gould of New York.

INDUSTRIAL NOTES

Security Sales Corp., with offices in New York and Chicago, has been dissolved, but has been granted the privilege of operating within the respective territories as factory branches of the Security Mfg. Co., Los Angeles. Lea J. Orr is in charge of the Chicago office and Marcel J. Orr of the New York branch.

Larco Wrench & Mfg. Corp. has purchased the plant and wrench business of the Cochran Mfg. & Forging Co., 78th Street and Woodlawn Avenue, Chicago. The Cochran company and its forging business is now being operated as the Great Lakes Forge Co., at 119th Street and Racine Avenue.

Cincinnati Milling Machine Co. has bought an interest in the Cincinnati Grinder Co. and will manufacture the latter company's line of machinery. The Grinding company will continue the sales end of the business.

Wharton Motors Co., Inc., Dallas, Texas, is completing the first unit of its plant. It will manufacture a line of cars, trucks and tractors.

Autocar Co. has increased its directorate from seven to nine with the addition of J. Howard Reber and Roscoe T. Anthony.

Block Rubber & Tire Co., Indianapolis, has awarded a contract for the first unit of its new plant estimated to cost $100,000.

Lincoln Motor Car Co. will continue operations on half-time for several weeks. It reports a gradual increase in orders.

Vim Tractor Co. has purchased the patent rights, patterns, etc., of the Tiger Drill Co., Beaver Dam, Wis.

Mac-Lar Battery Co. assets will be sold at auction on Feb. 14 by the Detroit Truck Co., receiver.

Locomobile Co. has reduced wages at the factory 10 per cent.

MOTOR WHEEL UNITS START

LANSING, MICH., Jan. 28—All units of the Motor Wheel Corp. are in operation this week, the Auto Wheel unit having been started Monday morning, as was also the Gier Pressed Steel plant. The Pruden Wheel unit was started some time ago, and the southern unit in Tennessee, which produces raw material for the Lansing plants, has been going at full blast for several weeks.

VICTOR ON 300 DAILY BASIS

SPRINGFIELD, OHIO, Jan. 28—Stockholders of the Victor Rubber Co. at the annual meeting yesterday elected directors and heard reports showing that the plant is turning out 300 cord tires daily. The normal output is 500 per day. Directors elected are:—Otto Miller, Allard Smith and W. L. Timmons, Cleveland; H. J. Robben, Cincinnati; F. R. Talbott, C. A. Swinehart and H. H. Durr, Springfield.

PREMIER PRESIDENT DIES

KANSAS CITY, Feb. 2—Dr. L. S. Skelton, president of the Premier Motor Corp. of Indianapolis, died here Saturday after a brief illness.

Calendar

SHOWS

Feb. 5-12—Minneapolis, Annual Automobile Show, Minneapolis Automobile Trade Ass'n.

Feb. 7-12—Columbus, National Tractor Show, Columbus Tractor & Implement Club, Ohio State Fair Grounds.

Feb. 7-12—St. Louis, Annual Automobile Show, St. Louis Automobile M'f'rs & Dealers' Ass'n, Robt. E. Lee, Mgr.

Feb. 12-19—Hartford, Conn., Annual Automobile Show, Hartford Automobile Dealers Ass'n, Armory, Arthur Fifoot, Mgr.

Feb. 12-19—Kansas City. Annual Automobile Show, Kansas City Motor Car Dealers' Ass'n.

Feb. 14-19—Winnipeg, Western Canada Automotive Equipment Show.

Feb. 18-28—San Bernardino, Cal., National Orange Show, Fred M. Renfro, Mgr.

Feb. 19-26—San Francisco, Fifth Annual Pacific Automobile Show, Exposition Auditorium, George Mahlgreen, Mgr.

Feb. 21-26—Louisville, Annual Automobile Show, Louisville Automobile Dealers Ass'n, First Regiment Armory, C. L. Alderson, Secy'.

Feb. 21-26—Salt Lake City, Annual Automobile Show, Intermountain Automotive Trades Ass'n, W. D. Rishal, Mgr.

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Atlanta, Annual Automobile Show, Atlanta Automobile Dealers' Ass'n, Auditorium, Virgil Shepard, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 5-12—Atlantic City, Annual Automobile Show, Automobile Trade Association of Atlantic City, Million Dollar Pier, A. H. Generatzky, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

Mar. 14-19—Washington, Annual Automobile Show, Washington Automobile Dealers' Ass'n, Rudolph Jose, Chmn.

Mar. 19-26—Detroit, Annual Automobile Show, Detroit Automobile Dealers' Ass'n, Morgan-Wright Building.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April— Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Feb. 7—Delhi, India, Delhi Motor Show.

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

October—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

Oct. 12-14, 1921—Chicago, Twenty-Eighth Annual Convention National Implement & Vehicle Ass'n.

Test Highway to Show Construction Defects

CHICAGO, Jan. 29—A road is being built in Illinois, Federal and State governments co-operating, for the purpose of determining what kind of road to construct to meet present-day traffic conditions. This test road which is well under way now and which will probably be completed early this summer is expected to answer the following questions which are confronting the engineers of to-day:

"What is the economical limit for motor truck loads?

"What is the corresponding limit for the type and thickness of the pavement?

"What is the load-carrying capacity of the standard types of hard-surfaced pavements of varying thicknesses?"

Clifford Older, chief engineer for the state highway department, believes "that the results obtained will give a definite idea of the value of the different types and thicknesses of pavement for carrying truck loads and also will furnish a basis for deciding how heavy pavements should be built and the limits of the loads which should be carried on them."

PAIGE RECORD AUTHENTICATED

NEW YORK, Jan. 31—The American Automobile Assn. has authenticated the record for stock cars established when Ralph Mulford covered a mile straightaway at Daytona in 35.01 seconds in a Paige "6-66" Daytona stock model.

IOWA EXTENDS ROAD WORK

DAVENPORT, IOWA, Jan. 28—Fifteen Iowa counties last year began paving primary roads, according to reports from the highway engineer's office, but this represented only about a ninth of the program road building forces in the state were ready to undertake.

Forty-five miles of hard-surfaced road were completed and 177 miles contracted for, to be completed this season. Two months ago there were ninety-four projects under way in thirty-two counties and these presented paving of 166 miles, gravelling of 203 miles and grading of 913 miles of highway.

Fiat Enters Three Cars in French Grand Prix

PARIS, Jan. 15 (*Special Correspondence*)—Fiat has just entered three cars for the French Grand Prix 183 cu. in. race to be run on July 23, probably at Strasbourg. This is the first appearance of the big Italian firm in an open speed contest since 1914. Drivers selected for these cars are Louis Wagner, who frequently raced for Fiat prior to the war, and the two Italians Minoia and Bordino. The two latter have figured up to the present as mechanicians.

SPAIN TO SHOW TRACTORS

NEW YORK, Feb. 1—An international exhibition of agricultural machinery, including tractor trials, will be held at Lerida, Spain, April 1-10. All machinery for the exhibition will be exempt from Spanish customs duties and exhibitors desiring information should write to the Comite de Organizacion, Exposicion Internacional de Maquinariam Agricola en Lerida, Urgel 187, Barcelona, Spain. The tractor trials will include a four-hour plowing competition, the minimum depth of furrows to be 20 centimeters.

Pennsylvania University Starts Highway Course

PHILADELPHIA, Jan. 31—State, municipal and private engineers have just begun attendance at a special course in highway engineering opened at the University of Pennsylvania. To qualify for the course, the men must have either a degree in engineering, or experienced in highway work.

The class started with seventy-eight members. Included in the number are thirty-six from the Pennsylvania State Highway Bureau, ten from the New York State Highway Bureau, six from the Delaware State Highway Bureau and ten from New England. The men taking the course average from thirty to forty years of age. The course, under the direction of Prof. Milo S. Ketchum, of the civil engineering department of the University, includes among its lecturers many of the most famous road builders of the country. In this connection, on Feb. 7, there will be a conference of highway engineers.

NEW ZEALAND PLANS AIR MAIL

NEW YORK, Jan. 29—New Zealand will establish airplane mail routes along lines proven to be practical by the United States Post Office Department, according to J. B. Murphy, of Timarou, who is in New York. He is interested in an aircraft operating company in Timarou and came to New York for a demonstration of the ten-passenger Liberty-engined Curtiss "Eagle," with a view to utilizing it in a tourist sightseeing service over Mt. Cook. The government is also encouraging civilian aeronautics by the enactment of laws and establishing landing fields.

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Trucks and Tractors Discussed at Chicago S. A. E. Meeting

Most of the professional sessions given over to discussion of maintenance and service problems. Truck fleet operation and the application of power to trucks are also considered. 500 attend the dinner.

By J. Edward Schipper

ENGINEERING activities during Chicago show week centered in the S. A. E. meeting. Professional sessions occupied an entire day and were followed by a dinner attended by over 500 members and guests.

The first session was given over to the subject of trucks and the second to maintenance and operation. The morning session included papers by L. L. Scott on steam power applied to a truck; N. J. Ocksreider on engineering analysis applied to truck selling and Capt. J. B. Haney on progress in design of ordnance equipment.

The afternoon session, which took up maintenance and operation, also had a program of three papers. N. J. Smith spoke of truck fleet operation, J. C. Thorpe on tractor service requirements, and T. F. Cullen on designing to facilitate service work. At the banquet H. L. Horning acted as toastmaster. The speakers were: David Beecroft, directing editor of the Class Journal publications and president of the S. A. E.; H. H. Merrick, president Great Lakes Trust Co., and Prof. John Paul Good of the University of Chicago.

The feature of the meeting was the discussion of truck operation maintenance and sales.

N. J. Smith, who is manager of truck maintenance of the Consumers Co., Chicago, spoke of the good results obtained by carrying maintenance to the greatest possible efficiency. The Consumers Co. operates over 150 trucks and by the system used under Smith's jurisdiction every one of these trucks receives a thorough inspection every night. A number of specially drilled men organized into specializing groups take care of the cleaning, lubricating and mechanical upkeep of these vehicles. The trucks in use there, as was brought out in the discussion, average about 1000 miles a month. They are washed every night and after the washing is completed they are checked over and must be satisfactory to the inspector before they are allowed to go out on the next day's work.

By carefully lubricating the trucks and by changing the oil as often as required, an astonishingly low upkeep cost has resulted. While it is true that the overhead of maintenance has somewhat increased by the elaborate care given, the cost of operating the fleet has been materially reduced in the long run and the depreciation of the equipment has been cut down to the limit. A number of questions put to Mr. Smith by the truck men present brought out some interesting information.

For instance, it developed that an average of 10,000 miles is secured on a set of tire chains. This figure does not apply to all classes of work, for in hauling coal it is possible to get an average of 15,000 miles

to the set of chains while in hauling stone or sand the mileage will be considerably shorter.

Regarding the regrinding of cylinders, Mr. Smith stated that he could not lay down any set rule. Some cylinders have run 30,000 miles without regrinding, while others have run shorter or longer than this distance by a very large margin. One of the members inquired regarding the regrinding of crankshafts, to which the speaker replied that he had not reground a crankshaft for four years. He stated that shafts which had been measured after having been in service for this length of time showed less than .002 in. wear.

Another variable factor in maintenance is the friction disk on the clutch. Some have to be refaced in one month while others will run for years. He thought that an average figure would be in the neighborhood of one and one-half or two years.

Smith has a man whose entire time is taken up by fuel and oil research. As a result mileage on fuel and oil has been continually increasing. This is accomplished by absolutely correct setting of carbureter and spark for each truck, by seeing that the proper timing of the valves and their correct setting is not departed from and also by the use of up-to-date devices which would tend to better conditions necessary to the attainment of economy. Crankcase oil, after it has been withdrawn when the oil is changed, is utilized for the lubrication of hoists and for other auxiliary machinery about the garage. Mr. Smith is at present experimenting with reclaimed oil for the cylinder lubrication, but has not as yet arrived at a definite conclusion.

Considerable interest and some amusement was expressed by the hearers to Mr. Smith's frank reply to the question of whether or not he was overloading his trucks. He stated bluntly that he is. He amplified his statement however by saying that the overload was compensated for by insisting that the trucks be never overspeeded. He confessed that the overloads sometimes amount to 30 per cent but said that overspeeding is far more damaging to the truck than overloading, hence the rigid rule against excessive speed.

N. J. Ocksreider, in his talk on engineering analysis applied to truck selling, divided his topics into two heads, first, the analysis of a given market, and second, the ability to analyze the transportation needs of the prospect. As an example of what he meant by proper analysis of the truck market he pointed out that a city district might be divided according to area, and while superficially all of the salesmen were allotted equal territories, the potential market in one division of the district might be far greater than in another. He outlined the necessity for making a careful study of all the factors involved in determining the number of actual prospects and the actual number of trucks required to meet all the transportation problems of any given district. Mr. Ocksreider, by his analysis, made clear the importance of apportioning sales effort and expense according to the possibilities of any definite areas.

The other phase of analysis applied to truck selling is in the use of engineers equipped to enter the establishment of a prospect and to properly analyze the truck equipment necessary to most efficiently handle the transportation problem involved. The factors taken into consideration include not only the number of trucks and their size but the routing, control and maintenance of the vehicle. The man to handle this work will of necessity be a qualified transportation engineer of sufficiently broad business experience to thoroughly grasp the needs of the plant under consideration. Not only must he accurately gage the type of equipment and the number of trucks of each capacity but also their performance characteristics as determined by engine size, wheel size, gear ratio, etc.

One of the most interesting talks of the entire session was that of J. C. Thorpe, a graduate engineer who has been an automobile dealer for several years and lately a tractor dealer. His views on the ethics of salesmanship and the obligations of the factory to the ultimate consumer have been voiced on previous occasions. He summed up his views of the dealer in the following words: "The only man who has a right to be a dealer is the man who sells good merchandise by good merchandising methods and who, having made the sale, remains in the capacity of a consulting expert on the use of the goods."

There has been considerable discussion on who is the best qualified man to be a tractor dealer. Thorpe gave it as his opinion that the best tractor dealer, regardless of whether he formerly sold automobiles, hardware or farm implements, is the man who keeps his tractors sold. The manufacturer should, he said, study the interest of the purchaser through the dealer. He must do it through the dealer because of the proximity of the dealer and his acquaintance with the purchaser. In doing this the manufacturer gradually develops his good will.

It takes years of effort to develop the desired degree of public good will and it may be destroyed entirely by one bad step. As an example of the method necessary for the manufacturer to develop this good Thorpe cited the policy employed by Marshall Field & Co., which is embodied in the expression, "The customer is always right."

In many instances the farmer buys a tractor by selecting the dealer rather than the machine. This, he said, should not be so. The matter of service, of course, enters into the relations between the tractor dealer and his customers to a marked degree, but it must be remembered that there is no such thing as free service. Some one must pay and it must be the customer unless the dealer is to go out of business. We must reach a definite understanding of the meaning of the word service and we will not do so until there is proper co-ordination between the engineering and merchandising departments of our factories. Good service is the result of cooperation between the dealer, factory and owner during the life of the machine to the end that the owner shall receive continuous use at reasonable cost.

Age of the tractor, Thorpe contended, makes no difference as regards the rendering of service. Neither should it make any difference whether the machine is in the hands of the original purchaser or not. In order for the dealer to give the proper quality of service he must be amply supplied with parts and the necessary technical knowledge to perform the repairs he is called upon to make. An incompetent dealer will discredit a good design and set at naught all the care and study given to the original design of the machine.

Mr. Thorpe stated that he did not look with favor on the practice of replacing parts at shipping and labor cost to the customer where these replacements are due to defective material, even though the ninety-day guarantee period had elapsed.

In discussing the faults of design common to tractors, Mr. Thorpe brought up the point that probably the most common defect is the absolute neglect of attention to the comfort of the operator. He said that it is absurd to expect an operator to sit with any comfort in a cast iron seat for 10 or 12 hours at a stretch. He pointed out the remarkable sales value in the tractor in which this point has been given attention. No one but the farmer can appreciate the courage necessary to get

up at 4 o'clock the morning after spending a 12-hour day in a seat upholstered only with black enamel.

Another feature of design which the speaker stated is overlooked is that of supplementary tools. He stated that because the tractor is considered only as a plowing machine by a large percentage of operators the average use is only 35 days per year. Proper supplementary tools would make the tractor available for many more tasks and for longer periods during the year, bringing the average up to 65 to 70 days. This would spread the overhead and reduce the operating expense, making the tractor appeal to the farmer as a better investment than it does to-day.

One point which the speaker brought out is applicable to the truck dealer as well as to the tractor dealer. The data the dealer has available should be interpreted to the prospect in terms of his problems. He said there is a woeful lack of the right kind of data. Where tests have been made they are of a highly technical character and the results have seldom been expressed in such a way that the customer can apply the information to his own particular problems.

T. F. Cullen spoke on the need for greater service accessibility in car design. He made the point that greater accessibility for service work also tends to lengthen the life of a car, as it makes service work easier to perform, less costly and therefore more likely to be undertaken at the first indication of trouble. He said the supply of skilled mechanics is never large enough to fill the demand. Any improvement, such as better service accessibility, which cuts down the time per operation in service work without impairing the car's subsequent efficiency, has exactly the same effect as increasing the number of skilled mechanics. With more accessible cars, service stations can turn out more work with fewer mechanics and therefore make bigger profits, or show a profit where they now show a loss, as many of them do. The dealer's success, both in selling cars and in servicing them, is just as essential to the factory as the owner's satisfaction.

More and more cars are sold each succeeding year to replace worn-out vehicles. Service reputation, based on the cars now in use, is rapidly becoming the predominating factor in these resales. Therefore anything that can be done to improve service work will make resales easier.

As an example of the results which could be secured by improving service accessibility, it is only necessary to recall that there are over 8,000,000 cars in use to-day, and improved design which would reduce the time necessary for service work to the extent of only 2 hr. per car per year, would save the owners over $15,000,000 per year on upkeep.

The paper by Louis L. Scott, chief engineer of the Standard Engineering Co., St. Louis, on the application of steam power to an automotive truck, will be reviewed in a later issue.

Tax on Automobiles Is a Tax on a Utility

THERE still remains in the public mind a vague belief that the passenger automobile can truthfully be called a "pleasure" car—in other words, that it is to a large extent a luxury. There even remains the feeling that the automotive truck is an expensive form of transportation and should be discouraged. These beliefs, erroneous as they are, have had a decided effect upon the sentiments both of bankers and of the buying public. Those sentiments are responsible for the effort now being urged before Congress to impose greatly increased taxes upon both cars and trucks.

It seems impossible that any policy so suicidal to the prosperity of the whole country as well as one so unjust to a great industry can be adopted. It is surprising that any argument is necessary in regard to the truck. The Government itself has records showing that the postal express lines running over distances up to 248 miles from Maryland into Washington resulted in selling farm products to consumers at something like 43 per cent less than the normal market prices. Other statistics show that truck haulage can often produce a saving over rail transportation up to distances around 200 miles. The advantages of truck transportation for shorter distances, especially in cities, have been proved by hundreds of thousands of truck owners. Even a slight investigation would show these services conclusively.

The fact that the passenger car is a factor of equal economic importance is not so easily demonstrated by statistics and this perhaps accounts for the feeling that the passenger car is a luxury, although the car passed out of that condition at least six years ago. A recent questionnaire sent out by the National Automobile Chamber of Commerce showed that 90 per cent of all passenger cars are used more or less for business purposes, and that more than two-thirds of the total mileage run by passenger cars is for business. So the utmost that can be charged against the passenger car to-day is that it gives pleasure after it has done a full day's work. The questionnaire brought out an even more startling fact that the average motor car owner increases his earning capacity about 57 per cent through its use. The value to the farmer has been shown time and again, and altogether no doubt can remain in the mind of any candid man who investigates that the automobile is far more than paying its own way to-day. In addition, of course, are the great intangible values that the automobile is giving—its contribution to comfort, pleasure and health.—From J. G. Vincent's address at Annual S. A. E. Meeting.

Airplane Taxi Fares

AN aerial taxicab in London costs approximately the same as an earthbound taxi in New York, according to Prof. E. P. Warner of the Massachusetts Institute of Technology and the National Advisory Committee for Aeronautics, in his paper, "Commercial Aviation in Europe," read before the Commercial Aviation Session of the Annual Meeting of the Society of Automotive Engineers.

The charge in England for an aerial taxi is 2s. 6d., or 44 cents for two persons per mile. This fare is only two and one-half times as large as that for an ordinary taxi in London, and it costs approximately the same amount to travel by airplane in England as by taxicab in New York. The actual costs of air travel in Europe have shown a tendency to steady reduction.

During the first eleven months of commercial flying between England and the Continent there was a total of twenty-four accidents, but only one passenger was killed. This works out roughly as one death for every 67,000 passengers, or one fatality for 1,640,000 passenger miles.

No European country operates its own mail planes, as has been the practice here. The mail operating companies are privately conducted and receive a fixed fee from the government.

Vauxhall Producing Two Chassis Types

That for general purposes has 130 in. wheelbase and a 3¾ x 5½ engine. The sporting type has 114 in. wheelbase but uses a larger engine, is lighter and has a higher gear ratio.

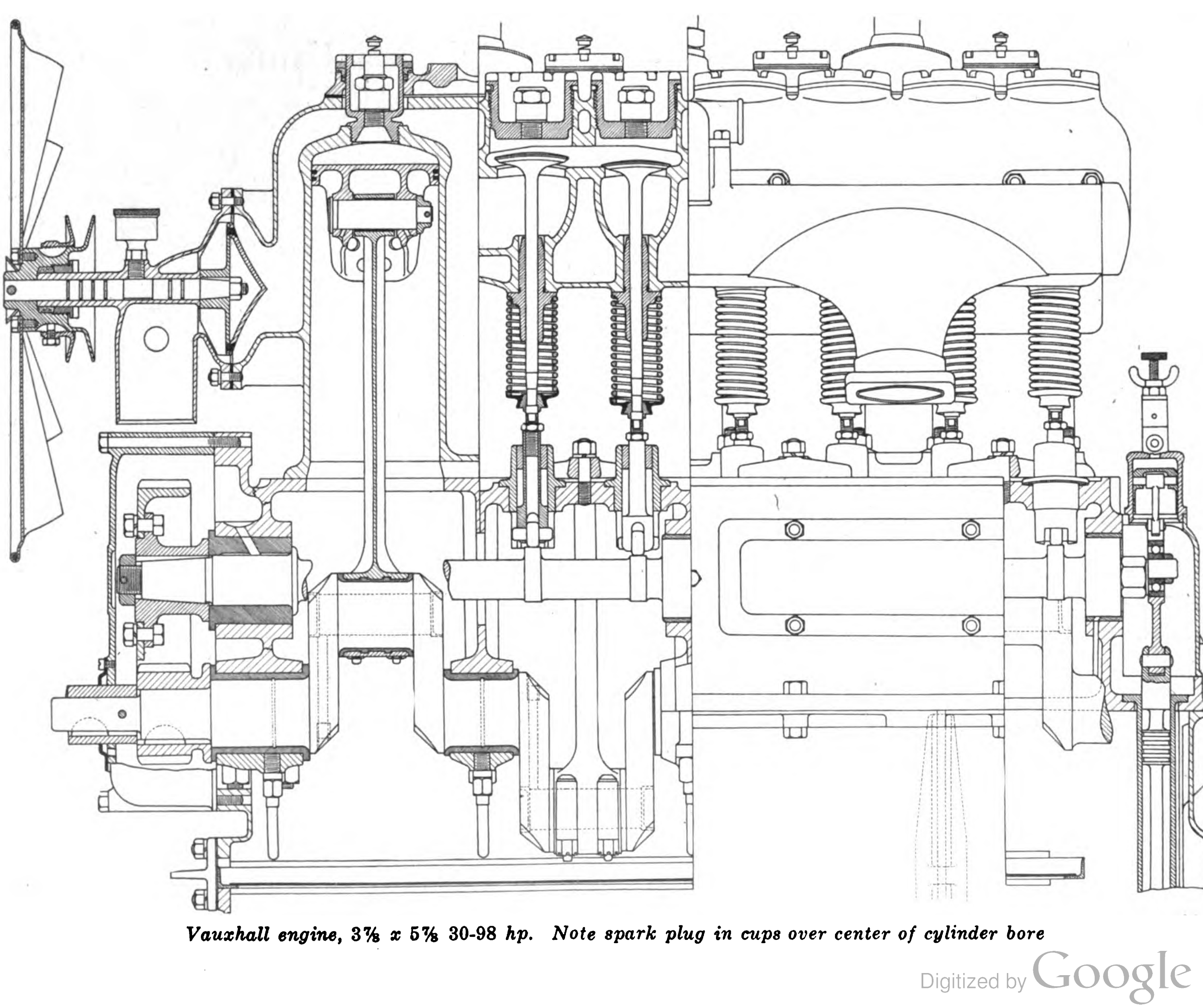
By M. W. Bourdon

TWO types of Vauxhall cars are to be made this season, as in past years. The smaller, termed the 25 hp. model, has a bore of 95 mm. and a stroke of 140 mm. (3¾ x 5½ in.). The block cast cylinders have L heads with the valves considerably inclined from the vertical. The cast iron pistons carry three rings and have the wrist pins fixed in their bosses. Pressure lubrication is employed. Oil is forced through the hollow crankshaft by a plunger pump operated from an eccentric pin at the rear end of the camshaft through a link having a ball-bearing on the pin. An upward extending link or connecting rod operates the piston of an air pump for the pressure feed fuel system.

Water circulation is of the assisted thermosyphon type, the belt driven fan shaft having at its rear end the impeller of a water accelerator enclosed at the front of the cylinder block. Magneto ignition is standard, the magneto being driven directly from the chain distribution on the left of the crankcase. The carbureter, located on the right, is bolted to an induction branch integral with the cylinder block on that side and leading by cored passages to the valve ports on the left, where the separate exhaust manifold is located.

A feature of both Vauxhall engines is the filter tray of gauze, which forms a false bottom to the crankcase, and can be withdrawn from the front below the cross member by removing the six nuts which hold the flanged front end to the front face of the oil sump.

Engine and gear-box are separately mounted on a subframe. The multi-disk clutch is connected to the four-speed gear-set by a shaft and flexible coupling. Right-hand control is employed and to the transmission is fitted



Vauxhall engine, 3⅞ x 5⅞ 30-98 hp. Note spark plug in cups over center of cylinder bore

an expanding type brake. An open propeller shaft, with star and block joints at front and rear ends respectively, conveys the drive to the spiral bevel gearing with 3.6 to 1 ratio in the rear back axle. Semi-elliptic springs are used, but the torque and drive are taken by a triangulated tubular torque member attached to the axle casing center at the rear and to a tubular cross member at the front. This chassis, which has a wheelbase of 130 in., has recently been reduced in price to $5,000, a reduction of approximately $1,000.

The second Vauxhall chassis is termed 30-98 hp. and has a bore and stroke of 3⅞ x 5⅞ in. As with the 25 hp., the four cylinders are block cast with L heads, but a distinct variation occurs in the position of the spark plug, which is mounted immediately over the center of the cylinder bore in a recessed cap, passing through a cored hole in the cylinder jacket and cylinder head. High lift cams with valves of 2¼ in. diameter, stiffer springs and slipper type aluminum pistons with two rings are other features wherein the larger model differs from the other. It has a five-bearing hollow crankshaft arranged for pressure lubrication, with the same type of oil and air pumps as in the case of the 25 hp. model.

There is very little difference, except in the points mentioned, between the two chassis in general construction, though the larger one has a shorter wheelbase (114 in. as against 130 in.) and straight bevel final drive instead of the spiral bevel. This chassis is also considerably lighter than the other, viz., 2650 lb. as compared with 2900 lb.; naturally, then, it has a higher gear ratio, viz., 3 to 1. It is made primarily for light sporting type four-passenger bodies and not for general purposes, as is the 25 hp. chassis. The sporting type shown at Olympia was fitted with a body of the clover leaf pattern seating three passengers and having a very light superstructure.

This chassis has also been subject to a price reduction of approximately $1,000, now being sold at $6,250.

Valuable Work Done by the Forest Products Laboratory

ORGANIZED research to-day is becoming more and more of a factor in progressive business. There is a decided advantage from the standpoint of the wood-using industries in having available a neutral research organization, such as the Forest Products Laboratory, which is not only the foremost of its kind in existence, but which is well organized, efficiently operated, equipped already with a large knowledge of the basic properties of wood, and with facilities for advancing research economically.

The laboratory's activities have touched practically all wood-using industries and have advanced in one way or another their knowledge of wood and their methods of using it. Every thousand feet of lumber (88 1/3 cu. ft.) made available through better utilization relieves the drain upon the forest by about 250 cu. ft. This is because under present utilization three cubic feet of wood must be grown in the forest for each cubic foot of finished lumber.

The work of the laboratory is concentrated upon devising means for saving as many of these cubic feet as possible, and upon securing the adoption of the improved methods by the industries. Almost invariably, the methods which have been developed have resulted, not only in an actual saving of wood, but also in a better or cheaper product delivered to the consumer.

Very definite progress has been made by the laboratory along many lines of conservation and utilization, and also along other lines, such as in the development of water-resistant glues.

The function of the Forest Products Laboratory is, in the main, two-fold—first, to carry on research and obtain authoritative information concerning wood and other forest products, and second, to make this information available, in usable form, to the industries and to the general public.

During the ten years of its existence the laboratory has made much progress in connection with items listed below. Aircraft parts boxing, crating, packing, chemistry of wood, decay and decay prevention, ethyl alcohol from wood waste, glues for wood, grading lumber, grading structural timbers, hardwood and softwood distillation, identification of wood, kiln drying and air seasoning, mechanical properties of wood, structure of wood, needle and leaf oils, preservation of wood, pulp and paper, steam bending, veneers and plywood, wood finishes.

As illustrations of the kind of work carried out at the laboratory, a few typical accomplishments are presented here.

1. The art of testing containers has been developed at the laboratory in the past five years. During that period much has been discovered concerning the proper construction of boxes and help has been given to various associations and to many individual manufacturers and users of boxes in the most efficient and economical methods of design and construction. Much progress has also been made in the design of crates for machinery. To make the knowledge gained more effective, and in response to insistent demands from box makers, packers, and shippers, courses of instruction in box and crate design are given periodically at the laboratory.

2. The experiments conducted at the laboratory during the past nine years have developed kiln drying from a haphazard, wasteful and thoroughly unsatisfactory rule-of-thumb process to a reasonably precise art. Methods and drying schedules have been developed for the drying of most commercial woods, ranging from oak vehicle stock, green from the saw, to one-inch pine and fir. Numerous patents have been taken out on apparatus for artificial seasoning, and two types of dry kiln have been developed to a state of high efficiency.

The most spectacular, and also the most urgent, applications of this drying work were the drying of gunstocks, artillery stock, and airplane stock during the war. This was done with thorough success in many kilns of the type developed at the laboratory, and according to specifications and schedules prepared by the laboratory. Courses of instruction in kiln drying are given each month and are proving of great help to the industry.

3. Search for substitute woods to replace the rapidly vanishing spruce and other commonly used pulpwoods has been going on steadily for many years.

4. All the important American woods, in commercial use, have been tested and their mechanical properties determined, and made available to the industries.

5. Investigations into the efficiency of many wood preservatives and into the best way to impregnate the important commercial woods of the United States have done much to advance the art of wood preservation.

Editorial on Doubling Fuel Mileage Commended by Prominent Engineers

Effort to arouse automotive industry to need and possibilities of greatly increasing miles per gallon of fuel meets with favorable response. Some conservative engineers consider radical changes desirable.

THE editorial bearing the title, Can We Double Mileage Per Gallon of Fuel? which appeared in AUTOMOTIVE INDUSTRIES for Jan. 27, has resulted in comment which indicates that many engineers agree with the view that it is possible to greatly increase the number of miles per gallon that cars travel under present conditions, and some of them state that radical changes must be made. While nearly all the comment received indicates that the basic cause of inefficiency of present day engines as now applied is recognized and must, as we pointed out, be remedied before very material increase in efficiency can be attained, there is naturally much difference of opinion as to the methods by which the desired result can best be attained. Some consider rather radical changes desirable while others point to lack of refinement in the average present day engine as the first problem to be attacked. Some doubt the possibility of attaining double the mileage now secured, at least in the case of cars which are now performing well above the average, but others think such an increase within the realm of possibilities.

Some of the comment we have received deals, primarily, with the methods we mentioned as being promising, one or two taking the view that the evidence to date in favor of these methods is not sufficient to justify a prediction of their general application. Our intention is not, of course, to "boost" any one method of securing the desired result, and we have tried to make it clear that much careful research is necessary before any method can hope to see general adoption. Our purpose was, first, to point out the inherent defects in present practice; second, to show that there are possibilities of material improvement, and third, to urge upon those in a position to develop these possibilities the importance of supporting and prosecuting research which will enable the industry to realize the benefits which are within its reach.

We propose to follow out this policy and give space to descriptions of any methods which seem to us to promise the desired results, as well as to reports of research work and constructive comment which lead in this direction. It is our intention to hammer away at the fuel problem until concrete results are attained, or at least until it becomes evident that such results are not attainable or that the automotive industry is too little interested to make the effort worth while. We bespeak the co-operation of those who we know have this matter at heart, but will, of course, welcome constructive criticism.

The following extracts from letters referring to the above-mentioned editorial will, we believe, prove interesting and instructive. They represent only a fraction of the total number of comments received.—THE EDITOR.

Andrew L. Riker.—I am heartily in accord with the editorial which appeared in AUTOMOTIVE INDUSTRIES of Jan. 27, as I believe that something must be done to make the automobile engine more efficient. I have had this in mind for some years past, having designed an engine some 18 years ago, operating on constant pressure cycles, as against the constant volume cycle, and cannot help but feel that we must abandon our old ideas and secure a new system of using fuel, which will permit us to have at least a fair efficiency on part load, as that is about the condition we are operating under practically 90 per cent of the time.

Harry L. Horning.—Accept my thanks and compliments for the very well-put editorial in your issue of the 27th. It certainly hits the nail on the head.

Percival S. Tice.—I have found your editorial of very great interest.

We have been working with a method of localized carburetion, which has given some very interesting results. At the same time it seems to be proven that the full advantage in economy of this method of supplying an engine with charge, cannot be realized unless the compression ratio is carried quite high—that is to say, so high as to be practically unusable in the ordinary class of automotive equipment.

It must be granted that there are very material improvements in thermal efficiency at small loads when full charges of air are taken into the cylinder under all conditions of load, but it must not be overlooked that to a very great extent the improvement in efficiency under small load conditions follows from the great reduction in charge dilution in such an engine, rather than from the increased compression pressure. In the ordinary engine, operating at about one-tenth load the charge dilution amounts to approximately 60 per cent by weight, while when full quantity of air is pumped the dilution will run from 4 to 6 per cent.

It is the writer's opinion that a more flexible and generally usable engine would result with localized fuel charges if it should be found possible to obviate this excessive dilution with products of previous combustion, and at the same time not very materially alter the compression pressures now obtaining over the load range.

A. L. Nelson.—I was very glad indeed to see the editorial comment on doubling the mileage per gallon on fuel which is published in the Jan. 27 issue.

I believe that the editorial is along the right line and that it is very commendable to urge engineers on at the

present time in order that they put forth their best efforts to produce engines and cars which will give us a much better efficiency than we are getting to-day.

It is also very apparent that we have to make more than an ordinary change in the present time equipment used, and it is surprising the many schemes which appear very feasible that are available when one looks at the problem with a view of seeing what can be done. I might add that we are making some analyses now which appear to offer perhaps 100 per cent increase in mileage without departing very far from standard construction of to-day.

I wish to personally thank you for the efforts you are making to get the problem before the engineers in the industry.

C. A. Norman.—I was very glad to read the editorial on improved fuel economy in AUTOMOTIVE INDUSTRIES for Jan. 27. It is certainly highly commendable for you to take this matter up and urge its careful consideration on engineers and manufacturers.

It may perhaps be of some interest to point out that the improvement attained (in the type of engine described) would not appear to be due simply to increased compression pressure at reduced load. The compression pressure in the Diesel engine remains constant at all loads, yet the thermal efficiency is actually improved at reduced load, on account of decreased "admission," meaning increased expansion. The improvement due to increased compression pressure is caused directly by the smaller amount of residue remaining to foul the charge and impair ignition; by the lower end temperature of compression due to less heat by the residue and consequent greater temperature and pressure ratio available from combustion; by the reduced cooling losses due to possible lower temperatures with leaner mixtures; finally, and perhaps mainly, by the possibility of securing good ignition with sufficiently high air ratio for complete combustion of the fuel.

I have been trying to discuss all these matters a little more thoroughly in a bulletin of the University Experiment Station, which also will contain my entropy chart. Very naturally, you could not enter upon all these things in an editorial without losing something in force of the main point to be driven home. Nevertheless, in engineering discussions I think that it may be of some value to set forth the detail function of expansion and compression separately in their influence on fuel utilization.

H. C. Dickinson.—The possibilities in the line of designing more efficient automobiles and power systems are almost unlimited. There is probably no question whatever that we could, and probably will, design automobiles capable of giving two or three, or possibly four times the mileage of present designs without any appreciable sacrifice in comfort, convenience or speed. The main possibilities along this line would seem to be: (1) Improvement of the fundamental economy of the power plant; (2) Development of a suitable transmission system which will enable the power plant to operate always at an economical speed and load; (3) Design of vehicles to permit much lighter weight without sacrificing speed and comfort.

Whatever may be the possibilities of improving car design with a view to economy, or even the possibilities of modifying existing engines to improve economy, the fact remains that there are at present in existence some eight to ten million motor vehicles, that these vehicles will be in service for an average of perhaps four years, that they are going to be operated and supplied with fuel as long as fuel is available at any price less than say double the present price, that no substantial modifications are going to be made in the vast majority of these vehicles. If the foregoing statements are true, the existing vehicles alone are destined to consume, before they are worn out, a very large part of all the motor fuel which will be produced from United States petroleum. I believe that the Geological Survey has estimated that the crude oil left in the ground would last about twelve years at the present rate of consumption. If this is the case, the existing cars running for four years would consume about 30 per cent of the total gasoline available from this crude oil by present methods of refining. It might be of interest to make a more definite estimate of this figure. In view of these facts, even if not a single additional uneconomical vehicle were constructed, the problem of fuel conservation in existing vehicles would be of paramount importance. As a matter of fact, millions of additional vehicles will be built substantially on present designs. There is no question, therefore, that the most immediate results in the way of fuel conservation can be secured through improvement in the fuel economy of existing equipment, without the addition of any complicated or expensive devices.

The figures given by the Bureau of Mines, indicating that 25 per cent of the fuel used is not even burned, are probably conservative. Moreover, probably much more than a 25 per cent increase in mileage of the average vehicle could be secured by careful operation alone. Almost any engineer or skilled mechanic can secure a large increase in the mileage of the average vehicle without any sacrifice in performance, and we can no longer afford to dismiss the fact with the simple statement that the fault is all due to the ignorance and carelessness of the average driver. The ten million drivers in this country are average people with average intelligence and are interested in saving fuel. If a saving of 25 per cent to 40 per cent of the fuel bill is as simple as it seems to be in the hands of the engineer, there certainly is a possibility of educating a considerable percentage of these ten million drivers so that they can secure such saving. Is it not worth while for the engineer to first determine precisely how the average driver can improve his mileage and then to proceed to educate the average driver to a point where he can secure this result?

Henry M. Crane.—Of course what you say regarding the necessity of maintaining the highest possible compression at the actual running speeds is absolutely true, and it is equally true that this is a condition almost impossible to obtain in the ordinary type of four-cycle engine. There is evidently, therefore, a possibility of very radical improvement in road mileage per gallon by changing the type of engine. No engineer has the right to overlook this possibility. On the other hand, we know that very many cars to-day are being put on the market that would be capable of great improvement in mileage if better design and also better workmanship were used in their construction. I think that the industry as a whole is very lax in its attitude toward such improvement and would like to feel that there is no use of doing much except wait for some revolutionary invention to come along.

I know you say that work should not cease on the development of the present conventional designs, but I am discussing the effect that the general tone of the article had on me and would be sure to have on the men in the industry who are not engineers.

Hugo C. Gibson.—The editorial in AUTOMOTIVE INDUSTRIES is very interesting. I believe that you can do no better service to the automotive industry than to harp and harp along these lines until the manufacturers are

forced into a position of attacking this problem wholeheartedly.

We are going right after it, hard. Of course, we have a strong incentive in the absolute necessity for furnishing the public with a quiet engine, and I believe that quietness of operation and economy go very much hand in hand. I never heard of a detonation that was either quiet or economical.

Th present tendency of the automotive industry, practically throughout the world, toward the small high-speed engine is, in my opinion, only justified by such economy as is represented in the low first cost of the apparatus. We all know that the Otto-cycle automotive engine is most economical in consumption at moderate speed—say from 900 to 1400, averaging perhaps 1100 r.p.m.—and that a really serious increase of cost of operation, not only of fuel and oil but a great depreciation of every operative part in the power line, occurs just so soon as we increase the rotative speed of the engine.

European practice is tending more and more toward the use of an increased number of selectable gear ratios which, providing the engine is large enough to permit its use at the economical speed of rotation, is a real step toward economy. This leads us to the question as to whether a four-speed gear driving direct on third, with stepped up fourth or direct on fourth, would be the most desirable. Personally I believe in the direct on third.

It is a fact that no high-speed machinery is quiet, and that noise means wear—even the high-speed electric motor is not quiet and it surely does wear in comparison with low speed. Friction horsepower curves show us clearly enough that the amount of gasoline used up in turning the small engine over at a high speed, apart from the amount used to deliver turning effort to the rear wheels of the car, is not in any sense compensated for by the slightly less effort required to propel a similar car, but fitted with a few more pounds weight in the engine.

Taking all the above into consideration, you can see why I am in favor of an engine large enough to furnish a reasonable touring speed at an economical r.p.m.

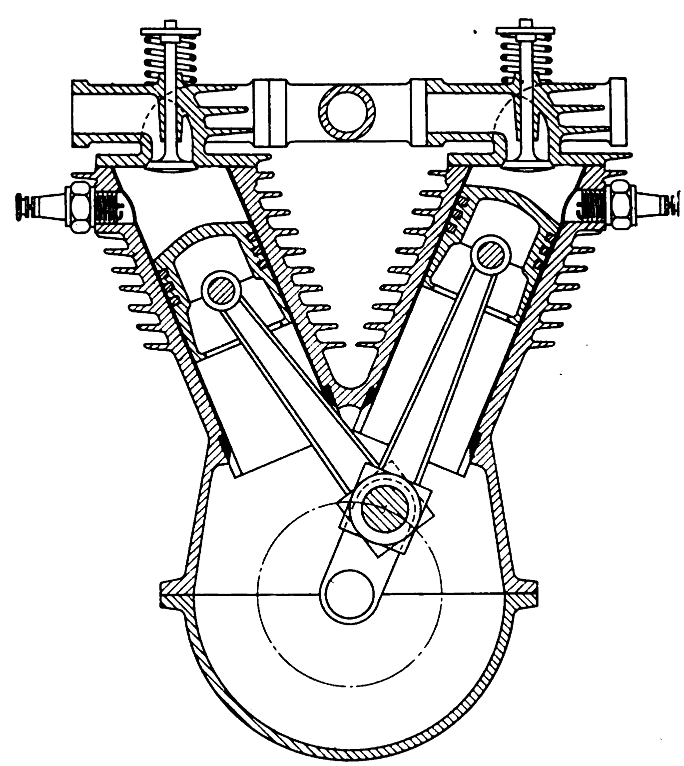
I believe with you that it is time for radical improvement and it is possible that this improvement may lie in raising the physical duty per piston—in other words, making a smaller boiler do the same work at the same speed of operation.

Otto M. Burkhardt.—I am very much interested in the editorial in AUTOMOTIVE INDUSTRIES of Jan. 27, 1921. In this it is stated that a prominent manufacturer has increased the fuel efficiency by admitting pure air through one of the dual inlet valves and a rich mixture through the other. In consequence the full compression pressure is claimed to be maintained regardless of load. This is truly an ideal, engineers have been hoping to materialize. The most reliable experiments in this direction of which I have knowledge are those by H. R. Ricardo compiled in a paper that was read before the Royal Aeronautical Society of Great Britain. This paper was published very recently in the English paper *Engineering*. Ricardo's success was not nearly as marked as stated in the editorial mentioned above, and what is more important Ricardo's success in saving fuel entirely depended on his success of keeping the mixture in strata.

Stratification of the charge it must be admitted in one way conflicts with high efficiency because strata preclude turbulence and turbulence as we know is all important to secure reasonably fast combustion. There are, of course, other difficulties such as uneven distribution of the charge in a long manifold. This condition is accentuated if only one part of the cylinder charge is taken through the carbureter.

An Aluminum Motorcycle Engine

A NEW type of motorcycle engine, which should be very light in weight, is described in *The Motorwagen*. It is of the 2-cylinder "V" type, and the two cylinders are cast together with the top half of the crankcase of aluminum. Cylinder liners of cast iron are set into the mold, and therefore do not have to be fitted. The cylinder heads are separate castings, and the upper surfaces of the cylinders are parallel with the lower surface of the upper half of the crankcase, hence both surfaces can be machined in a single operation. Making the cylinder heads separate obviates the necessity for valve cages. It appears to be the intention to use a ground joint for the cylinder heads, and no gaskets. The valves are arranged perpendicular to the cylinder head joints. The carburetor can be conveniently attached to a short, straight length of pipe between the two cylinder heads. Aside from the inclined cylinder bores, an arrangement which, of course, cannot be avoided, in a V type motor, all inclined surfaces have been eliminated, so that a casting can be machined on any suitable tool without special fixtures. Even the bosses for the spark plugs are arranged horizontally. In small engines the location of the spark plug bosses usually causes the designer considerable difficulty, but the problem has here been solved in a rather skilful manner.



Motorcycle engine with cylinders and upper half of crankcase cast in one piece

A CCORDING to G. C. Loening, the world war hindered rather than helped the development of commercial aviation, due to the fact that many interested in aeronautics have learned to think in terms of war machines rather than of types better suited to commercial work.

Cast Aluminum Instrument Boards in Wider Use

Are applied to most high-priced chassis of British and Continental make and, in simplified construction, to cars of moderate price. The all-metal board is smart in appearance and very workmanlike in arrangement.

By M. W. Bourdon

THE practice of using cast aluminum for dashboards and instrument boards, which first became pronounced at the Paris Salon of 1919, is spreading appreciably on European cars, and this form of construction appeared at the London show on cars of quite low power and on others of medium price, as well as on the high-grade jobs. Cast aluminum unquestionably makes a more workmanlike arrangement, though objections are raised against it in that when sand-blasted it shows up dirty finger marks very prominently, and when polished it forms another item to keep clean if its smart appearance is to be maintained. A smooth but dull finish would seem to be the best.

A simple form is shown in Fig. 1, the Vermorel, but here the dashboard itself is of wood with two latticed brackets of channel section carrying the separate aluminum instrument board and continued below to support the sloping front footboard. It will be noticed that a bracket extending from the right hand side serves as an additional support for the steering column, an unusual feature, but one which might with advantage be more widely adopted, for steering columns on many cars of all nationalities are prone to vibrate appreciably.

A more substantial construction is that of the Star, made by a firm usually inclined to be very conservative and one of the last it was imagined would adopt such an up-to-date construction. The photograph (Fig. 2) is almost self-explanatory, the only feature worthy of special mention being the pivoting of the throttle pedal on the aluminum "ramp" (sloping floorboard). The pedal consists of a curved plate with a tongue projecting down through a slot in the "board," the bottom end of this tongue abutting the flat surface of a lever linked to the carbureter and secured independently of the board. Thus the latter can be lifted clear with the pedal without breaking any joint in the throttle connections. The dashboard is separate from the ramp brackets, its foot being bolted to the top of the latter.

Another fairly simple construction is the D.F.P. (Fig. 3), but this does not give the idea of stability which should be a feature of cast aluminum boards; the dashboard, for instance, needs support from the cowl paneling, whereas, obviously, the reverse condition should apply. The Charron Laycock arrangement (Fig. 4) is far better in this respect, for the dashboard is a box-like casting with its rear face brought well back to cover the ramp. This car is one of quite small dimensions. It has a four-cylinder engine of but 2 9/16 x 4 5/16 in. and sell at $3,000 with a two-seated body.

The Brasier design (Figs. 5 and 6) is also of box form, but this differs considerably in that the space between instrument board and dashboard is enclosed below, the parts and wiring within being accessible, when the cowl has been fitted, only by removing the panels of the dashboard. This is an unnecessarily involved arrangement, as one of the illustrations makes clear. It consists of a number of separate castings with detachable panels and filling-in pieces of specially shaped sheet.

The Straker-Squire construction is unique. As seen in Fig. 7, the unit cast dashboard and ramp support the instrument board by a tubular cast bracket, which contains all the wires and other connections to the instruments. The Klaxon horn is so placed that the passenger's feet may cause damage to the terminals, and where it is somewhat inaccessible when adjustment is required—points which should not be overlooked if this location is selected.

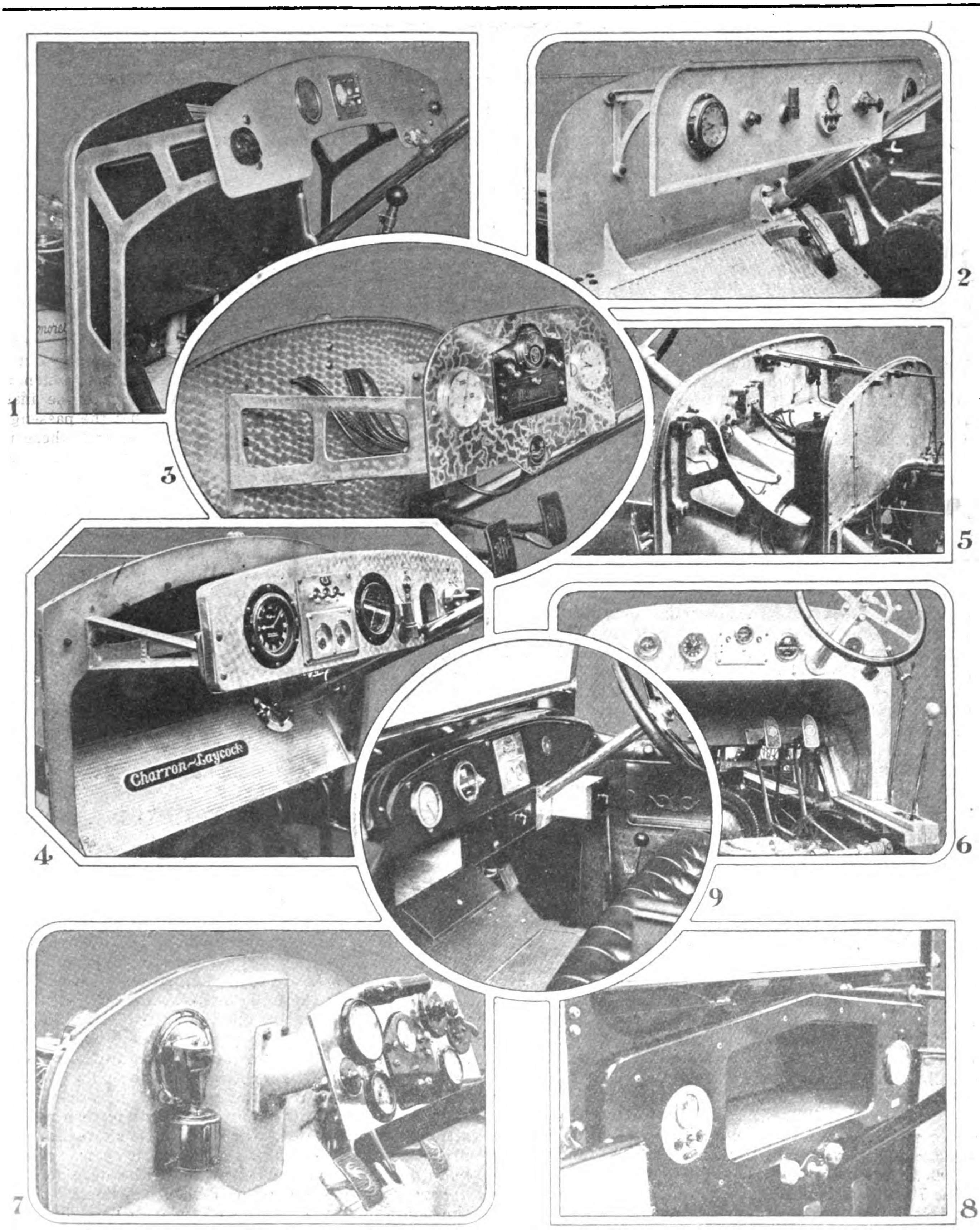
But by no means have the majority of British car manufacturers adopted the aluminum construction. Wolseley, for example, has an instrument board of polished mahogany depending from the cowl but, although the fuel tank is carried at the rear, no attempt is made to utilize the space in front thus made available for other purposes. Standard cars have a roomy enclosed shelf (Fig. 8) at the center for small parcels, gloves, etc., while Humbers (Fig. 9) provide a deep cupboard and a couple of drawers 14 in. long, all these finding space under the actual instrument board and in no way incommoding the occupants of the front seat—they are a distinct advantage and might well be used whenever space for them is available.

Developing a Magnetic Test for Twist Drills

THE Bureau of Standards is taking part in a co-operative investigation by a committee of the American Society for Testing Materials on the testing of twist drills by magnetic analysis. The steel has been specially prepared by one member of the committee and tested for homogeneity by a magnetic method at the Bureau. The drills are to be manufactured from this steel by another member of the committee under carefully controlled conditions, after which they will be tested again magnetically by various members of the committee. Following the magnetic tests, the drills will be returned to the manufacturer, who is to give them a thorough mechanical test. The committee will then meet and atttempt to correlate the mechanical performance of the drills with the results of the magnetic tests. The ultimate object of this investigation is the development of apparatus which can be used in a commercial way for the non-destructive testing of twist drills. The special apparatus for this work is in process of construction at the Bureau.

Types of Instrument Boards Used on British Chassis

(Note extensive use of cast aluminum)



Mechanical Requirements for Trailer Progress

The use of trailers began long before the development of the motor truck; railway trains utilize the principle. Certain mechanical changes are necessary, however, for the progressive development of the trailer in connection with motor driven vehicles. This article discusses this important question.

By Marius C. Krarup

UNTIL twenty years ago nearly all loads in transportation work, on land, were hauled in vehicles trailing after the power unit, unless the loads were very small, the roads very rough and tortuous or primitive customs prevailed. Elephants, camels, llamas, burros, pack mules and saddle horses, all combined, did not figure big in tons or miles as against railway trains and the standard combinations of horses and wagons. Then came the automobile and the motor truck, with their high speeds, and temporarily broke up the trailing system for transportation on common roads, while the tractor continued it for the slowest forms of work only.

There never was any much better reason for abandoning the trailing system for fast work than technical or industrial difficulty in getting all features in transportation by engine power perfected at the same time and quickly enough for satisfying the public demand.

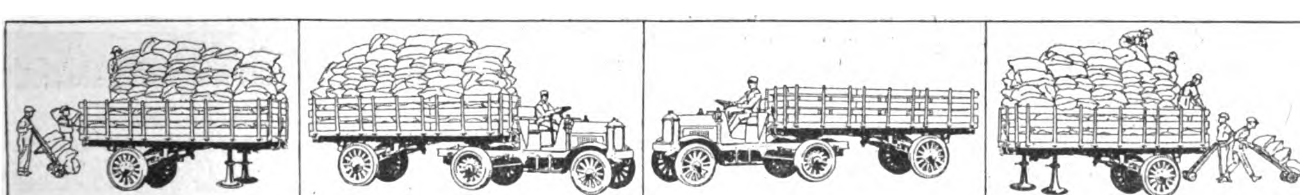
Motor trucks have come as an avalanche, rather than a development, as all can now see by looking backward over the last few years, and the almost abrupt transition to new methods would be more marvelous than anything that is real can be, if there were not many things in the use of trucks still to be adjusted to the great variety of working conditions. The orderly reintroduction of the trailer system, changed as much as necessary for reconciling it with the peculiarities of engine power, as well as modern production and marketing methods, is naturally among the first and most important steps toward improved adjustment to the realities, and has already been widely accepted as indispensable for strict and competitive economy in many lines of business.

Terminology of the Industry

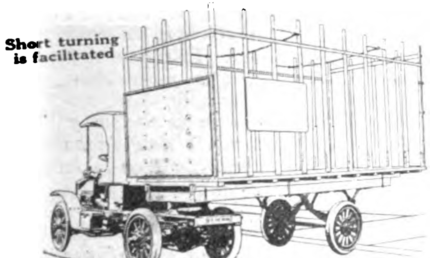
There are, perhaps, 50,000 trailers in use now in the United States, not counting railway cars or the working machines pulled by the tractors. The word "trailer" has, in fact, already become specialized in its sense, so as to refer particularly to separate structures intended for carrying loads in connection with automobiles, motor trucks or tractors. We speak of "four-wheeled trailers," "two-wheeled trailers," "semi-trailers" and "pole trailers." The phraseology is awkward as yet. Terms sounding more natural and businesslike may be found and adopted.

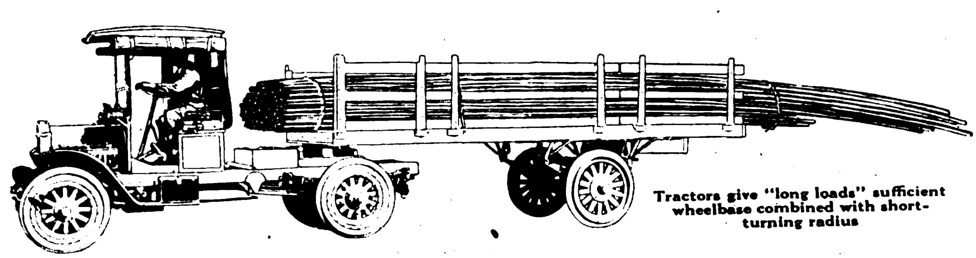
Such words as trailer, trailcart, loader or loadcart and pole-dolly or dolly—for designating the same types in the same order as before—might be found preferable. The word "dolly" is already widely used, though usually with a prefix indicating the purpose of its employment, as lumber-dolly, timber-dolly, pipe-dolly. The latter is used much in the oil regions.

The term "tractor-truck" is sometimes used to denote the shortened truck or light tractor used for hauling a semi-trailer. Traction-cab or cab would be more accu-

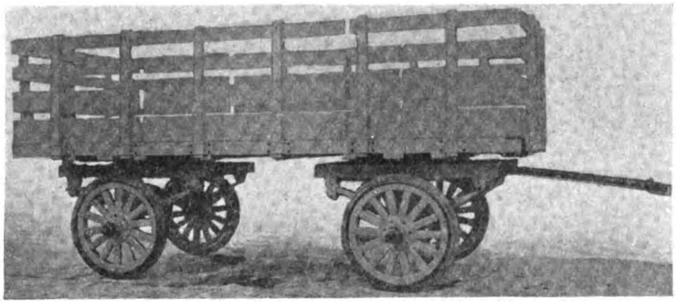


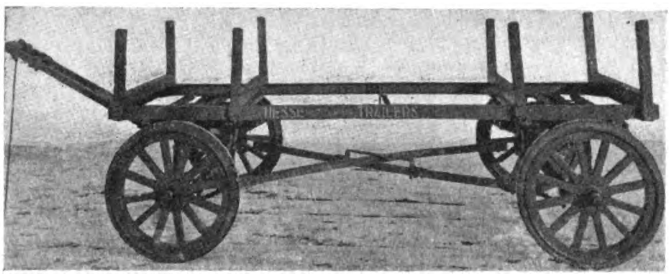
While one Trailer is being loaded— —the Tractor is hauling a loaded Trailer— —or returning with an empty Trailer— —while another Trailer is being unloaded.





(Above) Some operative advantages of the trailer system. (Below) Shows the short turn, the ease of maneuvering in tight places, and the suitability for long loads





(Above) Reversible four-wheel trailer made with two-wheel-and-axle assemblies turning on fifth-wheels under frame carrying body. In towing, the rear one is locked. In backing the front one may be locked. (Below) One manufacturer employs cross-connected axles and two fifth-wheels for a four-wheel trailer, which can be reversible

rate and handier. But in the following the current terms must generally be used.

Effect of Competition

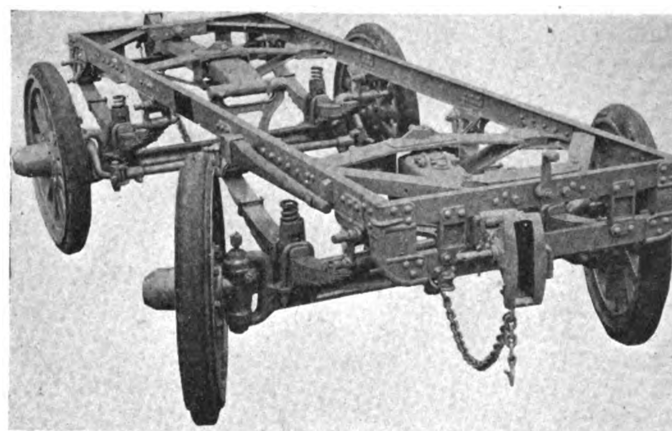
In order to perceive easily the reasons for special construction features in modern trailers it may be useful to note first the evident reasons for that temporary abandonment of the trailing system which has been witnessed. It was possible to give the motor truck a load capacity comparing fairly well with that of the draft truck. But it had no advantage on this point, and it became soon an article of faith that the merits of the motor truck were due to its speed, its capacity for sustained work and the extension of the business zone following the increased daily mileage.

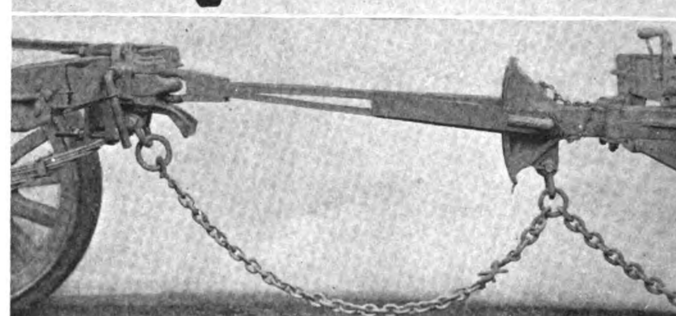
These advantages seemed sufficient so long as the motor truck competed mainly with its predecessor. We humans are modest in our demands if it is not evident that we can get more by insisting. Then there was the traction problem; tires and differential gears were imperfect, and too frequently the motor truck was in trouble taking care of its own propulsion. If it was found in practice that a certain large apparent surplus of engine power was required for the dependable operation of a truck, why would it not eventually be found that a corresponding and larger surplus would be required for operating with the larger load of a truck with a trailer? The answer was not at that time as clear as it is now. Furthermore, couplings suitable for motor truck speeds and short turning angles had not been devised. Neither could they be copied from railway practice, where short turns do not occur.

But in the course of a few years, when motor trucks became so common that they competed in the same lines of business, it was natural to look around for new advantages in economy and operation. The employment of trailers, when that point was reached, presented the conspicuous inducements of an old and familiar expedient and one whose adoption did not call for reconstruction of the expensive motor unit. All other methods that might be contemplated belonged in the realms of radical and dubious engineering—referring to such possibilities as are represented in the heavy steam lorries of England or the introduction of tractors for city commerce. They spelled heavy investments and postponed results. The rejuvenated trailer system, on the other hand, could be inaugurated by the owner and user of motor trucks at small initial expense, involved few delays and could be extended in the measure as it proved itself profitable.

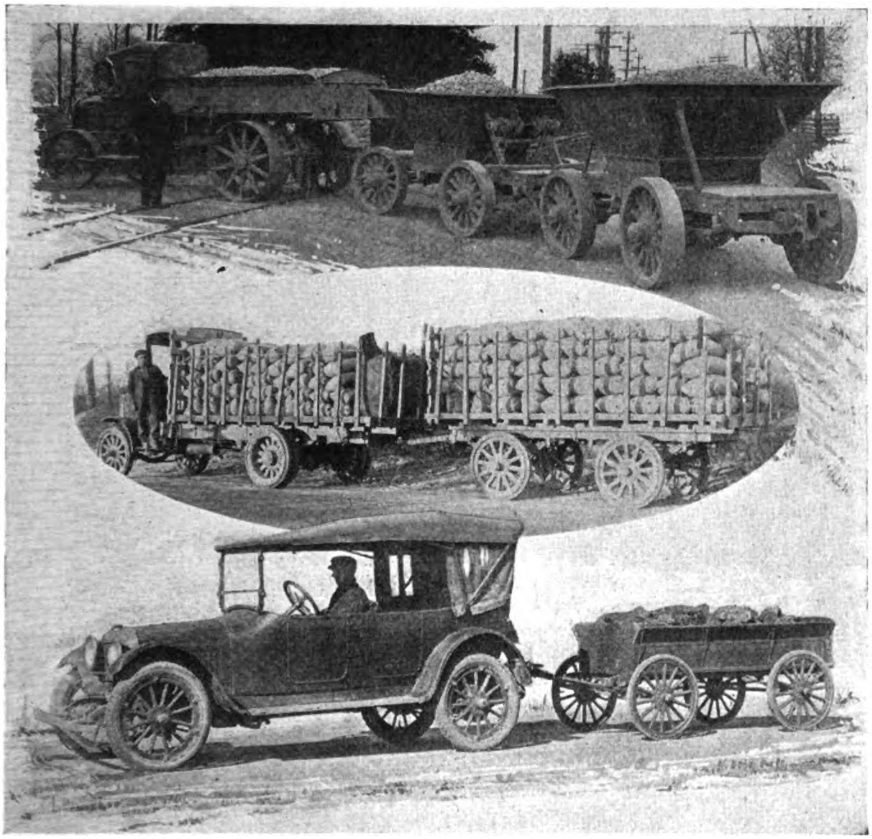
Operating and Upkeep Costs

The inception and rapid growth of the modernized trailer movement is therefore a natural upshot of conditions, logical and inevitable like every other materialistic movement that makes way for itself. The business-man no longer shows his enterprise and intelligence by adopting or resisting it, but by deciding in what particular form he can best make use of it. In some cases he may properly conclude to wait, but if he has a growing business with rush periods or seasons and the local roads are favorable, a trailer equipment of one type or another will usually save him operating and upkeep costs, even in those cases that seem most doubtful at first glance.





(Above) Typical four-wheel trailer chassis of reversible pattern, having hinged yoke at end of swiveled drawbar to compensate for spring action. The yoke is hinged to a horizontal yoke journaled at its rear end to center of transverse steering rod. Drawbar has a bumper head and encloses double-acting draft springs. A drawbar lock, to immobilize rear steering gear in turning or front gear in backing, is released by turning lock crank. To back, the bar at side of frame is inserted in rear drawbar and used as steering lever. (Below) Automatic hitch secured to motor unit in connection with chassis shown above. To couple, the operator raises hand lever and thereby parts the jaws. Then inserts connecting bar into guide and backs motor unit (truck or tractor), tripping the lock. The chains are for safety. To uncouple, the hand lever is raised, the chain unhooked and the motor unit is driven forward. When coupling is made, and the pivoted jaws are closed in the eye of the connecting bar, the spring on hand lever forces a lug between opposite ends of the jaws, securing the coupling till it is released by hand



This group represents three forms of standard practice for four-wheel trailers. (Upper) A loaded truck (designed on tractor lines) operates as tractor hauling two reversible trailers with dump bodies, having fixed axles and automobile steering linkage for each pair of wheels. (Oval) A clear case of the possibilities for surplus traction which the heavy loads on the truck's driving wheels affords. (Lower) Illustrates how the trailer system is applied to the domestic or industrial wants of farmers who own automobiles

The local roads need not be favorable if the goods handled are too bulky to make a full-weight load in the loading space of standard truck bodies. In the large majority of instances the economic issue is much clearer than it ever was between electric trucks and gasoline engine trucks. To decide it, one must know the facts—the facts of the business in question, of the motor trucks on hand or in the market, and of the trailer vehicles and methods.

Though it is generally said, or even admitted by trailer manufacturers, that trailers cannot be used very well for retail merchandise delivery, this implied restriction of the field seems too broad. Tricycle delivery carts operated on the semi-trailer principle have been employed successfully for many years, specially in Europe, antedating the heavy semi-trailers and escaping their name. And the side-car, which is also used for light delivery work, may be considered as a motor unit with a trailer at its side. The possibilities for light semi-trailers for this field of work seem to be wide open.

Adaptability to Requirements

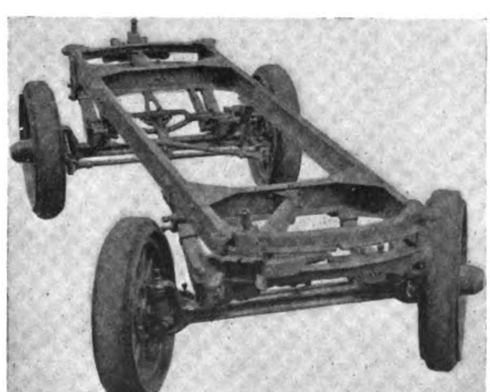
Perhaps the trailer system has been viewed too closely with reference to the improvement in load capacity which it offers in comparison with motor trucks alone. Trailers are based upon the fact, it is constantly said, that every motor truck, to be able to cope with emergencies, must be superpowered for its normal work, so that the idle surplus of motor and man power can and should be utilized for hauling additional loads whenever the working conditions are dependably normal, and particularly where road surfaces and grades are favorable. The same reasoning would argue for very large trucks with very small power, if other considerations were not active. But industrially and commercially only a limited number of motor types can be made and marketed, and the salable type is the superpowered truck having a large range of working capacity plus a margin for temporary or permanent deterioration.

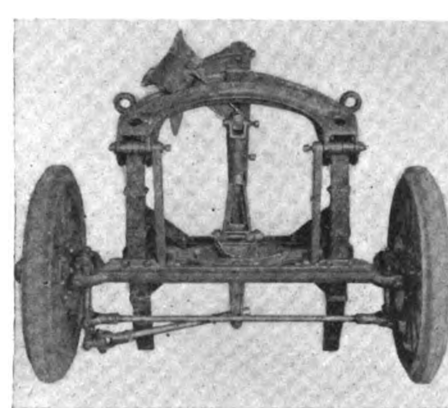
The trailer system does more than fill the gaps between motor trucks of different types and sizes; it adds a flexibility in operation which the largest assortment of specialized motor trucks could not supply in practice and provides a way for taking care of loads of abnormal lengths, bulk or weight which are incompatible with transportation in normal motor truck bodies.

Motor trucks have done so well that this broad opportunity for the trailer system could be slighted for a while, but it is now accentuated wherever loading time and waiting time make inroads in the truck's working hours, and in the driver's. There it appears plainly what the indivisibility of the motor truck unit means economically in contrast with the great flexibility in operating methods which trailers introduce and render practicable. What chance, to mention a parallel case, would electric trucks have had if batteries and battery cells had not been removable and interchangeable?

Three Main Characteristics

The trailer system is thus seen to be based on three principal characteristics. It is not based on the possibility of hauling a larger load by sailing closer to the

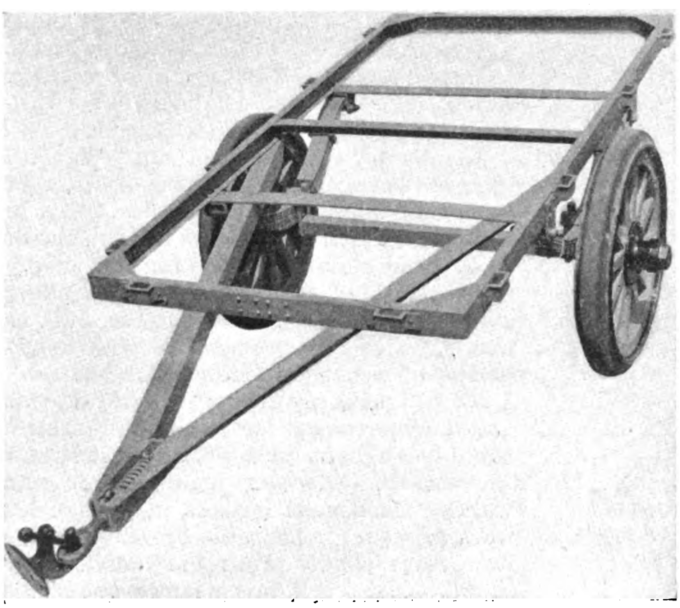




To the left—Another typical four-wheel trailer chassis. Outstanding features are the use of radius rods to safeguard the steering against being influenced by oscillations of the vehicle springs and a pivoted connection between drawhead and drawbar. This connection is utilized for backing but is ordinarily immobilized by a locking bolt. To the right—One end of chassis tipped to show details of steering gear from underneath. Drawhead is shown in pivoted connection with the locked drawbar

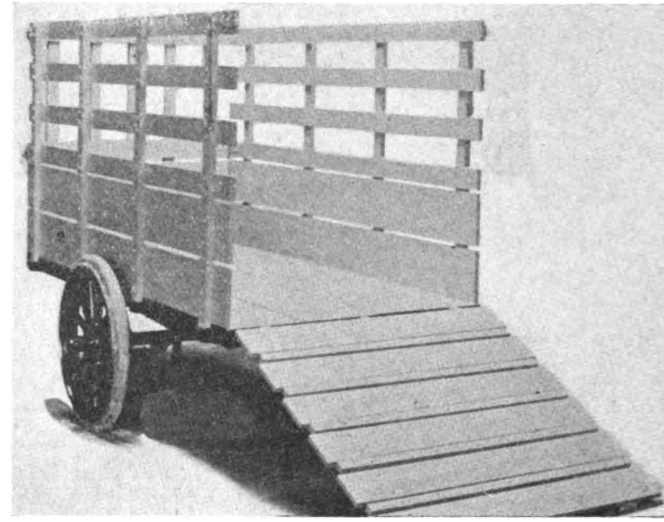
chance of a stall than a motor truck is expected to do. That would not be good business. But it is based on—

(1) Increased load capacity due to a better fit to the work on hand than normally may be expected of an unchangeable and uncompromising motor truck unit.
(2) Suitability for loads so awkward in shape, bulk or weight that the motor truck cannot handle them.
(3) Compound transportation unit, flexible in its application to work of varying demands and suited for keeping engine power and man power profitably employed during all the working hours.



Simple construction of typical two-wheel trailer with drawbar attached to pintle hook secured to the motor unit. The frame shown is adapted for receiving a stake body

Labor recognizes the last-mentioned point when it usually demands a somewhat higher wage where trailers are regularly employed. It wants a share in the advantages, and usually gets it. It gets the same in other cases without giving the value in work which is secured automatically by the trailer system properly organized.



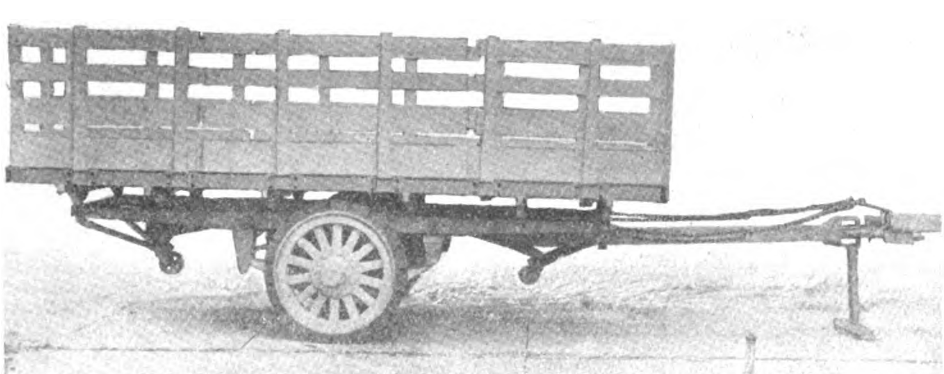
Light two-wheel trailer intended for transporting of one head of cattle and provided with hinged end gate than can be used as a ramp, as shown

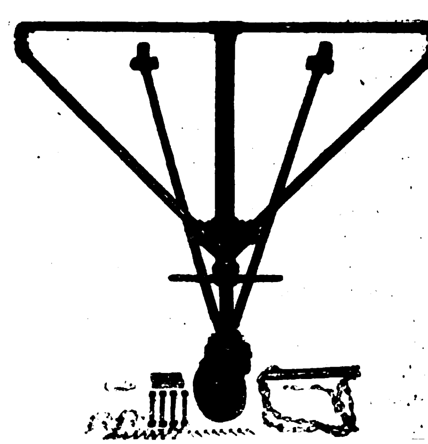
The semi-trailer type is often employed solely to gain the operative advantages of a "divisible unit," including that of the short turn, and this type has already reacted upon the motor truck industry with great force, causing short-wheelbase trucks or tractors to be manufactured specially for semi-trailer service. The tractor, the truck and the trailer are blended in variable proportions in this compound transportation unit.

Mechanical Construction

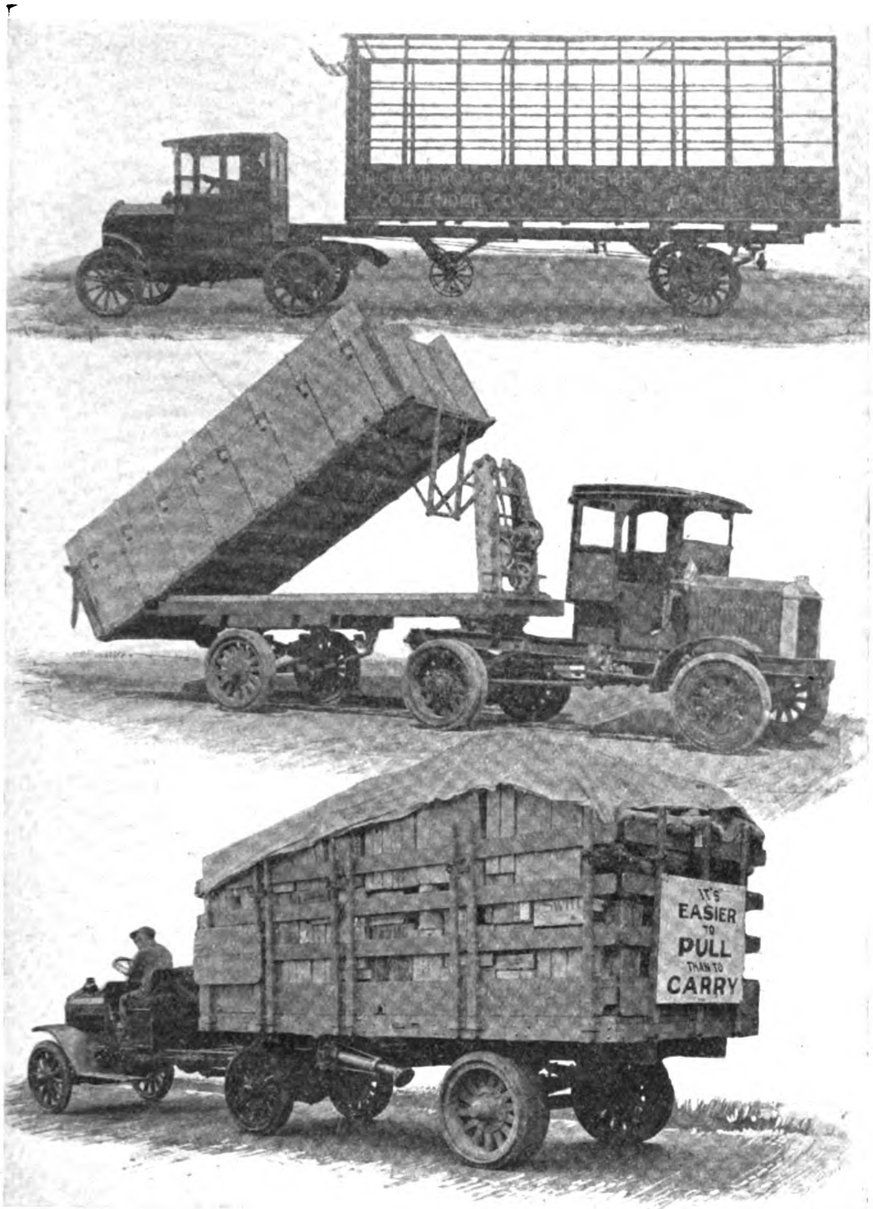
Much has been written on these fundamental matters and they are perhaps clear in principle to a majority of those interested, but when it comes to choosing a trailer outfit its mechanical construction detail and the relation of such detail to the work contemplated naturally enter for consideration.

The parts are not mechanically complicated, and generally accomplish what the maker intended, but there is some difference of opinion as to the necessity or importance of the functions. The intentions vary somewhat according to the views held, but more according to the type of the trailer outfit. The main points of interest in this respect are indicated in the accompanying illustrations and their captions. Some of the leading ideas





(To the left) Heavy two-wheel trailers known as "flats" are sometimes used with a truck as the motor unit. The connecting bar is adjustable in length and height and is hinged to a cross member of the trailer frame. The trailer load can be dumped automatically by releasing a lock on the drawbar and backing the trailer slightly, forcing the center of gravity backward beyond the vertical plane of the axle. Upon moving forward, the pull of the drawbar brings the body back into the horizontal position and locks it to the drawbar automatically. Folding screw jacks serve to uphold either end. (To the right) One of the folding screw jacks with caster foot. A similar jack is sometimes used for light semi-trailers



This group shows typical semi-trailers in use. (Upper) The fifth-wheel connection is here automatic and the required rocking movement in the relations of the trailer to the motor unit is effected by two rollers which also steer the two units into or out of hitch, running on rails with converging guide flanges. The foldable front support of the detached trailer takes the form of two substantial wheels. (Center) The use of dump bodies for semi- trailers is here exemplified. (Lower) The heavy structure, carrying the motto of the trailer industry, is provided with a telescoping folding jack, for supporting its front end, having a foot that rocks freely to perpendicular or slanting positions of the jack

in connection with this phase of the subject may be briefly mentioned separately, however.

If the trailer reduces the road speed, some of its advantages are lost, and it is therefore the aim to produce a construction which admits of as high speed as for a motor truck alone. In practice motor truck speed is perhaps actually reduced an average of 10 per cent to 15 per cent when the load is doubled, owing to the larger amount of work done and more frequent employment of the lower gears, but the speed consideration has led to very substantial construction of trailer chassis and to the adoption of interesting devices for securing accurate steering, approximate tracking, elimination of slamming in couplings, avoidance of shifting of loads and of all independent accelerations and decelerations of the trailer. Backing and maneuvering call for other mechanical provisions. The needed facilities for coupling, uncoupling, loading and unloading vary for the different types.

The ideal, mechanically, would be to have all trailer outfits perfect and foolproof on these points, but cost, weight and simplicity of construction are also involved, and the requirements vary greatly in importance as between outfits intended for 5 to 10 miles per hour with loads of 5 to 20 tons and other outfits meant for 15 miles per hour or more with loads which may be of great length or volume but of relatively small weight. The suitability of the mechanical equipment of trailers can, therefore, scarcely be judged on general principles but only with sharp reference to the line of business for which they are designed and the nature of the roads in the territory where they are to be operated.

The same may be said of choosing among the four types of outfits. In all cases there is a premium for applying to the limit the traffic manager's common sense and experience in his line of transportation work, while in the selection of motor trucks good business judgment is not enough but must be supplemented by scholarly insight in engineering and positive knowledge of the truck data which experience has established. The unaided business man must usually rely in large degree on commercial faith in buying motor trucks, but in buying trailers his own competence can easily be made good enough.

Summary of Mechanical Requirements

The requirements and functions which must be reflected in the mechanical equipment of trailers may be summarized as follows with special reference to each of the four types and to train formation:

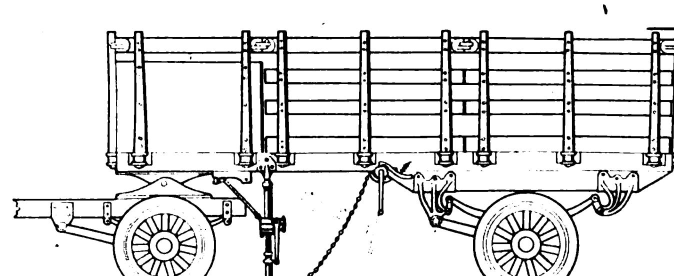
Four-wheel Trailers—Operation by one person, and he the driver of the motor unit.

Coupling and uncoupling handy, safe and reliable but not necessarily automatic.

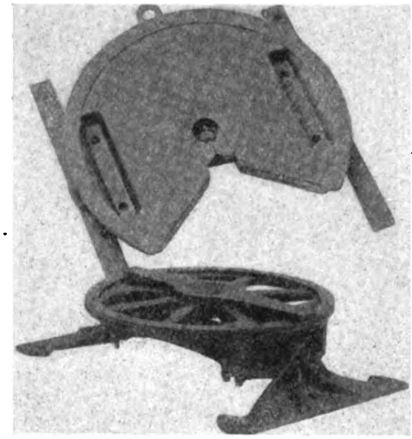
Double-cushioned drawbar action.

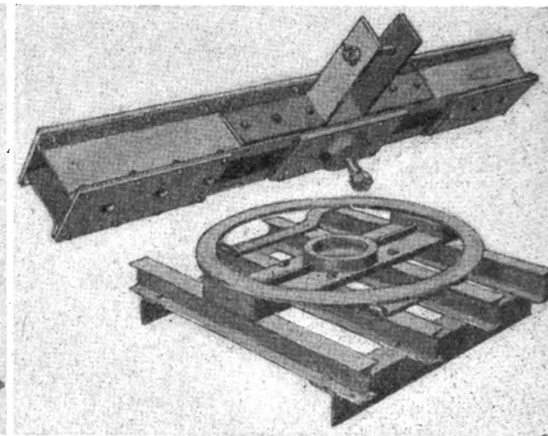
Automatic steering in tow.

Tracking with driving wheels of



Twin screw jacks hinged to trailer frame and arranged to be folded away by chain and winch. Both jacks are raised or lowered in unison by a crank from either side, but each may be adjusted independently





(Upper left) To make the fifth-wheel device couple automatically, a type has been developed in which the lower disk has a gate with converging edges and spring actuated locking jaws which close around the kingbolt in an annular groove when motor and trailer units are brought together. (Lower left) In semi-trailer equipment the fifth-wheel coupling is paramount, as it must transmit the traction pull, must cushion starting and stopping actions, steer the trailer and permit the latter varying relations to the motor unit. The top disk is bolted to the underside of the trailer body or frame and carries the kingbolt which couples the upper and lower disks, so as to maintain continuous contact between them and avoid wobbling. The lower disk is pivotally mounted by means of a transverse bar in brackets secured to the motor unit, so as to admit of forward and backward rocking, and the bar is held between drawbar springs allowing as much other movement as is necessary. (To the right) Details of a fifth-wheel device intended for a heavy pole-trailer. Rocking movement is effected by using a single transverse bolt for connection of the bolster with the adjustable trailer pole. Load chocks and adjustment chains are used, but are not shown

motor unit, approximate or as close as demanded by law.
Backing and maneuvering.
Braking, if high speeds or hilly roads are factors.
Reversibility, if required.

Two-wheel Trailers—Simplicity is the keynote for this type, which is usually intended for light loads balanced over the axle.
When intended for heavier work, drawbar and couplings should be equal to those required for four-wheeled trailers and should tend to prevent teetering.
Supports for either end when the vehicle is unhitched, to facilitate loading.

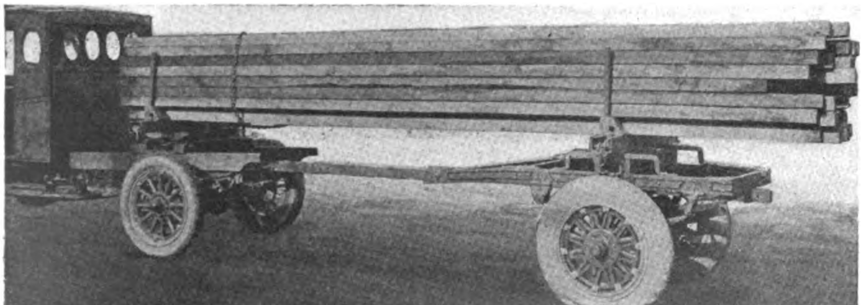
Semi-trailers—Operation by one person, and he the driver of the motor unit.
Equivalent of double-cushion drawbar action.
Adequate support for front end when unhitched, adjustable in height.
Simplicity of coupling and uncoupling, preferably automatic.

Pole-dollies—These share the nature of semi-trailers in some degree, as a portion of the load is always supported on the motor unit.
Adjustability to length of load, by extension reach.
Provision against shifting and twisting of load.
Equivalent of double-cushioned drawbar action, for heavy loads.

Train Formation—Four-wheeled trailers intended for use in train formation must have a steering and tracking system that will operate properly for this condition of service.
Close tracking, essential for short turns.
Reversibility, with drawhead for coupling at either end.
Trains of semi-trailers are not known to be in use.

Steering and Tracking Automatic.

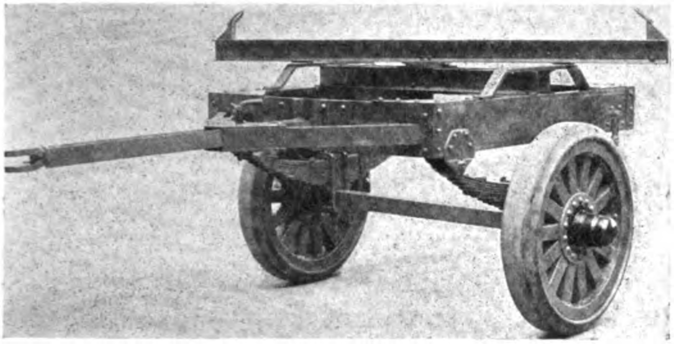
With reference to automatic steering and tracking, it may be recalled that rear wheels of wagons and motor vehicles do not track accurately with the steering wheels, but each wheel follows its own curve. To track accurately, it is evident that the follower-wheel should not begin to turn until it arrives at the spot where its leading wheel began turning, but the follower-wheel, when left free, begins turning at the same moment (instead of at the same spot) as the leading wheel. Close tracking must, therefore, be forced by positive mechanical action and consumes a little more power than free turning. It causes more tire strain and wear. It seems also probable that an automatic steering and tracking method, by causing the wheels to depart from the lines of smallest resistance in a more or less irregular manner—if the design is imperfect—may become responsible for a tendency to "snaking" at the higher speeds, considering that most road tracks are more or less tortuous while all positive mechanism for guiding the wheels, including the automobile or Ackerman system, has so far been only approximately correct, and is liable to be less correct when close tracking is aimed for.



Pole-trailer at work in lumber business. Shows similarity to semi-trailer type, but towing connection between the units is by adjustable pole, and load rests on swiveled bolsters and is closely held between laterally adjustable chocks and stakes forming parts of the bolsters

The trailer industry, as the illustrations show, employs both the Ackerman and the fifth-wheel methods, opinion being divided with regard to their comparative merits. Tracking may be approximated sufficiently well by either, depending much on details in design and workmanship. The issue between the two methods may be decided by considerations of load space and body shape. Side dump bodies, for example, find a large available space with low drop frames and rod-steering than two fifth wheels would allow.

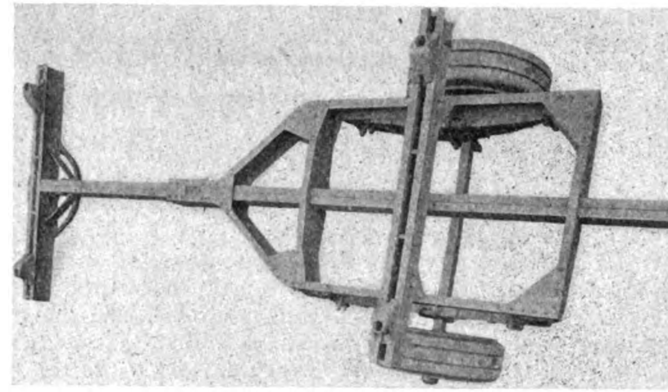
As to the degree of accuracy in tracking which is provided, we are practically stopping now at the idea that front wheels of each unit are made to track quite closely with rear wheels of the preceding



Pole-trailer with long pole adjustable, with a locking device in the trailer frame, to different distances from the motor unit, to which it is coupled by eye and pintle hook. Front end of load rests on bolster swiveled to platform of motor unit, similar to swivel bolster on trailer

unit, speaking of four-wheel trailers, but rear wheels are left free—a sensible compromise favoring simple construction and applicable in train formation.

Questions relating to the steering system are subject to debate, of course, and may be more fully elucidated with diagrams, but they are overshadowed in practical importance by questions of progress in couplings and supports. These apply particularly to semi-trailers, but also to two-wheel trailers and dollies. It is reserved for inventive ingenuity to make them more fully automatic while losing none of their present dependability.



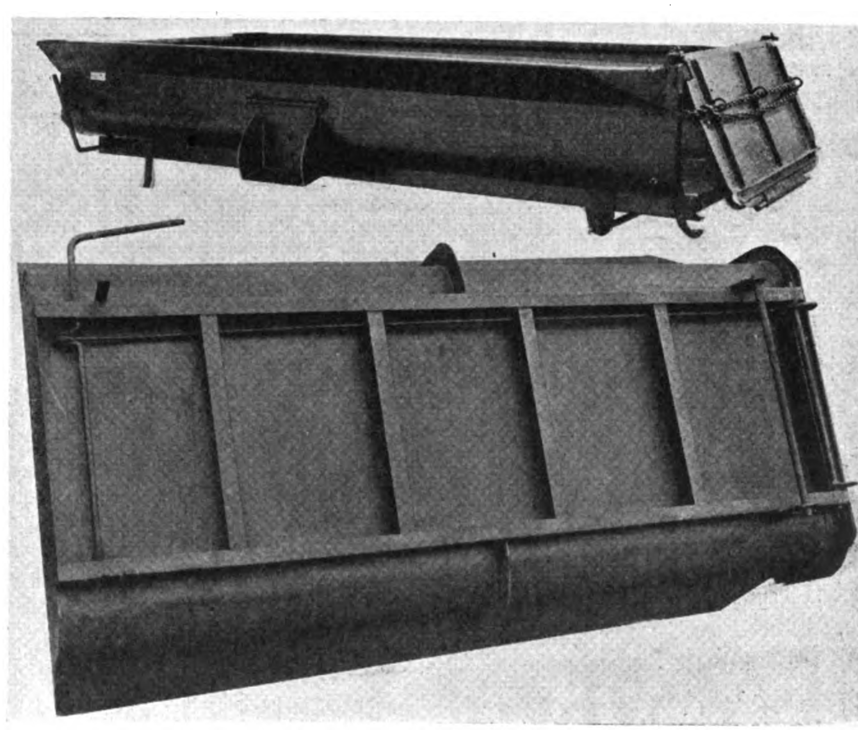
When intended for heavy loads the adjustable pole of the pole trailer is sometimes provided with the upper portion of a fifth-wheel coupling and a front bolster integral therewith, and neither front nor rear bolster is then swiveled. The picture shows adjustable load chock arranged for receiving round stakes

New All-Steel Truck Body

METAL construction, strangely enough, has not made as much progress to date in connection with truck bodies as with passenger bodies, although the service conditions in truck work are much more severe. Herewith are shown two photographs of an all-metal truck body made in Kansas City, in the production of which the electric welding process plays an important part.

The body is practically one piece, for the individual parts are welded together electrically. The longitudinal sills and cross sills are formed into a girder-like structure and provide a rigid bed to which the body itself is welded. This construction produces a body with a smooth interior, which is an advantage when hauling clay and similar materials, as there is then very little tendency for the load to adhere to the body when the latter is tilted.

Another feature is the double acting tail-gate which can be opened either from the bottom or the top. When opened from the top the two cotter pins are removed, as shown in one of the photographs, and the opening may then be regulated by the adjusting chain.



Two views showing the construction of the all-steel truck body

AN average of 120 pounds of aluminum is used in the manufacture of all automobiles—Fords excluded—according to a brief filed by the National Automobile Chamber of Commerce with the Ways and Means Committee of the House of Representatives. This figure was obtained from the Aluminum Company of America and it refers to the allotment of the crude aluminum set apart for the automotive industry by this company. In some cars the weight of aluminum used is as high as 250 pounds. The automotive use of aluminum is estimated at 120,000,000 pounds, 60 per cent of the production.

The brief was filed as supporting the request that the present duty on aluminum of two cents a pound should not be increased. One of the present obstacles to the use of aluminum in our industry is the price and if the tariff is removed, the demand for the metal would increase.

A British Traction Dynamometer

Instrument designed by National Physical Laboratory intended primarily for use in measuring drawbar pull of tractors. Hydrostatic pressure on plunger is registered on Bourdon gage and recorded together with time on paper arranged to travel at a speed proportional to that of the tractor.

THE National Physical Laboratory designed a special traction dynamometer which can be inserted between the tractor and plow without interfering with the control of the plow by the tractor operator for use at the farm tractor trials held at Lincoln, England, during the fall of 1920. To make this possible the recording instrument is separated from the dynamometer proper and placed on a light wheeled carriage which is towed alongside the tractor under test. The following description is abstracted from an article which appeared in *Engineering*.

The coupling between the tractor and plow consists of a cylinder and plunger, the former being attached to the draw-bar of the tractor and the latter, through links, to the plow. The pull on the coupling sets up a pressure in the oil confined in the cylinder, and this pressure is transmitted to a recording pressure gage by a flexible hydraulic tube. The best flexible tube that could be obtained would safely withstand an internal pressure of only one ton per square inch without reduction of flexibility, and as the dynamometer was required for pulls up to 3 tons, a diameter of plunger of approximately 2 in. was necessary.

The cylinder was made of steel and the plunger of bronze, the clearance between the two was made 0.001 in. and the plunger was provided with a very thin packing ring of oiled leather. In order to avoid the use of a gland the drawbar pull was converted to a thrust on a plunger by means of the links L, L, and the pins P_1, P_2. The thrust on the plunger is transmitted through the second plunger E, which is suitably guided in a continuation of the cylinder, and the connection between the two plungers is a loose one in order to allow the larger plunger to float freely in its cylinder. The pin P_1 passes through the slots in the guide-piece.

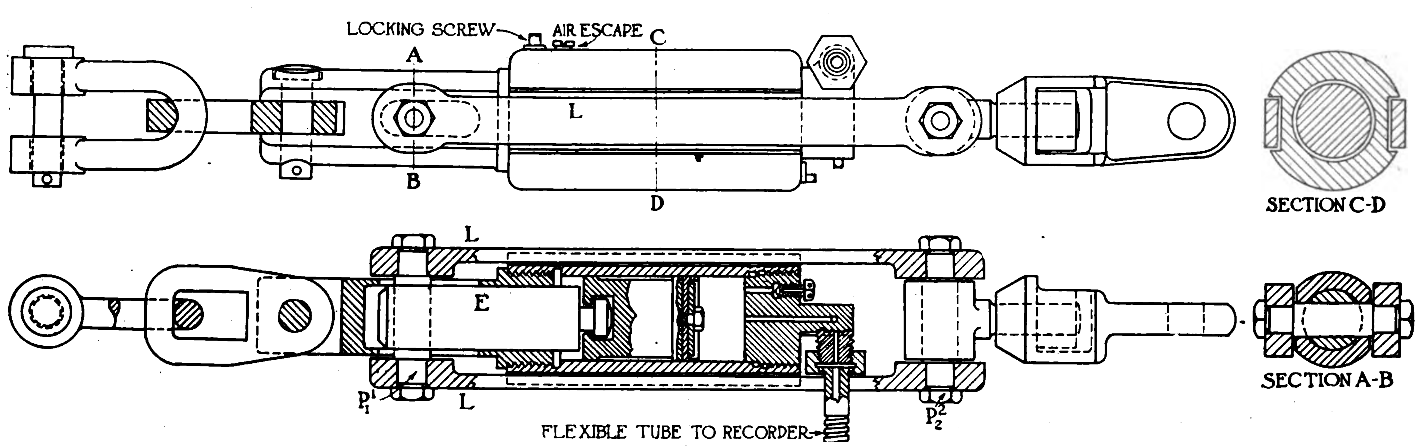
The connection to the tractor draw-bar was made in such a manner that the cylinder could rotate, and the opposite end of the dynamometer was provided with a swivel attachment for the plow. A rubber cover over the front portion served to exclude dust and grit from interior of cylinder.

The recording instrument consists of a standard Schaeffer & Budenberg pressure recorder modified for the present purpose by the addition of a second Bourdon tube, a clock, and the paper driving device. The recording paper is driven through gearing and a chain from one of the carriage wheels, and three speeds of the paper are provided for, namely, 1 in. of travel to 100 ft., 50 feet or 10 ft. motion of the carriage over the ground. The speed-change can be made while running if desired. As the recorder proper rests on the thick felt pads, the final drive is made by means of a leather vee belt, with tension adjustment. The hydraulic tube from the dynamometer is connected to a small valve-box, by which the pressure can be diverted to either of two Bourdon tubes.

The motion of the end of each Bourdon tube is magnified by a pen mechanism which is such that the travel of the pen is 4 in. for a maximum draw-bar pull of 4000 lb. using one of the tubes, and 3¾ in. for a maximum pull of 7000 lb. using the other tube. The pen mechanism can be transferred to either tube during a test if required.

A clock is provided for indicating time on the record paper. An electrical contact is made at equal pre-determined intervals of time which can be varied from 2 seconds to 6 seconds, and the time recording pen, which normally draws a straight line, is momentarily moved to one side when the contact takes place. A robust escapement from the clock is provided and in order that the number of time intervals indicated can be readily counted, every fourth contact is missed. Another similar pen is provided for recording revolutions of the tractor engine, or of the tractor driving wheels.

An oil pump taking oil from a small reservoir placed under the carriage, serves to prime the dynamometer and recorder. This pump is shut off when the apparatus is working. Measured distances on the chart between indications of equal time intervals are directly proportional to the speed, because the travel of the paper is proportional to the distance traveled. The average speed for an interval of 5 seconds can, therefore, be readily obtained, and the curve of speed plotted on the chart.



Traction dynamometer for measuring drawbar pull of tractors

A Budget Control System Which Is Producing Results

Manufacturers are taking special interest in the selling methods of dealers and distributers. This article gives valuable information which might be suggested to any distributer. The system deals with a branch-organized concern, but can be modified to suit other conditions.

By Norman G. Shidle

THE efficiency of budget control of finances has never been seriously disputed, but along with other recognized theories for good business administration such control is not always practiced. The present industrial situation emphasizes anew the necessity for business efficiency and demands in no uncertain tones a more economical and efficient expenditure of whatever funds are at hand.

Manufacturers are taking particular interest in the merchandising methods of their distributors and dealers, and are aiding in every way the intensive sales efforts which are being put forth. Probably no aid of greater value could be rendered than by the suggestion of a means of budget control which would eliminate waste and require a minimum effort for operation. Such a system has been developed at the Packard-Chicago distributors, and has been in successful operation for over a year.

The chief functions of this system of budget control, which is supplementary to the regular accounting system, may be enumerated as follows:

1. To enable the management to know at any time the exact status of the business.
2. To enable the management to pick out weak spots in the organization immediately and to bolster them up before any considerable damage has been done.
3. To place accurately and definitely responsibility for success or failure in a particular case.
4. To enable both distributer and branch manager to know which departments are making money and which departments are not making money. In other words, one department which is inefficiently operated cannot hide its deficiencies under cover of a total profit for the business.

The general purpose of the system may best be described by quoting from a talk made by C. G. Embleton, general manager of Packard-Chicago, when the budget plan was first presented to the branches. He said, in part:

"A budget system can be favorably compared to the governor on a truck. A truck without a governor is in a position to run wild at any time, and before long runs itself to destruction. Without some sort of a budget system, a business can also run wild up to the point of destruction, just as the truck can.

"A budget system is not a theory—it is a practical and necessary part of a business. Without such a system, the management is not in a position to purchase intelligently, whether it be the purchase of material or man-power. Without the budget you are not in a position to definitely know what to purchase and when, or how much money to spend at certain points.

"A budget plan, such as we have worked up, certainly will place the management in a position to know our business and how we stand at all times, and this also applies to every department head in our organization to whom will be handed that portion of the plan covering his particular department.

"Often we feel quite confident that a certain department is getting along in good shape, basing this opinion on their sales record and apparent efficient handling of their business, yet this analysis that we have taken brings to my attention a department that is not in healthy condition at all, and yet, prior to this analysis, I was of the opinion that this particular department was being handled in a very satisfactory manner.

"This plan will enable us to immediately draw our attention to the department that is weak. This being brought to our attention permits us to concentrate on this particular department and find out just what brings about the weakness as shown. It may be that the department is under-organized. It may be possible that there is too much help—too many of the wrong sort and not enough of the proper kind. It may be that the department will call for an extra advertising effort. At any rate, this plan will point out weakness, if any, which will permit us to take the necessary steps to strengthen."

The system devised is simple both in principle and application, but calls for a very careful and detailed study if its operation is to be thoroughly clear. To understand the working of the system, a general knowledge of the form of organization used by this firm is necessary. This does not mean that the system is applicable only to firms with a similar form of organization; on the contrary, it is adaptable to almost any of the usual forms of business organization. The purpose of presenting the chart of this particular concern is simply to facilitate a detailed explanation of the system.

The chart shown in Fig. 1 indicates the form of the Packard-Chicago organization. It will be noted that under the general manager there are four departmental managers, beside the advertising and financial managers who need not figure in this description. The service manager handles both parts and repairs. The budget administration is divided into these parts:

1. Carriages.
2. Trucks.
3. Accessories.
4. Parts.
5. Repairs.

In addition, however, the various branches function directly in connection with the general manager as well as indirectly through the various department heads. Each

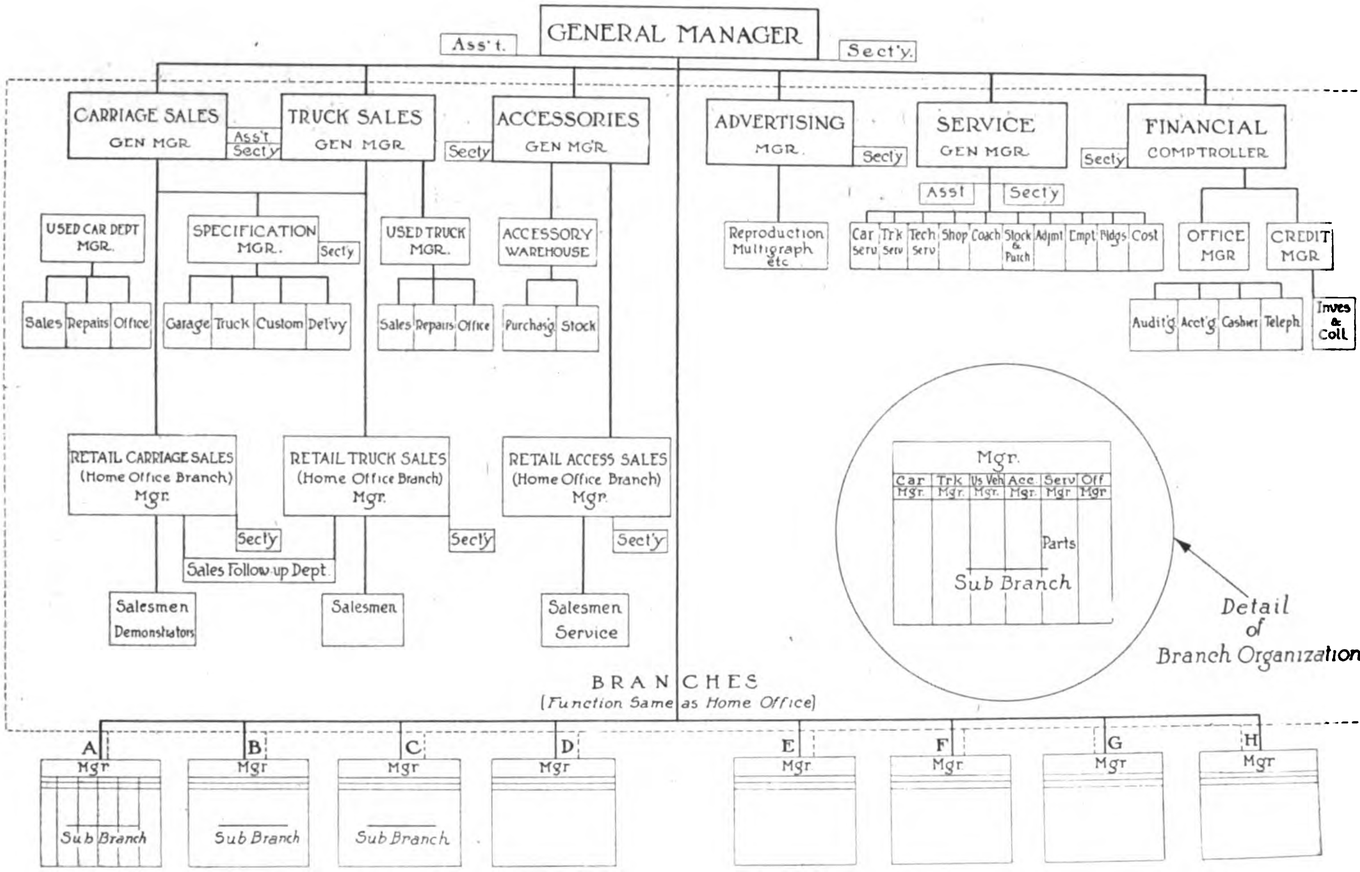


Fig. 1—Packard-Chicago organization chart

branch in turn has its operations divided into the five parts mentioned above, the branch organizations individually following the general lines of the main office organization. In the case of the smaller branches, of course, that organization is not carried out to as many refinements or with so large a staff, but in all cases the five departments—carriages, trucks, accessories, parts and repairs—are separately accounted for.

It may be well for the time being to forget the department managers, and consider simply the direct relationship between the general manager and the branch manager, for it is through this channel that the chief part of the system functions. The part played by the main office department heads can be fitted in later.

The first step is the determination of a quota for the year for the entire organization; that is, the number of vehicles which must be sold. The fiscal year extends from Sept. 1 to Aug. 31. The budget system is laid down to apply on the fiscal year and consequently the quota is determined by two operations:

1. Taking an inventory at time of beginning budget system.
2. Adding to that the shipment from the factory scheduled for next eleven months (assuming that system was installed at beginning of a fiscal year).

Since deliveries only, and not sales contracts, effect profits, shipments made during the month of August are not considered in the budget for the particular year, since the shipments made during that month will not be deliveries until the following year. This inventory of stock on hand and shipments to be received give the total of carriages which are to be sold. A similar form is used for trucks, accessories, parts and repairs, but the carriage forms will be used here alone to simplify the discussion.

The figure so determined is listed at the top of the form illustrated in Fig. 2. To make plain the operation, hypothetical figures may be inserted in the form. In this case, the quota for the entire carriage organization may be assumed to be, for instance, 800. Referring still to Fig. 2, the next figure to be filled in is the "average sales price," which may be assumed to be $5,000. This can be readily determined, of course, by dividing the total sales

Entire Organization

CARRIAGES

Fiscal Year Ending August 31, 1920

Quota—800

% of Quota	100%
Average Sales Price	$5,000
Gross Profit per Truck	$1,000
Net Profit desired—8% of Gross Sales	
Gross Sales	$4,000,000
Gross Profit	800,000
Net Profit	320,000
Allowable Expense	480,000

Average monthly deliveries made uniform by Gen. Mgr. and Dept. Mgr.

Month	
Sept	6
Oct	5
Nov	4
Dec	3
Jan	4
Feb	5
Mar	12
Apr	14
May	15
June	12
July	10
Aug	10
Total	100

Branch	Veh.	% Quota	Gross Sales	Gross Profit	Net Profit Desired	Expense Budget
A	100	12½	$500,000	$100,000	$40,000	$60,000
B						
C						
D						
E						
F						
G						
H						
I						
Total	800	100%				

Fig. 2

HOME OFFICE
REPORT FROM BRANCH "A"
CARRIAGE

Budget Distribution by Months—Fiscal Year Ending Aug. 31, 1920

Month	Vehicles			% of Quota		Gross Sales		Gross Profit		Expense		Net Profit		% to Sales	
	Sales	Quota	Del's	Quota	Del's	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Sept.	8	6	5	6%	5%	$30000	$27000	$6000	$5500	$5000	$3610*	$1000	$1890	3.33	7
Oct.															
Nov.															
Dec.															
Jan.															
Feb.															
Mar.															
April															
May															
June															
July															
Aug.															
Total		100		100		$500000		$100000		$60000	*	$40000		8	

*Expense figures include Net Profit of Used Car Dept.

Fig. 3

price of the allotment by the number of vehicles comprising the allotment. Next the gross profit per carriage is inserted; this is simply the difference between the buying and the selling price of the vehicle, and is in this case assumed to be $1,000.

The net profit desired is 8 per cent of the gross sales. Next are inserted the figures for gross sales and gross profit, both of which are readily calculated on the basis of figures already given. Since a profit of 8 per cent on gross sales is desired the net profit will be in this instance $320,000.

Subtracting this desired net profit from the gross profit of $800,000, the allowable expense figure of $480,000 is found. That is, $480,000 can be spent by the entire carriage organization in selling the quota of 800 and still make the desired profit of 8 per cent.

The data so far presented may in a sense seem to be "primer" material, but its chief utility is in its very simplicity. That is, the reasoning is simple enough, but the advantage lies in the clear, concise picture which is presented of the information as shown in Fig. 2.

Next the average monthly deliveries are filled in by percentages. By taking as an approximate basis the monthly averages for the three previous years, the percentage of the entire new quota which should be delivered each month is approximately determined. By means of this budget, a check on the selling progress of the entire carriage organization is available month by month. A certain percentage of the entire quota must be sold each month, and any "falling down" can be immediately checked.

A certain proportion of the entire quota is then assigned to each of the various branches. The individual quota of a branch is determined by records of previous years, together with an analysis of financial statistics for the particular region. In connection with estimating the sales possibilities of a particular territory, the financial statistics have been found to be a far better unit of measure than population figures; especially is this true as regards possible carriage sales.

On the bottom of this form, then, is listed by branches the number of vehicles to be sold by each branch during the entire year, the percentage of the total assigned to each branch, the gross sales in dollars expected of each branch, the gross profit desired, and the expense budget, that is the amount of money which may be expended by each branch in selling its assigned quota.

Thus, on this one sheet, is presented at beginning of the year in brief and clear form these things:

1. Quota for entire carriage organization, and total expenditures allowable for selling that quota.
2. Percentage of quota which must be sold each month by entire carriage organization.
3. Quota for each branch, and expenditure allowed to be expended by each branch to sell that quota.

This form presents in a broad way the task of the carriage organization, the scope of its work, and the limit of expenditure. This information is made available for the chief executive at a glance.

Centralized Cost Accounting

It must be noted at this point that the accounting for all the branches is handled through a central accounting department at the main office. That is, retail representatives of this organization who correspond to the ordinary dealers as regards sales functions, are really branch managers. Their bills are paid through the main office, and the costs of the various divisions of each of the branches are recorded and compiled at that central accounting office.

About the middle of every month, a balance sheet report for the previous month, together with a detail record of the expenses for his branch, is sent to every branch manager by the accounting department. These expenses are subdivided under the following classifications:

Miscellaneous Supplies.
Shop Tools.
Repairs to Machinery and Tools.
Repairs to Buildings, Fixtures and Equipment.
Power, Light, Heat and Water.
Errors and Allowances.
Miscellaneous Expense.
Rent.
Stationery and Office Supplies.
Telephone.
Telegraph.

"A" BRANCH

Comparison—All Departments—with Budget—August, 1920

	Vehicles			%		Gross Sales		Gross Profit		Expense		Net Profit		% to Sales	
Div.	Sales	Quota	Del's	Quota	Del's	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Carr.											*				
Trk.															
Access.															
Parts															
Repairs															
Total											*				
TOTAL TO DATE															
Carr.											*				
Trk.															
Access.															
Parts															
Repairs															
Total											*				

*Expense figures include Net Profit of Used Vehicle Departments

Fig. 4

Postage.
Traveling
Entertainment.
Service Vehicle Operation.
Legal and Auditing Fees.
Contributions.
Membership Fees.
Receiving and Shipping.
Guarantee Service.
Policy Service.
Vehicle Inspection.
Advertising—Classified.
Advertising—Circularization.
Advertising—Display.
Advertising—House Organ.
Advertising—Miscellaneous.
Exhibitions.
Meetings and Conventions.
Demonstrating.
Vehicle Delivery.
General Labor.
Defective Workmanship.
Idle Time.
Supervision.
Clerks and Stenographers.
Salesmen's Salaries and Commissions.
Parts Handling.
Expense Recharged.
Total Direct Expenses.
Indirect Expense.
Total All Expenses.

An examination of the figures included in these reports enables the branch manager to fill out each month the columns marked "Deliveries and Actual" on his copy of the form shown in Fig. 3, original of which is in the general manager's office.

Fig. 3 shows the form upon which a branch manager reports each month to the general manager the progress of his carriage sales. He fills out a similar form for trucks, accessories, parts and repairs.

An examination of Fig. 3 will show that approximately one-half of the columns are filled out at the beginning of the year; that is, the figures which go into them comprise the budget limits for the particular branch. The first column, "Sales," is used simply for general information and does not enter into the budget system, since, as previously explained, only deliveries count. The "quota" columns under the general head "Vehicles" and "Per Cent of Quota" are filled out at the beginning of the year on the basis of the figures compiled and recorded on the form shown in Fig. 2. The same is true of the columns marked "budget" under "Gross Sales," "Gross Profits," "Expense," "Net Profit," and "Per Cent to Sales" records the percentage relationship of the net profit to sales for the month.

The other columns, then, are to be filled in by the branch manager every month, after he has received his cost figures from the accounting department. To make the operation clear, we may again insert hypothetical figures, taking the month of September as an example.

Referring back to Fig. 2, it will be seen that 6 per cent of the entire quota should be sold during September and that the "A" branch was assigned an actual quota of 100 carriages for the year.

Then 6 per cent of that 100 is 6 carriages, which comprise the quota for September. In the same way, using the basis established on Fig. 2, the gross sales budget for carriages for September is $30,000 and the gross profit budget $6,000. The gross expense budget is simply prorated equally for each month of the year, because it was found that an excessive amount of accounting procedure would be necessary if an attempt were made to pro-rate the expense budget in accordance with the varying expense of each month. Thus the expense budget for September would be merely one-twelfth of the yearly budget or $5,000. The next profit budget total for the year is figured at 8 per cent of gross sales, but because of expense distribution being equal, the monthly budget profit per cent varies, and we see that this month only calls for 1000, or 3.33 per cent for the carriage department of this branch. Though expense is equal in its distribution, the net profit per cent called for in later months will of course be higher, due to deliveries being seasonable, and the total budget for the year as mentioned above will be 8 per cent.

The balance sheet and expense accounting reports, from the main office, it is evident, are necessary for filling out the "Actual Gross Profit," "Actual Expense," and "Actual Net Profit" columns. This entire budget system is supplementary to a thorough and efficient accounting system, the

Entire Organization—Carriage Master Sheet Comparison—By Branches—August, 1920

	Vehicles			% of Quota		Gross Sales		Gross Profit		Expense		Net Profit		% to Sales	
Branch	Sales	Quota	Del's	Quota	Del's	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
A											*				
B															
C															
D															
E															
F															
G															
H															
I															
Total											*				

TOTAL TO DATE

A											*				
B															
C															
D															
E															
F															
G															
H															
I															
Total											*				

*Expense figures include Net Profit of Used Truck Depts.

Fig. 5

purpose of the budget system being to limit expenditures, map out necessary achievement in advance, and present to both general manager and branch managers at any given time a clear and brief picture of the exact status of the business and all of its component parts.

Each branch manager, then, fills out each month a copy of Fig. 3 or each of the five departments of his branch, and studies them, while waiting comments from the general manager. Before noting the further use of the assembled branch office reports made by the general manager, it is well to note the use of the reports to the branch manager.

The form described enables the branch manager to determine immediately whether or not his carriage department is operating as effectively as it should. He knows each month whether each of his departments is yielding the fair profit desired. It is not enough that his branch is making money, each department must be operating profitably. By these five similar forms, the progress of each department is noted separately, and he is informed immediately by this record if any unit is not coming up to the standards set.

He can compare, at a glance, the actual expense with the budget of allowed expenditures. If that actual expense is higher than it should be, he can immediately refer to his detailed cost list and determine what expenses have been too heavy, and whether or not the increased expenditure was justified.

In addition to these five separate similar forms of each department, the branch manager is given each month the form shown in Fig. 4. This form comprises the same data as Fig. 3, except that the presentation is made in a different manner and brings out different points. Fig. 4 shows the comparative status of each of the various departments for the month, and below, the comparative status of the departments to date for the year. The branch manager can see, at a glance again, what departments are falling down, what departments are operating successfully. A duplicate copy of Fig. 4 is handed the general manager every month, together with an analysis, by the general manager's assistant.

From these reports data is compiled for the general manager which place before him a detailed, yet brief and concise, picture of:

1. The entire business.
2. The status of a particular branch.
3. The status of the various departments of a particular branch.
4. The status of the various departments of all branches combined.

When the form shown in Fig. 3 comes to the general manager, a summary of them is compiled and presented to the executive on an exactly similar form. Thus the executive has on Fig. 3 the same information for the entire organization that the branch manager has for his own branch. In like manner, the general manager has prepared a form similar to Fig. 4, which presents to him the facts in this classification for the entire organization. These forms differ only in that one is headed "A Branch," and the other "Entire Organization."

Thus Fig. 3 gives the general manager the month by month progress of one department of all the branches combined, a copy of which is given the division manager, thus effecting a united tie-up of sales effort and co-operative direction along lines of good business.

Fig. 4 gives him the status of each of the various departments of all branches combined, both for the preceding month, and to date for the year.

The general manager is enabled to compare at a glance the status of the various branches by reference to the form shown in Fig. 5. This form is compiled from the same data as was used in connection with Fig. 3, but is differently arranged in order to present a different phase of the business status. It shows the relation of the business of each branch to the budget for the preceding month; along with the same information for each branch to date for the year.

The forms shown in Figs. 6, 7 and 8 are almost self-

Comparison of Gross Profit, Expense and Net Profit, *by Amount*

12 Months Ended 8/31/20

BRANCHES

	A	B	C	D	E	F	G	H	I
CARRIAGE Gro. Prof. Expense Net Prof.									
TRUCK Gro. Prof. Expense Net Prof.									
ACCESSORY Gro. Prof. Expense Net Prof.									
PARTS Gro. Prof. Expense Net Prof.									
REPAIRS Gro. Prof. Expense Net Prof.									
TOTAL NET PROF. TO DATE									

Fig. 6

Comparison of Gross Profit, Expense and Net Profit *Percentages*

12 Months Ended 8/31/20

BRANCHES

	A	B	C	D	E	F	G	H	I
CARRIAGE Gro. Prof. Expense Net Prof.									
TRUCK Gro. Prof. Expense Net Prof.									
ACCESSORY Gro. Prof. Expense Net Prof.									
PARTS Gro. Prof. Expense Net Prof.									
REPAIRS Gro. Prof. Expense Net Prof.									
NET PROFIT									

Fig. 8

explanatory. These are prepared at quarterly intervals and are presented to the general manager as additional simplified data showing the status of certain phases of the business.

The form in Fig. 6 presents a comparison of gross profit, expense, and net profit for each department of each individual branch. The form in Fig. 7 is a comparison of gross profit, expense, and net profit average per vehicle by branches.

Fig. 8 shows a form on which the business of the various departments of the individual branches is compared on a percentage basis. The data on this form enables the general manager quickly to determine in a general way by the fairest yardstick which branches are doing exceptionally well and which ones are not coming up to the set standards.

It will be noted that the forms shown in Figs. 2, 3 and 4 are those which appertain directly to the operation of the budget system. That is, it is through these forms, and the other forms used, which are similar to them, that the actual operation of the business is compared with the standards set by the budget.

The other forms chiefly comprise data compiled from the information contained in the forms of Figs. 2, 3 and 4, but so arranged as to present clearly and briefly to the chief executive the exact status of any particular phase of any branch or the entire business at any given time. The forms shown in Figs. 5, 6 and 7 are little more than examples of an idea which is capable in innumerable variations and adaptations. That is, these same figures might be re-arranged and re-grouped in many other ways in order to present at sight certain other angles of the business. As a matter of fact, several other variations are used in the work of this organization.

If the budget control system consists in nothing more than the filling out of these forms, it would be comparatively barren of results and scarcely to be counted as profitable. The usefulness of the summarized information which can be placed before the chief executive in brief form is so obvious as to need no discussion. In no way other than the budget can the final net profit objective for the year be charted out and be made available by the easy stages of monthly comparisons.

The forms sent by the general manager to the branch managers, however, call for definite action. When these forms are first received by the general manager, he immediately dictates a short note to the branch manager upon any phases of that manager's report which seem to require it. Thus the attention of the branch manager is called to any deficiencies in his organization, and he is required to determine the "why and wherefore." Having done this he must reply to the comment of the general manager, explaining the reason for any trouble which has been brought to his attention, or noting the unusual circumstances which made the difficulty inevitable.

In this way every detail which goes wrong in any of the branch organizations is immediately apparent, and is immediately attended to and corrected. Such efficient action is obviously impossible without a budget system of some kind similar to the one described here. It is possible to know that a department is running behind only when a normal standard has been determined beforehand.

Comparison of Sales Price, Gross Profit, Expense and Net Profit, *Average per Vehicle*

12 Months Ended 8/31/20

CARRIAGES

BRANCHES

	A	B	C	D	E	F	G	H	I
Average S. P. Gro. Prof. Expense Net Prof.									

TRUCKS

	A	B	C	D	E	F	G	H	I
Average S. P. Gro. Prof. Expense Net Prof.									

ENTIRE ORGANIZATION

	CARRIAGE	TRUCK
Average Gro. Prof. Expense Net Prof.		

Fig. 7

It is necessary each year to make out Fig. 2 again, thus beginning every new year as though the system were starting for the first time insofar as the determination of the budget is concerned. This makes the budget for each year conform with current conditions and changes in the industry so that it always presents a fair standard by which to gage performance.

The system at Packard-Chicago is considered to have been highly successful in every way. As the operation continues further refinements and improvements are made, but the system as outlined here involves all the essential points necessary to insure an efficient and constant budget control of the various phases of the business. To George J. Saxon, assistant to the general manager, is due much of the credit for the effective working out and operating of this budget control system.

It has been impossible, of course, in an article of this length to explain every detail, but enough has been presented to show clearly how the system operates, and to indicate the workings of those parts not fully discussed here. The chief accomplishments of such a system of budget control are included in this list:

1. It simplifies for the chief executive the complex accounting reports and terms.
2. It gives the general manager and the branch managers simple, easily readable, concise pictures of the business.
3. It points out where control or greater effort are necessary and permits remediable measures at the time when they should do the most good.
4. It makes an accounting record a conversational picture instead of a set of cold figures difficult to interpret.

Cast Nichrome Carbonizing Containers

IN case hardening steel by the cyanide process, a great deal of difficulty is being encountered by reason of the short life of the containers which hold the molten cyanide. In the past these containers have been generally made of iron or steel, and these materials oxidize rapidly and holes burn through their walls, or cracks form in them. The loss of the container is not the most serious damage done in such a case, as the molten cyanide will leak through and destroy the fire brick lining of the furnace.

Recently, crucibles or containers of a nickel chromium alloy, known as nichrome, have been used for this purpose. Nichrome (which is made by the Driver-Harris Co.) has the valuable property that it resists corrosion at high temperatures. One of its earlier important applications was as resistance wire in electric circuits where the wire sometimes becomes exceedingly hot yet must not oxidize.

Cast nichrome can be machined readily with high speed tool steel, but owing to the toughness of the alloy the tools must be ground with special angles. The use of the alloy is practical at all temperatures up to 2000 deg. F. Not only does it not oxidize at these high temperatures, but it is also practically non-warping, retaining its shape up to the temperature limit mentioned. The alloy can also be forged when heated to the proper temperature, but it must be handled very carefully. It is malleable and ductile, but during the rolling and drawing operations, repeated annealings are necessary. It can be readily welded by experienced welders, by either the oxy-acetylene or the electric arc method. The operation calls for considerable skill, however, as welds of cast nichrome cannot be made in the same manner as a weld of cast iron or steel. Preheating is almost invariably necessary, and a thorough cleaning of the surfaces to be welded is important. The best results have been obtained by chipping, with an air or cold chisel, the surfaces of the parts to be welded, so that new metal is exposed. A flux is necessary for gas welding but not for arc welding.

Besides its great resistance to oxidization at high temperature, nichrome is resistant to the action of most acids and alkalies, hot or cold, and the castings are said to give satisfactory service in a great many applications in conjunction with the use of acids. The melting temperature of cast nichrome is 2660 deg. F., the softening temperature 2300-2200 deg. and the same working temperature 2000 deg. The specific gravity is 8.15. Its specific heat is 1.1 at 68 deg. F., and the weight 0.29 lb. per cu. in. It shows a Brinell hardness of 160-170 and a scleroscope hardness of 27-30. The coefficient of linear expansion is 0.0000091 per deg. F. between 32 and 212 deg. F.

Following are the physical properties at 70 deg. F.: Elastic limit, 40,000 lb. per sq. in.; ultimate tensile strength, 54,000 lb. per sq. in.; elongation, 1 per cent; reduction of area, 2½ per cent.

The physical properties at 1500 deg. F. are as follows: Elastic limit, 20,100 lb. per sq. in.; tensile strength, 24,500 lb. per sq. in.; elongation, 4 per cent; reduction of area, 4.3 per cent.

Experimental work done by the Driver-Harris Co. has led to the conclusion that the most efficient and economical cyanide furnace is one in which the cyanide pot is sealed into the furnace by means of a seal of chrome ore or magnesite. The seal is placed between the brick lining and the flange of the pot. In this type of furnace the waste gases of combustion are led into a separate flue, and there is, therefore, no connection between the combustion chamber and the hood which covers the cyanide pot. This method of construction effectually prevents the cyanide vapors from passing into the combustion chamber, thus prolonging the life of the nichrome cyanide pot.

Other advantages of the use of cast nichrome containers are a saving of cyanide, an increase in the life of the furnace lining and a more uniform temperature.

Cast nichrome containers are also used for lead hardening. Round, rectangular and bath tub shaped lead pots are made of cast nichrome in all sizes and weights, the largest being of 2000 lb. capacity.

For some years past cast nichrome has also been used for pyrometer protection tubes. Iron or steel tubes were formerly used for this purpose, but cast nichrome tubes are said to have proven much more durable. These tubes are supplied in either the plain, threaded or flanged forms, with either light or heavy walls.

The above information is taken from a book on Case Carbonizing published by the Driver-Harris Co.

THERE has been compiled by the Bureau of Standards for distribution, a table of equivalents of cubic feet in terms of cubic meters arranged in units from 1 to 1000 cubic feet; also cubic meters in terms of cubic feet, the arrangement being by tenths from 0.1 to 29 cubic meters.

What Dealers Think About Merchandizing New Models

There can be two reasons for a new model; one strictly a merchandizing reason, the other to keep the motor car up with the times. The latter point is for the engineers, and is not considered here. The dealers quoted in this article have decided opinions on the other point.

By Clyde Jennings

FOR what seems to be a very long time we had a market in which the factory capacity was the measure of car production. Now we are entering a period during which the car production will be measured by the selling capacity of the dealer.

This entire reversal of the situation makes for much more interesting circumstances. In the new circumstances there is not much of romance or thrill in the factory as a whole. It is only the production or labor man, who gets into the details which cannot be passed on to the public, who senses the thrill. There is too much that must be kept secret. In the recent past there was too much of "passing the buck" in the way of paying fancy freight rates and increased wages that were merely passed on to the public, through the kindly influence of the dealer. **Even the labor problem lost its savor when the men were merely bribed to work.**

During this period one very interesting observer remarked:

> **"We buy our automobiles from the man who insults us the least."**

Now it all is so different that it looks like a new world. The automobile selling situation, and in fact the entire industry, is like a landscape the morning after a big snow storm. Here and there is a spot where some dealer, who was happy in his factory connection, an optimist by nature and with something of the bulldog in him, just kept on selling. These dealers are the spots in this landscape where the snow has melted. Here and there is a larger spot where a factory, with a sales campaign unspoiled by days of hurry, has maintained production.

But in the main the landscape is unspoiled except by the memories which are covered. There is a fine opportunity for a new line of work. If this opportunity was mine I would do this thing as a starter:

> **Get very close to my dealers and hear what they think about my methods and what advice they have for the improvements of these methods.**
>
> **Listen to the advice of any man who can sell cars to the user. More than that, seek his advice, even ask for it and promise him immunity as a reward for his testimony.**
>
> **And the more sullen the dealer or salesman appeared to be, the more his advice would be sought. I would try to learn of every sore spot in his memory.**

Do the dealers have opinions?

Most certainly they do, and very frequently they are quite intelligent opinions. This may surprise some factory sales managers and advertising managers (more of the latter), but it is true and I know a good many successful sales managers who have the highest respect for dealer opinions. There have been some changes in selling and advertising staffs during the last few weeks that have been very interesting. Several men whose names and methods were recorded unfavorably in memory have sought new jobs.

It seems to be difficult for some men to learn that arrogance is not knowledge and that the show of arrogance does not often impress the other fellow.

But enough of this. The object of this article is to present to the manufacturers and their sales departments some opinions on a much discussed topic:

That of the changing of models.

Thirteen dealers have testified through a channel that was entirely friendly to them as to their best opinion on the merchandising side of the new model program. These opinions do not agree. That was to be expected. They do, however, indicate that a number of factories have treated their dealers fairly on this point. In fact, the factory record here is not nearly as bad as in other points on which these dealers testified. But the ideal is not arrived.

> **One interesting point is the outspoken opinion of several of these successful automobile sellers that the announcing of a new model is not a good merchandising point at all and that changes should be made entirely without the brass band accompaniment.**

Here is the question these dealers were asked to discuss:

> **When do you believe that models should be changed? Supposing you have on hand quite a number of cars and the model is suddenly changed, do you believe that the dealer should be given protection for those which he has been unable to move prior to entrance of new models?**

The first reply reads like the feudal system of government was in control of the automotive industry. Read it:

1—It is always bad policy to change models in midsummer. This makes the dealers stop buying and has a tendency to make the public stop buying, not knowing what is going to happen. This is especially bad when it comes immediately after having liberal shipments.

> **It is a well known fact that many manufacturers load up the dealers and distributers when about to change models and even though changes are not made, if the dealer does not take a certain number**

of cars, which would be impossible for him to sell, the factory will take the agency away from him leaving him with a lot of cars on hand.

This is also bad for the new dealer as well as the old inasmuch as the old dealer is often forced to sell at a low price in order to dispose of stock on hand.

I believe that models should be changed in any event about Jan. 1. Dealers should have an ample protection and ample notice of the change of models. Dealers should have at this particular time protection against decline in price where there is so much talk of depreciation of value.

—

The next two opinions are milder but point to the wrong:

2—Most of the standard car factories are not making any model changes and have not in the past two years. They have come to the conclusion that the series system is preferable. Make slight changes as they go along. I do not think that any reputable factory will change its model and leave the dealer hold the sack. They can never build up a real dealer organization with that policy.

Witness the Blank factory to-day. Their past sins are enough to keep the live one off of them. The factory that treats their dealers thus is composed of poor business men, and the dealer left in the lurch with old models on hand will gain if he ceases to do business with such concerns.

—

3—Model changes should be made Jan. 1, and first announcement at New York shows. Factories that wish to be square should protect their agents against change of models, unless plenty of advance notice is given that models will be changed. Too few factories give any consideration to distributer organizations but prefer to keep all distributers in the dark.

—

Now we will open the windows and let in some fresh air, for the next installment of dealer opinions indicates better thoughts about the factory. But they still are interesting:

4—The Blank people have always told us sixty days, at least, in advance when a model or a price was to be changed in normal times, giving us time to clear our boards and have our sub-dealers in the same shape.

During the present high cost of work, they have on all occasions, with the exception of one time, protected us as far as they could on all orders we had taken at the old price. This one occasion was entirely excusable and we distributers had to take our share of the loss.

I believe the manufacturer should notify the distributer and he in turn the dealers in advance of any change in model or price, and if the distributer or dealer has not been on his toes to move his product, he cannot consider that the manufacturer has not done all he could.

If the manufacturer does not notify the distributer, I should think that the distributer has a perfect right to use any means he could to get back at the manufacturer and to fight him to a standstill if necessary.

5—Dealers should be notified in ample time to unload. If over-stocked and they cannot unload, they should be given protection for cars they have been unable to move prior to entrance of new models. By notifying dealers sufficiently in advance of new models and not crowding or unloading on dealers, factories would receive the co-operation in disposing of all old models before new models come out.

—

6—I do not believe that any reputable factory would make any changes of model in mid-summer or at any time immediately following heavy shipments of previous models. Blank always makes its changes when the demand is at the very lowest point and so far it has protected the dealers to some extent on cars he had in stock. Another thing, it has always protected the dealer when there has been any reduction in price. Whether this will be done in the future, I cannot tell.

The factories would show very poor judgment in producing an entirely new model when the dealers were stocked heavily with the old ones.

—

The following replies are even more constructive than the last. These dealers have real opinions on this subject of such great mutual interest to the manufacturer and dealer. Read closely what follows.

7—Practically every factory has changed the very foolish method which prevailed heretofore of bringing out new models at regular intervals.

Practically all of them will pursue the plan of effecting improvements as they are perfected. In other words, as soon as a gear shift locking device is perfected by any factory, they will immediately be put into production without any statements as to changing models. Factories cannot expect distributers to operate on a large scale and carry a large stock, co-operate with them when production is large, unless they protect them in the event of a decline in price.

The fundamental principle of the business which has made it best for the manufacturer to set the resale price to my mind also makes it obligatory upon him to protect the distributer in the event of a decline.

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8—I believe that the idea of changing models is soon to be a thing of the past. I believe the various manufacturers will arrive at a standard chassis and that such improvements or changes as they see fit to make will be made from time to time without advance notice or other schedule. In other words, as certain developments prove themselves, they will be incorporated into the standard product of the various manufacturers at any time of the year that the occasion may justify. This is my idea of the proper method of handling stock.

I know of several cases where dealers and distributers have bought very heavily to protect themselves against a price raise. It is poor merchandising to buy beyond one's reasonable requirements regardless of what the

Next Comes Contracts

In this series of articles it has been the endeavor to point out that the dealer in motor cars really has the basis for a lack of confidence with the manufacturer.

The strongest argument in the dealers' discontentment has not yet been presented in these pages. It is the contract which—since this series was started—has been the subject of some discussion and which will be discussed more broadly within the next few weeks than ever before.

price situation is. A distributer or dealer is not justified in carrying more than a thirty or sixty days' stock at a time.

It is better to let a customer wait a short time for a car than to be over-stocked at all times. A little more old-fashioned conservatism in the automobile business would be a good thing.

When the factories intend changing models, they should advise the dealers and distributers a sufficient time ahead to permit them to get in shape for such change. As I remember, this has been the policy of the majority of the more reputable manufacturers. This condition will, undoubtedly, take care of itself as other injustices must.

Where a dealer is handling a product from a factory that has the reputation of being tricky, he should refuse to load up to such an extent that he is liable to be caught with an over-supply of obsolete models.

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There is a real constructive thought in opinion No. 8, which follows:

9—I believe new models should be announced about August or September. The distributer should know in ample time so that he can clean up his old stock. If a distributer has a large stock on hand, the factory should co-operate to move these models before the new model is announced.

This could be done by having each distributer send a detailed inventory to the factory about six weeks prior to the time the new model will be announced. The factory could check up and see which distributers are overstocked and distribute these models to other distributers who may be sold out and short of cars.

The factory should reimburse these distributers to the extent of carrying charges for the cars which they move for him to other points. By carrying charges, I mean interest, storage, handling, loading and insurance charges. That is, the distributer in New York who might receive automobiles from St. Louis whose regular charge from factory to New York is $80 per car, and if the charge from St. Louis to New York is $100, the factory should reimburse the distributer for his freight charges and refund the New York dealer $20.

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10—Models should never be changed radically. To deliberately design a new car, engine, body and so forth is wrong in principle as it depreciates the owner's investment and harms the selling organization. No one objects to improvements and the factory should refine its product wherever it would mean service.

Radical changes are not necessary in the automobile from the standpoint of better operation.

As many or more people will buy another make through being offended at having their cars put out of date over night, than will buy the newer model to be abreast of the time.

If models are to be changed, there should be some protection. The last of the old models should be placed in the dealers' hands on about Nov. 1 and the first of the new models shipped after Jan. 1.

—

The three opinions that follow set forth a different view, but they are none the less interesting.

11—In this part of the country, we have a rainy season when the North is having winter. As a suggestion for time for changing models, I believe Jan. 1 of each year would be fair to all. When models are changed, the dealer certainly should be protected on the old style model, because if his customer does get an old style car, figuratively speaking, he never forgives the dealer who "put it over him."

12—The change of models in this territory and in the summer has not affected us very much as there has not been any dealer in this territory who within the last few years had enough cars in stock to affect him materially, but I believe that where a dealer has a lot of obsolete models in stock the factory should furnish him the parts to bring this model up to practically the same standard as the new model. The manufacturer knew he was making a change when he loaded up the dealer.

—

13—With the revamping of conditions we are now going through, I am expecting that only the sound, well managed distributer organization and dealers will remain and those kind of people are entitled, and I am sure, will get the proper kind of consideration from the factories in relation to the condition of the merchandise they have on hand in contemplation of a change of models or prices by the factory.

The factories we are doing business with, I feel confident, realize the necessity of being in proper accord with their dealers and distributer organization and always will have the welfare of their field organizations in mind when making such important moves as changes in models and prices.

The manufacturer who does not value the members of his firing line sufficiently well to take them into consideration to the above extent will not be able to do business with responsible field organizations. Wise manufacturers realize the necessity of protecting to a reasonable extent their distributer and dealer organizations.

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It is our belief that these opinions are worthy of the consideration of the factory executive.

Study of Starting and Lighting Battery Characteristics

IN connection with the preparation of specifications for starting and lighting batteries requested by the Motor Transport Corps of the Army, the Bureau of Standards has made a brief study of the performance of these batteries in the operation of a few of the various types of automobiles; the experiments having been made on cars in ordinary running order. Performance curves showing the instantaneous demands upon the batteries when cranking the engines have been obtained by means of oscillograph records, these records showing characteristic differences typical of the design and condition of the various engines and starter systems. The initial values of current and voltage, which cannot be obtained by the use of ordinary indicating instruments, are shown at the time of closing the starter switch. After the starter has begun to turn, the current decreases rapidly, pulsating with the compression of the successive cylinders. The results which have been secured are to be regarded as suggestive rather than quantitative measurements of performance. They indicate the possibility of using this method for the study of problems relating to lubrication, ignition, compression, and distributer action. In addition, an exact method is secured for measuring the speed from one revolution to another. The characteristics of the charging current when the engine was running were also studied. Measurements have been made at different speeds, different throttle openings, and different temperatures.

Important Factors in Development of Foreign Trade

A visitor remarked the other day that we seemed to keep very close to fundamentals. Of course we do. Any study of the foreign field will reveal that American manufacturers neglect fundamentals. They can succeed only on proper fundamentals.

By George E. Quisenberry*

IT can be said that the coming months will test out the abilities of the American automotive manufacturers as foreign traders. The markets of the world have been ours for several years; whether we shall keep them remains to be seen.

But in the commercial fight that is certain to come we have several distinct advantages.

> **FIRST—The ability to manufacture more efficiently and on better production methods than any other country; SECOND—Our knowledge of advertising; THIRD—Our ability to provide adequate service.**

In each of these considerations the automotive manufacturers are world leaders. The problem now is to transfer them from the domestic to the foreign field and to use them in holding and extending our overseas trading.

The upward trend of exchange during the past few weeks has greatly heartened our exporters. With sterling leading the way, the currencies of almost every country have gained in value materially in the present movement and, with few exceptions, the buying power of foreign money is greater to-day than it was a few months ago.

This is one great advantage in favor of a reopening of foreign trading. But exchange, unfortunately, is something that the manufacturers themselves cannot control and cannot, by their own efforts, so effect that it will redound to their advantage. What they can control and what should be before them now, more strongly than at any time since the automotive industries first reached out after overseas business, is their sales and service policies. Here are the factors under which the individual exporter and manufacturer must stand or fall.

This article proposes to take up some of these things. Among them are:

> **1—Subjects as sales and service literature, 2—Campaigns for highway improvement, 3—Participation in motor shows and agricultural demonstrations, and 4—Above all, sales methods which meet the foreign buyer on his own ground.**

Of seventy automotive concerns manufacturing and selling all lines of equipment, a recent survey showed that fifteen only could provide foreign language literature for their products. Yet, each of the seventy was interested in foreign trading and is trying to obtain export outlets.

Service

What would be revealed in a similar survey devoted only to service and maintenance literature can only be imagined. One company, for example, which has placed its cars throughout the world, was unable recently to find a wiring diagram showing its models equipped with magneto ignition and it had not thought of the necessity of furnishing any diagrams at all, except in English, to its foreign distributers.

Service, in the export field, is even more important than at home. But this subject has been discussed numerous times and further reference need not be made to it, except the statement that future developments should stress this more strongly than perhaps anything else. The well-serviced car will be the one with the greatest sales in foreign countries and the exporter who devotes the proper attention to maintenance and upkeep will find himself amply repaid in increasing business and expanded profits.

For the coming year, the automotive exporter must keep himself in the markets. During a period of depression, this may be more or less of a thankless job, but one he must go through. Otherwise, when he attempts to regain his former standing, undoubtedly he will find the market closed. Those companies which have been longest in the foreign field are not abating their efforts in the slightest. One export company, notable among the American sellers of passenger cars abroad, has even increased its sales and advertising departments during the last month. Its traffic and accounting departments may employ fewer men than they did six months ago, but the sales and advertising divisions are stronger to-day than they ever were. That company means to keep the markets it has gained; it has confidence in the future of the automobile throughout the world.

Shows

In the next six months numerous shows and demonstrations have been arranged. Although few manufacturers would allow any of their dealers to keep out of any domestic show, regardless of the size of the place in which it is held, they have generally paid little attention to foreign exhibitions. A show is scheduled to be held in Mexico City in March. The Witwatersrand exhibition in South Africa was so successful last year that it will be repeated again in the same month and, following in April, May and June, at least eight or ten agricultural exhibitions will be held in different places throughout the Union. Some of these will be small, but each is a potential sales place for cars, trucks, tractors and other equipment.

A calendar of coming expositions shows many others, such as the Lima centennial exposition and the Indian tractor trials. Some are out and out motor car shows and others are the annual exhibitions of district or national agricultural societies. There are many of these societies

*Managing Editor El Automovil Americano.

in Latin-America, Spain, South Africa, Europe and elsewhere and most of them hold an annual exposition or fair. Even Bulgaria is planning a forthcoming exhibition, and extensive tractor trials, under governmental supervision, are to be held in India.

Naturally, the American manufacturer should be a leader in the promotion of the show idea. Outside of Europe and a few of the larger centers, the exposition plan has not penetrated far in the overseas territories. But it has been a business builder in the United States and it likewise will be a business builder in other countries.

Highways

The promotion of road building is an opportunity that but few makers have even considered. In the more undeveloped territories of South America, Australia and South Africa, and the Far East, there is already a great deal of road interest and it only needs a push to start the improvement of a large mileage of highways, with a resultant gain to the automotive industries that will dwarf all the difficulties and costs of the campaign.

In fostering foreign road campaigns, particularly in South America, the first thought needed to be put across is that the macadam, concrete or asphaltum road is not the only construction for solving communication problems. Many communities are holding back any highway improvement until they can have the best. But the automotive industry certainly knows what has been done in our own Middle West with the graded dirt road that may be improved at surprising small cost.

The graded dirt road will answer many of the needs of Latin America. It can be quickly and easily built at small cost and with widespread benefits. But it must have a champion and that champion should be the automotive exporter. Where roads do not exist at all, as in many parts of Argentina, Brazil, Chile and elsewhere, some sort of a highway should be cut through between the different cities. If these are graded and properly drained there are roads suitable for traffic nearly the entire year.

The problem in the Argentine is merely one of rain and drainage. Three-fourths of the country is without stone and is level and flat. Many of the provinces have no frost, and thus one of the major enemies of good roads is removed. The ease with which roads can be improved in such districts certainly should cause exporters to bend every effort to further highway projects.

American Cars

The American car lines are stronger to-day than they have ever been before for going after foreign business. The New York show dispelled any doubts that may have been entertained on this subject. The almost universal betterment of finish and workmanship and the more careful manner in which the cars were built should prove an important step forward in the export trading of American manufacturers. The cry against the American-made products has been that they were poorly finished, that colors were badly put on, that upholstery was inferior, etc. Perhaps there was some merit in these contentions when they were first made, but they should no longer hold. Now that the market has been turned into one in which production is not the only problem, the cars themselves should certainly disprove any such statements. The show revealed that more careful assembly and inspection had become the rule and it also showed that the manufacturers were ready to go further in meeting the demands of the individual customer.

Certain of the foreign markets have their individual requirements in such details as color and finish, ignition, steering, etc. Manufacturers are offering more color options to-day than they did a year ago; in fact, many companies announced themselves ready to furnish any color wanted. The number of makers refusing to fit magneto ignition and right steering is smaller than it was a year ago. Wire wheels were shown on a larger number of models—and wire wheels are desired equipment in many places.

All of these options, which have nothing to do with anything except the individual wishes of buyers and are not determined by the excellence of one kind of equipment over another, indicate that our companies are better prepared for the foreign trade fight that is to come. And it will be a fight, particularly on the higher priced cars. These markets can be held only by salesmanship of the highest type. Service, undoubtedly, will be the backbone of this salesmanship and next in line with it will be the attempt to give the buyer what he wants. He is, after all, the deciding factor in any business transaction and his wishes rather than those of the sales manager, the vice-president or even the president should be respected. That is sound salesmanship, in the foreign as well as the domestic markets.

To illustrate: One of the larger companies brought out its 1921 line early last fall. As its foreign business is large, its distributer in one of the Central American countries was immediately sent a shipment of the new models. The first cars sold readily, as the line was one of the larger sellers in that particular territory. Then sales stopped. The investigation which followed revealed that the tops did not stand up under the hot sun of this Central American country. The composition material became sticky under the heat and the Central American buyers did not like them, although they are entirely satisfactory in the home climate. The job itself was one of large production and to furnish different tops for the hotter climates puts the company to quite an expense. But the adjustment was made and the buyers of this particular car in the warm countries will not have to worry again over the durability of their tops.

This was good business. If the change had not been made quickly, the line would have lost an attractive market. But, judging from past events, how many manufacturers would have seen the wisdom of such an adjustment?

Mechanically, then, the American car lines—and likewise trucks, tractors and accessories—are suitable for all markets, or can be made so, if the manufacturer has the proper conception of building up his overseas trading. What are the other drawbacks to immediate business?

Cars in India

A BRITISHER just returned from India has been drawing attention to and indorsing the remarks of the newspaper *Englishman*, of Calcutta, on the big hold of American cars in British India. The figures quoted are from the Department of Statistics of India. They show that 1041 motor cars were imported into British India during September last, and of these 723 cars were consigned from the United States and 247 from the United Kingdom. During the six months April to Sept., 1920, the number of motor cars imported into British India was 7498, against 2553 cars in the corresponding period of the previous year. *Of the* 7498 *cars above referred to,* 5654 *were from the United States,* 1002 were manufactured in the United Kingdom, Canada recorded 532, France 49, Italy 43.

The increase in the imports for the six months of 1920 over the same period in 1919 is striking, and would indicate the rapidity with which the car is replacing the horse for vehicular traffic. A striking feature also is the poor show the imports from the United Kingdom make, and the relatively good position held by Canada.

Transmission Efficiencies

Editor AUTOMOTIVE INDUSTRIES:

The writer was very much interested in reading the above editorial, which appeared in the Jan. 6th issue of your paper.

The writer has been conducting extensive tests in the laboratories of the Joseph Dixon Crucible Co. with truck transmissions to determine the efficiencies of various lubricants, and the results obtained have been such as to confirm the results described in the paper recently presented to the American Society of Mechanical Engineers.

The tests conducted by the writer were such as to preclude, as much as possible, any errors in observation, since each test was repeated several times, and both the electrical and mechanical readings were employed as a counter-check.

Two different types of transmission were used in the tests conducted by the writer—one, a heavy truck type, which was apparently identical with the one described in the A. S. M. E. tests. This transmission is of a conventional design, with the constantly meshed gears located at the forward end of the transmission and the secondary shaft is arranged in the same horizontal plane as the primary shaft. The other transmission tested by the writer was a lighter truck type, with the constantly meshed gears also at the forward end, but with the secondary shaft below the primary shaft.

It was demonstrated in both cases that the direct drive is slightly less efficient than any of the lower gears, whether the secondary shaft is located in the same horizontal or the same vertical plane with the primary shaft. The difference, as may be expected, was slightly more pronounced in the two shafts in the same horizontal plane, but it was very clearly demonstrated that the greatest proportion of the power losses is due to the churning of the lubricant.

It is, of course, evident, that the churning effect of the secondary shaft is identical whether running in direct drive or in low gear, but the fact that the remaining gears of the primary shaft, except the constantly meshed gear, are running at lower speeds when in low gear, will readily account for a difference in the churning effect. This is due to the fact that all the gears of the primary shaft are running submerged in the lubricant to about one-third of their circumference, since the normal filling of the transmission case has to be approximately to a level flush with the underside of the primary shaft. If the level of one lubricant is below this line, it would be difficult to properly lubricate the anti-friction bearings employed.

In order to check the perhaps unexpected results of the extraordinarily high power losses, due to oil churning, a number of very interesting experiments were conducted by the writer with the lubricant drained from the transmission with sufficient lubricant clinging to gear teeth and bearings to prevent damage during the test runs. The results obtained showed very clearly that the power losses under these conditions were only a small fraction of those run with the case filled with oil. The data obtained, together with those of other tests, have made it possible to determine fairly accurately the effects of the different elements which contribute to the power losses in an automobile transmission.

The value of the test observations was enhanced by the fact that test runs were made at different temperatures, and, as was to be expected, the effect of the churning resistance of the lubricant at lower temperatures was particularly noticeable.

The writer feels that it would be of interest to you to be informed at this time of the results of his tests, which will be presented to the Engineering Fraternity in complete form as soon as some final check tests have been completed and the very extensive material has been properly digested and interpreted.

I should appreciate very much to receive your advices as to contradictory results of previous experimental evidence, but I believe that such evidence is not very conclusive in view of the fact that the majority of previous transmission tests were not conducted under the strict scientific precautions which conclusive efficiency tests require.

It is the writer's opinion that a thorough examination of the present transmission designs will demonstrate very clearly that there is considerable room for improvement in the design of our present type transmissions, especially from the standpoint of satisfactory lubrication.

G. A. UNGAR.

Smaller Engines to Better Fuel Economy

Editor AUTOMOTIVE INDUSTRIES:

I was very much interested in reading your editorial in the Jan. 20th issue on "Effect of Weight on Fuel Consumption." I believe that the last sentence in your editorial strikes a keynote, and which is a thought probably apart from the rest of the story, in which you state, "The chief reason why the light car consumes less fuel than the heavy car is due to the fact that a smaller engine can be used."

I believe that we should all work toward smaller engines, in order that we can obtain the best possible efficiency out of our power plants. We are all aware of the fact that the Otto Cycle is very inefficient at light load, and only shows real results when operating at, or near, full throttle opening. A comparatively small engine can be used if we decide that high speed can be sacrificed. Forty miles an hour should be fast enough for the average person. With a small engine, geared so as to give this as the highest speed, instead of sixty or better, we will be operating the engine at nearly full throttle a greater portion of the time. We might have to sacrifice slightly in acceleration ability, but refined design can combat this to a large extent.

The problem of manifold distribution is most serious at partial load while the full-throttle opening condition can be easily coped with. We find that trucks with a

(*Continued on page* 282)

The Relation of Cost of Labor to Factory Product

The marked need of stable definitions of labor cost, also of more intelligent compilation of cost data before adjusting sale arrangements on this basis are here set forth. At present, efficiency of labor does not figure in results. All factors included in labor cost must be determined.

By Harry Tipper

THERE is a great deal of misconception even among the heads of industrial concerns about the cost of labor and its relation to the total cost of the product. In this case, of course, labor is used to indicate the labor employed in production, it does not include the labor necessary for office work, sales executives and other departments of the business not concerned with the actual production effort.

A great deal of loose conversation has been made in and out of publications, and in and out of committees in various industrial establishments. Orders have been handed to production managers from the final heads of concerns instructing such managers to put into effect a reduction of wages on the basis that it would provide a reduction in costs on a given proportion without having first examined the proportionate amount of production labor required in relation to the total price of the product.

In one concern where the production manager has gone through various experiences with cost accounting and arrived at a system of cost analysis which appears sufficiently accurate and informing, **this manager was instructed to reduce wages ten per cent because the product had been reduced ten per cent in its price. He had the matter looked up and found that the effect of a ten per cent cut in the wages was equal to a one and one-quarter per cent cut on the sales price of the article.**

The actual amount of factory labor required in the production of a given article depends upon the character of that article, the character of the machinery and equipment involved in its manufacture and the character of the process.

It is true that in connection with all industry and using the term labor in its broader sense a very considerable portion of the final cost is taken up by the cost of labor, but this does not obtain when the term labor is used to discriminate factory labor, as is quite customary, and when single industries or establishments are dealing with their own particular part of the labor problem.

A number of the statements made by otherwise responsible men in industry handling matters of considerable importance either from the financial or production end, indicate the superficial character of the study which has been given to the subject of labor costs and the division of those labor costs in the departmental activities of the company involved. It is rarely the case that the cost of the labor in the factory per piece amounts to more than 40 or 50 per cent of the total sales price of the product.

The total labor required for the final sale of the particular article, including the manufacturing labor, the labor involved in designing, planning, accounting, office routine, demonstrative overhead and sales may reach very much larger percentages of the amount involved in the sales price of the article.

Many manufacturers have spoken as though the reduction of a given per cent in the price of their manufacturing labor would permit a similar reduction in the sales price, although obviously the labor percentage is only a proportion of the total and may reduce that proportion cost by half the percentage reduction in the sales, one-quarter, or in some cases one-tenth.

It is somewhat idle to discuss the exact effect of an increase or a reduction in the wage rate as arising out of a necessary reduction in the sales price, until the cost of that proportion of the labor affected is determined in terms of the sales price itself, and this is particularly the case when the efficiency of the labor is not considered at all in connection with the reconsideration of the rate.

This is just an indication of the amount of practical work required in the analysis of cost in order to arrive at a proper understanding of what is involved in the actual pay-roll pertaining to the different process of manufacturing and selling a given article.

In some products, where the cost of the product itself is very low and the labor required to handle is small, a very large proportion of the sales price may be the cost of selling, packing and physically distributing the product in question. In this case, a reduction in the amount of pay for the workers in the factory would have to be absurd, in order to meet a small reduction in the cost of the article itself.

In some special articles the value of the product is less than 5 per cent of the total sales price, the value of the package represents about 45 per cent and the value of the labor in manufacturing only 10 to 20. A reduction of 10 per cent in the sales price in this case would require a reduction of 50 per cent in the manufacturing labor rate in order to equalize the cost variation.

No solution of the question of labor costs can be secured from examining it from this standpoint alone, and certainly no solution can be determined by the arbitrary reduction of wages without the proper understanding of their relation to the cost of the product to the buyer.

This brings up again the question of what is involved in the labor cost, and what relation it bears to the labor rate which is paid in the plant. It also involves the question of what is meant by labor. This word is used to describe many different sections of the labor necessities included in the manufacturing establishment. It may be

used to indicate the total labor required outside of those officers of the corporation who are elected by stockholders. It should be used to include all labor involved in the manufacturing and sale of the article no matter whether the labor is executive or subordinate, or whether it is mental or manual. It is most frequently used, however, to describe the more or less manual labor included in the manufacture or the actual production of the articles which are made by the factory and which come under the variable wage scale.

The confusion which exists in the discussion of labor costs arises very largely from a lack of definition as to that operation of labor which is being referred to in the discussion and the relation which that part bears to the total labor costs involved in the particular establishment.

The conditions surrounding the manufacturing process in the particular establishment are rarely indicated in connection with the discussion of labor costs, and therefore the reasons for their importance or lack of importance are not made a part of the discussion itself, and cannot be considered in drawing conclusions therefrom.

The subject is one which is discussed so frequently in public and semi-public prints or meetings, that the indefinite character of the discussion is particularly unfortunate. As a matter of fact, the analysis of costs has not gone sufficiently far in its consideration and definition of the items under which the costs should be placed, and the proportionate importance of the labor in connection with such costs. In very few cases is the analysis between manufacturing costs and distribution costs clearly determined, and frequently there is little attempt to differentiate between the accessory costs to manufacturing not included in the actual production, but necessary to the production and the accessory costs to distribution and marketing not involved in the direct operation, but required for the completion of the operating necessities.

The cost analysis which has been considered and developed in a great many lines of business has been limited in its scope as a rule, and has not been of sufficient value to the manager and engineer who are concerned with determining not only the amount per unit, the effect of the variables per unit, but the accessories, the comparative importance of all the different elements necessary to the completion of the production or the accomplishment of the final sale.

The discussion of the cost of labor has not dealt with the average efficiency of the laborer at the time that the cost was determined, the effect of the variation in the efficiency upon the cost, the relation of the total cost per unit to the variation in the hourly rate and other matters which would be considered absolutely necessary in determining values of material or equipment.

There is so much misunderstanding already on the subject of labor costs that only careful definition of the particular cases involved will lead the discussion into more practical considerations of the subject, the factors which must be considered in its operation and the relation which it bears to general prices, in the particular cases which are being considered.

At any rate, the present loose and indefinite discussion does not help the solution of the situation and merely adds to the confusion by increasing the misunderstanding.

Selling the Sales Force to the Workmen

SEVERAL hundred salesmen of a Western automotive concern gathered for convention at the factory—salesmen representing the "pacemakers" in the sales force. While these men were holding their meetings and gatherings of one sort and another each was given a badge which he was told to present to a certain workman in the shop. Each salesman met a specified worker or group of workers and these workers took the salesmen through the shop and explained the plant activities and working processes.

On the face of it, this was solely for the purpose of familiarizing the salesmen with the plant. But it had a much deeper significance. It was, in fact, an effort to "sell" the sales force to the factory.

In many plants the workers are utterly unfamiliar with the things that the salesmen do. This plan was devised by the S. F. Bowser & Co., Inc., to overcome such a condition. Workers are apt to think that selling goods is a snap job; that a salesman needs merely to go around and take orders. And they may also feel that they alone could run the plant and distribute the goods without the aid of executives or salesmen. Consequently, there was a distinct educational value to these workers to find out just what is required of a salesman and just how hard salesmen have to work in times like these when business comes with difficulty.

In the Bowser plant paper is a department headed "Our Inquiring Reporter." In this particular issue the inquiring reporter asked a number of employees "What do you consider your most interesting experience since being employed at Bowser's?" This is the answer given to this question by Eugene Wells, an employee in the plant working in department 14:

"The sales convention was one of the most interesting occurrences since my coming to Bowserdom. It was at that time that I was seriously impressed with the fact that we in the shop are utterly dependent on the sales force and they on us.

"At that time they wanted us to 'hurry up' production to fill all the orders they could sell, and now that the much-talked-of after-war readjustment of prices is upon us, it is incumbent upon each of us to 'hurry-up' production as much as possible in order to cut down unit cost and thereby enable the salesmen to make sales that they might not be able to make at war-time prices, and incidentally keep the wheels turning here in the shop and all of us on the job as usual."

Smaller Engine to Better Fuel Economy

(*Continued from page* 281)

load gives greater ton-miles per gallon of fuel than do passenger cars. We also find upon analyzing the exhaust gases of trucks, that more complete combustion is obtained. These results are due to the truck engine operating at full-throttle the greater portion of the time.

The obvious conclusion is to endeavor to control these favorable conditions that we know of and the answer is the use of the small engine. AUSTIN M. WOLF.

A TEXTBOOK of rather elementary character dealing with ignition systems used on automotive vehicles has recently been published by the McGraw-Hill Book Co. under the title Automotive Ignition Systems. The authors are E. L. Consoliver and G. I. Mitchell.

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Minimizing Starting Difficulties

MUCH attention has been paid in recent years to various methods of heating inlet manifolds as a means of securing better vaporization of fuel, and it is now quite generally conceded that even the high end-point fuels now available can be successfully handled by this means. During the starting period, however, no exhaust heat is available. A choke or primer is usually employed to furnish a great excess of fuel in order that a sufficient amount of the lighter fractions to form an explosive mixture at low temperatures may be had. Only a small part of the raw fuel drawn into the cylinders is vaporized and much of the remainder finds its way past the pistons to dilute the lubricant in the crankcase. The detrimental results of this dilution are well known, and the waste of fuel is appreciable though small in comparison to other fuel waste to which we have unfortunately become so accustomed.

There are two means of pre-heating available. A small amount of fuel may be burned in such a way as to heat the inlet passages, or an electric heater can be installed which will at least partially vaporize the fuel used during the starting and warming-up period. If fuel is used for pre-heating it must be ignited by a spark, hence electrical apparatus and more or less other complications are added to a system already complex. Nevertheless, the problem is worthy of more study than it has been given, and it should be receiving study for the troubles incident to dilution of lubricant, and the difficulty of securing a quick start seem certain to increase as fuel becomes less and less volatile.

When means of properly heating the charge once the engine is started are provided the actual start can be greatly facilitated by the use of a small quantity of very volatile fuel such as ether as an alternative to other aids in starting. This involves the use of a relatively simple priming device, and may prove the best solution of the problem. Priming should, however, be used so far as possible without resort to the choke if the evil effects of lubricant dilution are to be avoided.

An incidental but by no means unimportant benefit to be derived from any method (except the use of an electrical heater) that makes for prompt starting is the lower demand that will be placed upon the battery. This constant source of difficulty can be made less annoying by anything that tends to keep the battery fully charged—an argument which does not, of course, favor the use of purely electrical means for aiding starting.

Speak for Economic Government

AN increasing number of automobile and truck manufacturers are becoming interested in export trade. To these manufacturers the figures showing the extent of this trade, issued monthly by the Federal Bureau of Foreign and Domestic Commerce, are of intense interest. It will probably be very interesting to these manufacturers to know that the issuance of these figures is endangered because of a lack of money to maintain the photostat department which prints the data. It also should be interesting to automotive manufacturers to know that the Patent Office is steadily losing its best men because they can earn several times as much as their Federal salaries in private work. This great and useful office is far behind in its work; its records are poorly kept and there is no remedy under the present system of appropriations. The fact that the Patent Office is self-supporting apparently has no influence on Congress. The receipts of the office are turned into the United States Treasury and the Commissioner of Patents must beg for appropriations, just as do the heads of non-productive bureaus.

Of course, we are all for economy in governmental affairs. But economy does not always consist in not spending money. It is the wise spending of money that should be sought. These two bureaus of the Government are useful and necessary institutions. They are worthy of support.

It would be a very wise precaution for manufacturers to write to the members of Congress from their states demanding support and economic man-

agement for the useful functions of the Government. There are other very worthy Federal institutions, among these being the Forest Products Laboratory to which we referred on this page a few weeks ago, and the Bureau of Standards.

It is surely a duty of the engineer and manufacturer to speak out on these things at this time. Write your congressman and senators to-day and we venture you will be surprised at the nature of the replies you receive.

Helps Patent Office Service

THE Conference Committee of the Senate and House of Representatives has recommended for favorable action House Bill 11984, known as the Nolan Bill. This bill carries an upward revision of the salaries to be paid to employees of the Patent Office, the intention being to make it possible for this office to hold some of its men longer than at present.

The bill, as recommended for passage, fixes the salary of the Commissioner of Patents at $6,000 a year. This office, besides being that of the executive of the Bureau, is often compared with that of a judgeship. The Commissioner sits as judge in patent hearings, which are the equal of many cases tried in the regular courts.

The passage of this bill undoubtedly would be a forward step for all of those interested in patents. It means a check in the present expensive labor turnover in the office—this turnover being expensive to all who are financially interested in patents. The time remaining at this session of Congress for passage of the bill is very short. If you are interested in improving patent office service, write to-day to the Congressmen from your district asking them to call up this bill and to support it with their votes.

There is a great need for this legislation.

Power and Moral Obligations

THE argument against any sort of democratic control in industry is largely based upon the lack of efficiency which would probably result. But the argument in favor of the present form of control through benevolent, or some other form of autocracy, rests almost entirely upon the assumption that the power in the hands of employers will for the most part be so utilized and administered as to operate industry for the best interests of society and in such manner as to render the best service to the community.

Consequently, the responsibility of each individual manufacturer to so administer the part of industry under his control is great. It presents to him an especially difficult problem for practical solution when business conditions are unfavorable and there is a strong temptation to disregard for the time being those moral obligations upon which the interdependent units of modern industry fundamentally rest.

There is a certain obligation that every manufacturer owes to every other manufacturer. Without a widespread conception of this moral basis of industry, business and manufacturing cannot successfully go on. Not long ago a parts maker wrote to one of his customers, stating the difficult position in which he was left by indefinite suspension of orders and calling attention to the necessity for recognizing the moral phase of the situation in endeavoring to formulate some plan by which an adjustment might be made which would be fair to both parties.

The reply to his letter ran something like this: "We have looked at our own situation and the situation with us is precisely the same as it is with you. Our customers have backed up on us. We in turn back up on you. You in turn back up on your material supplier, and so it goes." And the reader might be justified in reading the writer's thoughts to add, "And devil take the unfortunate company that has no one else to back up on." Were this idea to prevail, modern industry could not survive successfully, because it is made up of strongly interdependent units which must recognize toward each other certain fundamental moral obligations.

In like manner, there is a similar obligation between employer and employee. The economic power in the hands of the employer, which is especially strong just at this time, needs to be wielded in a just and calm manner. Where wage reductions are necessary, they should not be in the form of reprisals. It is at a time like this that the real test of the essential soundness of our present industrial system is made.

The China Famine Fund

IT has been suggested that the business papers should suggest to readers the great need of millions of Chinese for food to avert an unprecedented death percentage in that country.

This movement is not a part of the Hoover movement for feeding the children of Europe. The need in China is based on bad crop years, due to drouth and other features over which man has no control. There can be no question as to the need.

No question as to whether any man should share his plenty with others should arise. If you can spare something from your means, it is your duty to help others. If you care to justify any gift of this sort by economic arguments, think of the economic value of a human life, also of the trade prospects of a friendly China with her millions of people. The treasurer of this fund is Vernon Munroe, Bible House, Astor Place, New York.

A REVISED code of ethics was adopted by the American Society of Mechanical Engineers at their recent meeting in New York City. The second item in that code is worth the attention of every manufacturer and executive. It is as follows:

"His (the mechanical engineer's) first duty is to serve the public with his specialized skill. In promoting the welfare of society as a whole he advances his own best interests as well as those of the whole engineering profession."

In this brief quotation is contained an excellent statement of the modern conception of the basis and purpose of industry.

Chicago Show Starts Midwest Trade

Sales Approximate Two-thirds of 1920

Attendance Records Show Wide Public Interest—Rural Buying at Minimum

CHICAGO, Feb. 5—The New York automobile show established the fact that the buyer had returned to the market. The second national show held in Chicago during the past week further proved it. Shows which have been held in other cities in the intervening time likewise bore evidence of it. With reference particularly to Chicago, buying has returned where little real business has been transacted for the past two months and it has returned with great enough vim to lead the dealers to believe that with continual, effective pushing it can be carried on through the year.

From every standpoint of the distributer and dealer the Chicago national automobile show was a success. While the actual retail sales made on the floor were not as great as during the same period a year ago, reaching possibly 66 2/3 per cent of that figure, the great attendance and the unusually large number of live prospects obtained fully justified the optimism which the selling organization felt from the time the doors of the Coliseum and First Regiment Armory opened until they closed a week later.

The paid attendance, despite unsettled weather conditions—a few days of rain and other days that were threatening,—was 18 or 20 per cent better than last year. With the exception of the opening day practically all admissions were paid. The booths were so crowded the middle of the week that it was impossible for the selling organization to do really effective work.

Prospects Increase 50 Per Cent

In estimating that the list of prospects is far greater than during the same period in 1920, perhaps 50 per cent greater, there is taken into consideration only those prospects who showed a real interest. Dealers doubtless will find as has been the experience at other shows that one list will probably contain the names of prospects whose names are possibly on half a dozen other lists.

There were comparatively few buyers or prospects, as compared with last year, from the rural districts embraced in the Chicago distributer's territory. The number of country dealers showed a slight decrease. Dealers who did not come have fallen into the state of mind revolving about depressed conditions at home. Selling campaigns will shortly be projected by Chicago distributers to bring the dealers in the country to a different way of thinking.

Distributers feel from the out of town attendance of prospects and dealers that business in the agricultural states inclusive of Illinois will continue to remain in a quiescent state unless real merchandising efforts are brought into play. In spots there already appears to be an easing up among the farmers. Financial pressure by the banks is likely to cause grain selling soon.

(*Continued on page* 290)

Car Demand Steady in New York District

NEW YORK, Feb. 5—Metropolitan dealers find much encouragement in the steady tone of the market at the close of the first week of February.

There is every indication that the selling momentum gathered in the New York show, early in January, has been lasting and that a gradual increase in buying may be expected for the next few weeks.

Particular significance is attached to the fact that business in general along the row is nearly 100 per cent better than last October and November and considerably better than December, and it is pointed out that in addition to this the "spotty" business of January has settled down to a steady demand for cars day by day.

Wellborn Sees Return of Trade in South

ATLANTA, Feb. 5—That business has already greatly improved since the first of the year, inflated credit reduced, and is assuming a stabilized condition, and that the present outlook portends better and brighter times for all lines of business throughout the South, is the opinion expressed here in an interview by M. B. Wellborn, governor of the Sixth District Federal Reserve Bank.

The opinion is based on a survey of conditions made by the bank officials of the Southeastern states comprising the Sixth Federal Reserve District. Wellborn stated that the deflation period has about passed and that normal conditions are gradually returning.

GRAY-DAVIS SELLS LIGHT

BOSTON, Feb. 7—H. C. Dodge, Inc., has become the owner of the house lighting system formerly marketed by Gray & Davis, Inc. This plant is known as the "D-Light House Lighting Unit," and the company expects to manufacture under conditions which permit a larger volume of production under the supervision of a staff of engineers and high-grade mechanics.

Tire Dealers Form New National Body

Cleveland Selected as Headquarters—Seek Co-operation of Manufacturers

CHICAGO, Feb. 5—The National Tire Dealers' Association has been organized here following a three days' session of delegates from ten cities where local associations have already been established. Cleveland was selected for the national headquarters and Phillip O. Deitsch of that city was appointed secretary.

The purpose of the association, according to the constitution, is to advance and safeguard the business interests of tire dealers and to promote a co-operative relationship between the manufacturer, tire dealer and buying public.

A resolution was adopted defining the legitimate tire dealer.

"Whereas," it says, "we believe that the policies of a great many manufacturers have been unethical with reference to their interpretation of legitimate tire merchants, therefore be it resolved that this association consider a tire merchant to be one who sells tires at retail and whose policies are not dictated by any manufacturers. The definition of a tire merchant shall be as of firms having a permanent place of business, making their major profits from the sale of tires, tubes and tire accessories; also repair men and vulcanizers and such owners of garages who carry a stock of tires and tubes for resale."

Another resolution was adopted relating to the mutilation of used tires.

Would Stop Tire Frauds

"Whereas," it reads, "it is the practice of some unscrupulous tire dealers to repair and replace upon the market worn-out tires, be it resolved that this association recommends that its members mutilate by cutting in two all junk tires just before disposing of said tires to anyone so as to render them unfit for further service."

Another resolution was passed recommending that manufacturers take some similar action.

The officers elected were as follows: President, Thomas F. Whitehead, Chicago; vice-president, R. F. Valentine, Cleveland; treasurer, Henry Stenzel, Milwaukee. The directors in addition to Messrs. Whitehead, Stenzel and Deitsch are Edward P. Farley, Minneapolis, and A. B. Clark, Kansas City, for one year; Joseph Roberts, St. Louis; R. J. Walters, Baltimore, and R. R. Woolley, Cincinnati, for two years.

Protests Stir Anti-Dumping Action

Propose Sales Tax to Equalize Prices

Revision of Internal Revenue Act Shown as Way to Correct Uneven Competition

WASHINGTON, Feb. 7—Nation-wide protests against the dumping of surplus trucks, sold by the Army to foreign dealers, on American markets have brought about a proposal to amend the internal revenue act at the next session of Congress in order to afford protection to domestic dealers and manufacturers. Congressional leaders believe that this unfair competition may be checked through the enactment of fiscal legislation which would impose a sales tax on trucks and other automotive equipment sold by foreigners or their American agents, to equalize the excise and sales tax levied on local manufacturers and dealers.

The California delegation in Congress has been advised that the Slough Trading Co., an English organization, has taken advantage of customs regulations which permits entry of American-made goods free, to invade the market with several thousand war trucks. Sales agents of this organization, it is said, have been active in Los Angeles, where 75 trucks have been offered for sale at prices which defy competition.

Los Angeles dealers assert that prices are inflated for a time until a real prospective buyer appears and attractive discounts are offered which prohibit competition by other dealers. It is further claimed that these former Army trucks, remodeled or refinished in British shops, return without imposition of duty as "used" machines while they are later offered as new trucks.

Tariff Change Ineffectual

California congressmen have inquired as to the possibility of revising tariff duties, but found that the law could not be changed in this respect without meeting defeat as class legislation. Treasury officials thought it would be possible to offset this disadvantage by revision of the internal revenue act when it is called up at the special session next month.

There seems to be a good chance that this proposed legislation will be favorably received by committees and ultimately by Congress because the incoming legislative and administrative branches of the Government are committed to a policy of protection. It is stated that American manufacturers will co-operate with dealers in this measure in order that domestic markets may be protected.

The trucks were sold to the War Department, and an agreement was reached after the armistice that these machines would be sold abroad rather than disrupt American markets by their return and subsequent sale. The War Department kept to its bargain and sold to British and French dealers. These dealers repaired the trucks and cars and propose to reship them to this country. The exchange situation, free entry and the low costs make it possible for them to deliver these American-made foreign-owned trucks to American agents at prices far below current quotations for domestic products.

Depressive Effects Feared

Under existing tariff laws, American dealers and manufacturers are quite helpless to prevent the dumping at cut-rate prices, often below the production costs. The depressive effect of the Anthony "rider" to the Army appropriation bill, which would compel the sale of 10,000 trucks coupled with this latest menace to resumption of domestic sales, is expected to bring about unity among dealers and manufacturers in support of proposed amendments to the internal revenue bill.

The amendment, if adopted, would undoubtedly provide for the imposition of taxes on these imported trucks equal to the aggregate tax levied on trucks manufactured and sold in this country. The present Congress will not consider tax legislation, but it will be on the calendar for the next session.

Dealers have been advised this week that French traders contemplate action along lines followed by British dealers.

January Car Shipments One-third of Year Ago

CHICAGO, Feb. 5—Directors of the National Automobile Chamber of Commerce were informed by the traffic committee at their meeting here that carload shipments from the factories during January were 35 per cent of January a year ago, which marks a new low level.

It was decided that the directors would take up with counsel and the N. A. D. A. the recent court decisions regarding confiscation of cars transporting liquor.

The directors expect the recent reduction of 2 cents in the price of gasoline to help sales of cars and trucks.

BICKETT RUBBER ORGANIZED

WATERTOWN, WIS., Feb. 7—The Bickett Rubber Corp. of Watertown, Wis., has been chartered to engage in the manufacture of rubber products of all kinds. The capital is $100,000 preferred and 2000 non-par valued common stock. L. W. Bickett, Max G. Kusel and E. L. Hoge are the incorporators.

House Passes Bill to Sell Army Trucks

Action by Senate Will Decide Big Dumping Move—1000 Cars Included in Order

WASHINGTON, Feb. 8—Ten thousand Army trucks and 1000 passenger cars will be placed on the market within a few weeks unless the United States Senate amends or modifies the Army bill, which passed the House to-day, carrying the Anthony proviso, directing and authorizing the Secretary of War to declare a surplus of equipment and dispose of it on such terms and conditions as he may deem most advantageous to the best interests of the Government. Dealers and manufacturers throughout the country will have but little time to convince the Senate of the depressive effect the passage of this measure would have on the industry, inasmuch as there are few legislative days remaining for the present session.

Congressman Anthony was successful in obtaining favorable action on his measure. He steadfastedly refused to heed the pleas of the highway officials that the equipment be transferred. It was his contention that the road builders had sufficient automotive equipment on hand and could not absorb the trucks and other machines which he wanted sold. A slight revision, proposed by Congressman Mann of Illinois, clarifying the language of the provision, was adopted. The committee had reported "not less than 10,000 of the motor trucks and not less than 1000 of the automobiles owned by the War Department." The Illinois Congressman objected because it could be construed to mean that Congress forbid the Secretary of War to sell less than 10,000 trucks and 1000 automobiles at the same time.

May Sell in Small Lots

Congressman Greene of Vermont stated that the committee's language should be changed for it would not allow the War Department to sell five or ten trucks at a time. This change was subsequently made in the Mann amendment. The question was asked during the debate whether it would be possible to dispose of these trucks. Congressman Dempsey asserted it would not be a difficult matter and it would be possible for the Secretary of War to buy the balance himself, but in the markets.

The bill, as now passed, will be sent to the Senate. If the Upper House objects to this method of disposing of trucks and cars at a time when the domestic market is glutted and other Army trucks are dumped here by foreign dealers, it will be sent to conference.

Willys Corporation in Bankers' Control

Creditors and Stockholders Form Committees to Consider Plan of Action

NEW YORK, Feb. 7—Financial affairs of the Willys Corporation have been placed temporarily in the hands of a bankers' committee and no bills are being paid except with the consent of this committee.

A merchandise creditors' committee is being formed with the sanction of the bankers' committee and efforts are being made to obtain the consent of creditors for an extension of time which will permit of some constructive action.

The merchandise creditors' committee is headed by F. C. B. Page of the E. W. Bliss Co. and the other members include Joseph B. Tarbell of the American Brake Shoe & Foundry Co. and Theodore Beran of the General Electric Co.

A first preferred stockholders protective committee has been organized and it is understood its attitude will not be entirely sympathetic toward the bankers. The preferred stock of the Willys Corporation provides that no mortgages can be placed on any of the company's property except with the consent of 75 per cent of the preferred stockholders. Joseph P. Cotton of the law firm of McAdoo, Cotton & Franklin, is counsel for the preferred stockholders' committee which is headed by Howard Bayne and includes U. N. Bethell, Stedman Butterick, Thomas B. Gannett, Robert E. Hunter, Leclanche Moen and Robert L. Montgomery.

Stock Depositories Named

The depository for the preferred stock is the Columbia Trust Co. of this city and subdepositories are the First National Bank of Boston, the Central Trust Company of Illinois and the Girard Trust Company of Philadelphia.

A similar committee is being formed for the second preferred stockholders. A letter sent to them states that the company needs a large sum to meet contract obligations and commitments in connection with the new factory at Elizabeth, N. J.

The second preferred committee is headed by Arthur O. Choate of Clark, Dodge & Co. The depository will be the Bankers Trust Co. and the counsel O'Brien, Boardman, Parker & Fox.

All the various interests involved are exceedingly reticent as to their plans but it can be stated that reorganization and refinancing of the Willys interests is in prospect although none of the details are available. The subject has been under consideration by the bankers interested for several months. The bank chiefly interested is the Chase National and E. R. Tinker, president of the Chase Securities Co., is a director of most of the Willys units. Walter P. Chrysler, executive vice-president of the Willys Corporation, is directing the negotiations of the company with the bankers. Associated with him in this work is J. R. Harbeck, who recently resigned as vice-president and director of the American Can Co. to devote all his time to his automobile interests. These two men are also directing the affairs of the Maxwell-Chalmers Co.

Definite announcement of the reorganization plan is expected within the next thirty days as many of the corporation's bank loans mature about the middle of March. These loans were renewed at their last maturity date. They are said to aggregate about $20,000,000.

Willys-Overland Not Involved

The Willys-Overland Co. is not involved in any way in the refinancing of the Willys Corporation although 27 per cent of its stock is owned by the corporation. The property of the Willys Corporation includes the Electric Auto-Lite Corp. with a plant at Toledo, the New Process Gear Corp. with a plant at Syracuse, the Duesenberg Motors Co. and the huge new plant virtually completed at Elizabeth, N. J., for the production of the "Chrysler Six," which is not yet upon the market.

The Willys Corporation was incorporated in Delaware in 1917 as the Electric Auto-Lite Corp., and the present name was adopted two years later. In 1919 it acquired the entire capital stock of the New Process Gear Corp. and the Duesenberg Motors Corp. as well as the old plant of the Allen Motor Co. at Fostoria, Ohio.

The corporation has a purchase and sale contract with the Willys-Overland Co. providing for the manufacture by the corporation on a large scale of a new lightweight six-cylinder automobile. This contract provides, among other things, that the Willys-Overland Co. shall market this car through its sales organization and a special unit.

The security holdings of the Willys Corp. include 27 per cent of the common stock of the Willys-Overland Co.; $1,000,000 of the 7 per cent convertible second preferred stock of the Fisk Rubber Co. in which John N. Willys is one of the largest stockholders, and $1,000,000 of the 7 per cent convertible second preferred stock of the Federal Rubber Co. which is controlled by the Fisk Rubber Co.

Capital Stock Outstanding

The capital stock of the Willys Corporation consists of 5,000,000 shares of common of no par value; $15,000,000 of 8 per cent cumulative convertible first preferred with a par value of $100 and $10,000,000 of 7 per cent cumulative convertible second preferred with a par value of $100. All the preferred stock is outstanding and 4,450,000 shares of the common. Of the unissued common stock, 300,000 shares are reserved for the conversion of first preferred at the rate of two shares of common for each share of first preferred and 250,000 shares are reserved for the conversion of second preferred at the rate of two and a half shares of common for each share of second preferred. The company has no funded debt.

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U. S. Rubber Shows Higher 1920 Income

Report Earnings at Rate of $19.82 a Share—Inventory Position Good

NEW YORK, Feb. 7—The preliminary report of the United States Rubber Co. for last year shows net profit, after all charges and allowances for Federal, British and Canadian taxes, of $21,275,524, or the equivalent after preferred dividends of $19.82 a share on the $81,000,000 common stock. In the previous year the net profit was $17,730,237, equivalent after preferred dividends to $17.59 a share on the $72,000,000 common stock then outstanding.

The chief items of the income account are shown in the following table:

	1920	1919
Sales	$255,744,685	$225,589,465
Net income	26,925,173	21,396,099
Interest	5,649,649	3,365,862
Net profits	21,275,524	17,730,237
Pref. dividends	5,200,000	5,041,476
Divs. subsidiary cos.	18,718	19,567
Com. dividends	6,480,000	2,098,576
Surplus	9,576,806	10,570,618

In a statement by Samuel P. Colt, chairman of the board, he says:

"The company at no time during the year had any so-called forward contracts for crude rubber, and, therefore, was in a position to take advantage of the low market prices which have prevailed for some months, with the result that at the close of the year your company had on hand and subject to delivery about seven months supply of crude rubber at an average cost of $0.2679 per pound. Therefore, it was not necessary to write off anything on account of crude rubber.

"As to all other materials and supplies, the company had a short inventory position during the latter part of the year and, therefore, was able to take advantage of the decline in prices.

"In accordance with past conservative practice in respect to making reserves, your Directors will in due time consider the advisability of appropriating some part (not exceeding $6,000,000) of the net surplus of 1920 to be set aside as a reserve to take care of any contingencies that might arise."

HALLEYS CLOSES FOR TIME

LONDON, Jan. 17 (*Special Correspondence*)—Cancellation of orders leaving 100 completed chassis on their hands has resulted in Halleys' Industrial Motors, Ltd., Scotland, refraining from making any distribution among shareholders for 1920, despite a fair profit shown by accounts for the year's trading. The directors at a meeting have just announced that no orders were being received to take up these trucks in stock; clearly the outlook is not encouraging. Halleys make one model only, a 3½-ton chassis, which is the only British truck with a six-cylinder engine. Their plant is practically closed down for the time being.

Pierce-Arrow Adds $1,000,000 to Surplus

Company's Position Regarded as Strongly Entrenched—Inventory Losses Written Off

BUFFALO, Feb. 3—Pierce-Arrow company's report for 1920, made public to-day, makes a distinctly gratifying showing for Buffalo's biggest motor car industry. The net earnings after all charges, taxes and depreciations allowances of $1,769,914, or more than twice the annual preferred dividend requirements of $800,000, is considered good in view of the sharp depression which came in the automobile trade in the last half of 1920.

It is true that the balance of $3.88 a share applicable to the common stock is only a little more than half the $6.75 a share earned in 1919—but in that year the automobile industry was at high tide. But the fact that there was a surplus for the year of practically $1,000,000 carried to the balance sheet and that the total accumulated surplus is shown as $4,541,546 is satisfactory testimony as to the way Pierce-Arrow has weathered the trade cyclone.

Inventories are shown as of Dec. 31, 1920, at $16,470,662, an increase over those of the year previous amounting to $2,925,241. The valuation used in making the inventory have been pared to cost and replacement figures. Patents, trademarks, etc., are given only a nominal value and are lumped at "$2."

Quick net assets, aside from inventories, are shown as a total of $3,383,872, of which $1,338,099 is cash. Reserves set up for depreciation of plant, etc., are given as $2,032,784.

President G. W. Mixer, in submitting the report, states that the reorganization of the plant from the basis of its wartime activities has been fully completed and, in making these changes, much has been done to modernize equipment and reduce manufacturing costs.

Processes have been revised for both quality and economy. Mixer adds that some 80 per cent of the tools and machines used in making older models of cars and trucks no longer in active manufacture have been charged off against the previous reserve for depreciation. The plant is now in the best of modernized productive capacity for present and next season's output of models.

Although nothing is said in the report or its presentation as regards present business or indications, it is known the company is getting an increase of orders.

OLDSMOBILE SHIPS TRAINLOAD

LANSING, MICH., Feb. 4—A solid train consisting of 20 cars carrying 60 Oldsmobiles left Lansing this week for Chicago consigned to one of three Olds dealers in that city. The consignee, the North Side Oldsmobile Co., 5206 Broadway, will distribute the entire allotment.

RAILROAD CONCEDES PASSENGERS TO BUSES

RICHMOND, VA., Feb. 5—Representing that motor travel on highly improved highways paralleling its line has seriously affected its passenger traffic, causing this service to be operated at a loss, the Chesapeake & Western Railway Co. has petitioned the Virginia State Corp. Commission for permission to abandon passenger service on the road, it was announced to-day. The railroad is 50 miles in length, extending from Elkton to Stokesville in the valley section, and connecting with the Baltimore & Ohio and the Southern railways. It plans to continue its freight service.

Transit Company Adds New Truck Equipment

DETROIT, Feb. 4—Acason Motor Truck Co. has received an order for 100 trucks from the Red Ball Transit Co. of Indianapolis. The Transit company, according to General Manager W. B. Hiner, plans to greatly enlarge the scope of the work of the company during the year, and inter-city motor vehicle transportation operations are planned between all the larger cities in the country.

The Red Ball Transit Co., which specializes in inter-city overland hauling, was organized three years ago and has been highly successful. The company uses heavy duty trucks with large enclosed bodies resembling moving vans. The main lines now operate to cities between Indianapolis and New York by way of Cleveland on one route and by way of Pittsburgh on the other. There also is a line between Indianapolis and Chicago and another between Indianapolis, St. Louis and Kansas City. The headquarters of the company are at Indianapolis, with a branch office in Chicago.

The company does no local hauling, devoting its attention entirely to inter-city business. It is planned to extend the activities to the Pacific Coast, and sufficient business is on the books, according to Hiner, to justify the placing of 35 additional trucks in operation immediately.

SIMPLICITY FILES PETITION

GRAND RAPIDS, MICH., Feb. 4—A petition in bankruptcy was filed in the Federal District Court this week for the Simplicity Wheel Co. by Attorney Charles V. Hilding. Total liabilities are given as $175,000, and the estate of F. W. French, defaulting cashier of the Grand Rapids Savings Bank and head of the wheel company, is charged with $150,000 of the unsecured claims. Attorney Hilding is petitioner for the wheel company and also receiver for the French estate. Secured claims are $5,242 and the total assets are $36,340, consisting largely of stock in trade.

Miller to Reduce Salaried Employees

Third of Large Companies to Make 10 to 25 Per Cent Reduction

AKRON, Feb. 7—The Miller Rubber Co. is the third tire corporation in Akron to reduce salaries, in addition to flat wage cuts. Notices distributed by the company to all salaried employees, notify them of salary reductions understood to range from 10 to 25 per cent, to become effective Feb. 15. Miller, like practically all other Akron companies, previously had cut wages, hourly rates and piece work rates.

Miller officials in announcing the salary readjustments call attention to the necessity for the step in view of the readjustment of economic conditions, and also advise that salary reductions will be based upon efficiency of service of their employees, rather than enforcing a flat rate of reduction.

"We implore our employees," the notice says, "to recognize the conditions, as the readjustment of the world's business and commerce cannot possibly be made on a lop-sided basis, and while the reduction in commodities has not yet fully reflected to the consuming buyer, as liquidation proceeds buying prices will automatically seek their level. We ask that our employees make every effort possible to adjust themselves to the conditions as they exist, and those who have practiced the extravagances displayed should bring themselves to a realization that thrift and economy, both in personal affairs and in employment duties, will become absolutely necessary. We are adjusting the rates of salaries to equal the service rendered as nearly as possible."

Firestone Increases Hours

Wage readjustments made effective Feb. 8 by the Firestone Tire & Rubber Co., coincident with an increase in factory working hours, are expected to permit increased production without any material increase in cost, it is announced. Firestone departments have been working five hours a day. Under the new schedule employees in the factory will work seven hours a day for the same daily rate as under the five hour schedule, thus giving the company practically ten hours increased factory operation each week, without any payroll increase.

CHAIN OFFICERS ELECTED

MILWAUKEE, Feb. 7—The Auto Life Tire Chain Co., which established a factory at Cedarburg, Wis., several months ago, is increasing production to meet orders from jobbers and dealers. At the annual meeting the following officers were elected: President, E. A. Hoya; vice-president, A. L. Wolff; secretary, William F. Schad; treasurer, F. A. Andree.

Chicago Show Starts Midwest Business

Car Prices Evoke Little Comment —Distributers Prepare for Spring Buying

(*Continued from page* 286)

In a number of instances the matter of price was spoken of by the prospect but this did not figure very materially in the discussions at the booths. General business conditions affected in a large measure the sale of cars that would be bought by wage earners. The buyers of the higher-priced cars have pretty well established positions, and while the purchasers of the moderate priced cars are to a certain extent concerned in readjustments they are not affected as deeply as are the lower-priced car buyers.

That the dealers feel that the show will bring a strong revival of buying, with thorough merchandising efforts inaugurated around the prospects obtained at the seven-day exhibit, is evidenced by the fact that two of the principal distributers of the moderate priced cars have, during the week, received carload shipments of cars. They are forestalling any shortage in supply that the spring may bring.

Detroit Gains Faith in Normal Resumption

DETROIT, Feb. 7—The returning contingent of Chicago show visitors struck Detroit like a breath of fresh air. Detroit has been undeniably pessimistic for some weeks. A great many of those who went to the New York show came back with this pessimism relieved to some extent, but they were not convinced. Practically all those who went to Chicago have come back convinced that business has started on the upward trend.

The beginning of buying by the public will not be felt immediately at the factories, as there is considerable slack that must still be taken up. If the figure of 120,000 surplus cars in the country is correct, this means nearly two months' purchasing at the current rate. Unless buying is accelerated to some extent, the factories will not feel the actual buying until the middle of March. There is sufficient indication of dealer interest, however, to have convinced the average factory that it is perfectly feasible to start on a reasonable production schedule and thus build up an organization that will pick up the load when it begins to be felt.

There have been some great lessons learned during the past year. Manufacturers meeting at Chicago as well as New York discussed these freely. Perhaps the greatest thing that has been learned is the necessity for flexibility in the manufacturing schedule. No one could tell a year ago that business would drop so rapidly as it did toward the end of last year, and bankers' prophecies on this point were ignored. The result is that contracts for parts were made over long periods and for great quantities, working an injustice on the parts maker as well as resulting in piling up inventory at a time when it was very necessary to keep it down.

The parts makers have in many cases asked the car manufacturer to help bear the load. For instance, the Zenith Carbureter Co. has asked manufacturers using their product, where these concerns are well stocked with carbureters, to pass the business along and not let the parts manufacturer hold the bag. They have asked that for every 100 cars made the manufacturer take fifty carbureters. This request has been acceded to in a great many instances and is regarded as a very equitable arrangement.

Highest Production in May

To sum up the situation from the manufacturing standpoint, general production at present is running, leaving out Ford, at about 25 per cent capacity. This may be expected to increase, if one were to hazard a prediction based on general observation, to 35 per cent in February, 50 per cent in April and 60 per cent in May. At this figure it is very apt to remain for practically the balance of the year.

The Ford situation is expected to have a material benefit on the industry, in that a price increase which is confidently expected will be a material factor in showing the public that some of the cars at least are at rock bottom prices. It is a fact that is generally clear to the educated public that some cars are better buys from a money standpoint than others. This is a situation which will have to clear itself, and frankly speaking there are cars that will have to come down in price in order to meet competitors' prices.

From the parts maker's standpoint it is probable that until confidence is restored he will have to work on three-month orders rather than six-month until such a time that full confidence is restored, but unless every sign it is possible to see fails, he will find his shop again producing and his business growing on its merits.

Milwaukee Sales Most in $1500-$2000 Class

MILWAUKEE, Feb. 7—How well the annual Milwaukee show of 1921 functioned as the beginning of the new selling movement, is indicated by semi-official figures gathered from passenger car dealers who exhibited.

An analysis reveals the information that show sales were mainly in the medium and high-priced passenger car classes. More than one-half of the total retail sales were in the class from $1,500 to $2,000, and one-third from $2,000 to $3,000, the remainder being almost equally divided between the $500 to $1,000 and the $3,000 to $7,500 classes. Last year the majority of sales were in the $500 to $1,000 class.

Cleveland Confident of Increased Buying

Factory Representatives at Shows See Indications of Good Normal Business Year

CLEVELAND, Feb. 7—Factory representatives at the New York, Chicago, Cleveland and other shows have come home convinced that there will be a rebound from the low selling and low production conditions that have prevailed, and that the first movement upward is under way.

"The tide has turned and from now on we may be assured that the automobile business will gradually come into normal," said Frank C. Chandler, president of the Chandler Motor Co., upon his return from the Chicago show. "Orders are coming into the factory in better volume than they did in January. January was better than December, and March will be better than February. Later in the year conditions will be even better and I am optimistic about the record that finally will be written around the present year."

At the Templar factory, Daniel L. Britton, factory manager, said the force of workmen would be increased 50 per cent within the next three weeks to take care of increased schedules. Dealers' orders are coming in in such number that larger production is essential.

Peerless and Winton both report that increased output is contemplated. Other manufacturing establishments are putting their equipment in shape in order to take care of orders expected when the trade gets into full swing.

One of the hopeful signs has been seen in the agricultural districts of the State. The farmer has been mighty sore at the drop in prices for farm products, and especially so when he compared these new prices for what he produces with prices demanded for the things he must purchase. Salesmen have been received better lately in the Ohio agricultural districts, according to reports received by dealers.

The reduction in the price for gasoline is another factor that has helped to create an optimistic mood in the industry.

White Merges Working Forces

At the White Motor Co., which has been operating a full day and night force during the period when other plants were either shutting down or greatly curtailing production, a reduction in operations will take place March 1. In the last few months working time has been reduced to five days a week and lately to four days.

Commencing March 1, the night force of 1700 men will be combined with the day force. One force will work three days a week and the other three days. In this way more men will be employed than if the company had adopted the policy of working a single force six days a week.

N.A.C.C. Would Slash Billion From Budget

Taxation Committee Prepares Recommendations on Governmental Appropriations

NEW YORK, Feb. 8—Elimination of the one billion dollar increase proposed in certain Federal departmental estimates for 1922, reduction of a military and naval program to its lowest practicable point, and a further slash of 1 per cent in the estimate, as a first step in a return to "sane, normal conditions," are the major proposals contained in a tax program approved to-day by the directors of the National Automobile Chamber of Commerce. All told, the reductions asked amount to approximately $1,500,000,000.

Other proposals, summarized, include:

Funding of the cost of the war, spreading the operation over a period of 50 years, including therein the floating indebtedness, Victory notes, and war saving certificates which come due in 1923.

Suspension of the program of retirement of the war debt during the period of materially increased expenses growing out of the war or at least until 1923.

Funding of demand obligations of Allies and acceptance of funding securities for unpaid interest which they may be unable to meet.

Repeal of the excess profits, excise, transportation, consumption and other tax burdens growing out of the war.

Provision for additional revenue from a moderate protective tariff.

If still further revenue is required, consumption tax is suggested of 1 per cent on all commodities based on the retail sales to the consumer.

In explanation of the principles proposed and to bear out an expressed conviction that if the major premise of economy is accepted, no further taxes will be necessary, a table of proposed expenditures and estimated receipts for the fiscal year 1922 has been prepared by the taxation committee of the chamber, made up of C. C. Hanch, chairman; H. H. Rice, J. Walter Drake, Charles Clifton and F. I. Barrows. The table is shown on this page.

M. & A. M. A. Committees Named by Directors

NEW YORK, Feb. 7—Committees for the coming year have been appointed by the board of directors of the Motor & Accessory Manufacturers Association. The executive and finance committees, which are identical, are composed of the following: E. H. Broadwell, chairman, Fisk Rubber Co.; C. E. Thompson, Steel Products Co., Cleveland; E. P. Hammond, Gemmer Mfg. Co., Detroit; W. O. Rutherford, B. F. Goodrich Co.; G. Brewer Griffin, Westinghouse Electric & Mfg. Co., Pittsburgh; A. W. Copland, Detroit Gear & Machine Co., Detroit; J. M. McComb, Crucible Steel Co. of America, Pittsburgh.

The show and allotment committee is composed of Rutherford, Griffin and C. H. L. Flintermann of the Detroit Pressed Steel Co.

The banquet committee is headed by McComb and the membership committee by Copland.

FEDERAL EXPENDITURES AND RECEIPTS FOR 1922 PROPOSED BY TAXATION COMMITTEE OF N. A. C. C.

EXPENDITURES		
Total estimated ordinary expenditures 1921		$4,673,395,278
Less item Federal control railroads		1,025,000,000
Total estimated expenditures 1922 if maintained at level of 1921		$3,648,395,278
Urgent Deficiency Item		478,000,000
		$4,126,395,278
Less reduction of 10 per cent as first return to normal standard		412,639,528
		$3,713,755,750
Postal Service payable from Postal Revenue		585,406,902
Ordinary expenses payable from other Sources of Revenue		$3,128,348,848
RECEIPTS		
Internal Revenue:		
Income and Profits Taxes	$2,625,000,000	
Miscellaneous	1,375,000,000	
	$4,000,000,000	
Less loss due to repeal of excess profits	450,000,000	
Less all consumption taxes save tobacco and liquor based on 1921 receipts	$714,386,743	
	$2,835,613,257	
Loss due to reduction in surtax	230,000,000	
	$2,605.613.257	
Plus increase in corporate income due to excess repeal	45,000,000	
	$2,650,613,257	$2,650.613.257
Public lands		2.000.000
Miscellaneous sources		493.000.000
Panama Canal tolls, etc		14,530,000
Total estimated receipts exc. public debt		$3,510,143,257

Reeves Finds Trade in Rallying Stages

Coast Markets Better Than Central Districts—Kansas Credits Again Available

NEW YORK, Feb. 8—Alfred Reeves, general manager of the National Automobile Chamber of Commerce, has just returned from a three weeks' trip in the West, where he addressed meetings of dealers, manufacturers and bankers in Wisconsin, Illinois, Missouri, Iowa and Nebraska. He reports encouraging signs of returning business, although after the spring trade future progress in the automobile industry will depend largely on the progress that other industries make in returning to normal.

Information gathered on this trip, coupled with reports from other sections of the country, indicate that the best trade in cars and trucks at present is along the Atlantic and Pacific Coasts. It is somewhat spotty in other parts of the country.

New York, Pennsylvania, California, Ohio, Illinois and Wisconsin seem to show the best sales, while the poorest sections appear to be through the South, particularly Texas, in the Dakotas, and in Iowa and Nebraska, although with a general upward turn everywhere.

"As in 1914, 1917 and 1919, the automobile shows have marked the return of buying in this country and a change of spirit not alone in our own industry but among business men generally," said Reeves.

"Surveys in the different sections of the country supplied the interesting information that buyers are waiting for lower prices or more stable prices. They want to be sure that prices will not be changed within the next few months. Almost all say they intend to buy another car, and when asked the kind, invariably mention a car of higher price than the one they are using.

"Trade on the Atlantic Coast and on the Pacific Coast seems to be in the best shape. Wisconsin is doing well because her dairy products bring cash every day. Constantly improving trade is reported from Ohio and Illinois. Poor trade is reported from the South, especially Texas, and from sections of Nebraska, Iowa and the Dakotas.

"We find dealers with their houses in order and in the right spirit for a spring sales campaign. They have some grievances against the manufacturers, just as the manufacturers occasionally have grievances against the dealers. That there is a fine spirit of co-operation, however, is evidenced by the acceptance by the directors of the N. A. C. C. of the suggestion by the National Automobile Dealers Association for a conference of committees to review trade conditions to see what can be done in a co-operative way that will be mutually helpful.

"Our meetings with the bankers showed

(*Continued on page* 293)

Improvement Slight in French Industry

Factories Extend Activities — Citroen Cuts British Price— Urge Tax Revisions

(*Special Cable to* AUTOMOTIVE INDUSTRIES)

PARIS, Feb. 5—Only very slight improvement was shown in the French automobile industry during January. No factories were working more than 50 per cent of capacity and in some cases production was as low as 10 per cent. To give employment to the greatest number of men, factories are running only four days a week.

Many firms are meeting present difficulties by getting into other branches of the engineering trade. Renault is making tools and factory equipment. Berliet is building narrow track railroad material.

There have been no price reductions in the French market, but Citroen has cut prices £100 on the British market. The Lorraine-Dietrich factory is practically closed because of the fusion with Clement-Bayard, which makes one factory sufficient to meet the manufacturing requirements of the two companies.

The Austin tractor factory in France has ceased production. Renault has a stock of 1400 passenger cars. The weeding-out period has resulted in the disappearance of several of the smaller concerns. These are Turcat-Mery, Majola, Sizaire-Naudin and Butterosi. Many others are in considerable financial difficulties, but the courts are showing great leniency in not forcing firms into bankruptcy as long as any reasonable arrangement for continued operations can be made.

Some leaders in the industry believe the period of depression in France will last two years. The truck market is glutted with army stocks, there being still 23,000 trucks lying in Government parks and all dealers loaded up.

High car taxation and the high price of gasoline are largely responsible for the passenger car depression. The syndicate of automobile manufacturers has again petitioned the government to relieve the situation by abolishing the gasoline tax, which is now higher than the retail pre-war gasoline selling price, and also to repeal the 10 per cent luxury tax on automobiles.

As proof of the utility of automobiles the manufacturers point out that of 93,115 passenger cars paying taxation last year, 59,492 were officially recognized as utility vehicles and eligible for half-taxation rates.

The French Government aviation credits for the year 1921 total 527,354,645 francs, of which 33,215,000 are subventions for the regular passenger carrying lines, and 11,850,610 for the general budget civil aviation.

One Talbot-Darracq and two Sunbeams have entered for the Indianapolis race, the drivers being Boillot, Thomas and Resta.

Tax Repeal Helpful in Canadian Market

OTTAWA, ONT., Feb. 8—Present activities in the Ottawa district indicate that the automobile business will see good normal sales this year. Price reductions are already announced by certain manufacturers, new models are being placed on the market by Canadian firms and already shipments of several of the new cars have been received by Ottawa dealers. The industry has made rapid recovery from the adverse situation which prevailed as a result of the removal of the luxury tax and as a result of reconstructive developments last fall.

The dealers sustained a personal setback when the luxury tax was removed, but the loss of tax on unsold automobiles in stock at the time that the Government levy was abolished is being absorbed by the manufacturers and the retailers, and this incident is considered closed. An outstanding feature of the Montreal Automobile Motor Show just concluded was the genuine feeling of optimism that prevailed in the automobile trade and otherwise. Every exhibitor and dealer gave evidence of a cheerful tone throughout the trade and the outlook was considered extremely bright by everyone.

Higher Patent Salaries Favored by Committee

WASHINGTON, Feb. 7—The Nolan Bill, which fixes the compensation of employees of the Patent Office, has been reported out of the conference committee and recommended for favorable action. The conference committee accepted the salary recommendations of the House committee, which are about 20 per cent higher than those recommended by the Senate. In this bill the Commissioner of Patents receives $6,000. The time remaining for passage of this bill is quite short and those interested in its success would be wise to consult their Congressmen.

LANDIS MACHINE CUTS PRICES

WAYNESBORO, PA., Feb. 7—Beginning March 1, the Landis Tool Co. will make a general reduction in prices on all machines with the exception of the crankshaft grinding machine. This reduction will average 15 to 20 per cent on the entire line with the exception of the one machine.

Dunlop Management Arouses Disquiet

Dividends for Last Quarter Passed —Two Directors Resign— Arrange New Credits

LONDON, Feb. 5—(*By Cable to* AUTOMOTIVE INDUSTRIES)—The annual report of the Dunlop Rubber Co., Ltd., shows a balance of 1,700,334 pounds sterling, but the directors decided to pass the ordinary dividend and the preferred dividend for the last quarter.

Because of dissatisfaction over the management of affairs, Chairman Ormrod of the board of directors and Director Dawson have resigned. F. A. Szarvasy, chairman of the British Foreign & Colonial Corp., has become temporary chairman of the board and will be in control of finances.

Banks have come to the relief of the company, but it is proposed to raise a larger amount later by the sale of debentures. Szarvasy will make a full statement of the company's affairs to stockholders on Feb. 11. It is understood that Lord Ashfield of the London Underground Electric Railway later will become chairman of the board.

Necessary credits have been arranged to meet all obligations pending permanent financing. Because of the financial situation it has been found impossible to further finance the Dunlop American Co. and the English company has assumed the responsibility for it, thereby safeguarding its position through the assets of the American concern.

Domestic Mail Rates Extended to 5 Countries

NEW YORK, Feb. 4—The domestic postal rate, beginning this month, will apply on all letters and post cards to Bolivia, Colombia, Honduras, Nicaragua and Peru, according to an order just issued by the Postal Department. The new rates have been put into effect as the result of negotiations commenced at the International Postal Congress held last November at Madrid, Spain. The domestic rate also applies to periodicals (one cent for each four ounces or fraction thereof). The maximum weight for periodicals and other printed matter, including commercial papers, is 8 lb. 12 oz., while the maximum volume for single volumes of printed books will be 11 lb., the maximum dimensions for this class of mail matter in the form of a roll being 40 in. in length and 6 in. in diameter. Cuba also has confirmed the new postal convention.

PERFECTION ASSETS HIGH

MILWAUKEE, Feb. 7—Schedules filed by the Perfection Engine Co. upon an involuntary petition in bankruptcy, show assets of $27,273 and liabilities of $16,306. The first meeting of creditors is called for Feb. 11.

Willys Corporation in Bankers' Control

Formation of Single Operating Company May Follow—Interests of Company Extensive

(*Continued from page* 288)

The first preferred stock provides that without the consent of at least 75 per cent of the outstanding first preferred the corporation may not:

1—Create or permit any subsidiary company to create any mortgage other than purchase money mortgage, lien or incumbrance on the property.

2—Issue any obligations maturing later than one year from the date thereof.

3—Issue any stock having priority over or on a basis with the present first preferred.

4—Authorize additional first preferred stock without the consent of 75 per cent of the holders of outstanding first preferred unless the net value of the tangible assets of the corporation including the proceeds of the preferred stock to be issued, are three times the largest aggregate amount of first preferred stock outstanding, or the net earnings for twelve consecutive months out of the preceding fourteen months are three times the dividend requirements of the first preferred outstanding and to be issued.

The first preferred has preference as to dividends over both the second preferred and common stock and in case of voluntary liquidation or upon dissolution of any capital assets, holders of the first preferred are entitled to 110 and accrued dividends. The stock also provides for a sinking fund to begin this year.

The first preferred stock has no voting power unless four quarterly dividends are in default of sinking fund payments, in either of which events it shall have the right to elect the majority of the board of directors.

While no authoritative announcement has been made covering the proposed reorganization of the Willys interests, it can be said that the program which had been virtually determined upon a few weeks ago was for the consolidation of all the Willys units in a single company patterned after the General Motors Corp. This would include the Willys-Overland Co. and the Willys Corp. with their various subsidiaries.

Overland Covers Wide Field

The Willys-Overland Co. owns the Willys Morrow Co., of Elmira; the Wilson Foundry & Machine Co., of Pontiac; the Moline Plow Co., and all branches of the plow company. The Willys-Overland Co. has plants at Toledo, Elyria, Ohio, and Elmira, N. Y.

John N. Willys personally is credited with owning control of the Republic Truck Co., of Alma, Mich.; which in turn owns all the common stock of the Torbensen Axle Co. of Cleveland. Willys and two other men control the Fisk Rubber Co., which in turn controls the Federal Rubber Co. Another company controlled by Willys and his associates is the United States Light & Heat Corp. of Niagara Falls.

If such a consolidation were effected, it would result in the formation of a gigantic corporation ranking next to General Motors in the automotive field. Promoters of the plan would be confronted with countless difficulties and an immense amount of detail which could be smoothed out only by long continued conferences. One of the chief difficulties would rest in the fact that the preferred stock in nearly all the Willys companies contains provisions similar to that carried in the first preferred in the Willys Corp.

The difficulties of the Willys Corp. are the result of conditions brought about by the period of readjustment through which the country is passing and which caused the virtual collapse of the market for its products.

Bank Attitude Constructive

The bankers interested in the corporation have assumed a constructive attitude and it is confidently believed the merchandise creditors will do nothing to embarrass the backers of the reorganization plan. They are expected to assume the constructive attitude recently displayed by the creditors of the Moline Plow Co.

The troubles of the corporation are believed to be of a purely temporary character and when the demand for their products increases, as it undoubtedly will in a short time, it is expected the burden will soon be lightened. It is considered certain that none of the interests involved will take any step which would necessitate drastic action and that some means will be found which will adequately protect all the investments already made.

Walter Creditors to Get Commission on Sales

NEW YORK, Feb. 4—Business of the Walter Sales Co., Inc., in this city will be continued under a creditors' committee, on which will serve John G. Scattergood, vice-president of the Gotham National Bank; C. W. Decker, manager of the industrial finance department of Robertson-Cole Co.; Seymour K. Fuller, attorney for the Mutual Finance Corp., and William Walter, president of the Walter Motor Truck Co. Unsecured debts of the company total $125,000 and assets possibly less than $2,000.

The committee hopes to realize enough revenue to pay the claims of creditors in one or two years by continuing the sale of Walter trucks. An agreement has been made with a well-known truck company whereby William J. Aitken will sell its trucks on commission, and will also sell the Walter truck, the commission on the latter, less expense of sales, to be distributed pro-rata to the creditors.

Reeves Sees Trade in Rallying Stages

Question of Credits Important to Farmers—Hysteria in Industry Passed Over

(*Continued from page* 291)

that the big city banks are doing their share in carrying the distributers and big dealers. Because of the heavy burden of the small town banks in carrying crops of farmers, they have not been able to do much to help the small town dealer.

"We had a long session with Governor Miller of the Federal Reserve Bank of Kansas City, and Asa E. Ramsay, his deputy governor. They insisted that reduction of automobile credit last year was vitally necessary in their territory, not because the automobile business was not essential, but because it already had big credits, and other matters were more pressing. Mr. Miller said his bank had just gotten out of debt for the first time in eighteen months and he hoped soon to be able to again rediscount automobile and some twenty other kinds of paper that had been temporarily sidetracked during the pressing need from the agricultural districts. The member bankers have continued to care for their automobile customers.

"The farm trade is certain to be poorer than usual this year. Not alone are crops, raised with high labor costs, bringing very much lower prices than expected, but many tenants have raised their crops on land rented at high prices in some cases where the crop will not bring an amount equal to the rent.

"On this three weeks' trip we found that the hysteria in the industry has passed and that the manufacturers and dealers are putting their houses in order and are preparing for a conservative, normal year with intensive sales effort as the high keynote.

Truck Dealers Discouraged

"In connection with trucks, we found the dealers somewhat discouraged with present conditions. A slowing down in business has materially decreased the demand, while the open weather has permitted the railroads to carry all the freight offered. In fact, the railroads now report 300,000 idle freight cars.

"Bankers and the far-seeing dealers know that the truck business has a fine future, which depends somewhat on how soon we have renewed business activity and how soon the program for our much-needed building operations get under way. The railroads, too, will buy trucks for short haul work, which spells brighter days for motor trucks, of which we have less than a million in use."

Reeves will attend a dealers' meeting at Syracuse Friday night, and will visit other cities as his time permits.

Goodyear to Operate Under Voting Trust

Details of Refinancing Wait Stockholders' Approval — Name Supervising Committee

NEW YORK, Feb. 9—The eagerly awaited report of the plan decided upon for the reorganization and refinancing of the Goodyear Tire & Rubber Co. was made public to-day. It provides for recapitalization and readjustment of the debt and was agreed upon only after weeks of negotiation.

The program will be submitted to the stockholders for ratification at a special meeting to be held in the next fortnight. The adjourned meeting which was to have been held Friday for discussion of the refinancing will be deferred again.

There have been persistent reports that when the plan went into effect there would be important changes in the management with the elimination of President Seiberling from active control but official confirmation is lacking. Robert T. Swaine, who is associated with Paul D. Cravath, counsel for the company, said to-day there was no certainty any changes would be made and denied emphatically that any had been decided.

The agreement provides that provision satisfactory to the merchandise creditors will be made for the future election of directors by the creation of a voting trust or by the creation of management stock vested in five persons designated by the merchandise creditors whose claims are said to aggregate $70,000,000.

Before the plan can be declared operative it must be approved by the company's stockholders in a meeting to be held shortly, and the stocks which are to go to the merchandise and contingent creditors must be exchanged for the debt by negotiation with every creditor. Steps taken denote co-operative progress, but it is recognized that it will be several weeks before the plan can be consummated. The only issuance of securities for sale to the investor contemplated is $25,000,000 of first mortgage twenty year 8 per cent sinking fund bonds, but that financing will not be undertaken until the junior situation is cleared up.

Plan Generally Approved

The plan, as agreed to, is a sort of when, as and if issued affair, although it has been assented to by the bankers, the largest creditors and the holders of a majority of the company's common stock. Holders of the existing common and preferred stock will receive like amounts of stock in the reorganized company, except that the shares will be changed to no par value for the purpose of wiping out the existing deficit and of funding 25 per cent of the company's liabilities on merchandise commitments, on which specifications and prices have been fixed. Then the company will be recapitalized by the issuance of the following additional securities: Twenty-five million dollars of first mortgage bonds, $25,000,000 of ten year 8 per cent sinking fund debentures, $35,000,000 of 8 per cent preference stock, $65,000,000 of 7 per cent preferred stock, and 900,000 shares of common stock of no par value.

The bank creditors' committee will try to effect the sale of $25,000,000 of debentures, $35,000,000 of prior preference stock and 256,000 shares of common stock to present holders of the company's stock. Cash realized by the company from that sale will be applied toward the payment of its bank debt and to provide it with new working capital.

Will Pro-rate Contracts

Regarding the pro-rating of material contracts the plan says:

"Such arrangements as the merchandise creditors' committee may approve shall be made to the end that the company shall not be required to take materials on contracts on which specifications and prices have been fixed faster than they are needed for production, provided it takes no similar materials from others than those with whom it has contracts at present, and also to the end that deliveries when taken shall be equitably prorated, the particular kind of material considered, to such existing contracts, and in the case of rubber to existing contracts and rubber now pledged to secure bank debt. The banks holding debt so secured will be asked, as part of the plan, to extend the debt pending such use of the pledged rubber."

Present commitments for future deliveries of merchandise on which specifications and prices have been fixed are:—

For rubber	$ 7,200,740
For cotton	5,664,000
For fabric	41,879,763
For other materials	215,000
Total	$54,959,503

The plan will be carried out under the supervision of a bank creditors' committee, composed of Robert C. Schaffner, Chicago; John Sherwin, Cleveland, and Ralph Van Vechten, Chicago; a merchandise creditors' committee, composed of W. E. Bruyn, New York; F. L. Jenckes, Providence; Myron C. Taylor, New York; a preferred stockholders' committee, composed of George W. Crouse, Akron; Reamy E. Field, Cincinnati; Charles A. Morris, Cleveland; A. H. Scoville, Cleveland, and J. Herndon Smith, St. Louis, and a common stockholders' committee, composed of Fred S. Borton, Cleveland; C. R. Erwin, Chicago; E. E. Mack, Canton; Russel L. Robinson, Akron, and F. A. Seiberling, Akron.

VAN SICKLEN ON PART TIME

ELGIN, ILL., Feb. 7—A report that the Stewart-Warner Corp. is negotiating for the purchase of the Van Sicklen Speedometer Corp. is denied by the latter, but it is announced that the plant, closed for some time at Elgin, Ill., has been reopened and will operate upon a five-day basis. It is also announced that the holdings formerly held by Eastern parties have been purchased by residents of Elgin. This, however, will not make any change in the policy or management.

New York Would Ban Use of Heavy Trucks

Prohibitive Taxes Outlined for Legislation on Capacities of 5-Ton and Over

ALBANY, N. Y., Feb. 8—Heavy motor trucks will be taxed off the roads under the plan of legislation being drafted here to meet the recommendations of Governor Miller's annual message. No secret is made of the intention of the legislation, the lawmakers taking the view that the use of heavy trucks imposes prohibitive upkeep costs, and that the best way to check this is to tax the heavy vehicles out of existence.

Under the proposed legislation annual fees of $500 are fixed for trucks of 5-ton carrying capacity; $600 for 6-ton; $700 for 7-ton, and $800 for 8-ton. Trucks of less than 5-ton capacity would be permitted to operate for $50 to $90 a year.

License fees for passenger cars under the new proposed rate would not exceed 10 cents per horsepower, whereas the present rate is 25 cents. The bulk of the tax would apply on car value and it is estimated would add about $2,000,000 annually to the State's revenue.

"The high tax on motor trucks is being proposed with the deliberate purpose of putting an end to the use of super-motor trucks on our roads," said Senator Lowman, chairman of the Senate committee on internal affairs. "We cannot drive them off the roads but we propose to tax them off. They tear up the roads frightfully and make not only the upkeep of the roads but the cost of construction and maintenance of bridges along the State roads prohibitive. The interests involved must be compelled by the only means at our disposal to distribute the weight of their loads and use smaller trucks."

The new motor vehicle bill will be sponsored by Senator Hewitt.

N. A. C. C. Prepared to Act

NEW YORK, Feb. 9—New York subcommittees of the National Automobile Chamber of Commerce will be prepared to take instant action when the new motor vehicle legislation is presented, said Harry Meixell, secretary of the motor conference committee. Whether the act will be as drastic as outlined is questioned by him, but he said every precaution would be taken to protect the interests of the industry.

REYNOLDS ORDERED DISSOLVED

MT. CLEMENS, MICH., Feb. 10—The Circuit Court of Macomb County has signed an order dissolving the Reynolds Motor Truck Co. and appointing Charles J. Reimold permanent receiver under a bond of $75,000. A request by a creditors' committee for the appointment of a joint receiver as their representative was denied. The creditors committee now is considering the advisability of filing an involuntary petition in bankruptcy.

Manufacturers Hold Production Rate Low

Surplus Stocks Diminish Gradually as Buying Resumes—Labor Resents Wage Cuts

DETROIT, Feb. 8—The attitude of automobile manufacturers indicating determination not to be swept off their feet by optimism engendered by the show is indicated in an almost universal decision not to increase production schedules for the time being. The tendency toward conservatism is shown plainly in figures for January with a total output of 14,615 cars in 32 factories in Detroit and Michigan and in the Overland and Willys-Knight plants in Ohio. This is far behind that of December, though a comparison would not be fair for the reason that Ford operated until Christmas Eve. The output in the same factories in January, 1920, was 180,310, which included the output of both Ford and Dodge.

While there are indications that production for February will not be increased materially, the spring demand will prompt increased schedules in March. Whether this spring business will reach anything like normal proportions is a problem, but it certainly will mean the resumption of operations in all plants with current demand determining output. It is contended by many that with the curtailed production of the last few months, the surplus stocks are rapidly being dissipated and the factories will be kept busy supplying the demand after March.

The contention is admitted generally; though the more conservative among the manufacturers regard the term "busy" as meaning that the factories will be operating full time but with greatly reduced forces and the production schedules ranging from 40 to 50 per cent of the 1920 record. Adding to prevailing unfavorable conditions are the labor troubles, which are beginning to loom large despite unemployment. While the strike now in progress is confined to the body plants, the agitation for return to high wages paid last year and antagonism toward present reduced wage scales is felt in the automobile plants. This attitude is being nurtured by idle men.

Strike Closes Fisher Plants

The strike spirit spreading through the plants of the Fisher Body Corp. following the walkout in the trimming and painting shop resulted in an order yesterday closing all that company's plants and the plant of the Anderson Electric Co., which makes bodies for Packard and other companies, is closed. The Automobile Body Co., which was closed on account of the strike, has been reopened with non-union labor. The strike in the body department at the Packard plant is regarded as responsible chiefly for the closing of that factory.

Everett Bros. plant will not be in operation for some time and consequently is not affected. Briggs Mfg. Co., which resumed operations on slightly under 50 per cent basis ten days ago, has not been affected by the strike. This company builds Ford bodies exclusively and now has about 1300 men working, though they admit operations are indefinite and believe the plant again will close unless operations start at the Ford factory soon.

No one seems even to guess what the Ford plans are, though the fact that the parts makers have been given no orders to start is regarded as significant and builders of Ford parts are a unit in expressing belief there will be no production there until after March 1. This situation was forecast at the time the plant went down Christmas Eve. The plant is practically idle. Only about 500 men are at work and they are employed solely in replenishing the parts stock.

Dodge Surplus Still Large

Dodge plans are equally mysterious. Dodge had a large surplus of cars in storage when production was stopped and although there has been some demand, especially in certain sections, the stock in the warehouses, in transit and in the hands of dealers, still is said to be large. President, F. J. Haynes said this week, no plans for reopening had been made.

Packard, which went down ten days ago, still is idle, and the 30-day maximum fixed by Vice-President Roberts as the shut down period will find the gates closed.

Reo this week went on a ten hour day full time schedule with the entire force working. Reo executives expressed confidence of continued improvement. The company delivered 1800 vehicles in January; 720 passenger cars and the balance speed wagons.

Paige reports renewed optimism among the dealers and a slight improvement in sales, though not sufficient to justify an increased production schedule and the plant will continue operation as at present—on about 25 per cent output.

There is no change at the Hudson-Essex factories. The Essex plant is still closed, but a small force is building both styles in the Hudson plant.

Cadillac was down the greater part of January and had comparatively no output, employees being used in building up the parts stock. They began on a schedule of 40 cars daily Feb. 1, but up to the present have not reached this schedule and are building about 25.

Maxwell-Chalmers plants are still idle awaiting outcome of reorganization efforts in New York.

Lincoln Sales Encouraging

Lincoln officials report encouraging outlook from the sales end, and a tendency toward improvement but the manufacturing schedules are not to be increased until such time as sales justify.

Oldsmobile is working full time building the new four and some eights but no trucks save on orders. Oldsmobile reports an encouraging outlook, but the present schedule of around 60 daily will be continued for the time being.

Briscoe is working 700 men full time

(Continued on next page)

Tractor Show Opens Wide Sales Avenue

Registration Admission System Proves Advantages—Foreign Machines Bid for Business

COLUMBUS, OHIO, Feb. 7—The six National Tractor Show, held under the auspices of the National Implement and Vehicle Association, was opened to the public in a range of eight buildings at the State Fair Grounds here this morning. The show is probably the largest that has ever been staged by any branch of the automotive industry, on the basis of floor space occupied.

By comparing the list of tractor exhibitors with a recent list of tractor makers it is evident that a very considerable number of the newer and smaller concerns are not represented. Forty-nine makes of tractors are shown, including three foreign makes, the Italian Fiat and the French Renault and Sonua, all three of which have been described and illustrated in AUTOMOTIVE INDUSTRIES.

Of the 49 makes eight are creeper tractors—the Holt, Best, Bates, J. T., Cletrac, Monarch, Hicks and Renault, and the rest wheeled types. It should be mentioned, however, that the Bates is now made in both a creeper and a wheeled type. The wheeled Bates, which is shown for the first time, is identical with the familiar "steel mule" from the front end back to the rear axle.

This year the management has broken loose from the time-honored practice of charging an admission fee, and it is hardly to be doubted that free admission will become the general rule in the future for industrial shows of products of an exclusively utilitarian character. The show management, of course, will lose quite some money from admissions, but, on the other hand, there are several important advantages to this scheme.

In the first place, the offer of a free admission will induce some prospects only as yet mildly interested in tractors, to attend, especially farmers located at moderate distances, and it is, of course, far more important to get these lukewarm prospects to the show than those already sold on tractor farming.

Buttons Identify Visitors

Then, each visitor on entering the show is compelled to register and give his business—whether he is a farmer, a dealer or an exhibitor—and after having registered he is given a button which admits him to the show, and the color of this button reveals his status.

Finally, when the show is closed on Saturday evening, the management will have an excellent all live list of tractor prospects which no doubt will be available to all members of the N. I. V. A. if not to all exhibitors, and after the different sales departments have finished their work on this list most of the prospects should have been converted into owners.

(Continued on next page)

Tractor Show Opens Wide Sales Avenue

New Models All Have Four-Cylinder Engines and Enclosed Drives

(Continued from preceding page)

The participation of European tractor manufacturers in the show is worthy of note and shows that some competition from that source must be expected in the future. This is the first time that European tractors have been offered for sale here. No doubt the fact that the great majority of the farms in Italy and France are so small that a tractor cannot be used on them to advantage is compelling these manufacturers to look for outlets elsewhere, and the recent business depression abroad may also have had something to do with the move.

It is difficult to discern any general new trends in tractor design. There are a considerable number of new farm tractors at the show and all of them are of the modern type with four cylinder engines, enclosed drive and generally clean design. Following is a list of the new machines with a brief outline of their characteristics; full illustrated descriptions of the more important designs being reserved for a future issue.

The Huber Mfg. Co. exhibits the Huber Super Four which has a Midwest engine, but is otherwise very similar to the Huber Light Four. It has a 15-30 hp. rating and the two speeds are 3 and 4½ m.p.h. A dry disk clutch is used.

The J. I. Case show a new 40-72 hp. tractor designed along the same lines as their smaller machines, and their complete line has now been revised on modern lines. This is the first time, so far as the writer knows, that a giant tractor, that is, one of more than five plows capacity, has been designed on strictly modern lines with a completely enclosed drive and none but cut gears running in oil.

A larger Twin City model, a 20-35 hp., similar in design to the Twin City 12-20, is being exhibited by the Minneapolis Steel and Machinery Co. The gears on this tractor are made of chrome nickel steel and are shrunk onto wheel centers, the drive being taken on splines on the centers and ring gears. This machine weighs 8500 lb.

Aultman-Taylor Makes Change

Several important changes in their 15-30 hp. model have been made by the Aultman-Taylor Machinery Co. One is the substitution of a drop forged I section axle for the built-up front axle and another the provision of a cross spring in front. A tubular radiator is now fitted and there is a brake acting on the belt pulley.

Several changes in equipment have been made by the Samson Tractor Co. An air washer is now fitted, located on the left side of the cylinder block. Two Hyatt bearings are mounted in each front wheel, and clutch control is provided so the clutch can be locked in position when doing belt work. The fan is now made with a double bearing, driven by a wide flat belt and provided with an automatic tensioning device. An impulse starter, a radiator shield and an exhaust pipe extending below the rear axle, have been added to the equipment. A large hand hole is to be provided in the gear case hereafter.

The Holt Mfg. Co. exhibited a snow removal tractor as sold to the City of New York, and tractors for the same purpose were shown by the Cleveland Tractor Co. and the Bates Machine & Tractor Co. The Holt concern also shows a large logging tractor with completely enclosed cab.

Revere to Operate Under Receivership

LOGANSPORT, IND., Feb. 7—The Citizens Loan & Trust Co. of this city has been appointed receiver for the Revere Motor Car Corp. by the Circuit Court of Cass County in a suit filed at Hammond by C. Edwin Osborn and other stockholders. Under the order of the court, the bank will keep the company's property intact and the plant in operation for a sufficient length of time to permit the stockholders to refinance the company.

A bankruptcy suit instituted recently against the Revere corporation was dismissed in Federal Court after a special master had declared the company solvent with assets of $1,157,328 and liabilities of only $354,659.

The Revere corporation has been made defendant in damage suits aggregating $548,000, filed in the Circuit Court here by the Revere Motor Sales Corp. of Delaware. The complaints allege breach of contract, disregard of court judgment and inability or neglect to make payments on cars sold.

The breach of contract suit asks for $450,000 damages. The disregard of court judgment suit seeks $25,000. The failure to make payments suit asks for $59,000, while a fourth suit asks for payment of $14,000, alleged to have been loaned to the local concern by the plaintiff company. Efforts for an amicable settlement of the case, started two months ago, have failed.

S. A. E. TO EXTEND RESEARCHES

NEW YORK, Feb. 9—The semi-annual meeting of the Society of Automotive Engineers will be held at the West Baden Springs Hotel at West Baden, Ind., May 24-28. West Baden was selected after a careful canvass of various places by the meetings committee.

Research work under the direction of a committee will be one of the major activities of the S. A. E. and an appropriation of $30,000 for this work was made by the council at its meeting in Chicago last week. This work is expected to become as important an activity of the S. A. E. as standardization has been and still is.

Manufacturers Hold Production Rate Low

Most Companies Get Good Reports of Show Activities from Distributors

(Continued from preceding page)

which is about one-third their regular force. Officials bring good reports and say dealers are confident of steady upward trend. The company was in production in January and will not increase their output during February but will start on a schedule of 30 daily March 1 and expect to increase this until a maximum of 75 daily is reached.

Studebaker, which opened Jan. 17, built 800 "big sixes" in Detroit. Their schedule was increased to 525 cars weekly Feb. 1.

Oakland is operating on a basis of 50 daily and striving to reach 50 per cent of normal, but officials do not expect to reach that point for 60 days. Good reports received from dealers at the show and a survey of the situation reveal less cars on hand than at the same time last year. It is reported that more Oaklands were sold during the last 90 days than were manufactured.

Buick built about 200 daily during January, and the same schedule will be maintained through February, despite the good show business and the optimistic views of dealers. March production schedules depend entirely on demand during February. The factory is working full time but with short force.

There was no production at the Willys-Overland or Willys-Knight plants during January, but they hope to clean up their surplus cars by March and resume production.

Dort this week began production of the new models and officials say they have orders ahead for 60 days. Vice-president Averill says the great interest manifested during the show indicates renewed buying, but thinks consumers will be more conservative and careful and does not look for a buying epidemic.

Saxon did not produce in January but began this week on a schedule of five daily.

The Jackson plant is working full time with about 25 per cent of its force and limiting production to actual sales requirements.

Hupp Employing 30 Per Cent

Hupp is employing about 30 per cent of its normal force and building about 20 cars a day. Hupp executives report the outlook good and President C. D. Hastings is enthusiastic over the shows.

President Sarver of Scripps-Booth said last week was the best the company has had in a long time from a sales standpoint. This applied to the Chicago show and the entire country. The company is operating with a short force and the schedule of about 10 a day will be maintained until the demand justifies greater production.

Reimported Trucks Sell at Low Price

Reconditioned Vehicles Built for French Army Sell Far Below List

NEW YORK, Feb. 8—Sixty-six trucks including Packards, Macks, Pierce-Arrows, Whites and Rikers, originally bought by the French Government and shipped to France and recently returned to this country, were sold at public auction at the L. & F. garage in Brooklyn here to-day by Samuel T. Freeman & Co., Philadelphia auctioneers. All of the trucks were fitted with standard Army types of bodies, and had seen some service, although some few had been driven less than 500 miles, according to the odometer readings and the appearance of the tires. The trucks had been on public exhibition out in the open for three days preceding the sale and were driven in singly for sale.

The consignment consisted of ten 2-ton Whites, ten 2-ton Packards and five 3-tonners, sixteen 4-ton Rikers, five 5-ton Pierce-Arrows and five 2-tonners, and fifteen 5½-ton Macks, all with cabs.

All of the trucks were bought "as is." Two of the 2-ton Whites, all of which were of 1918 models, were bought in at $1,300 and $1,325, respectively, by individual buyers with the remaining eight apparently bought in by an insider at $900 each. The 1918 list price of these trucks, without bodies, was $3,300.

The 2-ton Packards, some of which were equipped with generators for electric lighting, which listed at $3,200 in the chassis, were sold for a total of $13,200, or at an average of $1,320. The lowest selling bid was $1,225 and the highest $1,400. All of these Packards were bought by individual users whose business include shoes, chemical works, general trucking, iron dealer, farmer, builder, granite dealer, butcher and dye business. The five 3-ton Packards, which originally listed at $3,900, went for $10,850, or an average of $2,170. The lowest selling bid was $2,125, highest $2,275.

The first two of the 4-ton Riker trucks, which originally listed at $4,050, went for $2,050 and $1,150 respectively. The balance sold for $850 each.

Three of the 5-ton Pierce-Arrows, which listed at $5,000 in the chassis, went respectively for $2,225, $2,250 and $2,100. Two others went for $1,700 each. The first two of the five 2-ton Pierce-Arrows, originally listed at $3,300, went for $1,400 and $1,325 respectively, and the remaining three at $1,200 each.

The first of the 5½-ton Macks, which listed at $4,750, chassis, went for $2,450.

WILLIAM D. TREMAIN DIES

FORT DODGE, Feb. 4—William D. Tremain, 64, pioneer automobile dealer of Ford Dodge, died Feb. 1 following a serious illness. He was born in Strawberry Point, Iowa, and engaged in business in Fort Dodge in 1882. The firm of Tremain & Rankin, in which he was a partner with his brother-in-law, George F. Rankin, entered the automobile business in 1907, being the 43rd dealer in the State. He is survived by his widow and three children, George W. Tremain, Mrs. William Whalen and Mrs. Harold Sitting, all of Fort Dodge; a sister, Mrs. W. W. Stearns, Humboldt, Iowa, and a brother, H. J. Tremain, Minneapolis.

Bates Tractor Reduced to Price Before War

JOLIET, ILL., Feb. 5—Bates Machine & Tractor Co. has reduced its prices on tractors to pre-war levels. In a statement by Harry H. Bates, sales manager, the action was said to have been taken in the belief that new steel prices will justify the company in making a sacrifice of its present high-priced stock of materials.

In addition, he said, the demand for Bates tractors has grown to such an extent that increased production this year to meet new orders will result in a large cut in production costs. There is no good reason, he said, why a farmer buying a tractor for his spring work should not be able to do so as advantageously as the man buying for his fall work.

Orders for the present year are in greater volume than last year, he said, partly due to the enlarged dealer organization of the company. The principal reason for the increase, however, he declares, is the increased belief among farmers that tractor use means larger crops and a larger margin of profit.

Implement Men Deny Price-Fixing Charge

PHILADELPHIA, Feb. 4—Recent charges of price fixing, made against farm vehicle and implement retailers by the Federal Trade Commission, were vigorously denied by delegates to the Eastern Retail Implement & Vehicle Dealers Association at its ninth annual convention, in the Adelphia Hotel, this week. The convention has delegates from Pennsylvania, New Jersey, Delaware and Maryland. Grant White of this city presided.

Franklin Briggs, Woodbourne, Pa., who is the organization secretary, declared that the report of the Federal Trade Commission, charging the members of the association with a mutual agreement on prices and the barring of other merchants from entering the trade, by means of a boycott, is false.

JORDAN TO INCREASE OUTPUT

CLEVELAND, Feb. 9—Production at the plant of the Jordan Motor Co. will be increased 50 per cent on March 1, according to an announcement made at the annual meeting of stockholders of the company this week. The company expects to gradually increase production until it reaches normal. The directors re-elected were E. S. Jordan, T. E. Borton, Otto Miller, C. L. Bradley, W. B. Rily, R. S. Beggs and Paul Zens.

METAL MARKETS

REPORTS of scattered buying of modest tonnages by automotive interests are accompanied by rumors of price cutting. Youngstown district sheet mills are said to have booked orders for sundry lots of highly finished automobile sheets at 6.50c, quantities placed ranging from 50 to 250 tons. It is impossible to verify a statement that 5000 tons of black sheets have been booked by one of the rolling mills at $3 a ton below the prevailing quotations. So much is certain, however, that values are more flexible than they have been in some time and that producers are ready to discuss price, whenever representative tonnages are involved. One or two automotive foundries in Detroit have sent out market feelers and are expected to place orders for modest tonnages of pig iron in the next few days. In some of the Middle West automotive foundries, the opportunity that presents itself at this time for the weeding out of industrial slackers is being taken advantage of and furnishes another reason for slowness in pig iron buying. There is, however, a general feeling in the iron and steel markets that activity in the automotive industries is about to be presaged by a gradually increasing quota of buying for second quarter deliveries. In this impression producers are strengthened by the steadily growing number of specifications and shipping instructions that have been furnished in the last few days for tonnages, delivery of which had been temporarily "suspended" by the automotive buyers last Fall. An interesting development in connection with the opposition to the proposed increase of the tariff on imported aluminum to 7c a pound is the fact that one of the importing and brokerage houses has submitted to the Ways and Means Committee of the House of Representatives a cablegram from the largest aluminum producers in Norway, stating that, in their opinion, "if the tariff on aluminum is increased in this country, Norway will no doubt retaliate by increasing the import duty on automobiles."

Pig Iron.—While the nominal quotation for foundry pig is $30, foundry base, further recessions are generally anticipated. There are now in progress negotiations between the coke interests and the pig iron producers with a view to developing prices for pig iron that will induce buying on a more liberal scale.

Steel.—Strip steel producers report somewhat better inquiry from the automotive industries and, while so far only a very small amount of fresh business for the cold-rolled variety has been booked, the outlook is regarded as far more propitious. The Trumbull Steel Co., Warren, Ohio, is reported to have begun shipments on a large tonnage of sheets which were ordered suspended about two months ago by a leading Detroit passenger car interest.

Aluminum.—Relative firmness in the "outside" market which rules at 25c for virgin ingots, 98 to 99 per cent pure, is not due to a better demand but rather to anticipation on the part of holders and importers that not only will there be an early resumption of buying, but that possibility of an increased duty offers a chance for increased profits on what stock is in hand at the time such augmented duties might be put into effect.

Copper.—The financing plans of some of the large copper interests who contemplate the issuing of debenture bonds with their accumulations of "red metal" as the security, are interpreted by many domestic consumers as an additional sign of intensive weakness

FINANCIAL NOTES

Rolls-Royce of America is now on production of about one car daily. Net earnings of about $20,000 accrued to the American company during 1920 from sale of British-made chassis. Orders for 75 chassis are on the books of the American company, the price being $11,500, on each of which a profit of about $2,000 will be made. The only part brought here from England will be a brake member, made of material impossible to obtain in this country.

Firestone Tire & Rubber Co. showed an increase of $10,304,338 in its inventory of Jan. 1, 1921, over the $26,969,535 inventory of Jan. 1, 1920. Materials on hand, in transit and in process Jan. 1, 1921, were valued at $21,168,140, compared with $11,217,872 on Jan. 1, 1920. Finished goods on Jan. 1, 1921, were valued at $16,105,733, compared with $15,751,662 the year previous.

Gardner Motor Co., Inc., in a statement as of Dec. 31 reports resources of $2,348,554 included, in which is merchandise valued at $1,510,230 and cash of $290,759. A profit and loss deficit of $1,044 is shown. The company has no current liabilities and no borrowed money. The company will continue operations along conservative lines.

Detroit Machine Tool Co. has increased its capital from $150,000 to $300,000, to permit of plant expansion in order to take care of production of ten automotive parts, for which a special department has been equipped.

Mullins Body Co., in a financial statement issued Dec. 31, reports net sales of $3,711,420 and a net profit of $701,290. Assets increased from $2,191,196 on Oct. 31, 1919, to $4,500,056 on Dec. 31, 1920.

Harley-Davidson Motor Co., in a balance sheet as of Oct. 1, 1920, shows current assets of $1,823,982; current liabilities, $1,147,964; P. & L. surplus, $5,174,850; total assets and liabilities, $8,728,187.

North Baltimore Tractor & Machine Co. of North Baltimore, Ohio, has declared a dividend of 10 per cent and has increased its capital from $50,000 to $100,000.

Gallon Metallic Vault Co., which owns and controls the Ditweiler Mfg. Co., has increased its capitalization from $400,000 to $1,000,000.

Cotta Creditors Name Trustee for Company

ROCKFORD, ILL., Feb. 8—The Rockford Trust & Savings Co. has been selected as trustee for the bankrupt Cotta Transmission Co. Two groups of creditors voted upon the question of trustee, the minority favoring the Central Trust Co. of Chicago. It was shown that ninety-four creditors, representing $349,263, supported the Rockford Trust company, while eight-nine creditors, representing $337,403, favored the Chicago company.

At the hearing of the officers, President T. D. Reber, Vice-President E. P. Reber, and A. D. Scoville, the secretary-treasurer of the Cotta company, testified concerning the financial condition of the company. Chicago attorneys endeavored to establish proof that the officers had exerted their influence upon creditors to secure their support of the Rockford trustee. Rockford creditors naturally preferred a home concern to one from abroad. Evidence brought out by the examination of the officers into the cause for the failure showed the prime factors:

First, The change of production from a three-speed transmission to a four-speed, to meet the requirements of pneumatic tired and faster moving trucks.

Second, Firms holding contracts placed by the Rockford company for jigs, tools, and special fixtures and forgings, stampings and other material required, were from one month to one year behind in keeping their promises to deliver the necessary material for production .

Third, General slowing up of business in the entire automotive field in the early spring of 1920, with the result that many orders were canceled and others held up indefinitely.

Harrison Takes Control of Abrasive Corporation

BOSTON, Feb.7—Nathan C. Harrison, who has been president of the International Abrasive Corp., has taken over control of the company and an entirely new board of directors has been elected. The corporation now owns the Harrison Supply Co. of Boston, the National Abrasive Co. of Amesbury, Mass., and Niagara Falls, Ont.; the Superior Corundum Wheel Co. of Waltham, Mass., and the Dominion Abrasive Wheel Co. of Mimico, Ont. The offices have been consolidated here.

Harrison is president and general manager of the company and Fred M. Lamson, a vice-president of the Old Colony Trust Co. of Boston, is secretary and treasurer. The directors include B. A. Brennan, president of the Fidelity Securities Corp. of Baltimore; Lawrence Chamberlain of New York, banker; Edward S. Foster, treasurer of the Carr Fastener Co. of Cambridge, Mass.; Charles G. Schirmer of Boston, banker; Frank D. White, head of the Lincoln Oil works, Rutland, Vt., and A. J. Sunstein of Pittsburgh.

RECEIVER NAMED FOR WIZARD

CHARLOTTE, N. C., Feb. 7—C. J. Bragg has been appointed receiver for the Wizard Automobile Co., Inc., by Judge Harding in the Superior Court here. The advertising of the company was condemned a short time ago by the national vigilance committee of the Associated Advertising Clubs of the World, which declared that the Wizard company had claimed enormous dividends before it had built a single car.

DEFIANCE ELECTS OFFICERS

DEFIANCE, OHIO, Feb. 7—At the annual meeting of the Defiance Motor Truck Co. the following were elected as officers and directors: C. H. Kettenring, president; J. C. Ayers, vice-president and general manager; Charles Behringer, vice-president and works manager; H. R. Morse, secretary, and J. F. Robertson, treasurer. Frank W. Warrington, general sales manager, was also elected a member of the board.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Feb. 10—January failures were larger than for any month since January, 1916. The number of commercial failures at 1.895 showed an increase of 370 over the failures for December. The liabilities involved, however, at $52,136,631 compare with the record total of $58,871,539 of December. In other words, while the number of failures increased over 24 per cent, the total liabilities decreased nearly 11½ per cent. This would seem to indicate that the smaller firms are experiencing greater difficulties in readjusting themselves to the new conditions.

Wholesale prices in January, as indicated by Dun's compilation, declined 6.4 per cent, as against a decline of 6.2 per cent in December.

The local loan market last week became very firm, especially in the call market where call money reached 8 per cent last Monday and 9 per cent on Wednesday. The range for the week was 7 per cent to 9 per cent, as against a flat 7 per cent the week before. The time money market was very quiet, but with nominal quotations slightly higher. A rate of 7 per cent was quoted for sixty to ninety days' and four months' paper, and 6¾ per cent for five and six months' paper. The week before, the uniform rate of 6½ per cent was quoted for all maturities.

The increased number of capital issues and withdrawals of funds from this center by the Government and interior districts are said to have been partially responsible for the tightening of the market. Anticipation of further Government and corporation bond issues is probably also an influencing factor. The Federal Reserve Bank announced last week that henceforth it will charge 6 per cent on notes discounted and secured by United States Treasury certificates of indebtedness.

The excess reserves over legal requirements of the New York Associated Banks increased $6,221,920 last week, while loans increased $3,085,000, and net demand deposits declined $868,000.

The week-end statement of the New York Federal Reserve Bank revealed a condition which was more or less expected in view of the tight money market. While gold reserves increased $4,220,000 and total reserves $5,414,000, total earning assets also increased $17,390,000. Total earning assets at $1,015,430,799 were again over the $1,000,000,000 mark. Net deposits increased $13,737,000. Contrary to the general trend, Federal Reserve notes in this district increased $8,746,000, marking the first increase since Christmas week. Consequently the reserve position of the bank was less favorable than it was a week ago.

The reserve position of the Federal Reserve banks as a whole again showed improvement.

MEN OF THE INDUSTRY

C. O. Miniger, vice-president of the Willys Corporation and general manager of the Auto-Lite division at Toledo, has been named to succeed J. Allan Smith as president of the United States Light & Heat Corp. Smith resigned to head a company which will manufacture the Nera car, a light-weight commercial vehicle designed by Carl Neracher. Miniger was one of the incorporators of the Electric Auto-Lite Co., and has been closely identified with the manufacture and sale of electric devices for motor cars for many years.

F. H. Ayers has been appointed director of sales of the Fisk Rubber Co. He has been sales manager for the past four years and has completed seventeen years of service with the company. William Wield has been promoted to the position of sales manager, and C. H. Gage and L. N. Southmayd have been appointed assistant sales managers. K. S. Chamberlain has been appointed manager of export sales.

D. H. Kelly has been elected president and assistant general manager of the United States Light & Heat Corp. to succeed C. L. Lane, resigned. Kelly for the past eight years was secretary of the Toledo Scale Co. and for the past two years has held the office also of assistant sales manager of the Willys light division of the Electric Auto-Lite Corp.

Frank J. Flynn has been appointed service manager for the Connecticut Telephone & Electric Co. He has been for several years with the Connecticut company in the field, both among service stations and jobbers. I. L. Doolittle, who has been service manager for the past two years, joins the sales division of the company.

Albert A. Franklin has become a member of the automotive department of the Byron G. Moon Co., Troy, N. Y. He was for two years advertising manager of the Haynes Automobile Co., and later acted as assistant advertising manager of the Waverly Company.

H. D. Bennett, assistant cashier of the Capital National Bank, Lansing, Mich., will leave that institution March 1 to become secretary-treasurer of the Garlock Sales Co. Bennett has been an official of the sales company for some time and has been nominal secretary-treasurer.

S. B. DeReatchi, export manager of the Miller Rubber Co., has resigned to accept a similar position with the Quaker Rubber Co. DeReatchi formerly was a colonel in the Mexican army under Carranza and also served as attache of the Mexican embassy in New York.

L. K. Cooper, for some time assistant to the general manager of sales of the Chevrolet Motor Co., New York, has been appointed sales manager of the Chevrolet Motor Co., of Illinois, with offices in Chicago. H. H. Mundy, formerly Chicago sales manager, has been transferred to Kansas City.

C. C. Smith, who has been assistant secretary and manager of the American Petroleum Industries for the past two years, has resigned and on Feb. 15 will take charge of the New York territory for the James Berry's Sons Co., oil jobbers.

L. M. Klinedinst has been appointed assistant sales manager of the Timken Roller Bearing Co. He has been connected with the company for sixteen years, serving last as manager of the tractor and farm implement division of the sales department.

Arthur P. Hawes has joined the organization of F. E. Wing, Marmon distributer in New England, as sales manager. Hawes was at one time manager of the Locomobile in Boston and later became manager of the Philadelphia branch of the same company.

R. G. Schulze, who has been head of the export department of S. F. Bowser & Co., Inc., manufacturers of gasoline pumps and tanks, has been appointed chief executive of the concern in England with entire supervision of the company's affairs in Europe.

E. A. White has been elected president of the American Society of Agricultural Engineers. He is the holder of a degree of doctor of agricultural engineering bestowed by Cornell University.

R. I. Pierce has resigned as production manager for the Gramm-Bernstein Motor Truck Co. to handle sales and supervise installations in the outlying sections for the Holland Furnace Co., Lima, Ohio, branch.

Thomas Calloway, assistant aeronautical manager of the Goodyear Tire & Rubber Co., has resigned to enter business in Chicago. Calloway was in charge of the Goodyear exhibit at the California aeronautical exposition.

C. A. Erickson has resigned as general manager of the Standard Radiator Co., Springville, N. Y., to enter the sheet metal automotive parts business. Erickson also was formerly chief engineer of Scripps-Booth.

A. R. Sadler, service manager of the Goodyear Tyre & Rubber Co. of Great Britain, Ltd., has sailed for London after a series of conferences with officials of the main Goodyear offices in Akron.

Newton Noble, for seventeen years head of the development department of the B. F. Goodrich Co., has resigned. Noble has made no announcement of his contemplated future connections.

S. T. Thompson has succeeded J. K. Cravens as director of sales of the Duplex Engine Governor Co., Inc., Brooklyn, N. Y. George L. Ritter will be assistant director of sales.

E. Hunn, Jr., assistant to President E. H. Hare of Hares Motors, has been made general manager of the Enterprise Motor Corp., New York distributor of Kelly-Springfield trucks.

John P. Franck has been appointed sales manager of the Ditweiler Mfg. Co., Galion, Ohio. He will also continue his connection with the Guide Motor Lamp Co.

T. W. Van Sickle has resigned from the sales force of the New Departure Mfg. Co., effective March 1. He has not announced future plans.

L. J. Ollier, export manager of the Studebaker Corp., has sailed for Europe on a business trip and will return about May 1.

MAURICE J. MOORE DIES

INDIANAPOLIS, Feb. 7—Maurice J. Moore, secretary-treasurer of the LaFayette Motors Co., died at St. Vincent's Hospital, Feb. 1, following an operation on a dislocated knee with which Mr. Moore had been troubled ever since his college days, when he injured it in a football game. He had lived in Indianapolis since coming here with the LaFayette Motors Co. in August, 1919. He was also president of the LaFayette Building Co., formed for providing homes for workmen of the motors company near the plant.

Mr. Moore formerly was with the Chevrolet Automobile Co., at Detroit and Flint, Mich. During the war he served as a major in the Motor Transport Corps.

INDUSTRIAL NOTES

Transport Truck Co. is completing a new storage dock that will add materially to the facilities for handling the company's business. The dock is 90 by 240 feet and has a total floor space of 2600 feet. The addition permits a complete switch track system operated on either side of the building and facilities for export crating are included.

Wright Carriage Body Co., Moline, Ill., has been changed to that of the Moline Body Corp. Originally opened for the manufacture of carriage bodies, the company has dropped this line and is now manufacturing bodies for motor vehicles.

Baker-Galva Tractor Co., organized last fall and which planned to erect a manufacturing plant in Galva, Ill., has abandoned the proposition and will go to Decatur, Ill., instead. Adequate financing is promised in Decatur.

Austin Machinery Corp. of Louisiana has been incorporated with a capital of $100,000 preferred stock and $200,000 common, to distribute in four southern states the products of the Austin Machinery Corp.

Reed-Prentice Co. plant, Worcester, Mass., will house the executive departments of that company, the Becker Milling Machine Co., and the Whitcomb-Blaisdell Machine Tool Co., after Feb. 21.

Northern Trailer Co., a subsidiary of the Bangor Motor Co., has begun manufacture of trailers, sleds, snow plows, etc., at South Orrington, Me.

Master Tire & Rubber Co. has elected as directors, George H. Kramer, George Marshall, Jr., and Edward Luthman.

American Auto Accessories Co., Denver, has changed its name to the Sewell Mfg. Co.

Liquidation Sought of Interlocking Tire

AKRON, Feb. 8—Following several conferences, creditors and stockholders of the Interlocking Cord Tire Co. have practically abandoned all attempts at reorganization of the company and have again petitioned the Common Pleas Court to name a permanent receiver so that liquidation may proceed. The reorganization plan was the outgrowth of offers made by President Walter Kline, Secretary C. E. Foust, Sales Manager J. W. Rinear, and Treasurer L. W. Rinear, to resign. All four are under criminal indictment for alleged violation of the Ohio Blue Sky law.

According to Elihu Harpham, temporary receiver, the company's direct liabilities are $150,000 and contingent liabilities will range from $50,000 to $150,000, with known assets not to exceed $125,000.

CASE PLOW ON 3-DAY WEEK

RACINE, WIS., Feb. 7—To aid workers to overcome the effects of a period of unemployment, the J. I. Case Plow Works Co., on Feb. 1 instituted a schedule of operation of three days per week. Preference is being given to married employes and single men supporting others. Several other large industries in Racine are following a similar plan. The recent Federal survey of industrial conditions gave Racine a total of 7000 out of work.

Calendar

SHOWS

Feb. 12-19—Hartford, Conn., Annual Automobile Show, Hartford Automobile Dealers Ass'n, Armory, Arthur Fifoot, Mgr.

Feb. 12-19—Kansas City. Annual Automobile Show, Kansas City Motor Car Dealers' Ass'n.

Feb. 14-19—Winnipeg, Western Canada Automotive Equipment Show.

Feb. 18-28—San Bernardino, Cal., National Orange Show, Fred M. Renfro, Mgr.

Feb. 19-26—San Francisco, Fifth Annual Pacific Automobile Show, Exposition Auditorium, George Mahlgreen, Mgr.

Feb. 21-26—Louisville, Annual Automobile Show, Louisville Automobile Dealers Ass'n, First Regiment Armory, C. L. Alderson, Secy'.

Feb. 21-26—Salt Lake City, Annual Automobile Show. Intermountain Automotive Trades Ass'n, W. D. Rishal, Mgr.

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Atlanta, Annual Automobile Show, Atlanta Automobile Dealers' Ass'n, Auditorium, Virgil Shepard, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 5-12—Atlantic City, Annual Automobile Show, Automobile Trade Association of Atlantic City, Million Dollar Pier, A. H. Generatzky, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

Mar. 14-19—Washington, Annual Automobile Show, Washington Automobile Dealers' Ass'n, Rudolph Jose, Chmn.

Mar. 19-26—Detroit, Annual Automobile Show, Detroit Automobile Dealers' Ass'n, Morgan-Wright Building.

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show. Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April—Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland. Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

October—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

Oct. 12-14, 1921—Chicago Twenty-Eighth Annual Convention National Implement & Vehicle Ass'n.

Champion Is Elected to Head Old Timers

CHICAGO, Feb. 4.—The Old Timers' Club, which was a more or less informal and spontaneous organization originated a year ago in the office of the Standard Parts Co., in Cleveland, assumed definite form this week at the first annual dinner of the organization at the Congress Hotel.

After a year of button-wearing and rapid growth officers were elected, and the organization formalities are to be completed by a committee. Albert Champion of the Champion Ignition Co., Flint, was chosen president. He came to America twenty-one years ago from France, a professional bicycle rider, and has been a part of America's automobile industry ever since.

Clifford Ireland, member of Congress, was toastmaster. Addresses were made by David B. Beecroft, directing editor of the Class Journal papers; Forrest J. Alvin of the United States Motor Truck Co., Cincinnati, and Samuel E. Hibben, attorney, Chicago. The officers follow:

President—Albert Champion, Champion Ignition Co. Vice-Presidents—Passenger car section, Howard Marmon, Nordyke & Marmon Co.; motor truck section, Martin L. Pulcher, Federal Motor Truck Co.; parts and accessories section, John Younger, Standard Parts Co.; jobbers' section, Gregory Flynn, Edward A. Cassidy Co., New York; distributors' section, W. L. Hughson, San Francisco; dealers' section, Thomas J. Hay, Chicago; newspaper section, Walter Bermingham, *Chicago Evening Post;* automobile publication section, C. G. Sinsabaugh, *Motor Life;* contest section, Richard Kennerdell, chairman, contest board, A. A. A.; organizations section, Alfred Reeves, general manager, National Automobile Chamber of Commerce; advertising section, Lloyd R. Maxwell, Erwin Wasey & Co., Chicago. Secretary—F. Ed. Spooner, Detroit. Treasurer—H. S. Firestone, Firestone Tire & Rubber Co.

McCord Creditors to Guard Interests

DETROIT, Feb. 9—Creditors of the McCord Mfg. Co. will meet Friday to select an advisory committee to take charge of the company's affairs to guard against any action which might prove detrimental to the interests of both the company and creditors.

A letter announcing the meeting was sent out over the signatures of ten banking creditors headed by Frank G. Smith, vice-president of the First and Old National Bank, Detroit. The concern lists total assets as of Dec. 31 of $11,700,000 to pay quick liabilities of about $500,000 accounts payable and $1,900,000 long term bonds. They are confronted with large inventories and accounts receivable, which they are unable to convert quickly into liquid assets. The letter says the inventories are reduced to prices which would be salable when the demand revives, but the customers' contracts are on a basis of higher prices.

PEUGEOT TO BUILD HERE

NEW YORK, Feb. 7—The Peugeot Automobile Co. of France will form an American company to be known as the Peugeot Company of America, with an authorized capital stock of $3,000,000 8 per cent cumulative preferred, and 50,000 shares of common stock of no par value. The company will manufacture Peugeot cars at a plant to be located in New England. Of the stock, $1,500,000 preferred and 25,000 common shares will be issued at once.

Mexican Development Opens Way to Tractors

NEW ORLEANS, Feb. 7—The Department of Fomento (development) of the Federal Government of Mexico, which has been supplying agricultural implements and seeds at cost to farmers of small tracts throughout that country, also is now prepared to handle tractors, motor trucks and other automotive farm and road-building machinery, likewise at cost, for other and larger farmers who may order it through that department, according to Arturo M. Elias, the new consul-general of Mexico, who arrived at his headquarters in New Orleans, Feb. 1.

"I would suggest," said Consul Elias, "that tractor and truck manufacturers wishing to get a foothold in Mexico, communicate with the Department of Fomento as to the placing of their automotive machinery. Such letters may be made in English, and should be addressed to the Secretary of the Department of Fomento, who is a minister in the President's cabinet. The Mexican government owns and operates the Compania Naviera Mexicana, which now has nine steamers in operation between New Orleans and Mexico, and the agricultural machinery will be handled from shipside, at New Orleans, the government taking it from the hands of the manufacturer at that point. More than 20,000 persons have returned to agricultural pursuits since the new government of Mexico came in, and the need for these implements is great."

RANGER TRUCK ADVANCED

HOUSTON, TEX., Feb. 7—Price of the Ranger truck, model TK-22, has been increased from $2575 to $2875 by the Southern Motor Mfg. Assn., Ltd., of this city.

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Revised Registration Figures Show Trend of Sales

Analysis of the 8,932,458 registrations shows sales possibilities of the Southern States just beginning to be developed. Agricultural States have largest number of cars per capita, but still form large market.

THE annual registration article, published in AUTOMOTIVE INDUSTRIES of Jan. 13, stated that there were 8,887,572 cars and trucks registered in the United States, and announced at that time, a later revision of these figures. This article presents these revisions, made after careful checking with the final records of the various secretaries of state. A discussion of the various conclusions which may be drawn from the statistics was also promised in the Jan. 13 number, and is included in the present article.

The revised figures given in this article show accurately the number of cars registered in the various states. Few changes are to be noted in the revised figures, except in the case of Florida, the figures for which were not available in time for the previous publication and had to be estimated.

The revised total registrations is still closer, however, to the nine million mark, 8,932,458 cars and trucks being registered in the United States during 1920. The total in each case comprises the registrations as of Dec. 31, 1920. This is an actual increase of 1,335,955, or 15.65 per cent over 1919. There is one car for every 11.84 persons.

The total fees for the year ran well over $98,000,000, thus making available a large sum of money for road maintenance and improvement. This is nearly $30,000,000 more than was paid into the various state treasuries during the previous year in license fees. A reliable computation states that 92 per cent of these fees are devoted to highway work and 8 per cent to administrative work.

For purposes of sales analysis, the country logically divides into four sections, industrial rather than sectional, except in the case of the Southern States. This division is as follows:

1—Agricultural States.
2—Manufacturing States.
3—Mining States.
4—Southern States.

Viewing the registration from this standpoint permits an analysis of the automotive market as well as of the trend of sales during recent years.

The States included in these sections are as follows:

1—Manufacturing States:
Massachusetts, New York, Pennsylvania, Michigan, Indiana, Delaware, Connecticut, Rhode Island, New Jersey and Wisconsin.

2—Agricultural States:
Arkansas, North Dakota, South Dakota, Kansas, Minnesota, Nebraska, Oregon, Oklahoma, Texas, Washington and Iowa.

3—Mining States:
Wyoming, Nevada, Utah, Montana, Colorado, Arizona, Idaho and New Mexico.

4—Southern States:
Florida, Georgia, Virginia, North Carolina, South Carolina, Kentucky, Tennessee, Louisiana, Mississippi, Alabama, West Virginia.

As would be expected the manufacturing states show the largest total registration. The totals for the sections for 1920 are:

Manufacturing States	3,607,750
Agricultural States	2,468,093
Mining States	374,106
Southern States	1,084,050

This shows that about half of the total number of cars and trucks in use are concentrated in the big manufacturing states. This proportion corresponds in a general way with the proportion of population concentrated in these sections. The population of the manufacturing group according to the 1920 census figures is 43,308,991, while the total for the three other groups is 49,111,684.

Relative Density of Automobiles

A comparison of the relative density of automobiles in the various sections brings out more definite trends. The chart shown in Fig. 1 presents the course of registrations per capita since 1912. The curve shows graphically the trend of sales resistance during the last ten years.

In 1912, it will be noted, the manufacturing states were far ahead in the proportion of cars registered. At that time the manufacturing states had one car for every 80 persons, while the agricultural states lagged far behind with one car for every 140 persons. This state of affairs was natural since selling effort was much easier in cities than in the rural districts. Even though there was a potential market for cars on the farms at that time, it was not cultivated since large sales were to be made with less effort in the cities.

The same thing applies to sales in the mining states at that period, while the Southern States were behind probably for much the same reason in 1912. In this later case, however, the lack of good roads should probably be added as a reason, since the South contained sufficient urban areas to present in many cases a concerted group of potential buyers for selling effort.

Following the curve through succeeding years, the increased sales resistance in the large cities and more congested areas of the manufacturing states becomes apparent, together with the consequent development of the farm market. The years 1912 to 1915 each recorded an enormous percentage of gain in the agricultural states, while the number of persons per car did not seek a low level as rapidly in the better supplied manufacturing areas.

Registration of Motor Vehicles

State	Total Net Registration	Non-Resident and Re-Registration	Passenger Cars	Commercial Cars	Motorcycles	Chauffeurs and Operators	Total Fees
Alabama	74,637	3,123	61,941	12,696	1,035	....	$832,980
Arizona	34,559	1,816	29,826	4,733	542	416	192,245
Arkansas	59,082	333	....	....	....	478	591,465
California	568,892	126,827	534,814	34,078	20,047	865,699	5,554,265
Colorado	128,951	10,881	121,223	7,728	3,364	9,814	818,938
Connecticut	119,134	....	95,123	24,011	6,543	....	1,561,191
Delaware	18,300	....	....	....	674	....	329,980
District of Columbia	9,712	....	8,403	790	519	7,468	54,231
Florida	73,914	....	63,466	10,448	1,275	2,190	554,695
Georgia	144,422	2,028	....	....	1,688	5,147	1,918,512
Idaho	50,873	851	....	....	764	802	882,050
Illinois	568,759	....	503,762	64,997	10,597	63,451	5,897,879
Indiana	332,707	....	300,226	32,481	8,823	9,758	2,029,103
Iowa	437,300	97,908	....	....	4,000	....	7,507,202
Kansas*	265,396	5,903	248,322	17,074	2,972	....	1,498,924
Kentucky	112,685	....	99,426	13,259	1,543	5,000	816,159
Louisiana	66,000	....	59,400	6,600	500	....	39,600
Maine	62,907	4,636	55,395	7,512	1,566	78,539	818,756
Maryland	116,341	9,960	104,909	11,432	7,332	54,269	2,124,925
Massachusetts	304,631	35,346	253,245	51,386	15,143	361,579	3,860,232
Michigan	412,717	35,640	366,946	45,771	8,011	74,648	5,694,486
Minnesota	65,517	2,389	....	....	1,158	3,497	155,985
Mississippi	63,484	834	58,502	4,765	194	194	127,627
Missouri	296,919	16,400	....	....	3,954	26,791	2,111,697
Montana	60,646	862	59,450‡	1,200‡	675	....	415,383
Nebraska	223,000	....	204,000	19,000	2,000	....	2,070,144
Nevada	10,464	....	....	....	141	....	....
New Hampshire	34,680	4,800	30,240	4,440	2,542	44,093	645,968
New Jersey	227,737	41,351	204,125	23,612	11,041	294,438	3,503,937
New Mexico	22,109	....	....	....	219	....	200,000
New York	669,290	....	521,417	148,873	29,453	358,022	8,511,597
North Carolina	140,860	....	127,415	13,455	1,418	....	1,785,000
North Dakota	90,840	10,164	89,385	1,455	898	....	691,510
Ohio	615,397	16,000	533,879	81,518	26,956	....	5,846,042
Oklahoma	204,300	....	....	....	1,320	....	2,393,788
Oregon	103,790	15,946	....	....	3,516	3,963	2,085,000
Pennsylvania	570,164	72,545	521,835	48,329	23,981	258,135	....
Rhode Island	50,375	5,772	40,800	9,575	2,225	58,710	531,000
South Carolina	92,818	1,933	....	....	908	....	527,868
South Dakota	120,395	2,410	112,589	7,806	777	....	768,000
Tennessee	101,852	....	90,214	11,638	1,151	....	1,215,776
Texas	427,693	....	....	....	4,293	23,385	3,510,356
Utah	42,578	....	37,016	5,553	1,114	1,120	350,938
Vermont	31,625	....	....	....	946	33,817	555,422
Virginia	134,000	10,000	101,800	13,670	2,233	5,520	1,825,000
Washington†	173,920	13,337	147,170	26,750	4,915	....	2,828,896
West Virginia	78,862	6,000	68,162	10,700	1,659	10,514	1,100,000
Wisconsin	293,298	....	277,093	16,205	8,002	....	3,127,073
Wyoming	23,926	....	....	....	327	....	267,179
TOTALS	8,932,458	555,995	6,131,519	793,540	234,954	2,636,156	$91,025,398

*Registration year ends July 1. Figures for Jan. 1 †Estimated. ‡Figures as of December 1.

This action continued until 1917, when the agricultural states finally showed fewer persons per car than the manufacturing states, while the mining states passed the manufacturing during the same period and even slipped down below the agricultural states by a slight margin.

This relation has been preserved to a large extent in the 1920 figures, which show the number of persons per car in these sections as follows:

Agricultural States	8.10
Mining States	8.90
Manufacturing States	12.00
Southern States	20.08

Market in Southern States

During this entire period the Southern states have consistently lagged behind. This fact, together with the changes noted in the three other curves, would indicate that intensive sales effort has not yet been directed to the states comprised in this group. But as the number of persons per car becomes lower in the three other groups it is apparent that sales resistance will increase accordingly.

And at a time when sales resistance is particularly acute for a variety of reasons, unconnected with this factor, it would seem necessary in the near future seriously to study the possibility of intensively cultivating that market which, in one phase at least, offers less sales resistance.

The slow progress in the Southern states, of course, can be attributed to several factors:

1—Roads in this section of the country are not nearly as good as in the States comprised in the other groups.

2—A large negro population, most of which does not comprise a market for automobiles, makes the figures for this group of States somewhat higher than it would be if only potential automobile buyers were included.

3—Lack of educational facilities and popular education as compared with the North. Automobile sales increase as the general level of education rises.

To make a detailed analysis of the Southern market for any particular make of car would involve the consideration of a number of important factors besides the mere registration figures. The number of cars registered, however, form a sound indication of certain trends and can well be used as a foundation upon which to base a more detailed analysis of this large potential market.

In this connection, it is well to note that the development of a good used car market among certain parts of the population of the South may form the basis of a future market for new cars. One dealer tried this in a certain section, and found the colored population to be large buyers of used cars. This particular dealer was able to absorb the used cars of a particular make from several territories in his vicinity.

With $11,099,617 collected in motor fees during the last year, nearly all of which should be available for road maintenance, the roads in this Southern group should be well kept up. That is one of the greatest barriers to automobile and truck sales is being rapidly broken down, thus rendering this section the next logical area for intensive sales cultivation. The latest federal figures show that $92,500,000 will be spent on roads during 1921 alone in this group of states, about 15 per cent of the entire amount to be spent in 1921 throughout the United States.

Ohio Shows Large Gain

The gain in registration showed by Ohio is particularly noteworthy, since this state was near the top in total registrations even in 1919. For such a state to lead all the rest in actual gain is unusual at this stage of the business. New York, for instance, which leads in total registrations both in 1919 and 1920, is in second place in actual gain, while Pennsylvania, which has the third largest registration total, is in sixth place as regards actual gain.

In other words, Ohio is making more rapid strides than any of its close competitors in the race for first place. Of the states that are high up in the population scale, Ohio has the greatest number of cars per capita. Taking only those states whose population is four million or more, the number of persons per car is as follows:

Ohio	9.38
Texas	10.91
Illinois	11.41
Pennsylvania	15.45
New York	15.52

Thus it appears that Ohio, although a thickly populated industrial state, has already absorbed many more cars per person than any other similar state. Only two other manufacturing states surpass it in this respect, Michigan and Wisconsin, neither of which has nearly as large a population.

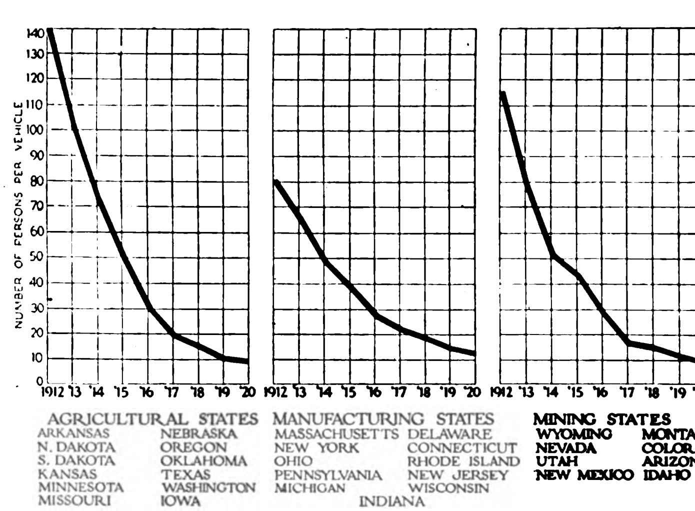
Large Gains By Large States

As might be expected, however, the largest states have made the greatest actual gain in registration during the last year. The five leaders in actual gain are as follows:

Ohio	104,366
New York	97,628
Texas	96,383
California	91,442
Illinois	90,321

Agricultural States Lead in Cars Per Capita

None of the first thirteen states in the list of cars per capita is classed as a manufac-



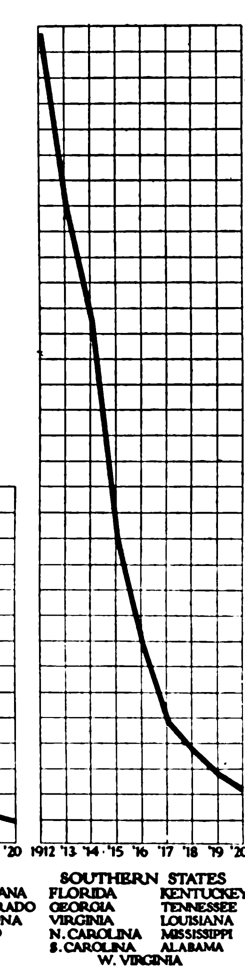
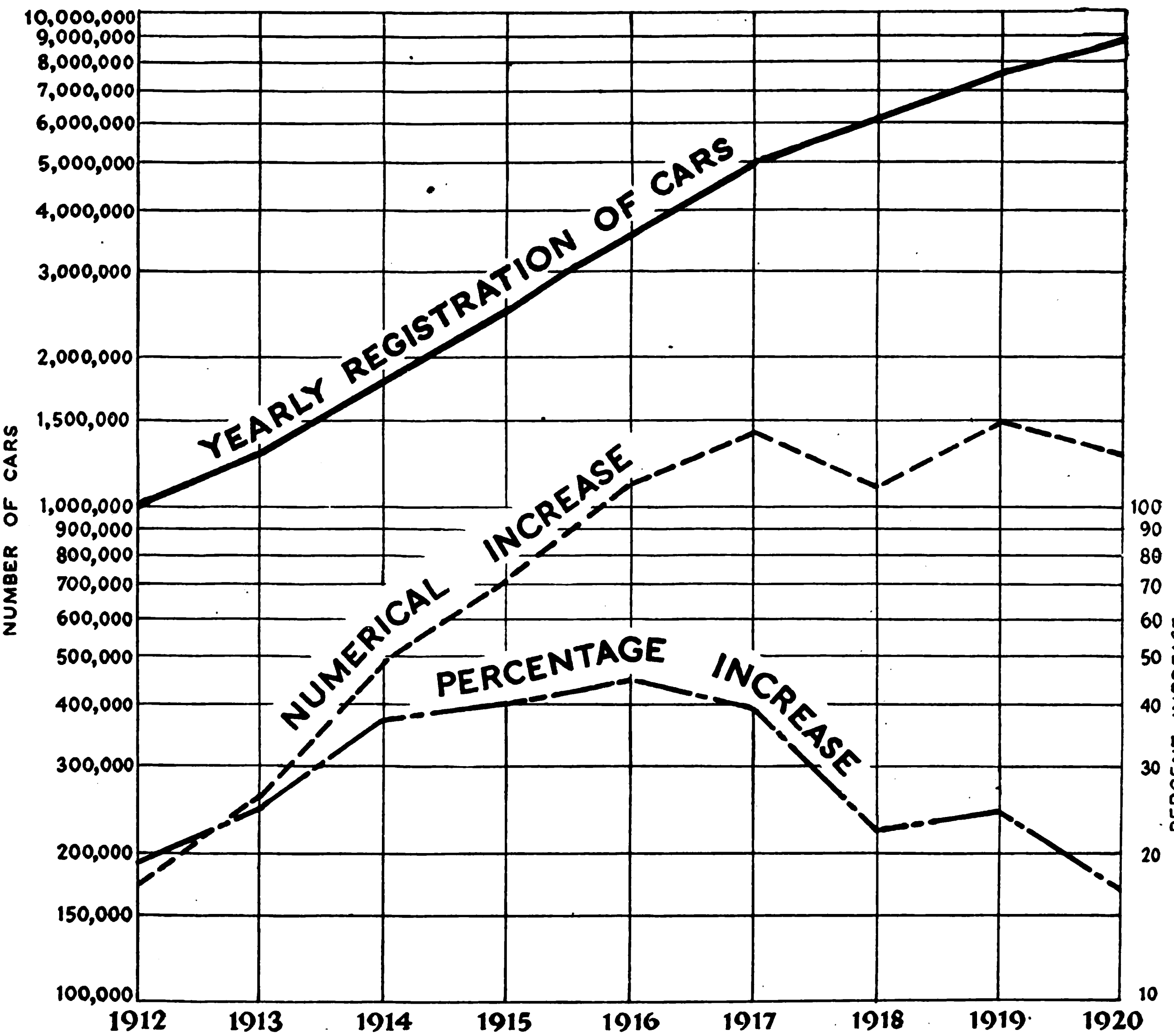


Fig. 1



turing state. The first six in the list are predominantly agricultural states. In some of the states, such as South Dakota, Iowa and Nebraska these statistics show one motor vehicle for practically every family. It must be remembered, however, that the figures include both cars and trucks and that if a more detailed and careful analysis were possible it would probably show the farm market still to be large for both cars and trucks.

The large number of persons per car in the manufacturing districts can be attributed rather to the comparatively high cost of keeping a car and to the difficulties of storing it than to any other reasons. As municipal facilities for parking, housing and storing vehicles are improved so will the city market for vehicles be materially increased.

Michigan has the honor of being the first manufacturing state in this list, with only 8.91 persons for every vehicle, while Wisconsin is next with 8.98, followed by Ohio as noted previously.

West Virginia Makes Big Percentage Gain

The largest percentage gain was made by West Virginia with 57.2, followed by Virginia with 42.6, and Mississippi with 42.12 per cent. The ten states making the largest percentage gain during 1920 in order were: West Virginia, Virginia, Mississippi, Oklahoma, North Carolina, South Carolina, Louisiana, Texas, Tennessee and Alabama.

Every one of these states may be definitely classed as a southern state. This bears out the conclusions discussed earlier in the story that merchandising in the southern states is only in the beginning of its development.

This fact that the southern states show so large a percentage of increase should be linked up with the table showing number of persons per car. In the latter table, it will be noted, the southern states are still far behind. These facts, taken together, would indicate that the South is just beginning to develop its fuller potentialities as an automotive market and that there is still a very large field there for sales before anyone need begin even thinking about the mythical saturation point so generally discussed.

A large increase in the number of automobiles together with a depressed business situation have combined to bring very close the saturation point so far as easy sales and "order-taking" merchandising is concerned. But a close analysis of the registration figures gives no indication whatever that the real saturation point is even on the horizon. When the necessary replacements are considered, together with the potential markets revealed from a study of the registration figures, it becomes evident that there is still a very large market for motor vehicles in the United States which has as yet been developed to a slight degree. Because registrations of cars and trucks have been segregated in

Cars and Trucks in the United States, December 31, 1920

New York	669,290
Ohio	615,397
Pennsylvania	570,164
California	568,892
Illinois	568,759
Iowa	437,300
Texas	427,693
Michigan	412,717
Indiana	332,707
Massachusetts	304,631
Missouri	296,919
Wisconsin	293,298
Kansas	265,396
New Jersey	227,737
Nebraska	223,000
Oklahoma	204,300
Washington	173,920
Georgia	144,422
N. Carolina	140,860
Virginia	134,000
Colorado	128,951
S. Dakota	120,395
Connecticut	119,134
Maryland	116,341
Kentucky	112,685
Oregon	103,790
Tennessee	101,852
S. Carolina	92,818
N. Dakota	90,840
West Virginia	78,862
Alabama	74,637
Florida	73,914
Louisiana	66,000
Minnesota	65,517
Mississippi	63,484
Maine	62,907
Montana	60,646
Arkansas	59,082
Idaho	50,873
Rhode Island	50,375
Utah	42,578
New Hampshire	34,680
Arizona	34,559
Vermont	31,625
Wyoming	23,926
New Mexico	22,109
Delaware	18 300
Nevada	10,464
D. of C.	9,712
Total	8,932,458

only a few states for a number of years past, the only conclusions available in regard to truck registration must be based on incomplete data. In only eight states has the separate truck registration for the last four years been completely available. On the basis of these states, bearing in mind the limitations outlined, however, some interesting deductions may be made. The states in question are New York, Pennsylvania, Michigan, New Jersey, Massachusetts, Maryland, Maine and Rhode Island.

The total truck registration of these typical states since 1917 is as follows:

1917	136,356
1918	215,637
1919	288,116
1920	306,605

It is interesting to compare the percentage of this gain with the percentage gain in total vehicle registrations for the country during that same period.

	Total registration	Car registration 8 States	Trucks in 8 States
1917 ..	39%		
1918 ..	20%	13%	36%
1919 ...	23%	26%	34%
1920 ..	17%	20%	20%

These figures would indicate that trucks experienced exceptionally good years in 1918 and 1919, but that the slump hit them a little sooner than it did the passenger cars; so far as domestic distribution is concerned at least. The more uniform increase and stability of the passenger car figures might indicate more better planned and more stabilized merchandising policy in general; a merchandising system better able to withstand sudden shocks and somewhat less dependent upon abnormal demand for steady business.

The failure to continue the percentage increase through 1920 is probably due in part to after-war conditions. It was in these manufacturing states that there was the great test of transportation which did so much to prove the emergency value of the truck. But it was also in these states that there was the greatest slump in transportation demands. Many of the trucks used in these states for war-time transportation were sent west to relieve the great congestion that appeared there. Port conditions were not so urgent after the war strain was over and at the points where transportation had been keyed up to the greatest emergency, there was the sharpest slump.

Then, too, truck registration figures are complicated by the legal definition of a truck in registration laws. In some states a truck is a vehicle on solid tires. That naturally makes an incomplete showing for trucks as the use of pneumatic tire-equipped trucks increases.

Confused Registration Figures

The confused state of the various registration systems has been mentioned before. It is necessary to explain one or two points in the present figures that they may not be misinterpreted. The registrations in Minnesota, for instance, comprise merely the cars and trucks registered during the year 1920. This does not include anything like all the cars in that state, since Dec. 31, 1920, was the end of a three-year registration period. The total for the three years would not, however, present an accurate count of the number of vehicles in the state either. The three-year figure was 324,360 and is mentioned as a matter of information.

A new law was passed in this state by the voters at the last election, which provides for a yearly registration system. The methods of working out this law, however, are now being debated by the legislature, and, since the three-year registration period previously provided for has passed, there is at the present moment no registration of motor vehicles in Minnesota.

There have been only two changes of any importance since the publication of the registration figures in AUTOMOTIVE INDUSTRIES Jan. 13. These are in the cases of Florida and Maryland, the figures for which were not available before. Maryland now appears 24th in the list of total registrations instead of 25th, as in the previous list, while Florida is actually in 32nd place instead of 38th, as placed in the previous compilation.

Slight revisions appear in the case of about 10 other states, none of the changes being important enough to change the states' positions in the list of total registrations.

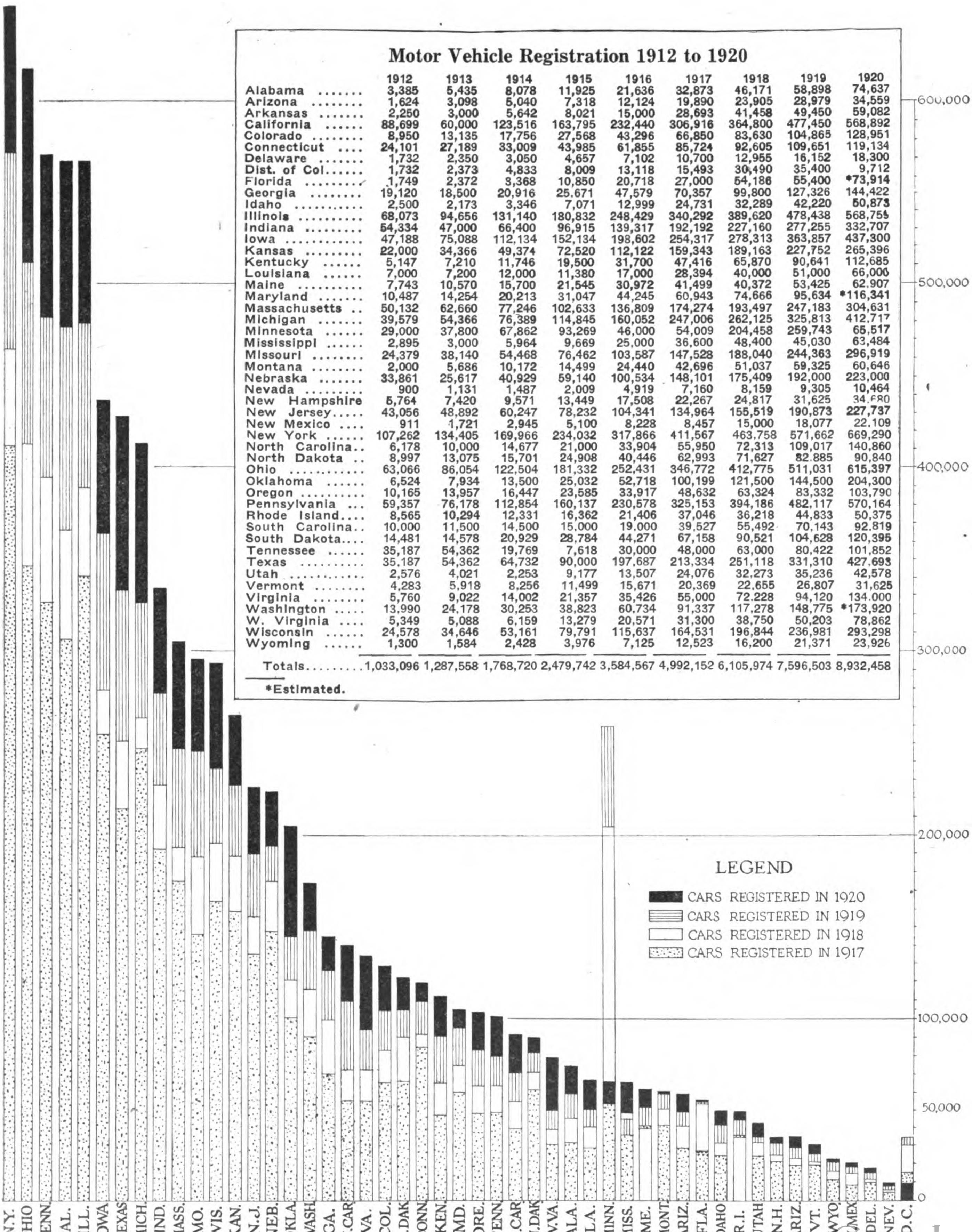
Some states register tractors with trucks and do not register trailers; others register trailers with trucks and do not register tractors; others register both tractors and trailers with trucks; and still others register neither trailers nor tractors in any way. These facts should be borne in mind when any calculations are being made on the basis of apparently segregated registrations.

It is the practice in some States, as well, to classify vehicles on the basis of use rather than construction.

Gain in Registration 1919—1920

Ohio	104,366
New York	97,628
Texas	96,373
California	91,442
Illinois	90,321
Pennsylvania	88,047
Michigan	86,904
Iowa	73,443
Oklahoma	59,800
Massachusetts	57,448
Wisconsin	56,317
Indiana	55,452
Missouri	52,556
Virginia	39,880
Kansas	37,644
New Jersey	36,864
N. Carolina	31,843
Nebraska	31,000
W. Virginia	28,659
Washington	25,145
Colorado	24,086
S. Carolina	22,675
Kentucky	22,044
Tennessee	21,430
Maryland	20,707
Oregon	20,458
Mississippi	18,454
Florida	18,514
Georgia	17,096
S. Dakota	15,767
Alabama	15,739
Louisiana	15,000
Arkansas	9,632
Connecticut	9,483
Maine	9,482
Idaho	8,653
N. Dakota	7,955
Utah	7,342
Arizona	5.580
Rhode Island	5,542
Vermont	4,818
New Mexico	4,032
New Hampshire	3.055
Wyoming	2.555
Delaware	2,148
Montana	1.321
Nevada	1,159
Dist of Columbia	—25.688
Minnesota	—194,226
Total	1,335,955

Increase or Decrease in Car and Truck Registrations 1912—1920



Motor Vehicle Registration 1912 to 1920

	1912	1913	1914	1915	1916	1917	1918	1919	1920
Alabama	3,385	5,435	8,078	11,925	21,636	32,873	46,171	58,898	74,637
Arizona	1,624	3,098	5,040	7,318	12,124	19,890	23,905	28,979	34,559
Arkansas	2,250	3,000	5,642	8,021	15,000	28,693	41,458	49,450	59,082
California	88,699	60,000	123,516	163,795	232,440	306,916	364,800	477,450	568,892
Colorado	8,950	13,135	17,756	27,568	43,296	66,850	83,630	104,865	128,951
Connecticut	24,101	27,189	33,009	43,985	61,855	85,724	92,605	109,651	119,134
Delaware	1,732	2,350	3,050	4,657	7,102	10,700	12,955	16,152	18,300
Dist. of Col......	1,732	2,373	4,833	8,009	13,118	15,493	30,490	35,400	9,712
Florida	1,749	2,372	3,368	10,850	20,718	27,000	54,186	55,400	*73,914
Georgia	19,120	18,500	20,916	25.671	47,579	70,357	99,800	127,326	144,422
Idaho	2,500	2,173	3,346	7,071	12,999	24,731	32,289	42,220	50,873
Illinois	68,073	94,656	131,140	180,832	248,429	340,292	389,620	478,438	568,755
Indiana	54,334	47,000	66,400	96,915	139,317	192,192	227,160	277,255	332,707
Iowa	47,188	75,088	112,134	152,134	198,602	254,317	278,313	363,857	437,300
Kansas	22,000	34,366	49,374	72,520	112,122	159,343	189,163	227,752	265,396
Kentucky	5,147	7,210	11,746	19,500	31,700	47,416	65,870	90,641	112,685
Louisiana	7,000	7,200	12,000	11,380	17,000	28,394	40,000	51,000	66,000
Maine	7,743	10,570	15,700	21,545	30,972	41,499	40,372	53,425	62.907
Maryland	10,487	14,254	20,213	31,047	44,245	60,943	74,666	95,634	*116,341
Massachusetts ..	50,132	62,660	77,246	102,633	136,809	174,274	193,497	247,183	304,631
Michigan	39,579	54,366	76,389	114,845	160,052	247,006	262,125	325,813	412.717
Minnesota	29,000	37,800	67,862	93,269	46,000	54,009	204,458	259,743	65,517
Mississippi	2,895	3,000	5,964	9,669	25,000	36,600	48,400	45,030	63,484
Missouri	24,379	38,140	54,468	76,462	103,587	147,528	188,040	244,363	296,919
Montana	2,000	5,686	10,172	14,499	24,440	42,696	51,037	59,325	60,646
Nebraska	33,861	25,617	40,929	59,140	100,534	148,101	175,409	192,000	223,000
Nevada	900	1,131	1,487	2,009	4,919	7,160	8,159	9,305	10,464
New Hampshire	5,764	7,420	9,571	13,449	17,508	22,267	24,817	31,625	34,680
New Jersey.....	43,056	48,892	60,247	78,232	104,341	134,964	155,519	190,873	227,737
New Mexico	911	1,721	2,945	5,100	8,228	8,457	15,000	18,077	22.109
New York	107,262	134,405	169,966	234,032	317,866	411,567	463.758	571,662	669,290
North Carolina..	6,178	10,000	14,677	21,000	33,904	55,950	72,313	109,017	140,860
North Dakota ..	8,997	13,075	15,701	24,908	40,446	62,993	71,627	82.885	90,840
Ohio	63,066	86,054	122,504	181,332	252,431	346,772	412,775	511,031	615,397
Oklahoma	6,524	7,934	13,500	25,032	52,718	100,199	121,500	144,500	204,300
Oregon	10,165	13,957	16,447	23,585	33,917	48,632	63,324	83,332	103,790
Pennsylvania ...	59,357	76,178	112,854	160,137	230,578	325,153	394,186	482,117	570,164
Rhode Island....	8,565	10,294	12,331	16,362	21,406	37,046	36,218	44,833	50,375
South Carolina..	10,000	11,500	14,500	15,000	19.000	39,527	55,492	70,143	92.819
South Dakota....	14,481	14,578	20,929	28,784	44,271	67,158	90,521	104,628	120,395
Tennessee	35,187	54,362	19,769	7,618	30,000	48,000	63,000	80,422	101,852
Texas	35,187	54,362	64,732	90,000	197,687	213,334	251,118	331,310	427,693
Utah	2,576	4,021	2,253	9,177	13,507	24,076	32,273	35,236	42,578
Vermont	4,283	5,918	8,256	11,499	15,671	20,369	22,655	26,807	31,625
Virginia	5,760	9,022	14,002	21,357	35,426	55,000	72.228	94,120	134.000
Washington	13,990	24,178	30,253	38,823	60,734	91,337	117,278	148,775	*173,920
W. Virginia	5,349	5,088	6,159	13,279	20,571	31,300	38,750	50,203	78,862
Wisconsin	24,578	34,646	53,161	79,791	115,637	164,531	196,844	236,981	293,298
Wyoming	1,300	1,584	2,428	3,976	7,125	12,523	16,200	21,371	23,926
Totals..........	1,033,096	1,287,558	1,768,720	2,479,742	3,584,567	4,992,152	6,105,974	7,596,503	8,932,458

*Estimated.

Percentage Increase in Registration

Dec. 31, 1919 to Dec. 31, 1920

West Virginia	57.20
Virginia	42.60
Mississippi	42.12
Oklahoma	41.40
Florida	33.46
N. Carolina	32.92
S. Carolina	32.19
Louisiana	29.42
Texas	29.09
Tennessee	27.18
Alabama	26.79
Michigan	26.67
Oregon	25.19
Kentucky	24.22
Wisconsin	23.76
Massachusetts	23.24
Colorado	23.00
New Mexico	22.30
Missouri	21.45
Maryland	21.00
Utah	20.79
Ohio	20.39
Indiana	20.32
Iowa	20.23
New Jersey	19.62
Arkansas	19.45
Arizona	19.30
California	19.11
Idaho	19.01
Illinois	18.89
Pennsylvania	18.28
Vermont	17.93
Maine	17.70
New York	17.00
Washington	16.80
Kansas	16.52
Nebraska	16.14
S. Dakota	15.07
Georgia	13.40
Delaware	13.31
Rhode Island	12.35
Wyoming	11.98
Nevada	11.58
N. Dakota	9.69
New Hampshire	9.66
Connecticut	8.65
Montana	2.22
Dist. of Columbia	—72.56
Minnesota	—75.50
Average Increase	15.65

The Agricultural Market

It is reasonable to suppose that the value of the state crop would have some general relation to the automobile population in the state. Where the value of the crop per person is large, there is an indication of potential buying power and the number of automobiles should be proportionately large. Where this is not the case, there would seem to be an excellent market, undeveloped up to the present time for one reason or another.

The values of the crops in the agricultural states during 1920 according to *Agricultural Statistics* were as follows:

Texas	$788,983,000
Iowa	783,488,000
Nebraska	522,186,000
Kansas	399,844,000
South Dakota	366,582,000
Arkansas	359,538,000
Oklahoma	329,579,000
North Dakota	220,290,000
Washington	144,422,000
Oregon	108,632,000

This list includes the chief states which are predominantly agricultural, but not necessarily those which produce the greatest crop values. They are, however, what may be classed as our chief agricultural states. Bearing in mind that these states have the fewest persons per car, it is interesting to compare the population per car with the per capita value of the crops. As noted previously, these two lists should logically correspond in a general way. Here is the way it actually works out:

State	Persons Per Car
1. South Dakota	5.24
2. Iowa	5.50
3. Nebraska	5.82
4. Kansas	6.64
5. North Dakota	7.11
6. Oregon	7.57
7. Washington	7.82
8. Oklahoma	9.91
9. Texas	10.91
10. Arkansas	29.70

	Per Capita Crop Value
1. South Dakota	$547
2. Nebraska	406
3. North Dakota	340
4. Iowa	324
5. Oregon	238
6. Kansas	224
7. Arkansas	204
8. Texas	190
9. Oklahoma	164
10. Washington	101

An examination of this table shows that the per capita crop valuation is a fairly accurate estimate of the automobile sales in these ten agricultural states. While there is, of course, some variation, it is slight except in one case. South Dakota heads the list both in cars per capita and in per capita crop value.

Iowa, though fourth in per capita crop value is second in cars per capita. This indicates that Iowa has been very thoroughly sold on automobiles and trucks, as does the numbers of persons per car figure itself. There is, however, $81 difference in the per capita crop value between Iowa and Nebraska yet Iowa has slightly more cars per capita. On this basis it would seem that Nebraska still offers a fertile field for automotive sales and that sales resistance in that state has not yet grown so strong as in Iowa.

Texas leads Oklahoma by $26 in the per capita crop value list, yet is behind Oklahoma in the persons per car classification. As before, this seems to indicate that Texas offers an excellent field for future sales, especially when these figures are considered in connection with those in a later article showing the amounts available for road building in the various states. Texas has a larger amount available for expenditure in 1921 than any other state, $60,000,000 being the sum set for building new roads in Texas during 1921.

The major exception, previously mentioned, is found in Arkansas. This state with a per capita crop value of $204 stands seventh in that list being only $20 behind Kansas which has but 6.64 persons per car, and Arkansas is $15 above Texas in this list, while Texas shows only 10.91 persons per car. Yet Arkansas stands far down at the bottom of the agricultural states in the list of persons per car, with only one car for every 29.7 persons in the state.

These figures would seem a rather large undeveloped market for cars and trucks in Arkansas; a market which has not been touched to any great extent as yet for one reason or another. Whether or not this is actually the case, the suspicion is rendered very strong by the fact that the relation between registrations and per capita crop value bears a fairly accurate proportion in each of the other agricultural states.

Motorcycles Gain Slightly

Motorcycles have been holding their own in the United States since the end of the war. After showing a very small decrease in 1919, the total registrations for 1920 went ahead of the two previous years. The total registrations in 1920 were 234,954, an actual increase of 1568 and a percentage gain of .68 per cent over 1919.

These figures do not indicate that

NUMBER OF PERSONS PER CAR, Dec. 31, 1920

State	Pop.	Cars and Trucks	Pop. per Car
So. Dakota	635,839	120,395	5.24
Iowa	2,403,630	437,300	5.50
Nebraska	1,295,502	223,000	5.82
California	3,426,536	568,892	6.02
Kansas	1,769,257	265,396	6.64
N. Dakota	645,730	90,840	7.11
Colorado	939,376	128,951	7.29
Nevada	77,407	10,464	7.39
Oregon	783,389	103,790	7.57
Washington	1,356,316	173,920	7.82
Wyoming	194,402	23,926	8.12
Idaho	431,826	50,873	8.48
Indiana	2,930,544	332,707	8.82
Michigan	3,667,222	412,717	8.90
Wisconsin	2,631,839	293,298	8.98
Montana	547,593	60,646	9.02
Ohio	5,759,368	615,397	9.36
Arizona	333,273	34,559	9.67
Oklahoma	2,027,564	204,300	9.91
Utah	449,446	42,578	10.56
Texas	4,661,027	427,693	10.91
Vermont	352,421	31,625	11.13
Illinois	6,485,098	568,759	11.41
Missouri	3,403,547	296,919	11.50
Connecticut	1,380,585	119,134	11.59
Rhode Island	604,397	50,375	11.99
Delaware	223,003	18,300	12.19
Maine	768,014	62,907	12.21
Maryland	1,449,610	116,341	12.46
Mass.	3,852,356	304,631	12.67
N. Hamp.	443,083	34,680	12.76
Florida	966,296	73,614	13.10
New Jersey	3,155,374	227,737	13.95
Penn.	8,720,159	570,164	15.29
New York	10,384,144	669,290	15.52
N. Mexico	360,247	22,109	16.30
Virginia	2,306,361	134,000	17.20
S. Carolina	1,683,662	92,818	18.13
N. Carolina	2,556,486	140,860	18.15
W. Virginia	1.463.610	78,862	18.54
Georgia	2,894,683	144,422	20.05
Kentucky	2,416,013	112,685	21.46
Tennessee	2,337,459	101,852	23.35
Mississippi	1,789,384	63,484	27.99
Louisiana	1,797,798	66,000	27.24
Arkansas	1,750,995	59,082	29.70
Alabama	2.347.295	74,637	31.49
Minnesota	2,386,271	65,517	36.45
Dist. of Col.	437,571	9,712	45.00
Totals	105,683,108	8,932,458	11.84

MOTORCYCLE REGISTRATIONS
1918-1920

	1918	1919	1920
Alabama	1,180	1,103	1,035
Arizona	685	596	542
Arkansas	**	**	**
California	27,887	28,028	20,047
Colorado	3,909	3,636	3,364
Connecticut	4,246	4,495	6,543
Delaware	707	699	674
Dist of Col.	2,353	2,412	519
Florida	1,629	1,412	1,275
Georgia	1,681	1,722	1,688
Idaho	707	731	764
Illinois	10,834	10,920	10,597
Indiana	9,112	8,995	8,823
Iowa	2,529	3,035	4,000*
Kansas	4,173	3,589	2,972
Kentucky	1,479	1,503	1,543
Louisiana	399	490*	500
Maine	1,497	1,608	1,566
Maryland	5,351	5,872	7,332
Massachusetts	12,862	13,698	15,143
Michigan	7,818	7,875	8,011
Minnesota	5,021	6,389	1,158
Mississippi	100*	120*	194
Missouri	3,980	4,131	3,954
Montana	852	847	675
Nebraska	2,900	2,500	2,000
Nevada	121	125	141
New Hampshire	2,452	2.632	2,542
New Jersey	12,517	11,416	11,041
New Mexico	300	200	219
New York	28,597	28,561	29,453
North Carolina	1,333*	1,459	1,418
North Dakota	1,659	901	898
Ohio	20,717	20,444	26,956
Oklahoma	1.622	1,310	1,320
Oregon	3,501	3,570	3,516
Pennsylvania	26,621	25.760	23,981
Rhode Island	1.464	2.301	2 225
South Carolina	1,147	869	908
South Dakota	1,323	888	777
Tennessee	800	1,133	1,151
Texas	2,496	3,889	4,293
Utah	1,298	1,185	1,114
Vermont	734	800	946
Virginia	2.414	2,520	2,233
Washington	6,317	5,050	4,915
West Virginia	847	994	1,659
Wisconsin	7,238	7,223	8,002
Wyoming	313	353	327
TOTAL	233,665	233,386	234,954

*Estimated **Not segregated

the motorcycle industry is standing still as might be supposed from a superficial survey. A number of factors, such as the enormous government and foreign trade work done during the war, enter into any detailed examination of the registration statistics as an indication of the present status of the industry. A consideration of these factors shows the industry to be in a healthy condition and to be progressing at a normal rate and puts a different aspect upon the actual registration figures.

There is not space in this article to analyze thoroughly the present status of the American motorcycle industry, but an article in a later issue will summarize all phases of the present situation and point out probable trends in the immediate future, based upon a careful survey of the industry as a whole.

The states which have the largest number of automobiles have also the largest number of motorcycles. This would indicate that motorcycles fill a distinct field of their own and are not competitors of the automobiles; that the motorcycle is the compliment of the automobile and that it thrives in the same places as the car and has hard going where cars are not numerous.

The ten states having the largest number of motorcycles, for instance, are as follows:

New York	29,453
Ohio	26,956
Pennsylvania	23,981
California	20,047
Massachusetts	15,143
New Jersey	11,041
Illinois	10,597
Indiana	8,823
Michigan	8,011
Wisconsin	8,002

The first four states in the motorcycle list correspond with those of the similar automobile table, while all of these first ten in the motorcycle list appear among the first fourteen in the automobile tabulation.

Tractor Registrations

While the registration of tractors and trailers is not yet general enough to form a sound basis for finding the number in use in the country, it is interesting to examine the figures available with a view to understanding the present status of the question in general. Consequently, the accompanying table is of value in showing the states in which it is possible to determine the number of tractors and trailers with any degree of accuracy and those in which figures of any kind are not available.

About ten states now register tractors separately, and one more will begin to register them in 1921. In most cases, however, the number of registrations is not a guide to the number of tractors, since the majority of these ten states register only commercial tractors or tractors which use the roads. Consequently, estimates made by reliable sources form a truer basis for determining the actual number of tractors even in the states which register them. Such reliable estimates have been used in this table wherever available.

It would be advantageous to the industry if tractors could be universally registered, but that does not mean that they should be licensed and taxed. There is one state already, for instance, that registers all tractors but does not license them. The accompanying table, however, is printed as a matter of interest and as being the best data available on this subject at the present time.

Estimated Number of Tractors

With no figures at all available from twenty-three states, and with the figures from many other states obviously inaccurate, there is no sound basis upon which to estimate the number of tractors actually in use in this country. Assuming the life of a tractor to be seven years with good care, the number at present in use would be something like 433,000, the estimate being based upon production figures. Again, however, accurate production figures are difficult to obtain, and at the present time few tractors get "good care," so that 433,000 is probably a high estimate.

There are five big tractor states for which no figures are given in the acompanying table. The total of the states shown in the table is 153,458. Estimating very roughly from the meager facts available, a good guess as to the number of tractors now in use would be something like 300,000 to 350,000.

A tractor expert estimated about a year ago that there is an immediate market for about 695,000 tractors in the country.

The table shows a total of 17,677 trailers registered in 12 states. Figuring on a population basis, these 12 states comprise about 40 per cent of the entire country. Thus, using population as a basis, it may be estimated roughly that there are 45,000 trailers now in use in the United States.

TRACTORS AND TRAILERS IN U. S., 1920

	Tractors	Trailers
Alabama	....	....
Arizona	1,500†	....
Arkansas	1,350†	....
California	20,000†	....
Colorado	4,000§	2,532
Connecticut	....	....
Delaware	....	61
District of Columbia	....	....
Florida	....	....
Georgia	....	....
Idaho	....	....
Illinois	215*	....
Indiana	10,379†	....
Iowa	17,683†	537
Kansas	16,379	....
Kentucky	....	....
Louisiana	8,000§	....
Maine	550†	....
Maryland	183*	262
Massachusetts	1,800†	495
Michigan	20,350‡	3,711
Minnesota	....	....
Mississippi	2,000†	....
Missouri	....	....
Montana	....	....
Nebraska	....	....
Nevada	300†	....
New Hampshire	200†	....
New Jersey	400†	792
New Mexico	....	....
New York	7,500§	2,862
North Carolina	2,500†	....
North Dakota	....	....
Ohio	8,313†	4,500
Oklahoma	2,835†	....
Oregon	....	....
Pennsylvania	6,823†	876
Rhode Island	100†	19
South Carolina	....	....
South Dakota	6,808†	....
Tennessee	....	....
Texas	....	....
Utah	....	....
Vermont	....	....
Virginia	3,500†	....
Washington	....	1,030
West Virginia	....	....
Wisconsin	9,790	....
Wyoming	....	....
Totals	153,458	17,677

*Registration figures.
‡State Bureau of Agriculture estimate.
‡State Agricultural College estimate.
§Other estimates.

Design Tendencies in 1921 American Passenger Car Chassis

Decrease in percentage of eight and twelve cylinder models with gain in four and six type indicates tendency toward simplification, as does also the gain in percentage of unit power plants. Marked increase in pressure and splash-pressure lubrication. Less pronounced gain in I and L-head cylinders. Transmission emergency brake used on several cars.

By Herbert Chase

ANALYSIS of the specifications of American passenger car chassis for 1921 reveals no very pronounced deviation from 1920 practice. This is no doubt due in large part to the fact that the industry was too busy on production of cars early in 1920 to consider many changes in the 1921 product even if the engineering department had concluded that such changes would be desirable. It is known, however, that the engineering staff of practically all plants has been unusually busy during the past few months when production has been extremely light, so that there are apt to be more changes in the 1922 product than in the 1921, but even these do not promise to be of a radical nature, for the industry has long since reached a point where its product is so nearly standardized that pronounced changes are taboo unless their need is imperative.

Too Little Attention to Fuel Saving

Not a few engineers usually regarded as conservative consider that some radical departure in engine type will soon be forced by the exigencies of the fuel situation, but the current models of passenger cars, taken as a whole, do not indicate that the relatively inefficient use of fuel so long in evidence has been appreciated or at least considered of sufficient importance to warrant the attention it should have received. More cars are being fitted with means for exhaust heating of the inlet manifold, but even this first step toward obtaining better efficiency has not been taken by many, and by many others is applied in a very crude manner. With but few exceptions other refinements calculated to increase fuel economy are lacking, though they are fortunately receiving serious consideration by some of the more progressive manufacturers.

Tendencies Toward Simplification

A commendable tendency away from an unnecessary multiplication of cylinders which many predicted when a few concerns considered designs of this character warranted, is continuing. Less than 1 per cent* of all chassis listed now have twelve-cylinder engines, as against 4 per cent in 1917 and 2.75 per cent last year. There is also a falling off in percentage of cars fitted with eight-cylinder engines—8.5 per cent, as against 12.6 per cent in 1916 and 9.17 per cent last year. While there is a slight increase in sixes—56.8 per cent in 1920 as against 57.7 per cent this year—there is a greater increase in fours—from 30.3 to 33 per cent.

Another tendency toward simplicity is the increasing use of the unit powerplant in place of separate engine and gearset. Eighty-eight per cent of all models use this construction as against 79.5 per cent last year. One advantage thus gained is the elimination of extra shaft and universals between engine and gearbox, but this advantage has been offset in some cases by the lack of accessibility, particularly of the clutch. In some new and, in most respects, well designed chassis it is necessary to disconnect the rear axle and the transmission in order to remove the clutch. Reasonable accessibility can and should be provided without sacrificing the benefits of the unit construction. Improvements in this respect should certainly be sought after and applied, for the service problem is much too serious to be aggravated by failure to afford accessibility wherever it can be secured. To appreciation of this fact is partly due the decision of certain manufacturers to use engines with fewer cylinders and consequently less complication.

Another slight tendency toward simplification is indicated by the fact that the per cent of models using thermo-siphon cooling has increased in the past year from 29.3 to 31.8. While the advantages of this construction are no doubt worth while, it should not be forgotten that they are attained at the expense of some increase in weight, for the pump circulation makes possible the use of a smaller radiator and a cooling system containing less water.

The Light Car Notably Absent

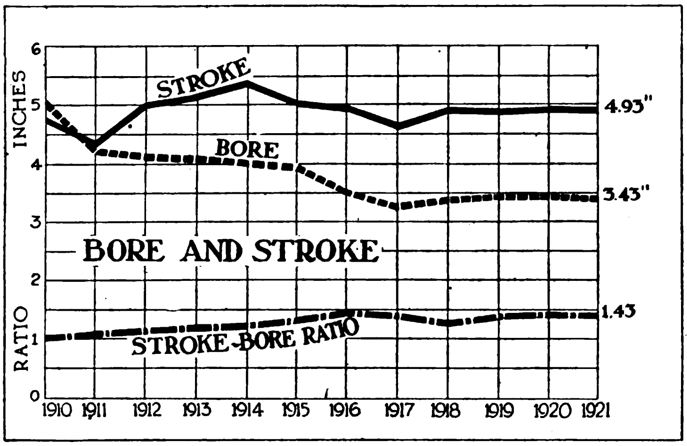
The average wheelbase of all models is 120.77 in., this figure having varied less than 1/10 in. since 1918. Average horsepower is also about the same as last year, indicating that taxation and the cost of upkeep and fuel are not considered of sufficient moment for American manufacturers to follow the example set by British and Continental manufacturers in the production of a considerable number of cars weighing less than 1500 lb. with body, and having engines of 100 cu. in. displacement or less, many of them air cooled. While some of these cars have a tread of less than 56 in. others have standard tread. They carry two and some four passengers and in nearly all respects are of conventional construction, hence are not to be classed as cycle cars. There would seem to be possibilities in a car of this character in this country.

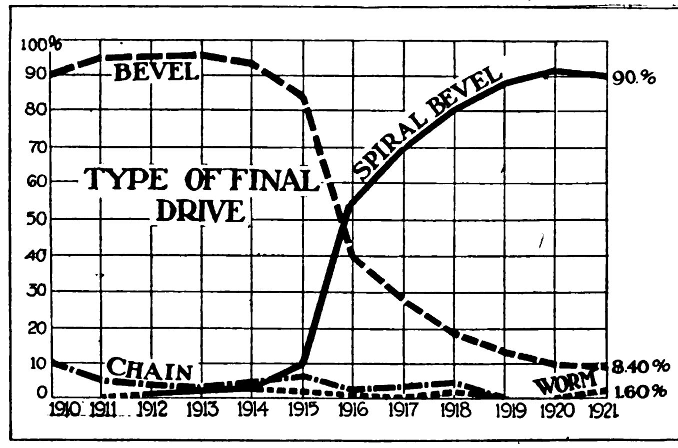
The use of L-head and valve-in-head engines continues to increase at the expense of the T-head, F-head and Knight types. Only 4 per cent of all models use T-head construction, as compared to 7.47 per cent last year. The so-called "F"-head, in which one valve is in the head and one in an L at the side of the cylinder, also shows a decrease from 5.68 to 3.1 per cent.

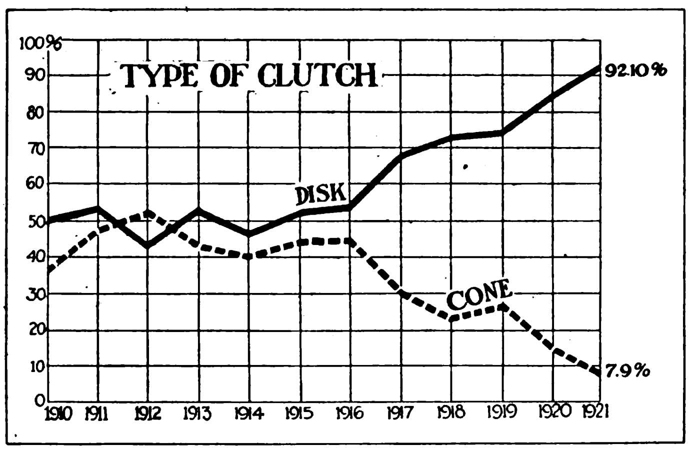
There is practically no change in the type of drive employed for the camshaft. The use of helical or spiral gears shows a slight increase from 75.2 to 77.7 per cent, whereas the use of the silent chain has increased from 18.3 to 19

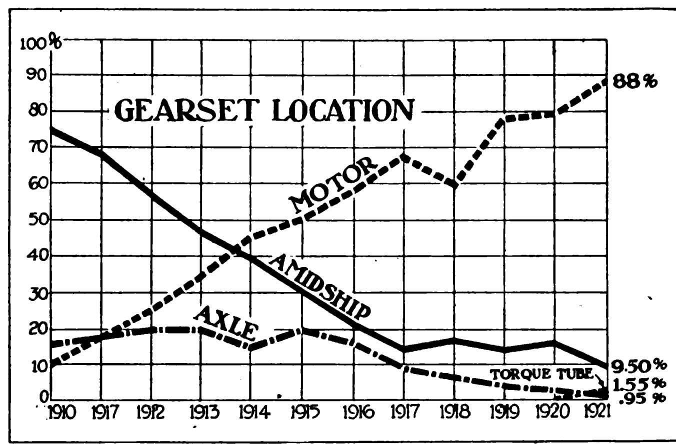
*Percentage figures in this article refer to the per cent of models listed in the accompanying table, concerning which information has been supplied under the heading in question. The figures do not take into consideration the number of each or any model which the various manufacturers produce.

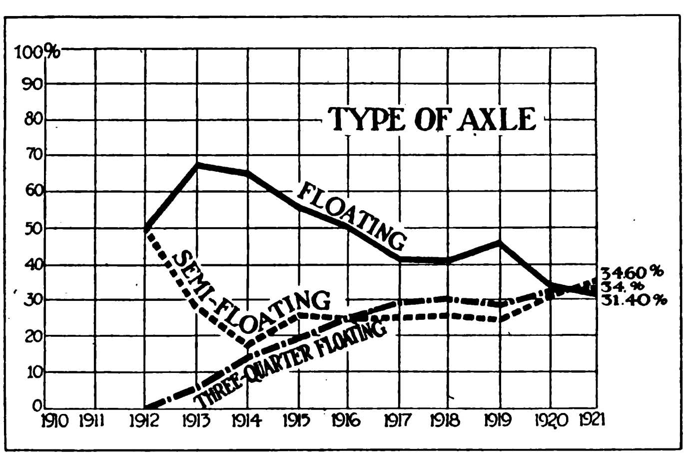
Tendencies in Passenger Car Design 1910 to 1921

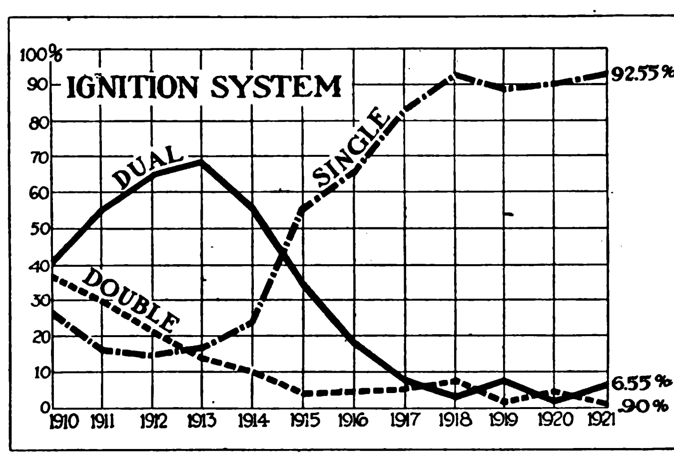


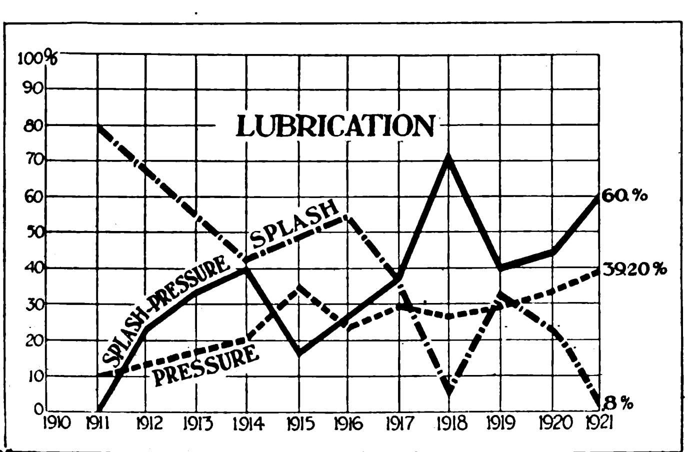


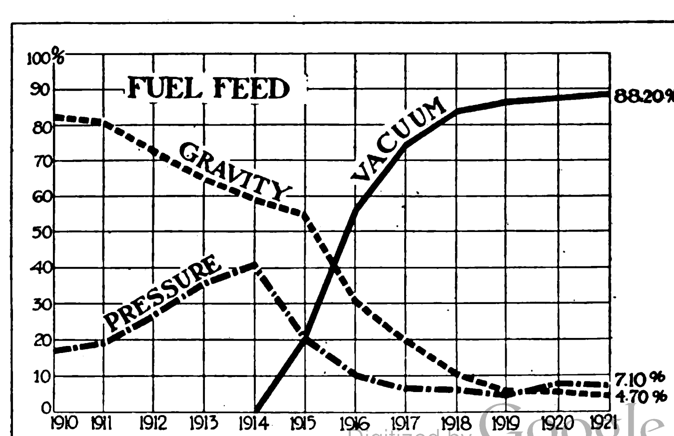


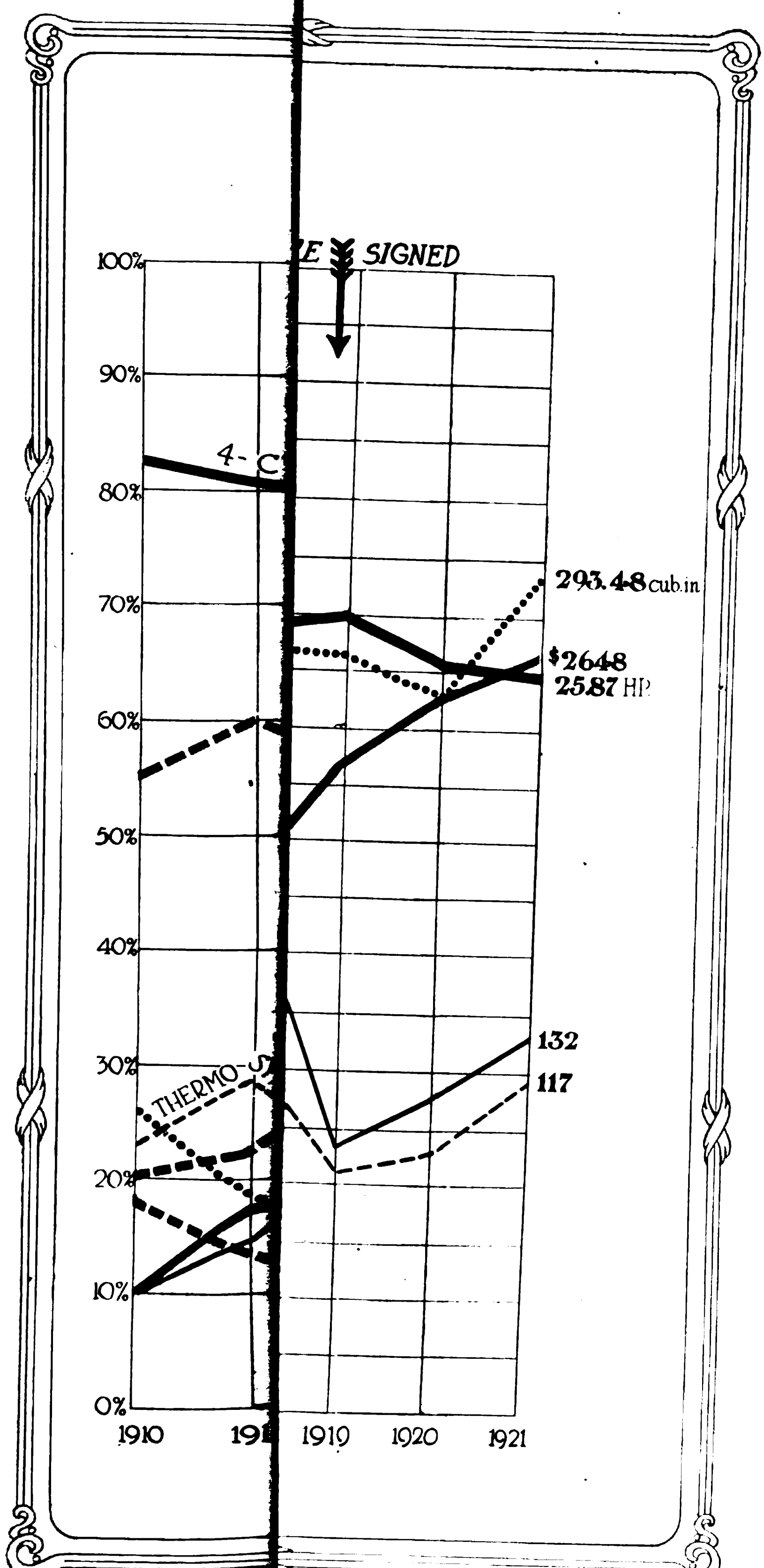












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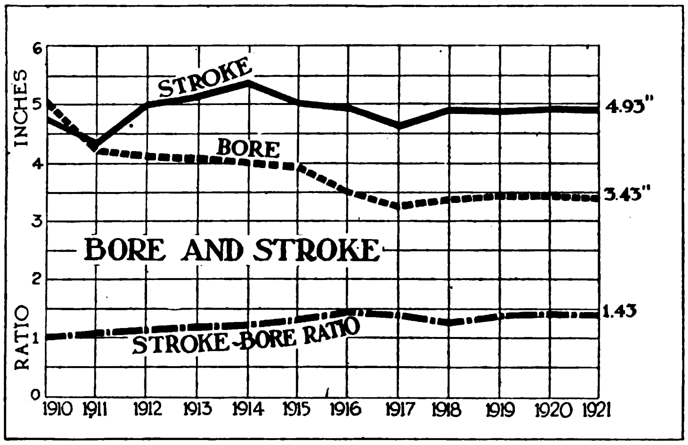
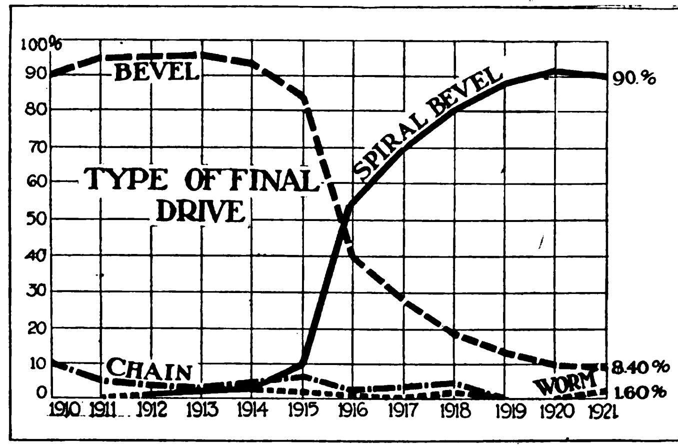
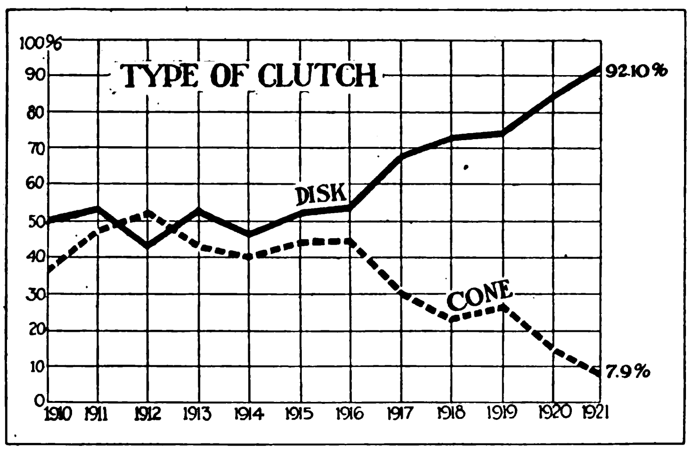
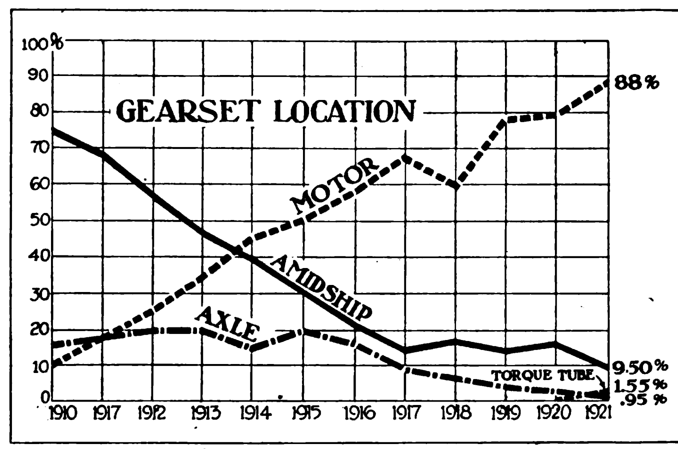
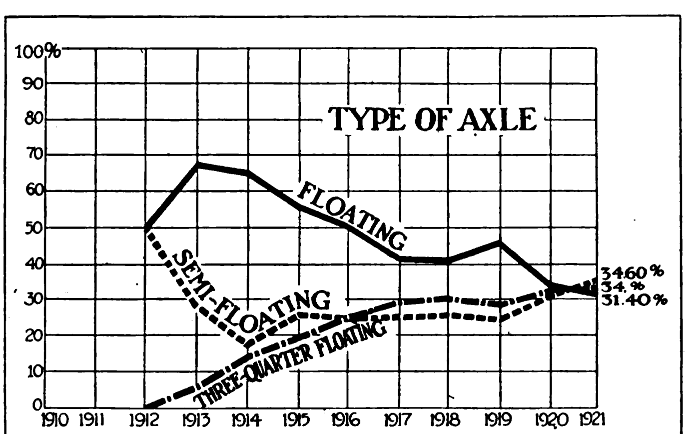
Tendencies in Passenger Car Design 1910 to 1921

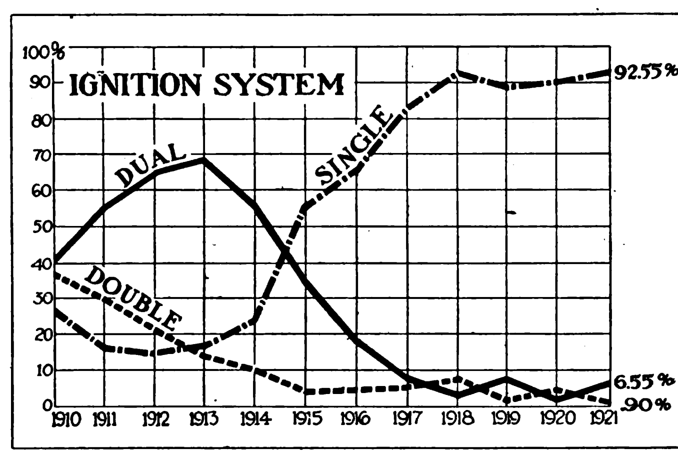


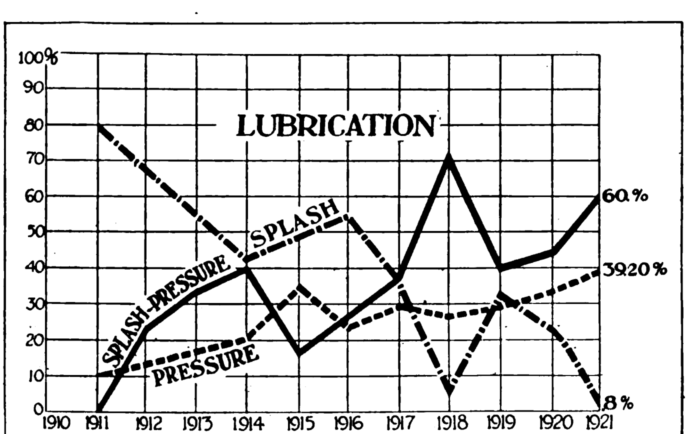


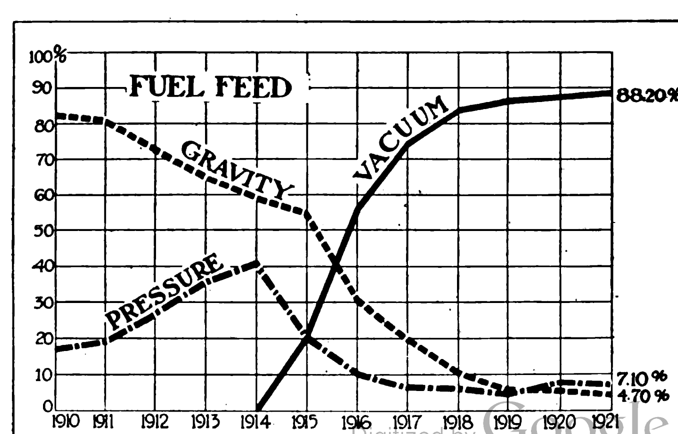


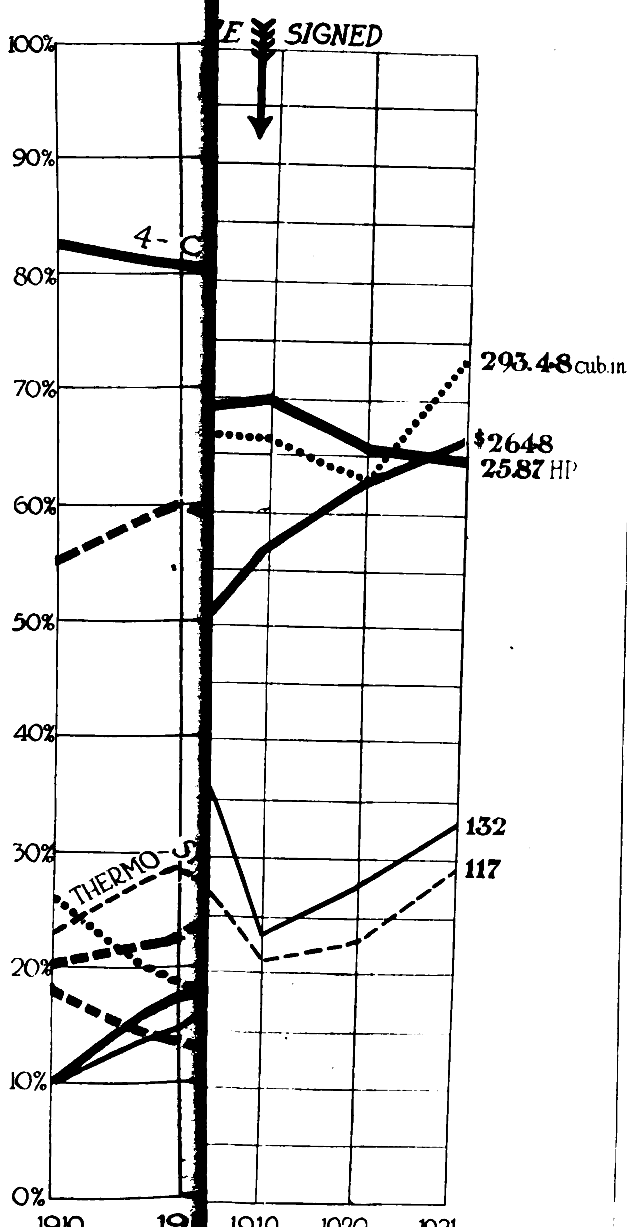












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per cent; practically all other drives are straight spur gears, this type being used on 2.5 per cent of models this year as against 5.5 per cent last year.

Electrical Equipment

In the matter of electrical equipment the change is slight, but accessibility has been improved in some instances, for example by placing the distributor on top of the engine. There is still much room for improvement in the matter of battery location. The lesson of properly supporting this troublesome unit has been fairly well learned, but the question of accessibility is too often overlooked. The battery is often regarded as a necessary evil, and there can be no denying the fact that its life is all too short. For this reason if for no other it should be placed where it can be easily inspected and filled, for its life will depend partly upon the care given it, and it is more apt to be neglected if hard to get at.

Last year less than 1 per cent of models listed were without electric starting. This year even the small minority have seen the light and no American car is without this useful accessory. A few makes are using belt drive for the lighting generator, a practice quite general in the case of British cars. The belt drive is quiet and can be made easily adjustable, but the fact that it occasionally requires adjustment while most other forms of drive do not, except perhaps at rare intervals, is certainly not a point in favor of the belt driven type.

Single ignition shows a small gain in popularity, and is used on 92.5 per cent of models. While the advocates of dual ignition have more than doubled they comprise only 6.55 per cent of the total, as compared with nearly 70 per cent in 1913. The gain in battery ignition is of course due only in part to the merits of the system considered alone, but it is evident that its reliability has greatly increased, else the users of dual ignition would not now include so small a percentage of the total. Nevertheless it is not uncommon to hear a driver whose battery is in poor shape say that he wished the car had magneto ignition, so that this important factor would not be dependent upon what is perhaps the most unreliable element in the modern car.

Lubrication

In respect to lubrication perhaps the most important factor is the greater attention being paid to lubrication of chassis parts. Some think and many hope that the days of the grease cup are numbered. However this may be, the use of more positive means of chassis lubrication is increasing. The use of grease has been rendered much more satisfactory by providing a more positive and more easily operated means of forcing the grease to the desired point. Some still lack confidence in grease lubricating systems, however well applied, and look to the provision of means for feeding oil to the wearing parts as the most promising method of accomplishing the desired result. Oil cups with means for gradual feed are being placed on the market and at least one system of forcing oil from a central reservoir to all chassis points needing oil is being used.

In the matter of engine lubrication the statistics show a considerable increase in the percentage of cars using the splash-pressure system; 43.5 per cent of models used this system in 1920 while 60 per cent use it this year. The pressure system in which oil is forced to both main and crank-pin bearings also shows an increase from 33.3 to 39.2 per cent. Less than 1 per cent of the models now listed depend entirely upon splash lubrication.

The percentage of cars using vacuum feed has slightly increased, the statistics showing that 87 per cent of models used this system in 1920, while 88.2 per cent use it in 1921. There is a slight decrease in the use of both the pressure and gravity feed systems.

Turning now to the transmission system, we find that the use of the disk and the plate type of clutch is increasing at the expense of the cone type. No less than 92.1 per cent of American cars are now fitted with multiple disk or plate type as compared with 84.9 per cent last year. The cone type, which in Europe is much more popular than in this country, is rapidly disappearing here; 15.1 per cent of 1920 models used the cone type, but only 7.9 per cent of 1921 models employ this type of clutch. The reason for this preference is no doubt due to the fact that the disk and plate types require less attention than the cone type when they are well constructed. The use of pressed or moulded facings instead of woven fabric is becoming more general, due in part to the fact that this type of facing has a higher coefficient of friction and is said to be more durable than woven fabric.

Only slight changes are noticeable in gearsets. The vast majority of these have three speeds and many of them are fitted with air pumps for use in tire inflation. Manufacturers of stock transmission are quite generally providing means for mounting the air compressor, a standard S. A. E. base being employed.

A large number of cars now use hollow propeller shafts fitted at one or both ends with fabric disk universals, but the use of one or more all metal universal joints still predominates.

As between axle types there is apparently but little choice, although the semi-floating type is used on 34.6 per cent of models, while 34 per cent use the three-quarter type and 31.4 per cent use the full floating axle. Only very slight changes have taken place in this respect in the last year.

Final Drives

The use of the spiral bevel final drive has slightly decreased, but it is still employed by 90 per cent of all models as compared to 90.6 per cent last year. The straight bevel shows a slight decrease also, from 9.4 to 8.4 per cent, while the worm gear, which had no advocates last year, is now employed on 1.6 per cent of the models listed.

Quite a number of cars are using transmission emergency brakes, the foot brake applying only on rear wheels in these cases. The great majority of cars, however, still have both brakes on the rear wheels, but the percentage of the latter which use the contracting band is decreasing. The use of the contracting band is very rare in Europe and is losing ground in this country partly because it is more difficult to prevent dragging and partly because it catches a great deal of dirt and is sometimes torn loose by broken skid chains. The internal type is better protected but unfortunately is not so easily adjusted and relined as the external type.

The use of the wooden wheels predominates by a very large margin, but at least one manufacturer is fitting steel disk wheels as standard equipment and many others fit wire or disk wheels at the option of the purchaser. Semi-elliptic springs are used by a very large percentage of the total number of models, but a few use cantilever, platform, transverse, or three-quarter elliptic types.

Over half of the cars listed employ Hotchkiss drive. In one or two instances an adjustable spring shackle is fitted to make it possible to take up wear and thus prevent noise which would otherwise result. Improvements in this particular have long been recognized as desirable but little has been accomplished to date.

Gear ratio has continued to increase for several years past until the average now employed is 4.52 as against 4.38 last year. This is indicative of higher speed engines and a lower power factor or average engine load, a tendency which makes for lower fuel economy and one which should therefore be countenanced only if the advantage gained more than offsets the loss in fuel.

Specifications of American

MAKE AND MODEL	Wheelbase	Number of Cylinders	Bore and Stroke	Piston Displacement	Make of Engine	Cylinder Shape	Cam-shaft Drive	Water Circulation	LUBRICATION System	LUBRICATION Type of Pump	CARBURETION Make of Carburetor	CARBURETION Fuel Feed	IGNITION System	IGNITION Make	IGNITION Control	ELECTRIC SYSTEM Generator Make	ELECTRIC SYSTEM Voltage	CLUTCH Make	CLUTCH Type
Ace G	123	6	3¼x5	248.9	Guy	I	Worm	Pump	Splash-Pr.	Piston		Vacuum	Single	At Kent	Hand	Auto-Lite	6	Warner Gr.	Disk
Allen 43	110	4	3½x5	192.4	Own	L	Helical	Ther.	Splash-Pr.	Gear	Stromberg	Vacuum	ingle	Conn	Hand	Westinghouse	6	Borg & Beck	Plate
American C	127	6	3¼x5	248.9	Hersh-Sp.	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	At Kent	Hand	G. & D.	6	Borg & Beck	Plate
Anderson S-40	120	6	3¼x4½	224.0	Continental	L	Helical	Pump	Splash-Pr.	Gear	Rayfield	Vacuum	Single	Remy	Hand	Remy	6	Borg & Beck	Plate
Apperson 8-21	130	8	3¼x5	331.8	Own	L	Helical	Ther.	Pressure	Gear	Johnson	Vacuum	Single	Remy	Hand	Bijur	6	Own	Plate
Auburn 6-39	120	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Rayfield	Vacuum	Single	Remy	Hand	Remy	6	Borg & Beck	Plate
Beggs-Six 28-T	120	6	3¼x4½	224.0	Cont	L	Helical	Pump	Pressure		Stromberg	Vacuum	Single	Conn	Hand	Auto-Lite	6	Borg & Beck	Plate
Bour Davis 215	126	6	3½x5¼	303.1	Continental	L	Helical	Pump	Splash-Pr.	Piston	Zenith	Vacuum	Single	Westinghouse	Hand	Westinghouse	6	Mun ie	Disk
Brewster 91	125	4	4 x5½	276.5	Own	K	Chain	Pump	Pressure	Gear	Zenith	Vacuum	Single	Bosch	Hand	U. S. L.	12	Own	Cone
Briscoe 4-34	109	4	3⅜x5	178.9	Own	L	Helical	Ther.	Splash-Pr.	Piston	Scoe	Gravity	Single	Conn	Hand	Auto-Lite	6	Own	Cone
Buick 1921	118	6	3⅜x4½	241.6	Own	I	Helical	Pump	Splash-Pr.	Gear	Marvel	Vacuum	Single	Delco	H. & A.	Delco	6	Own	Disk
Cadillac 59	132	8	3⅛x5⅛	314.4	Own	L	Chain	Pump	Pressure	Gear	Own	Pressure	Single	Delco	H. & A.	Delco	6	Own	Disk
Case V	126	6	3½x5¼	303.1	Continental	L	Helical	Pump	Splash-Pr.	Piston	Rayfield	Vacuum	Single	Delco	H. & A.	Westinghouse	6	Borg & Beck	Plate
Chalmers 6-30	117	6	3¼x4½	224.0	Own	L	Chain	Ther.	Splash-Pr.	Gear		Vacuum	Single		Hand		6	Own	Disk
Chalmers 6-30	122	6	3¼x4½	224.0	Own	L	Chain	Ther.	Splash-Pr.	Gear		Vacuum	Single		Hand		6	Own	Disk
Champion Tourist	116	4	3½x5	192.4	Hersh-Sp.	L		Ther.			Zenith		Single	Dyneto	Hand	Dyneto		Borg & Beck	Plate
Champion Special	118	4	3½x5	192.4	Lycoming	L		Ther.			Zenith		Single	Dyneto	Hand	Dyneto		Borg & Beck	Plate
Chandler	123	6	3½x5	288.6	Own	L	Chain	Pump	Splash-Pr.	Piston	Rayfield	Vacuum	Single	Bosch	Hand	Bosch	6	Borg & Beck	Plate
Chevrolet 490	102	4	3 11/16x4	170.9	Own	I		Pump	Splash-Pr.	Gear	Zenith	Gravity	Single	Remy	Hand				Cone
Chevrolet FB-50	110	4	3 11/16x5¼	224.3		I		Pump	Splash-Pr.	Gear	Zenith	Vacuum	Single	Remy		Auto-Lite			Cone
Cleveland 40	112	6	3 x4½	190.8	Own	I	Chain	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Bosch	Hand	Bosch	6	Borg & Beck	Plate
Climber S-6	125	6	3¼x5	248.9	Hersh-Sp.	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Bosch	Hand	Westinghouse	6	Muncie Hoosier	Disk Plate
Cole 870	127	8	3½x4½	346.3	Northway	L	Helical	Pump		Gear	Johnson	Vacuum	Single	Delco	H. & A.	Delco	6	Northway	Cone
Columbia Six DC	115	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	At Kent	Hand	Auto-Lite	6	Borg & Beck	Plate
Comet	125	6	3½x5¼	303.1	Continental	L	Helical	Pump	Circ-Sp.	Piston	Stromberg	Vacuum	Single		Hand	Wagner	6	Borg & Beck	Plate
Commonwealth 44	117	4	3½x5	192.4	Hersh-Sp.	L	Helical	Ther.	Circ-Sp.	Gear	Carter	Vacuum	Single	Splitdorf	Hand	Dyneto	6	Borg & Beck	Plate
Crawford 21-6-40	122	6	3½x5¼	303.1	Continental	L	Helical	Pump	Circ-Sp.		Stromberg	Vacuum	Single	At Kent	Hand	Westinghouse	6	Brown-Lipe	Disk
Crow-Elkhart L53-56	117	4	3½x5	192.4	Lycoming	L	Helical	Ther.	Circ-Sp.	Piston	Zenith	Vacuum	Single	Conn	Hand	Dyneto	6	Borg & Beck	Plate
Crow-Elkhart H53-56	117	6	3⅛x5	230.1	Rutenber	L	Helical	Pump	Circ-Sp.	Piston	Zenith	Vacuum	Single	Conn	Hand	Dyneto	6	Borg & Beck	Plate
Cunningham V-4	132	8	3¾x5	441.7	Own	L	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	Delco	Auto	Delco	6	Own	Disk
Daniels 8 D-19	132	8	3½x5¼	404.1	Own	L	Helical	Pump	Pressure	Gear	Zenith	Pressure	Single	Delco	Hand	Delco	6	Own	Disk
Davis 51	120	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	Delco	Hand	Delco	6	Borg & Beck	Plate
Dodge Brothers	114	4	3⅞x4½	212.3	Own	L	Helical	Pump	Circ-Sp.	Gear	Stewart	Vacuum	Single	North-East	Auto	North-East	15	Own	Disk
Dort 17-A	108	4	3½x5	192.4	Lycoming	L	Helical	Ther.	Circ-Sp.	Piston	Carter	Vacuum	Single	Conn	Hand	Westinghouse	6	Own	Cone
Dixie-Flyer H-S-70	112	4	3½x5	192.4	Hersh-Spill	L	Helical	Ther.	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Eisemann	Hand	Dyneto	6	Borg & Beck	Plate
Dorris 680	132	6	4 x5	377.0	Own	I	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	Bosch	Hand	Westinghouse	6	Warner-Gr.	Disk
Dupont A	124	4	3 11/16x5		Own	L	Helical	Pump	Splash-Pr.	Gear	Yale & Town	Vacuum	Single	Eisemann	Hand	Westinghouse	6	Brown-Lipe	Disk
Elcar 7-R	117	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	Delco	Hand	Delco	6	Warner Gr.	Disk
Elgin Six K		6	3⅛x4¾	218.6	Falls	I	Helical	Ther.	Splash-Pr.	Piston	Stromberg	Vacuum	Single	Wagner	Hand	Westinghouse	6	Borg & Beck	Plate
Essex A	108½	4	3⅜x5	178.9	Own	F	Helical	Ther.	Circ-Sp.	Piston	Own	Vacuum	Single	Delco	H. & A.	Delco	6	Own	Disk
Friend Four	112	4	3¼x4½	149.3	Own	I	Helical	Ther.	Pressure	Gear	Stromberg	Vacuum	Single	Conn	Hand	Wagner	6	Borg & Beck	Plate
Ferris	130	6	3½x5¼	303.1	Continental	L	Helical	Pump	Pressure	Piston	Zenith	Vacuum	Single		Hand	Leece-N.	6	Brown-Lipe	Disk
Franklin 9-B	115	6	3¼x5¼	261.3	Own	I	Helical	None	Pressure	Gear	Own	Vacuum	Single	At Kent	Auto	Dyneto	12	Own	Plate
Ford T	100	4	3¾x4	176.7	Own	L	Spur	Ther.	Circ-Sp.		Holley	Gravity	Dual	Own	Hand	Own	6	Own	Fric.
Gardner "G"	112	4	3½x5	192.4	Lycoming	L	Helical	Ther.	Circ-Sp.		Carter	Vacuum	Single	Westinghouse	Hand	Westinghouse	6	Borg & Beck	Plate
Grant HX	116	6	3 1/16x4½	198.9	Own	I	Helical	Ther.	Splash-Pr.	Gear	Stromberg	Vacuum	Single	At Kent	Hand	Bijur	6	Borg & Beck	Plate
Globe B-10	115	4	3⅜x5	178.9	Supreme			Ther.			Stromberg	Vacuum	Single	Delco	Hand	Delco	6	Warren	
Hansen 60	121	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Marvel	Vacuum	Single	Delco	Hand	Delco	6	Borg & Beck	Plate
Harroun A-A-2	106	4	3¼x5¼	174.2	Own	I	Helical	Ther.	Splash-Pr.	Piston	Stromberg	Vacuum	Single	Remy	Hand	Remy	6	Own	Cone
Halladay 21	116	6	3⅛x5	230.1	Rutenber	L	Helical	Pump	Splash-Pr.	Eccentric	Stromberg	Vacuum	Single	At Kent	Hand	Westinghouse	6	Borg & Beck	Plate
Hatfield A-42	115	4	3½x5	192.4	Hersh-Sp.	L	Helical	Ther.	Circ-Sp.	Gear	Zenith	Vacuum	Single	Conn	Hand	Dyneto	6	Borg & Beck	Plate
Haynes 47	132	6	3½x5	288.6	Own	L	Helical	Pump	Circ-Sp.	Piston	Rayfield	Vacuum	Single	Kingston	Hand	Leece-N.	6	Borg & Beck	Plate
H. C. S. Series 3	120	4	3⅝x5½	227.1	Weidely	I	Helical	Pump	Pressure	Gear	Stromberg	Pressure	Single	Delco	Hand	Delco	6	Warner-Gr.	Plate
Holmes Series 4	126	6	3½x4¼	245.3	Own	I	Helical	None	Pressure	Gear	Stromberg	Vacuum	Single	Eisemann	Auto	Dyneto	12	Brown-Lipe	Disk
Hudson Super-Six O	126	6	3½x5	288.6	Own	L	Helical	Pump	Circ-Sp.	Plunger	Own	Vacuum	Single	Delco	H. & A.	Delco	6	Own	Disk
Hupmobile R	112	4	3¼x5½	182.5	Own	L	Chain	Ther.	Splash-Pr.	Gear	Stromberg	Vacuum	Single	At Kent	Hand	Westinghouse	6	Own	Disk
Jackson 6-38	121	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	Remy	Hand	Auto-Lite	6	Borg & Beck	Plate
Jordan M	120	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	Delco	Hand	Delco	6	Detroit	Plate
Kenworthy 8-90	130	8	3 x5¼	296.9	Own	I	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single		Hand	Bijur	6	Brown-Lipe	Disk
Kissel Custom Built	124	6	3 5/16x5½	284.4	Own	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Remy	Hand	Remy	6	Warner-Gr.	Disk
King H	120	8	3 x5		Own	I	Chain	Ther.	Pressure	Gear	Ball & Ball	Vacuum	Single	At Kent	Hand	Westinghouse	6	Detroit	Plate
Kline Kar 655-K	121	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Rayfield	Vacuum	Single	Conn	Hand	Wagner	6	Borg & Beck	Plate
LaFayette 134	132	8	3¼x5¼	348.4	Own	L	Chain	Pump	Splash-Pr.	Gear	Own	Pressure	Single	Delco	H. & A.	Delco	6	Own	Disk
Lexington Series S	122	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Rayfield	Vacuum	Single	Conn	Hand	G. & D.	6	Borg & Beck	Plate
Lexington Series T	128	6	3¼x4½	224.0	Ansted	I	Helical	Pump	Pressure	Gear	Rayfield	Vacuum	Single	Conn	Hand	G. & D.	6	Own	Disk
Liberty	117	6	3⅛x5	230.1	Own	L	Helical	Ther.	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Wagner	Hand	Wagner	6	Borg & Beck	Plate
Locomobile 48	142	6	4½x5½	524.8	Own	T	Helical	Pump	Splash-Pr.	Gear	Ball & Ball	Pressure	Double	Berling	Hand	Westinghouse	6	Own	Disk
Lorraine 21-T	114	4	3½x5	192.4	Hersh-Sp.	L	Helical	Ther.	Splash-Pr.	Gear	Johnson	Vacuum	Single	Westinghouse	Hand	Westinghouse	6	Borg & Beck	Plate
Lincoln	130	8	3⅜x5	357.8	Own	L	Chain	Pump	Pressure	Gear	Own	Vacuum	Single	Delco	H. & A.	Delco	6	Own	Disk
Maibohm B	116	6	3⅛x4¼	195.6	Falls	I	Helical	Ther.	Splash-Pr.	Piston	Stromberg	Vacuum	Single	At Kent	Hand	Bijur	6	Borg & Beck	Plate
Meteor R&RR	129	4	4¼x6	340.4	Roc-Dues	H	Chain	Pump	Pressure	Gear	Zenith	Vacuum	Single	Simms	Hand	Westinghouse	6	Borg & Beck	Plate
Marmon 34	136	6	3¾x5⅛	339.7	Own	I	Helical	Pump	Pressure	Gear	Stromberg	Gravity	Single	Delco	H. & A.	Delco	6	Own	Plate
Maxwell 25	109	4	3⅝x4½	185.8	Own	L	Helical	Ther.	Splash-Pr.	Piston		Vacuum	Single		Hand		12	Own	Cone
McFarlan 1921	140	6	4½x6	572.5	Own	T	Helical	Pump		Gear	Rayfield	Vacuum	Dual	Berling	Hand	Westinghouse	6	Borg & Beck	Plate
Mercer 5	132	4	3¾x6¾	298.2	Own	L	Chain	Pump	Pressure	Gear	Ball & Ball	Vacuum	Single	Eisemann	Hand	Westinghouse	6	Own	Plate
Merit B	119	6	3 1/16x4½		Walker	I	Helical	Ther.	Splash-Pr.		Stromberg	Vacuum	Single	At-Kent	Hand	Westinghouse	6	Borg & Beck	Plate
Metz Master Six	120	6	3⅛x5	230.1	Rutenber	I	Helical	Pump	Splash-Pr.	Piston	Stromberg	Vacuum	Single	Conn	Hand	G. & D.	6	Borg & Beck	Plate
Mitchell	120	6	3¼x5	248.9	Own	L	Helical	Pump	Splash-Pr.		Rayfield	Vacuum	Single	Remy	Hand	Remy		Borg & Beck	Plate
Moon 6-48-21	122	6	3¼x4½	224.0	Continental		Helical	Pump	Pressure	Gear	Rayfield	Vacuum	Single	Delco	Auto	Delco	6	Borg & Beck	Plate
Nash 681	121	6	3¼x5	248.9	Own	I	Helical	Pump	Splash-Pr.	Gear	Marvel	Vacuum	Single	Wagner	H. & A.	Wagner	6	Borg & Beck	Plate

ABBREVIATIONS—**¾ Ell**—¾ Elliptic; **¾ Float**—¾ Floating; **Amid**—Amidships; **Auto**—Automatic; **B & P**—Ball and Plain; **B & R**—Ball and Roller; **B R & P**—Ball, Roller and Plain; **Cant**—Cantilever; **Circ-Spl**—Circulating Splash; **Ell**—Elliptic; **F**—1 Valve in Head, 1 in Side; **Float**—Floating; **Fric**—Friction; **Gear**—Gear Pump; **H & A**—Hand and Automatic; **H**—Valves horizontal in side; **I**—I-Head; **K**—Knight Type; **L**—L-Head; **Opt**—Optional; **Plat**—Platform; **S-E**—Semi-Elliptic; **Semi-F**—Semi-Floating; **Sp. B**—Spiral Bevel;

Passenger Car Chassis for 1921

TRANSMISSION							Gear Ratio on Direct	RUNNING GEAR				Make of Steering Gear	Make of Speedometer	Crankshaft Bearings and No.	BEARINGS			MAKE AND MODEL
GEARSET			Final Drive	Torque Taken By	Make of Rear Axle	Rear Axle Type		TIRES		Wheels	Rear Springs				Gear Set	Rear Axle	Front Wheel	
Make	Location	Speeds						Front	Rear									
Warner Gr.	Unit E.	3	Sp. B	Tor-A.	Salisbury	Float	4.56	32x4	32x4	Wood	S-E.	Gemmer	Stewart	Plain 3	B.&R.	B.&R.	Roller	Ace G
Own	Unit E.	3	Sp. B	Springs	Columbia	¾ Float	4.62	32x4	32x4	Wood	S-E.	Ditweiler	Stewart	Plain 3	B.&R.	Roller	Roller	Allen 43
Warner	Unit E.	3	Worm	Springs	Salisbury	Float	4.50	32x4	32x4	Opt.	S-E.	Warner		Plain 3	B.&P.	B.&R.	Roller	American C
Durston	Unit E.	3	Sp. B	Springs	Salisbury	Float	4.50	33x4	33x4	Opt.	S-E.	Gemmer	Stewart	Plain 4	B.&P.	B.&R.	Roller	Anderson S-40
Own	Amid.	3	Sp. B	Springs	Own	Semi-F.	4.25	34x4½	34x4½	Opt.	¾-Ell.	Own	Van Sicklen	Plain 3	Roller	Roller	Roller	Apperson 8-21
Grant-Lees	Unit-E.	3	Sp. B	Tor-A.	Salisbury	Float	4.75	33x4	33x4	Wood	S-E.	Jacox	Stewart	Plain 4	Ball	Ball	Roller	Auburn 6-39
Detroit	Unit E.	3	Sp. B	Springs	Standpar	¾ Float	3.75	33x4	33x4	Wood	S-E.	Ditweiler	Stewart	Plain 4	B.&P.	Roller	Roller	Beggs-Six 20-T
Muncie	Unit-E.	3	Sp. B	Springs	Salisbury	¾ Float	4.50	33x4½	33x4½	Wood	S-E.	Lavine	Stewart	Ball 3	Ball	Roller	Roller	Bour-Davis 21-S
Own	Unit-T.	3	Sp. B	Tor-T.	Own	Float	4.25	32x4½	32x4½	Wood	Cant.	Own	Stewart	Plain 3	Ball	Ball	Roller	Brewster 91
Own	Unit-E.	3	Sp. B	Springs	Own	Semi-F.	4.18	31x4	31x4	Wood	S-E.	Own	Stewart	Plain 3	B.&P.	B.&R.	Ball?	Briscoe 4-34
Own	Unit-E.	3	Bevel		Own	Float	4.08	33x4	33x4	Wood	Cant.	S.P.C	Stewart	Plain 4	Plain	Roller	Ball	Buick 1921
Own	Unit E.	3	Sp. B	Springs	Timken	Float	4.43	35x5	35x5	Wood	Plat	Own	Van Sicklen	Plain 3	B.&R.	Roller	Roller	Cadillac 59
Grant-Lees	Unit E.	3	Sp. B	Springs	Columbia	¾ Float	4.87	34x4½	34x4½	Wood	S-E.	Jacox	Van Sicklen	Plain 3	Ball	Roller	Roller	Case V
Own	Unit E.	3	Sp. B	Springs		Semi-F.	4.75	32x4	32x4	Wood	S-E.	Own		Plain	B.&R.	Roller	Roller	Chalmers 6-30
Own	Unit E.	3	Sp. B	Springs		Semi-F.	5.18	33x4½	33x4½	Wood	S-E.	Own		Plain	B.&R.	Roller	Roller	Chalmers 6-30
Grant-Lees		3	Bevel		Columbia	Float		32x3½	32x3½	Wood	S-E.					Roller		Champion Tourist
Grant-Lees		3	Bevel		Columbia	Float		32x4	32x4	Wood	S-E.						Roller	Champion Special
Own	Unit E.	3	Sp. B	Springs	Own	Float	4.40	33x4	33x4	Wood	S-E.	C.A.S.	Stewart	Plain 3	Ball	Ball	Roller	Chandler
		3				¾ Float		30x3½	30x3½	Wood	Cant.			Plain 3		Roller		Chevrolet 490
		3				¾ Float		33x4	33x4	Wood	S.E-S.C.					Roller	Ball	Chevrolet FB-50
Mechanics	Unit E.	3	Sp. B	Springs	Own	Semi-F.	4.45	32x4	32x4	Wood	S-E.	C.A.S.	Van Sicklen	Plain 3	Ball	Roller	Roller	Cleveland 40
Muncie	Unit E.	3	Sp. B	Springs		Semi-F.	4.75	32x4½	32x4½	Wood	S-E.	C.A.S.	Van Sicklen	Plain 4	Roller	Ball	Roller	Climber S-6
Northway	Unit E.	3	Sp. B	Springs	Columbia	Float	4.45	33x5	33x5	Wood	S-E.	Gemmer	Stewart	Plain 3	B.&P.	Roller	Roller	Cole 870
Durston	Unit-E.	3	Sp. B	Springs	Timken	¾ Float	5.10	32x4	32x4	Wood	Cant.	Gemmer		Plain 4	Ball	Roller	Roller	Columbia Six D.C.
Munice	Unit E.	3	Sp. B	Tor-A.	Columbia	¾ Float	6.66	33x4	33x4	Opt.	Cant.	Gemmer	Stewart	Plain 3	Roller	Roller	Roller	Comet
Muncie	Unit E.	3	Sp. B	Springs	Peru	Float	4.25	32x4	32x4	Wood	S-E.	C.A.S.	Van Sicklen	Plain 2	Plain	Roller	Ball	Commonwealth 44
Brown-Lipe	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.45	32x4	32x4	Wood	S-E.	Lavine	Stewart	Plain 3	Roller	Roller	Roller	Crawford 21-6-40
Covert	Unit E.	3	Sp. B	Springs	Peru	Float	4.25	32x3½	32x3½	Opt.	Ell.	Ditweiler	Stewart	Plain	Roller	Roller	Roller	Crow-Elkhart L53-56
Covert	Unit E.	3	Sp. B	Springs	Peru	Float	4.25	33x4	33x4	Opt.	Ell.	Ditweiler	Stewart	Plain	Ball	Roller	Roller	Crow-Elkhart H53-56
Own	Unit E.	3	Sp. B	Springs	Timken	Float	4.08	35x5	35x5	Opt.	¾ Ell.	Gemmer	Warner	Plain 3	B.&R.	Roller	Roller	Cunningham V-4
Own	Unit E.	3	Sp. B	Tor-A.	Timken	Float	3.50	34x4½	34x4½	Opt.	S-E.	Gemmer	Stewart	Plain 3	Ball	Roller	Roller	Daniels 8 D-19
Warner	Unit E.	3	Sp. B	Tor-A.	Timken	¾ Float	5.90	33x4	33x4	Wood	S-E.	Warner		Plain 4	Ball	Roller	Roller	Davis 51
Own	Unit E.	3	Sp. B	Tor-T.	Own	Float	4.16	32x3½	32x3½	Opt.	¾ Ell.	Own		Plain 3	Roller	Roller	Roller	Dodge Brothers
Mechanics	Unit E.	3	Bevel	Springs	Flint	¾ Float	4.07	31x4	31x4	Opt.	Cant.	S.P.C.	Stewart	Plain 2	B.&P.	Roller	Roller	Dort 17-A
Grant-Lees	Unit E.	3	Sp. B	Tor-T.		Float	4.72	32x4	32x4	Opt.	¾ Ell.	C.A.S.	Van Sicklen	Plain 2	Ball	Roller	Roller	Dixie Flyer H-S-70
Warner-Gr.	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	3.35	33x5	33x5	Wood	S-E.	Ross	Van Sicklen	Plain 7	Ball	Roller	Roller	Dorris 680
Brown-Lipe	Unit E.	4	Sp. B	Springs	Columbia	Float	4.45	32x4	32x4	Opt.	S-E.	Jacox	Warner	Plain 3	Roller	Roller	Roller	Dupont A
Warner Gr.	Unit E.	3	Sp. B	Springs	Salisbury	¾ Float	4.50	33x4	33x4	Opt.	S-E.	Gemmer	Stewart	Plain 4	Ball	B.&R.	Roller	Elcar 7-R
Mechanics	Unit E.	3	Sp. B	Springs	Columbia	¾ Float	5.10	33x4	33x4	Wood	Cant.	C.A.S.	Van Sicklen	Plain 3	Ball	Ball	Roller	Elgin Six K
Own	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.66	32x4	32x4	Wood	S-E.	Gemmer		Plain 3	Roller	Roller	Roller	Essex A
Own	Unit E.	3	Sp. B	Tor-A.	Peru	Float	4.60	32x3½	32x3½	Wood	Trans.	Warner		Plain 2	B.&R.	B.&R.	Roller	Friend Four
Brown-Lipe	Unit E.		Sp. B	Tor-A.	Columbia	¾ Float	4.08	32x4½	32x4½	Wire	S-E.	Gemmer		Plain 3	Ball	Ball	Roller	Ferris
Own	Amid.	3	Sp. B	Springs	Own	Semi-F.	4.33	32x4	32x4	Wood	Ell.	Own	Stewart	Plain 7	Ball	Ball	Ball	Franklin 9-B
Own	Unit E.	2	Bevel	R-R-T-A.	Own	Semi-F.	3.63	30x3	30x3½	Wood	S-E.	Own		Plain 3	Plain	Roller	B.&R.	Ford T
Mechanics	Unit E.	3	Bevel	Springs	Flint	¾ Float	4.41	32x3½	32x3½	Wood	S-E.	Ditweiler	Stewart	Plain 2	Roller	B.&R.	Roller	Gardner G
Durston	Unit E.	3	Sp. B	Springs	Columbia	¾ Float	4.66	32x4	32x4	Wood	S-E.	Jacox	Van Sicklen	Plain 3	Plain	Roller	Roller	Grant HX
	Unit E.	3	Sp. B	Springs	Eaton	Semi-F.	4.90	32x4	32x4	Wood	S-E.	Gemmer						Globe B-10
Detroit	Unit E.	3	Sp. B	Springs	Timken	¾ Float	4.66	32x4	32x4	Wood	S-E.	Gemmer	Stewart	Plain 4	Ball	Roller	Roller	Hanson 60
Grant-Lees	Unit E.	3	Bevel	Springs	Adams	¾ Float	4.00	30x3½	30x3½	Wood	Cant.	Gemmer	Stewart	Plain 3	Ball	B.&R.	Roller	Harroun A-A-2
Grant-Lees	Unit E.	3				¾ Float		33x4	33x4	Wood	¾ Ell.	Ditweiler	Stewart	Ball-2		Roller	Roller	Halladay 21
Grant-Lees	Unit E.	3	Sp. B	Springs	Columbia	¾ Float	4.63	32x4	32x4	Wood	S-E.	Gemmer	Stewart	Plain 2	Ball	Roller	Roller	Hatfield A-42
Own	Unit E.	3	Sp. B	Springs	Own	¾ Float	4.77	34x4½	34x4½	Wood	S-E.	Jacox	Stewart	Plain 3	B.&R.	Ball	Ball	Haynes 47
Warner Gr.	Unit E.	3	Sp. B	Tor-A.	Own	¾ Float		32x4½	32x4½	Wire	S-E.	Gemmer		Plain 3	Ball	B.&R.	Roller	H. C. S. Series 3
Brown-Lipe	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.90	34x4½	34x4½	Wood	Ell.	Gemmer	Van Sicklen	Plain 7	B.&R.	Roller	Roller	Holmes Series 4
Own	Amid.	3	Sp. B	Springs	Timken	Semi-F.	4.90	34x4½	34x4½	Wood	S-E.	Gemmer	Stewart	Plain 4	Roller	Roller	Roller	Hudson Super Six O
Own	Unit E.	3	Sp. B	Springs	Own	¾ Float	4.87	32x4	32x4	Wood	S-E.	Jacox		Plain 3	B.R.P.	B.&R.	Ball	Hupmobile R
Covert	Unit E.	3	Sp. B	Springs	Salisbury	¾ Float	4.75	32x4½	32x4½	Steel	S-E.	Own		Plain 4	Ball	Roller	Roller	Jackson 6-38
Detroit	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.66	32x4	32x4	Wood	S-E.	Gemmer	Van Sicklen	Plain 4	B.&P.	Roller	Roller	Jordan M
Brown-Lipe	Amid.	3	Sp. B	Springs	Columbia	¾ Float	4.08	32x4½	32x4½	Opt.	S-E.	Ross	Warner	Plain	Ball	Roller	Roller	Kenworthy 890
Own	Unit E.	3	Bevel	Tor-A.	Columbia	Float	4.87	32x4½	32x4½	Wood	Cant.	Jacox		Plain 3	B.&R.	Roller	Roller	King H
Warner Gr.	Unit E.	3	Sp. B	Springs	Own	Float	4.25	32x4½	32x4½	Wire	S-E.	Jacox	Stewart	Plain 3	B.&P.	Roller	Roller	Kissel Custom Built
Grant-Lees	Unit E.	3	Sp. B	Springs	Stanpar	Semi-F.	4.56	33x4	33x4	Wood	¾ Ell.	Wholrab	Stewart	Plain 4	Ball	Roller	Roller	Kline Kar 6-55-K
Own	Unit E.	3	Sp. B	Tor-T.	Own	Float	4.50	33x5	33x5	Wood	S-E.	Own	Waltham	Plain 5	B.&R.	Roller	Roller	LaFayette 134
Warner Gr.	Unit E.	3	Sp. B	Springs	Own	¾ Float	4.62	32x4	32x4	Opt.	S-E.	C.A.S.	Stewart	Plain 4	B.&R.	Ball	Ball	Lexington Series S
Warner Gr.	Unit E.	3	Sp. B	Springs	Own	¾ Float	4.62	32x4½	32x4½	Wood	S-E.	C.A.S.	Stewart	Plain 3	B.&R.	Ball	Ball	Lexington Series T
Detroit	Unit E.		Sp. B	Springs	Timken	Semi-F.		32x4	32x4	Wood	S-E.	Gemmer	Stewart	Plain 4	Ball	Roller	Roller	Liberty
Own	Amid.	4	Sp. B	R-R-T-A.	Own	Float	3.87	35x5	35x5	Wood	¾ Ell.	Own	Stewart	Plain 7	Ball	Ball	Roller	Locomobile 48
Munice	Unit E.	3	Sp. B	Springs	Columbia	¾ Float	4.63	32x4	32x4	Wood	S-E.	Ditweiler	Van Sicklen	Plain 2		Roller	Roller	Lorraine 21-T
Own	Unit E.	3	Sp. B	Tor-T.	Timken	Float	4.45	33x5	33x5	Opt.	S-E.	Own		Plain 5	B.&R.	Roller	Roller	Lincoln
Munice	Unit E.	3	Sp. B	Springs	Peru	Float	4.50	32x3½	32x3½	Wood	S-E.	Jacox	Stewart	Plain 3	Ball	Roller	Roller	Maibohn B
Own	Amid.		Sp. B	Springs	Stanpar	¾ Float	3.92	32x4½	32x4½	Wire	Ell.	Gemmer	Warner	Plain 4	Ball	Roller	Roller	Meteor R&RR
Own	Unit T.	3	Sp. B	Tor-T.	Own	¾ Float	3.75	33x5	33x5	Wire	Trans.	Own	Van Sicklen	Plain 3	B.R.P.	B.&R.	Roller	Marmon 34
Own	Unit E.	3	Bevel	Springs	Own	¾ Float		30x3½	30x3½	Wood	S-E.	Own		Plain 2	Roller	Roller	Ball	Maxwell 25
Brown-Lipe	Amid.	3	Sp. B	Tor-A.	Timken	Float	3.50	33x5	33x5	Opt.	S-E.	Warner	Stewart	Plain 4	Roller	Roller	Roller	McFarlan 1921
Own	Amid.	4	Sp. B	Springs	Own	Float	3.22	32x4½	32x4½	Opt.	S-E.	Gemmer	Stewart	Plain 3	Roller	B.&R.	Roller	Mercer 5
Grant-Lees	Unit E.	3	Sp. B	Springs	Columbia	¾ Float	5.10	32x4	32x4	Opt.	S-E.	Ditweiler	Stewart	Plain 3	B.&P.	B&R.	Roller	Merit B
Brown-Lipe	Unit E.	3	Sp. B	Springs	Timken	¾ Float	4.67	32x4	32x4	Wood	S-E.	Own		Plain 3	Roller	Roller	Roller	Metz Master Six
	Amid.	3		Tor-T.	Own	Float	4.41	33x4	33x4	Wood	Cant.			Plain 3	B.&R.	B.&R.	Roller	Mitchell
Warner	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.66	32x4	32x4	Opt.	S-E.	Warner	Stewart	Plain 4	Ball	Roller	Roller	Moon 6-48-21
Own	Unit E.	3	Sp. B	Springs		Semi-F.	4.50	33x4	33x4	Wood	S-E.	Gemmer	Stewart	Plain 3	P.&R.	Roller	Roller	Nash 681

Splash-Pr—Splash Pressure; **Spur**—Spur Gears; **T**—T-Head; **Ther**—Thermo-Syphon; **Tor-A**—Torsion Arm; **Tor-T**—Torsion Tube; **Trans**—Transverse; **Unit-E**—Unit with Engine; **Unit-T**—Unit with Torque Tube; **Unit-A**—Unit with Axle. **EQUIPMENT—At Kent**—Atwater Kent; **Conn**—Connecticut; **G. & D.**—Gray & Davis; **Hersh-Sp**—Herschell-Spillman; **Leece-N**—Leece-Neville; **Roc-Dues**—Rochester Duesenberg; **S. P. C.**—Saginaw Products Co.; **West-M**—Weston-Mott.

Specifications of American Pass

MAKE AND MODEL	Wheelbase	Number of Cylinders	Bore and Stroke	Piston Displacement	Make of Engine	Cylinder Shape	Camshaft Drive	Water Circulation	LUBRICATION System	LUBRICATION Type of Pump	CARBURETION Make of Carburetor	CARBURETION Fuel Feed	IGNITION System	IGNITION Make	IGNITION Control	ELECTRIC SYSTEM Generator Make	ELECTRIC SYSTEM Voltage	CLUTCH Make	CLUTCH Type
NashFour	112	4	3¼x5	.....	Own	I	Helical	Pump	Circ-Sp	Gear	Schebler	Vacuum	Single	Wagner	Hand	Wagner	6	Borg & Beck	Plate
National.....Sextet B.B.	130	6	3½x5¼	303.1	Own	I	Chain	Pump	Pressure	Gear	Rayfield	Vacuum	Single	Delco	H. & A.	Westinghouse	6	Borg & Beck	Plate
Oakland.....34-C	115	6	2 11/16x4¾	177.0	Own	I	Helical	Pump	Pressure	Gear	Marvel	Vacuum	Single	Remy	Hand	Remy	6	Own	Plate
Oldsmobile.....43-A	115	4	3 11/16x5¼	224.3	Own	I	Helical	Pump	Splash-Pr.	Gear	Zenith	Vacuum	Single	Remy	Hand	Auto-Lite	6	Hoosier	Plate
Overland.....4	100	4	3⅜x4	143.1	Own	L	Helical	Ther.	Splash	....	Tillotson	Gravity	Single	Conn	Hand	Auto-Lite	6	Own	Plate
Packard.....Single Six	116	6	3⅜x4½	241.6	Own	L	Chain	Pump	Pressure	Gear	Own	Vacuum	Single	Delco	Auto	At-Kent	6	Own	Disk
Packard.....Twin Six	136	12	3 x5	424.1	Own	L	Chain	Pump	Pressure	Gear	Own	Pressure	Single	Delco	Auto	Bijur	6	Own	Disk
Paige.....6-42	119	6	3¼x5	248.9	Own	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	At-Kent	H. & A.	G. & D.	6	Borg & Beck	Plate
Paige.....6-66	131	6	3¾x5	331.4	Continental	L	Helical	Pump	Splash-Pr.	Gear	Rayfield	Vacuum	Single	At-Kent	H. & A.	G. & D.	6	Borg & Beck	Plate
Paterson.....650	120	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	Delco	Hand	Delco	6	Borg & Beck	Plate
Peerless	125	8	3¼x5	331.8	Own	L	Helical	Pump	Pressure	Gear	Ball & Ball	Vacuum	Single	At-Kent	H. & A.	Auto-Lite	6	Own	Disk
Piedmont.....4-30	116	4	3½x5	192.4	Lycoming	L	Helical	Ther.	Splash-Pr.	Piston	Ball & Ball	Vacuum	Single	Delco	Hand	Dyneto	6	Borg & Beck	Plate
Piedmont.....6-40	122	6	3¼x4½	224.0	Continental	L	Helical	Pump	Splash-Pr.	Piston	Stromberg	Vacuum	Single	Remy	Hand	Remy	6	Borg & Beck	Plate
Pierce-Arrow	138	6	4 x5½	414.7	Own	T	Helical	Pump	Pressure	Gear	Stromberg	Pressure	Single	Delco	H. & A.	Delco	6	Own	Disk
Pan.....A	108	4	3¼x5	165.9	Own	I	Chain	Ther.	Circ-Sp	Piston	Rayfield	Vacuum	Single	Westinghouse	Hand	Westinghouse	6	Borg & Beck	Plate
Pan American.....E-6-55	121	6	3¼x5	248.9	Hersh-Sp	L	Helical	Pump	Splash-Pr.	Gear	Rayfield	Vacuum	Single	Westinghouse	Hand	Westinghouse	6	Borg & Beck	Plate
Pilot.....6-50	126	6	3¼x5	248.9	Hersh-Sp	L	Helical	Pump	Splash-Pr.	Gear	Tillotson	Vacuum	Single	Conn	Hand	Bijur	6	Borg & Beck	Plate
Porter.....46	142	4	4¾x6¾	478.4	Own	I	Helical	Pump	Pressure	Gear	Zenith	Pressure	Single	Berling	Hand	Westinghouse	12	Own	Plate
Premier.....6-D	126¾	6	3⅜x5½	295.3	Own	I	Helical	Pump	Splash-Pr.	Gear	Johnson	Vacuum	Single	Delco	Hand	Delco	6	Borg & Beck	Plate
Premo Car.....6-40-A	117	6	3⅛x4¼	195.6	Falls	I	Helical	Ther.	Splash-Pr.	....	Zenith	Vacuum	Single	Conn	....	Dyneto	....	Borg & Beck	Plate
Raleigh	122	6	3¼x5	248.9	Hersh-Sp	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Bosch	Hand	Westinghouse	6	Borg & Beck	Plate
Ranger	116	4	3⅜x5	178.9	Own	I	Helical	Ther.	Splash-Pr.	Gear	Zenith	Gravity	Single	Conn	Hand	Bijur	6	Borg & Beck	Plate
Reo.....T-6	120	6	3 3/16x5	239.4	Own	F	Helical	Pump	Circ-Sp	Eccentric	Rayfield	Vacuum	Dual	Northeast	Hand	Northeast	6	Own	Plate
Roamer.....6-54-D	130	6	3½x5¼	303.1	Continental	F	Spur	Pump	Splash-Pr.	Piston	Stromberg	Vacuum	Single	Bosch	Hand	Bijur	6	Borg & Beck	Plate
Rock Falls.....14000	136	6	3¾x5	331.4	Continental	L	Helical	Pump	Splash-Pr.	Gear	Rayfield	Vacuum	Single	Bosch	Hand	Westinghouse	6	Borg & Beck	Plate
R. & V. Knight.....J	127	6	3½x4½	259.8	Own	K	Chain	Ther.	Pressure	Gear	Stromberg	Vacuum	Single	Wagner	Hand	Wagner	6	Borg & Beck	Plate
R. & V. Knight.....R	116	4	3¾x5	220.9	Own	K	Chain	Ther.	Pressure	Gear	Stromberg	Vacuum	Single	Wagner	Hand	Wagner	6	Borg & Beck	Plate
Saxon.....125	112	4	3⅜x5	178.9	Root & Van.	I	Helical	Ther.	Pressure	....	Stromberg	Vacuum	Single	Wagner	H. & A.	Wagner	6	Detlaff	Disk
Sayers Six.....D.P.	118	6	3¼x4½	224.0	Continental	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Delco	Hand	Delco	6	Borg & Beck	Plate
Scripps Booth.....B-39	115	6	2 11/16x4¾	177.0	Northway	F	Helical	Pump	Pressure	Gear	Marvel	Vacuum	Single	....	Hand	Remy	6	....	Cone
Seneca	108	4	3⅛x4½	138.1	Le Roi	L	Helical	Ther.	Splash-Pr.	....	Schebler	Vacuum	Single	Conn	Hand	Allis-Chalm.	6	Borg & Beck	Plate
Skelton.....35	112	4	3½x5	192.4	Lycoming	L	Helical	Ther.	Circ-Sp	Piston	Carter	Vacuum	Single	Conn	Hand	Westinghouse	6	Borg & Beck	Plate
Standard.....I	127	8	3¼x5	331.8	Own	L	Helical	Pump	Pressure	Gear	Zenith	Vacuum	Double	At-Kent	Hand	Westinghouse	6	Borg & Beck	Disk
Stanwood-Six	118	6	3¼x4½	224.0	Cont.	L	Helical	Pump	Pressure	Gear	Stromberg	Vacuum	Single	At-Kent	Hand	Westinghouse	6	Borg & Beck	Plate
Stevens-Duryea.....E	138	6	4 7/16x5½	510.4	Own	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Dual	Berling	Hand	Westinghouse	6	Own	Plate
Stearns-Knight.....SKL-4	125	4	3¾x5⅝	248.5	Own	K	Chain	Pump	Pressure	Gear	Schebler	Vacuum	Single	At Kent	Hand	Westinghouse	12	Own	Disk
Stephens.....90	122	6	3¼x4½	224.0	Own	I	Helical	Ther.	Pressure	Gear	Tillotson	Vacuum	Single	Conn	Hand	Auto-Lite	6	Borg & Beck	Plate
Studebaker.....Big 6	126	6	3⅞x5	353.8	Own	L	Helical	Pump	Splash-Pr.	Gear	Ball & Ball	Vacuum	Single	Wagner	Hand	Wagner	6	Own	Cone
Studebaker.....Spec. 6	119	6	3½x5	288.6	Own	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Wagner	Hand	Wagner	6	Own	Cone
Studebaker.....EJ	112	6	3⅛x4½	207.1	Own	L	Chain	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Single	Wag. & Rem.	Auto	Wag. & Rem.	6	Own	Plate
Stutz.....K & H	130	4	4⅜x6	360.8	Own	T	Helical	Pump	Pressure	Gear	Stromberg	Pressure	Dual	Delco	Hand	Remy	6	Own	Disk
Templar.....445	118	4	3⅜x5½	196.8	Own	I	Chain	Pump	Pressure	Gear	Stromberg	Vacuum	Single	Simms	Hand	Bijur	6	Borg & Beck	Plate
Tulsa	117½	4	3½x5	192.4	Hersh-Sp	L	Helical	Ther.	Splash-Pr.	Gear	Zenith	Vacuum	Single	Conn	Hand	Dyneto	6	Borg & Beck	Plate
Velie.....34	112	6	3⅛x4¼	195.6	Falls	I	Helical	Ther.	Circ-Sp	Gear	Stromberg	Vacuum	Dual	At-Kent	H. & A.	Westinghouse	6	Borg & Beck	Plate
Velie.....48	115	6	3¼x4½	224.0	Continental	L	Helical	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Dual	At-Kent	H. & A.	Bijur	6	Borg & Beck	Plate
Westcott.....C-38	118	6	3¼x4½	224.0	Continental	L	Helical	Pump	Pressure	Gear	Rayfield	Vacuum	Single	Delco	H. & A.	Delco	6	Borg & Beck	Plate
Westcott.....C-48	125	6	3½x5¼	303.1	Continental	L	Helical	Pump	Splash-Pr.	Gear	Rayfield	Vacuum	Single	Delco	H. & A.	Delco	6	Warner Gr.	Plate
Willys-Knight.....20	118	4	3⅝x4½	185.8	Own	....	Chain	Ther.	Circ-Sp	Gear	Tillotson	....	Single	Conn	Hand	Auto-Lite	6	Own	Plate
Winton.....25	132	6	3¾x5¼	347.9	Own	L	Chain	Pump	Pressure	Gear	Stromberg	Vacuum	Single	....	Hand	Bijur	6	....	Disk
Wasp	132	4	4¾x5½	389.9	Wisconsin	T	Spur	Pump	Splash-Pr.	Gear	Stromberg	Vacuum	Dual	Bosch	Hand	Westinghouse	6	M. & E.	Plate

Received Too Late to Insert in Preceding Table

MAKE AND MODEL	Wheelbase	Number of Cylinders	Bore and Stroke	Piston Displacement	Make of Engine	Cylinder Shape	Camshaft Drive	Water Circulation	LUBRICATION System	LUBRICATION Type of Pump	CARBURETION Make of Carburetor	CARBURETION Fuel Feed	IGNITION System	IGNITION Make	IGNITION Control	ELECTRIC SYSTEM Generator Make	ELECTRIC SYSTEM Voltage	CLUTCH Make	CLUTCH Type
Ambassador.....R	136	12	2⅞x5	389.5	....	I	Helical	Pump	....	....	Stromberg	Vacuum	Single	....	....	Westinghouse	....	....	Disk
Leach Power Plus.....Six	128	6	3½x5	288.6	Continental	L	Helical	Pump	Splash-Pr.	Piston	Rayfield	Vacuum	Single	Delco	Hand	Delco	6	Brown-Lipe	Disk
Northway	128	6	3½x5¼	303.1	Own	I	Helical	Pump	Splash-Pr.	....	Special	Vacuum	....	Special	....	Special	....	Brown-Lipe	Disk

ABBREVIATIONS—¾ **Ell**—¾ Elliptic; ¾ **Float**—¾ Floating; **Amid**—Amidships; **Auto**—Automatic; **B & P**—Ball and Plain; **B & R**—Ball and Roller; **B R & P**—Ball, Roller and Plain; **Cant**—Cantilever; **Circ-Spl**—Circulating Splash; **Ell**—Elliptic; **F**—1 Valve in Head, 1 in Side; **Float**—Floating; **Fric**—Friction; **Gear**—Gear Pump; **H & A**—Hand and Automatic; **H**—Valves horizontal in side; **I**—I-Head; **K**—Knight Type; **L**—L-Head; **Opt**—Optional; **Plat**—Platform; **S-E**—Semi-Elliptic; **Semi-F**—Semi-Floating; **Sp. B**—Spiral Bevel;

General Average and Percentage Figures Based on Data in Above Table

General Averages

Horsepower, S.A.E. rating	25.87
Bore	3.43
Stroke	4.93
Stroke bore ratio	1.43
Displacement	293.48
Wheelbase	120.77
Gear Ratio	4.52
Tires	32 x 4
Number Chassis	132
Number makes	117

Engine Starting

Electric Starter	100 per cent
Acetylene Starter	none
Air	none
Optional	none
Mechanical	none
No Starter stock	none

Fuel Feed

Gravity	4.70 per cent
Gravity Pressure	none
Pressure	7.10 per cent
Vacuum	88.20 per cent

Type of Clutch

Disk	92.10 per cent
Cone	7.90 per cent
Expanding band	none
Contracting band clutch	none
Cone	none
Electric	none

Location of Gearset

Amidship	9.50 per cent
Unit with axle	0.95 per cent
Unit with engine	88.00 per cent
Unit with torque tube	1.55 per cent

enger Car Chassis for 1921—Continued

TRANSMISSION — GEARSET — Make	TRANSMISSION — GEARSET — Location	TRANSMISSION — GEARSET — Speeds	TRANSMISSION — Final Drive	TRANSMISSION — Torque Taken By	TRANSMISSION — Make of Rear Axle	TRANSMISSION — Rear Axle Type	Gear Ratio on Direct	RUNNING GEAR — TIRES — Front	RUNNING GEAR — TIRES — Rear	RUNNING GEAR — Wheels	RUNNING GEAR — Rear Springs	Make of Steering Gear	Make of Speedometer	Crankshaft Bearings and No.	BEARINGS — Gear Set	BEARINGS — Rear Axle	BEARINGS — Front Wheel	MAKE AND MODEL
Own	Unit E.	3	Sp. B	Springs	Own	Semi-F.	4.50	32x4	32x4	Wood	S-E.	Gemmer	Stewart	Plain 3	Roller	Roller	Roller	Nash-Four
Brown-Lipe	Unit E.	3	Sp. B	Tor-A	Columbia	Float	4.08	32x4½	32x4½	Wood	S-E.	Warner	Warner	Plain 3	B.&R.	Roller	Roller	National ...... Sextet BB
Muncie	Unit E.	3	Bevel	Springs	West-M	Float	4.50	32x4	32x4	Wood	S-E.	Jacox	Stewart	Plain 3	Ball	B.&R.	Ball	Oakland 34-C
Warner	Unit E.	3	Sp. B	Tor-T	Own	Semi-F.	4.66	32x4	32x4	Wood	S-E.	Jacox	Stewart	Plain 3	Ball	Roller	Ball	Oldsmobile 43-A
Own	Unit E.	3	Sp. B	Springs	Own	¾ Float.	4.50	30x3½	30x3½	Wood	Cant.	Own	Stewart	Plain 3	B.&R.	Ball	Roller	Overland 4
Own	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.30	33x4½	33x4½	Wood	S-E.	Own	Stewart	Plain 7	Ball	Roller	Roller	Packard ...... Single Six
Own	Unit E.	3	Sp. B	Springs	Own	Semi-F.	4.36	35x5	35x5	Wood	S-E.	Own	Waltham	Plain 3	Ball	Ball	Roller	Packard ...... Twin Six
Own	Unit E.	3	Sp. B	Springs	Salisbury	¾ Float.	4.75	32x4	32x4	Wood	S-E.	Jacox	Stewart	Plain 3	B.&R.	B.&R.	Roller	Paige 6-42
Own	Unit E.	3	Sp. B	Springs	Salisbury	¾ Float.	4.55	33x4½	33x4½	Wood	S-E.	Jacox	Stewart	Plain 4	B.&R.	B.&R.	Roller	Paige 6-66
Durston	Unit E.	3	Sp. B	Springs	S-P & Sal.	S-F & F.	4.50	33x4	33x4	......	S-E.	Jacox	Stewart	 4				Paterson 650
Own	Unit E.	3	Sp. B	Springs	Own	¾ Float.	4.90	34x4½	34x4½	Wood	Plat	Gemmer	Van Sicklen	Plain 3	Ball	B.&R.	Roller	Peerless
Grant-Lees	Unit E.	3	Sp. B	Springs	......	Float	4.50	32x3½	32x3½	Wood	S-E.	Ditweiler	Stewart	Plain 3	Roller	Roller	Roller	Piedmont 4-30
Grant-Lees	Unit E.	3	Sp. B	Springs	Spacke	¾ Float.	4.50	32x4	32x4	Wood	S-E.	Lavine	Stewart	Plain 3	Roller	Roller	Roller	Piedmont 6-40
Own	Amid	3	Sp. B	Tor-A	Own	Semi-F.	4.28	35x5	35x5	Wood	S-E.	Own	Waltham	Plain 7	B.&P.	B.&R.	Roller	Pierce-Arrow
Own	Unit E.	3	T-Worm.	Springs	Own	Semi-F.	4.90	33x4	33x4	Wood	S-E.	Gemmer	Stewart	Ball 2	B.&P.	Roller	Roller	Pan ...... A
Detroit	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.90	33x4	33x4	Wood	S-E.	C.A.S.	Stewart	Plain 3	Ball	Roller	Roller	Pan American E-6-55
Muncie	Unit E.	3	Sp. B	Springs	Columbia	¾ Float.	4.50	32x4½	32x4½	Wood	S-E.	Ditweiler	Stewart	Plain 3	Ball	Ball	Roller	Pilot 6-50
Own	Amid	4	Sp. B	Tor-A	Own	Float	3.25	35x5	35x5	Wood	Ell.	Own	Warner	Plain 3	Ball	Ball	Ball	Porter 46
Own	Unit E.	3	Sp. B	Springs	Stanpar	Semi-F.	4.50	33x5	33x5	Wood	S-E.	Own	Stewart	Plain 3	B.&R.	Roller	Roller	Premier 6-D
Muncie	Unit E.	3	......	Springs	Timken	Semi-F.	......	32x3½	32x3½	Wood	S-E.	Ditweiler	Stewart	......				Premocar 6-40-A
Grant-Lees	Unit E.	3	Sp. B	Springs	Spacke	Float	4.90	32x4½	32x4½	Opt.	S-E.	Gemmer	Stewart	Plain 3	Ball	Ball	Roller	Raleigh
Detroit	Unit E.	3	Sp. B	Springs	Columbia	¾ Float.	4.60	32x4	32x4	Wood	S-E.	Jacox	Stewart	Plain 3	Ball	Roller	Roller	Ranger
Own	Amid	3	Sp. B	Springs	Own	Semi-F.	4.66	33x4	33x4	Wood	S-E.	Own	......	Plain 4	Roller	Roller	Roller	Reo T-6
Grant-Lees	Unit E.	3	Sp. B	Springs	......	¾ Float.	3.87	32x4½	32x4½	Wire	Cant.	Jacox	Warner	Plain 3	Roller	Roller	Roller	Roamer 6-54-D
Grant-Lees	Unit E.	3	Sp. B	Springs	Columbia	¾ Float.	4.87	35x5	35x5	Wood	¾ Ell.	Gemmer	Warner	Plain 4	Roller	Roller	Roller	Rock Falls 14000
Brown-Lipe	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.90	32x4½	32x4½	Opt.	S-E.	Jacox	Stewart	Plain	B.&R.	......	Roller	R & V Knight ...... J
Brown-Lipe	Unit E.	3	Sp. B	Springs	Salisbury	Float	4.75	32x4	32x4	Opt.	S-E.	Jacox	Stewart	Plain 3	B.R.P.	Plain	Roller	R & V Knight ...... R
Covert	Unit E.	3	Sp. B	Tor-A	Adams	Semi-F.	4.75	32x4	32x4	Wood	Tr. S-E.	C.A.S.	Stewart	Plain 2	B.&R.	Roller	Roller	Saxon 125
Grant-Lees	Unit E.	3	Sp. B	Springs	Stanpar	Semi-F.	4.75	33x4	33x4	Wood	S-E.	Lavine	Stewart	Plain 4	Ball	Roller	Roller	Sayers Six ...... D.P.
Warner	Unit E.	3	Sp. B	Springs	Central	......	4.87	32x4	32x4	Wood	S-E.	Jacox	Stewart	Plain 3	B.&P	B.&R.	Ball	Scripps-Booth B-39
Warren	Unit E.	3	Sp. B	Tor-A	Peru	Float	4.75	30x3½	30x3½	Wood	Cant.	Ditweiler	Stewart	Plain 2	Ball	Roller	Roller	Seneca
Muncie	Unit E.	3	Sp. B	Springs	Peru	Float	4.25	32x3½	32x3½	Wood	S-E.	C.A.S.	Stewart	Plain 2	Ball	B.&R.	Roller	Skelton 35
Grant-Lees	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.45	34x4½	34x4½	Wood	S-E.	Gemmer	Stewart	Plain 3	Ball	Roller	Roller	Standard ...... T
Grant-Lees	Unit E.	3	......	......	Standpar	¾ Float.	....	33x4	33x4	Wood	¾ Ell.	Gemmer	Stewart	Plain	Roller	Roller	Roller	Stanwood-Six
Own	Unit E.	3	Sp. B	Tor-T	Own	Float	3.94	35x5	35x5	Wood	¾ Ell.	Own	Waltham	Plain 4	B.&P.	Ball	Ball	Stevens-Duryea ...... E
Own	Unit E.	3	Sp. B	Tor-A	Own	Semi-F.	4.50	34x4½	34x4½	Wood	Cant.	Own	......	Plain 3	B.&R.	B.&R.	Roller	Stearns Knight SKL4
Mechanics	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.90	33x4½	33x4½	Wood	S-E.	C.A.S.	Stewart	Plain 3	Ball	Roller	Roller	Stephens 90
Own	Amid	3	Sp. B	Springs	Own	Semi-F.	3.71	33x4½	33x4½	Wood	S-E.	Own	Van Sicklen	Plain 4	Roller	Roller	Roller	Studebaker Big-6
Own	Amid	......	Sp. B	Springs	Own	Semi-F.	4.33	32x4	32x4	Wood	S-E.	Own	Van Sicklen	Plain 4	Roller	Roller	Roller	Studebaker Spec.-6
Own	Amid	3	Sp. B	Springs	Own	Semi-F.	4.55	32x4	32x4	Wood	S-E.	Own	Stewart	Plain 4	Roller	Roller	Roller	Studebaker ...... EJ
Own	Unit A.	3	Sp. B	Tor-A	Own	Semi-F.	3.50	32x4½	32x4½	Wire	S-E.	Gemmer	Stewart	Plain 3	Ball	B.&R.	Roller	Stutz ...... K & H
Detroit	Unit E.	3	Sp. B	Springs	U.S.	Semi-F.	4.40	32x4	32x4	Wood	S-E.	Jacox	Warner	Plain 3	B.&P	B.&R.	Roller	Templar 445
Muncie	Unit E.	3	Sp. B	Springs	Salisbury	Float	4.50	33x4	33x4	Opt.	S-E.	C.A.S.	Stewart	Plain 1	B.&P	B.&R.	Roller	Tulsa
Durston	Unit E.	3	Sp. B	Springs	Columbia	¾ Float.	4.63	33x4	33x4	Wood	S-E.	Gemmer	Stewart	Plain 3	Ball	B.&R.	Roller	Velie 34
Durston	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.60	33x4½	33x4½	Wood	¾ E.	Gemmer	Stewart	Plain 4	B.&P	Roller	Roller	Velie 48
Warner Gr.	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	5.09	33x4	33x4	Wood	S-E.	Gemmer	Van Sicklen	Plain 4	B.&R.	Roller	Roller	Westcott C-38
Warner Gr.	Unit E.	3	Sp. B	Springs	Timken	Semi-F.	4.45	32x4½	32x4½	Wood	S-E.	Gemmer	Van Sicklen	Plain 3	B.&R.	Roller	Roller	Westcott C-48
Own	Unit E.	......	Sp. B	Springs	Own	Semi-F.	5.00	33x4	33x4	Wood	S-E.	Own	Warner	Plain 3	B.&R.	Roller	Roller	Willys Knight 20
......	Unit E.	4	Sp. B	Tor-A	......	Float	4.90	35x5	35x5	Wood	S-E.	......	Warner	Plain 4	B.&R.	Roller	Roller	Winton 25
Dundore	Unit E.	4	Sp. B	Tor-T	Timken	Float	3.70	33x5	33x5	Wire	S-E.	Gemmer	Warner	Plain 4	B.&R.	Roller	Roller	Wasp

Received Too Late to Insert in Preceding Table

......	Unit E.	......	Sp. B	T-A	Timken	Float	4.45	32x4½	32x4½	......	S-E.	......	......	Plain 3	Roller	Roller	Roller	Ambassador ...... R
Brown-Lipe	Unit E.	3	Sp. B	Springs	Timken	¾ Float.	4.50	32x4½	32x4½	Opt.	S-E.	Lavine	Waltham	Plain 3	B.&R.	Roller	Roller	Leach Power Plus ...... Six
Brown-Lipe	Unit E.	3	Sp. B	Springs	......	Float	4.10	33x5	33x5	Wood	S-E.	......	......	Plain 3	......	......	......	Northway

Splash-Pr—Splash Pressure; **Spur**—Spur Gears; **T**—T-Head; **Ther**—Thermo-Syphon; **Tor-A**—Torsion Arm; **Tor-T**—Torsion Tube; **Trans**—Transverse; **Unit-E**—Unit with Engine; **Unit-T**—Unit with Torque Tube; **Unit-A**—Unit with Axle. **EQUIPMENT**—**At Kent**—Atwater Kent; **Conn**—Connecticut; **G. & D.**—Gray & Davis; **Hersh-Sp**—Herschell-Spillman; **Leece-N**—Leece-Neville; **Roc-Dues**—Rochester Duesenberg; **S. P. C.**—Saginaw Products Co.; **West-M**—Weston-Mott.

Final Drive

Straight bevel ....8.40 per cent
Chain ....none
Worm ....1.60 per cent
Spiral bevel ....90.00 per cent

Type of Axle

Floating ....31.40 per cent
Semi-floating ....34.60 per cent
Three-quarter ....34.00 per cent

Timing Gear Drive

Spur gear ....2.50 per cent
Helical or spiral ....77.70 per cent
Silent chain ....19.00 per cent
Worm ....0.80 per cent
Bevel ....none

Number of Cylinders

One ....none
Two ....none
Four ....33.00 per cent
Six ....57.70 per cent
Eight ....8.50 per cent
Twelve ....0.80 per cent

Shape of Cylinder

I-head 26.30
L-head 62.60
T-head 4.00
Knight type 3.10
H-head 0.90
F-head 3.10

Cooling

Air cooled ....0.90 per cent
Thermo-syphon ....31.80 per cent
Pump circulating ....67.30 per cent

Ignition Systems

Single 92.55
Dual ....6.55 per cent
Double ....0.90 per cent
Duplex ....none

Engine Lubrication

Splash ....0.80 per cent
Splash-pressure ....60.00 per cent
Pressure ....39.20 per cent

Growth of Motor Vehicle Production Capacity

Merchandising effort must be directed to supplying a market for production capacity if plant and equipment are to be efficiently utilized. Both passenger car and truck production increased during 1920, while tractor production also went ahead. 750,000 vehicle replacements estimated to be necessary at present time.

IN the present status of the automotive industry, the fact that there were produced in 1920

Passenger cars	1,906,000
Trucks	335,000
Tractors	200,000

is of minor importance. The question confronting the industry to-day is that of equalizing the capacity for production and the capacity for absorption of these vehicles.

The problem of possible absorption is not to be a part of this article. In the registration article which precedes these pages, the present status of ownership is discussed and the development to date is shown by curves. The sales executive can extend these curves according to his own ideas. There are very strong variables to be considered. The wealth and buying disposition of the people are the most important of the unknown factors. No man can determine these factors for his neighbor. We all look to the future through our own glasses. One factor in this variable can be illustrated in this way: In a highly prosperous year, such as 1919, there will be a sharp demand for new cars from owners who believe that their old car is shabby. Every sales executive knows the difference between this urge during the first and second half of 1920. The factor that caused this difference was entirely apart from anything that the automotive industry could control. Call it psychological, or by whatever name you will, it practically destroyed for the time being the replacement market.

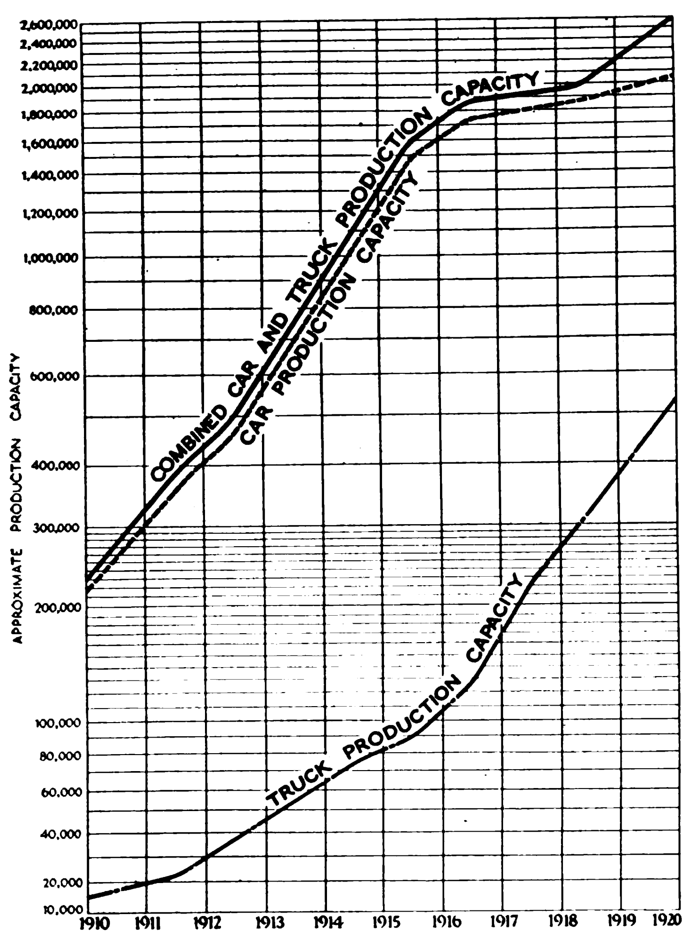


Fig. 1

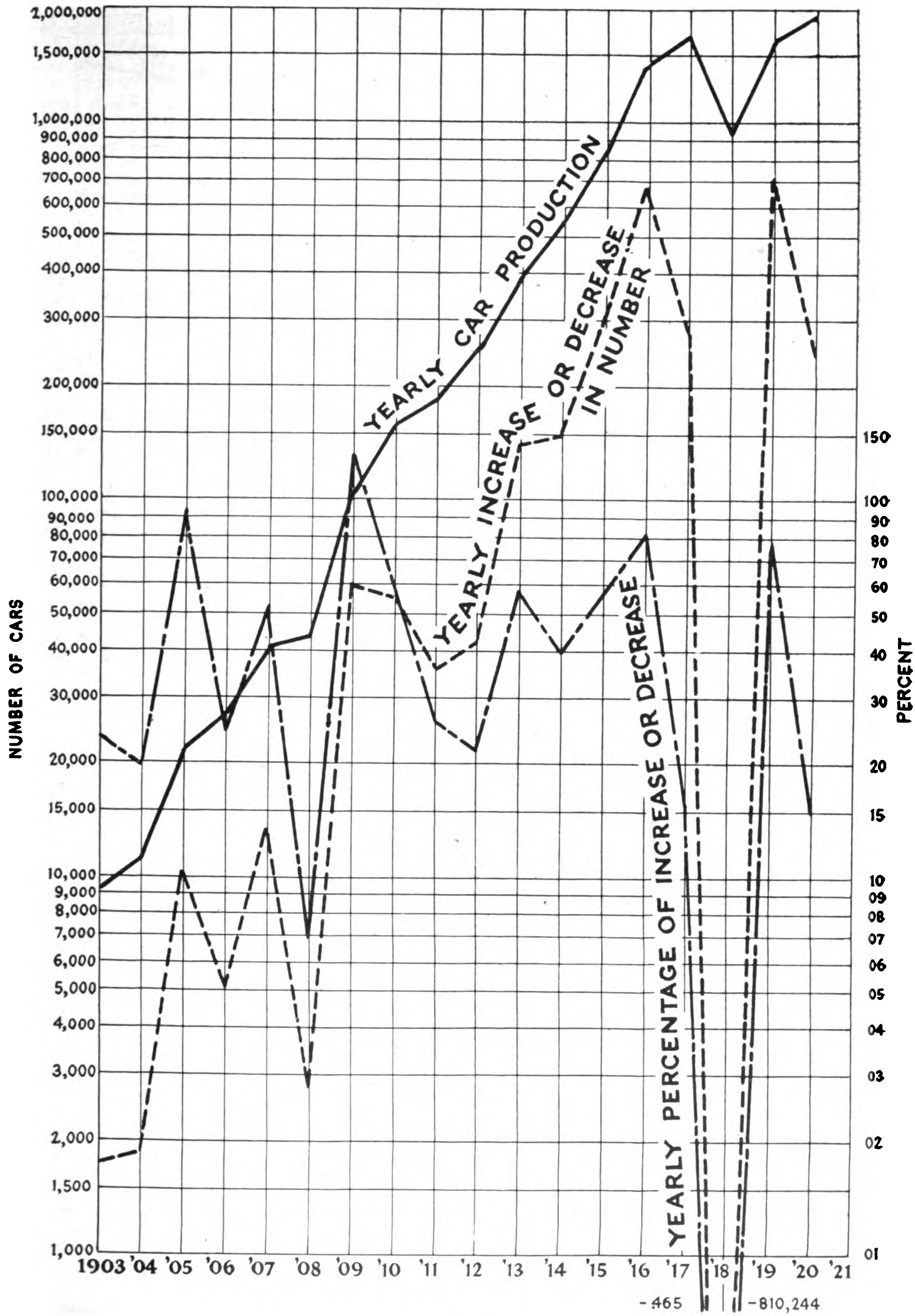
In connection with this article there are printed several charts on production. Some of these are based on actual production. Others are based on production of selected years. In the latter charts the years selected are those during which we have reason to believe that the production was practically at capacity. To make this production capacity curve representative of a growing industry, the year's production has been charted as of July 1, midyear, so that the upward sweep of the chart for the latter half of the year may represent the capacity under construction. The figures for 1920 are based on actual records for the first half of the year, with allowances based on a questionnaire to a large number of manufacturers.

Present Production Problems

When the business slump hit the automotive industry along with the rest about last July, it found a very large number of manufacturers with half-completed projects for expansion and additions. Some of these unfinished projects were so large in particular cases as to contemplate a production capacity increase of 100 per cent or more. Other additions were smaller in scope, but twelve months ago a large majority of automotive manufacturing plants were not only striving for maximum production from their then present facilities, but had actually started building or expansion work of some kind.

Final production figures for 1920 showed a total of 2,241,000 cars and trucks. Production had slumped off very considerably during the last six months of the year. Consequently, it is evident that the production capacity of even the old plants and equipment was well above the actual production figure for that period. When the partly completed additions are taken into consideration as well—additions which were in many instances practically ready to start production—the actual production capacity figure mounts even higher.

The chart shown in Fig. 1 indicates that this potential


2,000,000
1,500,000
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
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150,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
15,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,500
1,000
NUMBER OF CARS
YEARLY CAR PRODUCTION
YEARLY INCREASE OR DECREASE IN NUMBER
YEARLY PERCENTAGE OF INCREASE OR DECREASE
150
100
90
80
70
60
50
40
30
20
15
10
09
08
07
06
05
04
03
02
01
PERCENT
1903 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17 '18 '19 '20 '21
-465
-810,244

Fig. 2

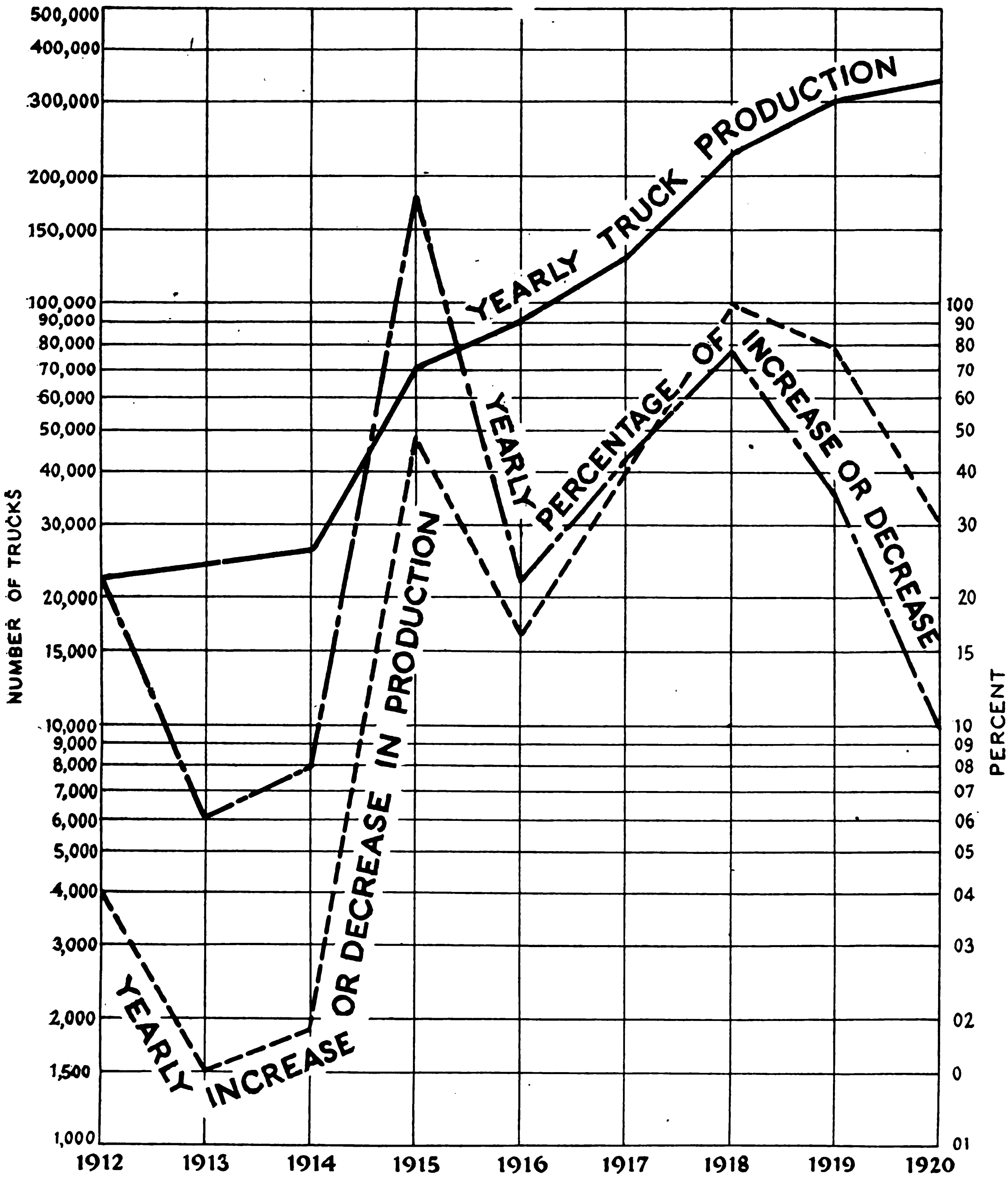


Fig. 3

capacity at the end of 1920 was 2,660,000 cars and trucks, 419,000 more than the number of vehicles actually produced. In other words, to operate their plants at maximum efficiency, the automobile manufacturers will have to provide a market for 419,000 cars and trucks more than were produced during 1920.

To do this during 1921 would be a very large task, but to lay a foundation for the future is both possible and necessary. One fact should be recognized by manufacturers, however, in planning for future production and sales development, namely, that one of two things must take place if every manufacturer is to prosper to the fullest extent.

1—Markets, either domestic or foreign, must be developed to absorb an actual yearly production of this size before any additions to plant capacity are made;

(or) 2—This potential production capacity must be reduced by turning the buildings and equipment to manufacturing other materials or units.

What will actually happen, however, will probably be neither of these things. Instead few manufacturers will probably be able to "prosper to the fullest extent of their production capacity" for some time to come. Each one is likely to prosper more nearly to the extent of his merchandising capacity during 1921.

As individual merchandising effort becomes more effective and potential markets are more fully developed,

however, the status of the industry as a whole will be improved and facilities will be provided for the absorption of the production of its entire capacity.

A study of the registration figures and an analysis of the possibilities of properly organized foreign merchandising point strongly to the fact that the first alternative mentioned can readily be achieved if intelligent and efficient effort is put forth. There are undoubtedly potential markets for more cars each year than would be represented by the production of all the plants working at their full capacity as shown by the highest figure in the production capacity chart. And as the production men struggled during the last few years to meet the demands of the sales department, upon the sales department now rests the fundamental task of meeting the requirements of the production possibilities.

The chart shown in Fig. 2 shows the climb of actual car production since 1903, together with the yearly increase or decrease in number and percentage. The production line itself is marked by a steady climb, unbroken except for the war year 1918. The largest per cent of increase in production was in 1909, while the largest increase in actual numbers occurred in 1919.

Yearly truck production shows an even more steady growth than that of passenger cars, since the war was an impetus rather than a retardation to truck production. Yet the production curves for both cars and trucks show exactly what would be expected in the case of a young, growing industry. This is shown in Figs. 2 and 3. At some future time the production line for both cars and trucks may be expected to become almost horizontal, but there is no indication that this will occur within the next few years.

Truck production showed its greatest percentage of increase during 1915, while the greatest actual increase came in 1918, when the demands of the U. S. Government for trucks were added to those of our allies.

Replacements

In considering future markets and production, the question of replacements inevitably plays an important part. Various difficulties enter into an accurate estimate of replacements, but figures close enough to indicate general trends can be compiled. The following table shows the number of replacements in the United States during the last six years. In obtaining these results exports have been taken into consideration. Replacements during this period were approximately as follows:

Year	Registration	Increase	Built	Exported	U. S.	Scrapped
1914	1,768,000	......	569,000	26,000	543,000	......
1915	2,479,000	708,000	892,000	64,000	828,000	120,000
1916	3,584,000	1,105,000	1,583,000	81,000	1,502,000	397,000
1917	4,992,000	1,408,000	1,868,000	80,000	1,788,000	380,000
1918	6,105,000	1,113,000	1,153,000	47,000	1,106,000	......
1919	7,596,000	1,491,000	1,974,000	82,000	1,892,000	401,000
1920	8,915,000	1,319,000	2,241,000	172,000	2,069,000	750,000

This estimate does not take into consideration the number of cars in the hands of dealers on Jan. 1, the date on which the table is based.

The apparent absence of replacements in 1918 is due probably to a very widespread rejuvenation of old cars during the war and a somewhat decreased production during the same period. It may also be attributed somewhat to the previous uncertain condition of registration figures in one or two States, which consequently showed rather complete registration figures for the first time.

Rise in Value of Product

The chart in Fig. 4 shows the steady rise in the wholesale value of the cars and trucks manufactured since 1910. As would be expected the highest figure is that for 1920, the two billion mark being passed for the first time during last year. This is an increase of about 13.31 per cent over 1919.

Tractor production is not as well defined as is production in other lines in the automotive industry. The record of production available is accurate for the four years, 1916 to 1919. The figures were gathered by Federal Bureau of Public Roads. There are no accurate figures available for 1920. The figures used in the following tabulation for 1920 are from records of parts makers who supply tractor manufacturers. This is the tabulation carried out for 1920:

	1916	1917	1918	1919	1920
Manufactured	29,670	62,742	132,697	164,590	200,000
Sold in the U. S...	27,819	49,504	96,470	136,162	150,000
Sold for export ...	.....	14,854	36,351	19,693	15,000
On hand Dec. 31 ..	.....	15,525	15,401	27,740	60,000

So far as parts makers have heard from their customers, the prospects for 1921 are roughly that about 75 per cent of 1920 production will be turned out during 1921.

The increase of the potential capacity of the tractor industry is difficult to estimate. There is no organization which has this information. Recently a number of tractor manufacturers were asked to estimate the increased capacity of the industry. Most of them replied that they lacked the information necessary to make such an estimate. The sales manager of one of the oldest and largest manufacturing plants in the industry replied that his plant had an increased capacity of 570 per cent over Jan. 1, 1915. His estimate was that the capacity of the industry had been increased ten to fifteen times during the period mentioned.

Another large manufacturer estimated the increased capacity of the industry during this period as 400 per cent.

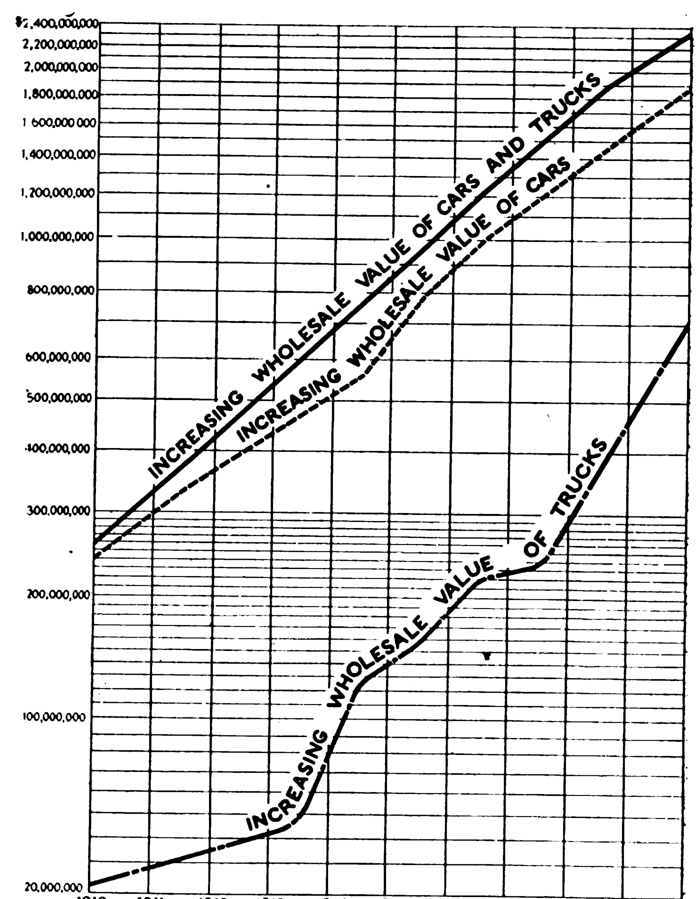


Fig. 4—Increasing wholesale value of cars and trucks plotted by big production years

Automotive Exports from England, France and Italy Increase

Value of complete cars and trucks exported from England in 1920 four times that of 1919 total, while Italy exports two-and-one-half times as much during first half of 1920 as during entire previous year. France also shows big gain, passing the billion francs mark for first time.

THE value of exported automotive products rose during 1920 for England, France and Italy. About four times as many complete cars and trucks were exported from the United Kingdom during 1920 as during 1919. The value of tires and tubes exported during 1920 shows a total of about 150 per cent more than the previous year.

French automotive exports increased in value 971,970,000 francs over the 1919 total, while Italian exports more than doubled in value. The tables presented in this article give all the detailed data available at this time on the exports from these three countries.

French Exports

In 1913, the last year unaffected by war conditions, the French automobile industry exported to the value of about 227 million francs. The following year the volume of business was on an increasing scale until the war clouds burst, but with five months of war the total was less than for the preceding year. During 1919 the volume of business was higher than in 1914, while by 1920 all records had been broken. Figures for only the first eleven months of the year are available, but these show a total of 1096 million francs, and on the assumption that December is equal to the average of the previous eleven months, this gives a total in round figures of 1200 million francs of export business for the year.

These figures give the impression of a most wonderful revival on the part of France, particularly in view of the fact that general depression prevailed for nearly one-half of the past year. In order to completely understand these figures, however, it is necessary to bear in mind the method under which exports are valued by the French authorities. The official figures consider the metric tonnage of automobiles exported, and a value is given to these for statistical purposes. In 1914 the value per metric ton for all classes of passenger cars was 850 francs. By 1915 this had been increased to 1150 francs; in 1916 the value

French Automobile Exports from 1914 to 1920.

Value of Exports in FRANCS.

	1914	1915	1916	1917	1918	1919	1920 (11 Months)
Great Britain	35,106,800	16,734,800	2,445,000	112,300	1,600	11,539,500	252,391,500
Germany	12,290,300	....	....	....	....	465,000	9,469,500
Belgium	14,141,400	....	....	15,600	....	12,234,000	192,214,500
United States	1,726,400	3,459,200	1,864,200	150,200	31,200	2,187,000	14,955,000
Argentina	5,843,700	902,800	815,900	289,600	143,500	733,500	15,078,000
Italy	3,751,600	6,052,100	3,836,300	1,007,800	897,900	4,539,000	22,281,000
Switzerland	3,253,900	505,200	362,600	739,600	487,400	2,791,500	33,666,000
Spain	5,267,000	4,574,400	2,910,700	766,600	396,200	27,025,500	209,595,000
Egypt	587,300	392,900	196,600	32,800	14,000	153,000	5,952,000
Mexico	393,100	13,800	....	....	....	3,000	6,666,000
Brazil	2,230,700	294,400	232,400	48,300	12,500	....	10,177,500
Russia	3,559,800	24,455,800	62,308,000	0,842,700	....	3,255,000	1,527,000
Holland	50,800	1,068,400	53,000	....	....	2,001,000	7,690,500
Portugal	2,093,000	1,108,000	657,200	205,100	218,400	5,170,500	18,718,500
Austria	654,500	....	....	....	....	....	366,000
British India	350,700	1,307,600	17,200	39,900	....	141,000	6,729,000
Denmark	95,500	378,900	199,700	....	....	1,401,000	8,725,500
Chili	1,054,800	471,800	298,000	....	73,300	54,000	1,609,500
Turkey	1,267,200	....	....	....	....	448,900	4,212,000
Uruguay	96,900	62,100	65,600	....	....	606,000	4,393,500
Roumania	395,300	82,800	4,154,100	9,310,100	....	2,637,000	6,766,500
Colombia	270,200	66,000	12,200	....	....	....	660,000
Australia	522,800	136,900	109,200	....	....	....	219,000
Canada	203,400	....	....	....	....	....	255,000
Dutch Indies	....	621,600	....	....	....	....	....
Other Countries	9,664,100	3,295,160	3,664,183	1,263,040	992,290	3,133,100	52,158,000
French Colonies	18,642,950	3,781,380	4,335,870	1,460,100	854,490	43,990,500	210,003,000
Total	123,514,250	69,766,040	88,537,953	36,283,740	4,122,780	124,509,000	1,096,479,000

Exports of Automobiles and Parts from United Kingdom, 1906-1920.

Year	Motorcycles Complete		Parts	Cars and Trucks Complete		Chassis		Parts	Tires and Tubes	Airplanes Airships and Parts
	No.	Value, £	Value, £	No.	Valu, £	No.	Value, £	Value, £	Value, £	Value, £
1906	739	23,077	27,511	1379	495,399	....	323,395 (a)	....	....	....
7	800	27,970	25,252	2318	857,647	....	467,311 (a)	....	....	....
8	1048	37,206	20,148	2216	800,636	225	75,984	381,939 (b)	....	....
9	1884	69,141	36,294	2580	952,431	221	85,356	525,818 (b)	....	....
1910	3341	122,582	37,894	3555	1,376,886	564	213,536	1,015,105 (b)	....	15,486
11	7350	278,856	79,110	4536	1,804,419	735	296,689	1,085,130 (b)	....	18,490
12	13055	528,496	186,378	5277	2,023,715	1180	437,224	1,221,529 (b)	....	21,796
13	16850	733,269	217,330	7595	2,396,369	1234	465,283	788,239	708,924	46,756
14	20877	958,473	280,531	6054	1,972,226	1436	679,696	780,876	515,545	19,677
15	10927	510,374	230,883	3279	1,129,469	483	187,181	560,866	664,998	170,466
16	12847	594,969	258,692	2483	1,197,886	566	268,504	755,069	1,199,066	282,187
17	14159	898,254	204,001	1565	743,527	658	373,487	688,870	1,108,636	660,980
18	5652	363,104	156,138	2893	2,036,635	65	38,756	418,829	1,163,623	539,945
19	8330	575,848	322,140	1515	1,057,991	676	468,105	1,075,078	2,421,906	696,992
1920	21304	1,672,903	667,654	5325	3,929,455	3124	2,474,877	1,986,410	6,500,761	1,918,470

(a) Includes parts. (b) Includes tires and tubes.

Note: Figures during the war period include merchandise exported for Governments of the Allies but not for British Forces.

was 1500 francs, and in 1920 a metric ton of automobiles was considered to be worth 3000 francs.

If the fact is taken into consideration that the value of French automobiles exported to foreign countries is now calculated at about 3.5 times higher than 1914, it is found that the number of cars sent out of the country is really less than before the war. The coefficient adopted by the French Treasury Department is roughly correct, the only objection that could be made against it being that it is rather high for the cheaper grades of cars, for which a coefficient of 2.6 might have been employed.

The figures of French automobile exports during the war, which are here published for the first time, are of considerable interest. Russia headed the list in 1915 with nearly twenty-four and a half million francs worth of vehicles—evidently army trucks. The following year this amount had grown to more than sixty-two million francs; for 1917 it dropped to less than 21 million francs, and in 1918 France sent nothing to Russia. In three years Russia received nearly 108 million francs worth of French automobiles; how much of this she paid for is not known.

The year 1918 was the low water mark of French automobile exports, the total being only slightly more than four million francs. At that time, of course, the French factories were fully occupied with war orders, and Russia having fallen away no war trucks were being sent to that country.

Italian Exports

THE Italian automobile industry reached the high water mark of its export business in 1917, when trucks and touring cars to the value of 114,978,805 liras were sent out of the country. The great bulk of this business consisted of army trucks supplied to France and England, with a small number to the American Forces then in France.

The year 1918, the last of the war, showed a falling off in the volume of export business, the figure being rather more than 45 million liras; this was owing to the fact that the Italian automobile factories were set to work to repair the losses sustained in the Caporetta disaster. The year 1919, the first under peace conditions, showed a wonderful revival with 43.5 million liras worth of exports, both the number and the value of the vehicles being higher than in 1914.

As the last figures available for the Italian industry only cover the first six months of 1920, the effect of the labor troubles during the fall of that year are not yet known. The year began well, and had the second half been as flourishing as the first half, Italy would have reached a record under peace conditions.

Italian Automobile Exports

from 1910 to 1920.

Year	Number of Trucks	Number of Pass. Cars	Value of Trucks Liras	Value of Pass. Cars, Liras
1910	166	2,120	1,873,500	20,806,070
1911	212	2,918	2,236,072	29,127,875
1912	309	3,647	2,929,580	35,786,180
1913	232	3,233	2,305,470	31,875,467
1914	362	3.291	4,037,325	36,634,670
1915	2,286	2,485	35,830,400	27,550,575
1916	5,639	842	74,663,100	9,369,151
1917	8,032	702	103,139,140	11,839,665
1918	1,867	1,071	28,557,500	16,784,900
1919	1,409	1,144	25,659,210	17,917,813
1920 for 6 months	Trucks and Pass. Cars	2,234	52,759,953	

Italy is the European nation having the greatest proportion of export to home business, and at the present time is sending probably 70 per cent of her output abroad. It has been declared that Italian manufacturers are obliged, under Government decree, to export 90 per cent of their production. This is not correct, for although a law to this effect was proposed, it was never put into operation.

Italian exports for the first half of 1920 were:

Italian Automobile Exports

from January 1 to June 30, 1920.

	No.	Value Liras
Automobiles weighing 1102 pounds	15	251,000
From 1102 to 2204 pounds:		
Belgium	85	
France	10	
England	227	
Spain	40	
Switzerland	197	
Australia	48	
Other Countries	189	15,276,749
From 2204 pounds and up:		
Belgium	73	
Denmark	24	
France	47	
England	395	
Norway	28	
Holland	55	
Spain	105	
Switzerland	111	
Turkey	36	
India and Ceylon	45	
Algeria	39	
Egypt	86	
Other Countries	379	37,232,204

Before the war Great Britain was Italy's best individual client, but France, Germany, Austria, Switzerland and the South American States were all big purchasers. No detailed official post-war statistics have been published which would show the changes that have taken place.

Italy, it is estimated, had 50,000 men directly engaged in the automobile industry in 1920, compared with 70,000 at the height of the war, and 10,000 in pre-war days. The productive capacity of the factories has therefore increased five times.

A REPORT made by the Red Sociedad Automovolistica Sevillana, of Seville, Spain, shows that the 1920 automotive registrations for that city alone were 877 passenger cars, 220 trucks and 30 motor buses. The three leading makes of cars were shown as of American manufacture.

Italian Automobile Exports by Countries for 1914 and 1915.

Country	1914				1915			
	Cars Pass.	Value Liras	Trucks	Value Liras	Cars Pass.	Value Liras	Trucks	Value Liras
Albania	1	16,000	...	....	86	1,191,000	....	....
Austria-Hungary	153	1,738,000	4	59,000	7	59,000	15	200,000
Belgium	17	226,500	....	....	71	1,096,000	44	646,400
Bulgaria	9	119,000	....	....	5	60,000	....	....
Denmark	1	10,000	....	....	4	50,000	....	....
France	210	2,341,000	158	1,698,325	374	5,301,500	1515	24,333,500
Germany	389	4,486,000	22	242,000	90	1,034,000	25	237,500
Great Britain	985	9,297,000	68	830,000	684	6,139,425	238	3,044,000
Greece	73	1,061,800	11	127,000	31	341,800	25	400,000
Malta	4	41,000	....	....	....	....	....	....
Montenegro	....	....	2	24,000	....	....	....	....
Norway	16	163,000	....	....	24	223,000	....	....
Holland	41	382,000	16	192,000	21	174,000	....	....
Portugal	22	303,000	3	36,000	8	85,250	72	1,119,000
Roumania	69	978,000	1	7,000	26	393,000	65	975,000
Russia	156	1,831,000	1	10,000	342	4,260,500	178	2,712,000
Serbia	7	127,000	....	....	2	22,000	....	....
Spain	36	948,000	5	56,000	51	464,000	44	661,000
Sweden	10	104,500	....	....	7	64,000	....	....
Switzerland	219	2,704,000	15	200,000	37	338,500	9	38,000
Turkey European	36	385,630	2	16,000	....	....	....	....
China	4	37,000	....	....	....	....	....	....
Philippine	1	10,000	....	....	....	....	....	....
Japan	38	473,000	....	....	8	101,000	....	....
British India and Ceylon	48	670,600	....	....	84	761,000	30	520,000
Dutch Indies	68	713,050	....	....	72	785,500	4	68,000
Siam	5	41,000	....	....	3	36,000	1	18,000
Malacca	15	150,200	....	....	13	134,000	....	....
Turkey Asiatic	1	8,000	....	....	....	....	....	....
Australia	157	1,400,700	3	46,000	194	1,708,750	18	270,000
New Zealand	2	20,000	....	....	....	....	....	....
Spanish Africa	3	35,400	....	....	....	....	....	....
Algeria	2	31,000	....	....	....	....	....	....
Egypt	3	34,000	14	168,000	1	8,000	....	....
Morocco	1	13,000	....	....	2	24,000	....	....
Argentine	131	1,636,400	6	100,000	35	403,000	....	....
Brazil	35	423,490	6	110,000	12	148,000	....	....
Chili	14	193,000	....	....	2	15,000	1	20,000
Colombia	2	14,000	....	....	4	66,000	....	....
Cuba	12	145,000	....	....	7	92,000	....	....
Equator	1	10,000	....	....	....	....	....	....
Mexico	10	263,000	1	22,000	....	....	....	....
Salvador	1	8,000	....	....	1	12,000	....	....
United States	217	2,570,000	....	....	163	1,786,350	....	....
Uruguay	6	81,800	....	....	12	156,000	....	....
Venezuela	2	20,000	....	....	....	....	....	....
Istria	19	118,500	17	69,000	....	....	....	....
Tripoli	39	191,000	7	35,000	1	15,000	....	....
Italian Somaliland	....	....	....	....	1	12,000	2	18,000
Total	3,291	33,465,570	362	4,047,325	2,485	27,560,575	2,286	35,280,400

Design Tendencies in 1921 British Passenger Car Chassis

Light car with 100 cu. in. or smaller engine increasingly popular due to lower tax and upkeep cost. Return to pump circulation predicted. Majority of new makes prefer cone clutch to plate type. Fewer four speed gearsets and transmission brakes. Use of spiral bevel increasing.

By M. W. Bourdon

THE accompanying tabulated specifications of British passenger cars gives clear evidence of the increasing popularity of the light two and four-passenger car with a four-cylinder engine of less than 100 cu. in. capacity. As will be seen, over twenty-five makers are producing these small chassis, and though the majority are made in plants with small outputs, the aggregate production is variously estimated at 500-750 per week. The average weight of the most popular examples is approximately 1400 lb. for the two-seaters and 1700 lb. for the light four-passenger models complete with bodywork. The wheelbase varies from 90 in. to 110 in., while the track varies from 44 to 56 in.

The table does not include cyclecars, of which—with three or four wheels and motorcycle type single or V twin engines, belt, chain or shaft transmission—there is an almost endless number of makes, the majority issuing from small plants, some with an output of but two or three chassis a week. But the table includes such well-known and popular makes as the 12-hp. A.B.C. and the 8-hp. Rover, both of which, despite their horizontally opposed twin-cylinder air-cooled engines, are recognized as light cars by reason of their controls, transmission and chassis being on lines generally adopted in larger types.

These light two or four-seaters are making a forcible appeal to British users by reason of their low cost of upkeep, economy in fuel and the smaller annual tax to which they are subject on the new scale of £1 (say $5) per horsepower, the latter calculated on the formula $\frac{D^2 N}{2.5}$, where dimensions are in inches and D equals diameter of cylinder bore and N the number of cylinders. The fact that stroke is not taken into consideration in the official formula has not led to any marked increase in piston speed, even in recently designed engines.

Stroke-bore ratios have not, in fact, increased in British cars of any size, popular sizes being usually in the neighborhood of 1.7 or 1.8 to 1. The longest stroke among British engines is 160 mm. (6⅛ in.), employed in the Sizaire-Berwick, which has a bore of 95 mm. (3¾ in.). But several makes have a stroke of 150 mm. (5⅞ in.), notably Sunbeam, Star and Vauxhall.

There have been one or two additions since 1919 to the list of "super-grade" chassis, the new Sheffield Simplex and the Leyland being prominent in this respect. The first mentioned is the first passenger car engine to have the Ricardo trunk piston, while the latter is the first British car with eight cylinders in line. Among more reasonably priced cars of recent design the 18-hp. Phœnix is noteworthy, for while it has an overhead camshaft and other features conducive to volumetric and general efficiency it is designed from a production standpoint, and among British chassis is considered in the forefront in this regard.

Dealing with design features generally, there has been a slight increase in the percentage of four-cylinder engines (76 as against 66); this is not due to any maker discarding the six but to an increase in the number making fours. Air cooling has made no headway during the year; in fact, except for cyclecars, it has receded, and no British car larger than the 12-hp. A.B.C. has other than water-cooled cylinders. Nor has there been any increase worthy of mention in the proportionate number of detachable head engines. They comprise 49 per cent of the whole number, 40 per cent of those with loose heads having the cylinder barrels cast as a unit with the upper half of the crankcase. In one or two instances (the H.E. is an example) the detachable head has the valve caps usually associated only with integral heads.

As regards valve arrangement, the L head cylinder predominates to even a greater extent than last year, some 72 per cent of engines being so equipped as compared with 62 per cent twelve months ago. Percentages indicate that valves-in-the-head engine has decreased in favor, for the table shows only 21.5 per cent of engines with overhead valves against 31 per cent last year. But actually, judged by the standard of cars produced, they have increased, for they are embodied in the designs of firms such as Wolseley and Standard, each with outputs exceeding the aggregate of those of a selected dozen or more of the smaller plants making L head engines. In the operation of overhead valves, the overhead camshaft is favored, viz., 57 per cent, as against 43 pushrods. With the latter all makers except one (Dawson) have rockers between cams and valve stems.

The T head engine has disappeared entirely from passenger car engines, but the pair-cast cylinder is still found in 4 per cent of four-cylinder motors, notably in one of the smallest of these, the 10-hp. Singer.

Aluminum pistons have made no headway, though they are found in 26 per cent of engines, the types in this material most generally favored being the Ricardo "slipper" design and the split skirt pattern, with an internal cast iron expansion ring close to the lower edge of the skirt. Both of these have almost an entire freedom from piston slap when cold. Only seven makers fit a scraper ring at the bottom of the skirt, but approximately 40 per cent arrange for the lowest of the compression rings to serve the same purpose, by beveling the lower edge of its slot and drilling small holes through at 45 deg. from bevel to interior with the inner end of the hole lower than the top.

In pre-war designs 90 per cent of wrist pins were fixed in the piston bosses, but at present only 52 per cent are thus secured, for there is a pronounced tendency either to follow American practice and fix the pin in the connecting rod or to allow it to float in both piston and rod. The latter arrangement is the most popular variation from hitherto standard practice, and 28 per cent of engines have floating wrist pins.

Hollow shaft (pressure) lubrication has not gained ground on a percentage basis, but in trough systems it is becoming increasingly prevalent to provide direct leads under pressure from the oil pump to the crankshaft main journals and frequently also to the camshaft bearings. Thus, while 51 per cent of British engines have trough lubrication for the big-ends, fully 50 per cent of these have direct leads to the crankshaft journals or camshaft bearings, if not to both. There is no pronounced tendency when the hollow shaft system is adopted to carry the oil up to the small end of the connecting rod, both this and the cylinder walls depending upon splash. Plunger oil pumps are not particularly favored by British engine designers. Only some 21 per cent have the oil circulated by this means. The twin pinion gear pump is by far the most popular. No attempt has been made by British passenger car makers to adopt a dry sump system of lubrication or to cool the oil by any means other than by longitudinal fins cast at the bottom of the crankcase sump.

In regard to fuel feed, the reason why the gravity system shows an advance in favor as compared with last year (56 per cent as against 48 per cent) is the increase in the number of small cars for which the vacuum system has not been considered necessary or desirable. Complaints have certainly been made against the vacuum feed on account of the occasional derangement of its mehanism, but criticism on this score has not had any effect in decreasing its number of adherents or preventing it from being adopted by makers previously favoring gravity or pressure systems. The desirability of making the vacuum tank larger and capable of being filled direct, so that the fuel can be fed by gravity therefrom when the mechanism fails, has not been seriously considered, and only one maker, namely, Sizaire Berwick, has a vacuum tank of other than normal size. In the case mentioned the tank is cylindrical and horizontal and holds 1½ Imperial gallons.

In water circulation systems there is discernible a slight tendency to return to the pump, but this inclination is only just commencing, and the thermo-syphon system still predominates. Forty-eight per cent of cars have thermo-syphon pure and simple, while 8 per cent are termed "assisted" thermo, having a belt driven water accelerator, usually at the rear end of the fan spindle, the rotor being located within the cylinder water jacket. This assisted thermo system is, however, coming to be recognized as a very poor substitute for the pump arrangement, where the pump is really efficient in serving its purpose and is provided with a direct mechanical drive.

Magneto ignition continues to hold its own, being standard on 94 per cent of makes, 5 per cent of which have a battery system in reserve. Battery systems alone are used on only 6 per cent of cars, and Wolseley, who specifies it, is still fitting magnetos. There are indications, however, that battery ignition will be found in increasing numbers before twelve months are past, if one may judge by hints thrown out by the two or three electrical firms who are standardizing an equipment of this type.

In connection with distribution gearing the silent chain is used in 55 per cent of cases, but in only half the number of these is any adjustment provided.

Turning to transmission details, the single plate or disk clutch is represented on only 27 per cent of cars as compared with 41 per cent last year, but here again this does not infer that it is falling into disfavor among those firms who have adopted it. Rather is it the case that the majority of new makers have preferred to use the cone type. There has been a slight falling off in the number of four-speed gearsets, for while twelve months ago these appeared on 59 per cent of cars, only 50 per cent have them at present.

The increasing use of fabric disks for universal joints is a pronounced tendency of British design. On open propeller shafts 28 per cent have disk joints at both ends, in some cases the flexibility of the disks being considered sufficient to warrant the elimination of a sliding joint to allow for variations in centers with spring deflection.

Metallic universals show improvement in increase of bearing area and lubrication. It is by no means infrequent to find the casings of such joints supplied with oil directly from the gearset or the back axle, while, where hand replenishment is called for, it is now rarely needed on account of better provision for retaining lubricant within the casings. When leather sleeves are used to prevent escape of oil between joint casing and shaft they are far more efficient in their purpose than hitherto.

As was expected, 1920 has shown a considerable accession to the ranks of those makers using spiral bevels for the final drive, and, as compared with only 33 per cent last year, 46 per cent now have spiral bevels in the rear axle; both straight bevels and worm have given way, the latter appearing in 9 per cent fewer cars than at the end of 1919.

Another pronounced tendency occurs in connection with brakes, for whereas before the war it was exceptional to find a British car with both sets applying to rear wheel drums, only 39 per cent now have a transmission brake; but rear wheel brakes, whether there be one set or two, are internally in 90 per cent of cars. The external band brake finds favor in only a few cases, though among these are the Daimler cars. The latter, however, have a transmission brake applied by lever, the band brake on the wheel drums being pedal operated.

In suspension systems the semi-elliptic spring is still predominant, though the quarter elliptic is increasing in favor for cars of all sizes and powers and seems likely to displace both semi-elliptics and cantilevers in popular priced jobs. The wood wheel is fast disappearing, its place being taken by the pressed-steel hollow-spoked variety and the single disk. The latter is standard on 20 per cent of cars as compared with 20 per cent wire spoked and 56 per cent pressed steel. Strangely enough the wire spoked variety is, generally speaking, used on only the cheapest and the most expensive cars. On the former it is, however, merely a laced spoke wheel on cycle lines, whereas for high-class cars the Rudge-Whitworth and Dunlop wheels are favored.

Eighty per cent of British cars have a belt drive for the electric generator, a fact which is by no means to the credit of British designers when one considers the advantages of direct drive and the ease with which it can be arranged.

While two-unit electric systems vastly predominate, the one-unit arrangement shows a slight increase in favor—mostly, however, in connection with engines up to 100 cu. in. in capacity.

Unlike American and Continental cars, only 25 per cent of British make have the unit system of engine and gearset. Four per cent and 3 per cent of gearests are on back axle and torque tube respectively, while 68 per cent are separately mounted. Sixty per cent of the latter are separate units in the main frame; sub-frames are used to carry both engine and gearset in 30 per cent of the remainder, while 10 per cent of separate gearsets have a sub-frame to themselves. Ball bearings are favored more than the roller type for both gearsets and back axles, though of gearset layshafts 70 per cent have plain bushes and the pilot bearing is also plain in an equal number.

British Passenger Car

Compiled for Automotive

Number	Name	Cylinder In.	Detachable Head	Cylinder Shape	Piston M't'r'l	S-Scraper Ring No. of Rings	Piston Pin Fixed in	Engine Lubrication System	Type of Oil Pump	Fuel Feed	Water Circulation	Number	Type of Radiator	Distribution Gear	Adjustment for Chain	Clutch
1	A.B.C.	2-3.6x3.6	Yes	I	C-I	3	Float	Circ	Plunger	Grav	None	1		Gear		Disk
2	A.C.	4-2 3/4x3 15/16	Yes	L	Al	3	Float	Pres	Plunger	Grav	Ther	2	T	Chain	Yes	Disk
3	A.C.	6-2 9/16x3 15/16	Yes	I	Al	3	Float	Pres	Plunger	Grav	Pump	3	T	Chain	Yes	Disk
4	Albert	4-2 11/16x4	Yes	I	C-I	3		Pres		Grav		4	H	Chain		Disk
5	Angus-Sanderson	4-3 x 5	Yes	L	C-I	3	Float	Pres	Plunger	Grav	Ther	5	T	Gear		Cone
6	Argyll	4-3 1/8x5 1/8	Yes	K	C-I	3	Piston	Pres	Plunger	Vac	Pump	6	T	Chain	No	Disk
7	Armstrong-Siddeley	6-3 1/2x5 1/4	No	I	C-I	3	Float	Pres	Gear	Grav	Pump	7	H	Chain	No	Multi
8	Arrol-Johnston	4-3 1/8x4 3/4	No	L	C-I	3	Piston	Pres	Gear	Grav	Ther	8	H	Chain	No	Disk
9	Austin	4-3 3/4x5	Yes	L	Al	3	Piston	Pres	Gear	Vac	Pump	9	H	Chain	Yes	Disk
10	Autocrat	4-2 3/4x4 3/4	Yes	L	CI-	3	Float	Spl	Plunger	Grav	Ther	10	H	Gear		Multi
11	Bean	4-2 3/4x4 3/4	No	L	C-I	2 & S	Float	Pres	Gear	Grav	Ther	11	H	Chain	Yes	Cone
12	Beardmore	4-2 11/16x4 1/2	Yes	I	C-I	3	Piston	Spl	Gear	Grav	Ther	12	J	Gear		Disk
13	Beardmore	4-3 1/8x4 3/4	Yes	L	C-I	3	Piston	Spl	Gear	Grav	Ther	13	T	Chain	No	Cone
14	Beardmore	4-3 1/2x6 5/16	No	L	St	3	Piston	Spl	Gear	Press	Pump	14	T	Gear		Cone
15	Belsize	4-3 1/2x4 5/16	No	L	C-I	3	Piston	Spl	Gear	Grav	Pump	15	H			Cone
16	Bentley	4-3 1/8x5 7/8	No	I	Al	3	Float	Pres	Gear	Vac	Pump	16	H	Gear		Cone
17	Blackburn	4-3 1/2x5	No	L	C-I	3		Pres	Plunger	Vac	Ther	17	H	Chain	No	Cone
18	Briton	4-2 1/2x4 5/16	No	L	C-I	3	Piston	Spl	Vane	Grav	Ther	18	H	Gear		Disk
19	Briton	4-2 11/16x4 3/4	No	L	C-I	3	Piston	Spl	Vane	Grav	Ther	19	H	Gear		Cone
20	Calcott	4-2 3/4x4 5/16	No	L	C-I	3	Float	Spl	Gear	Grav	Ther	20	Hor. T	Chain	Yes	Cone
21	Calthorpe	4-2 9/16x3 3/4	No	L	Al	2	Rod	Spl	Plunger	Grav	Ther	21	T	Chain	No	Disk
22	Clement-Talbot	4-3 1/8x5 1/8	No	L	C-I	4	Piston	Pres	Gear	Press	Pump	22	H	Gear		Cone
23	Clement-Talbot	4-4 x5 1/2	No	L	C-I	4	Piston	Pres	Gear	Press	Pump	23	H	Gear		Cone
24	Cluley	4-2 7/16x4 5/16	No	L	C-I	2	Piston	Pres	Gear	Grav	Ther	24	H	Gear		Cone
25	Crossley	4-3 1/2x5 7/8	Yes	L	C-I	3	Float	Pres	Gear	Vac	Pump	25	T	Chain	Yes	Cone
26	Crossley	4-4 x5 1/2	No	L	C-I	3 & S	Piston	Pres	Gear	Vac	Pump	26	T	Chain	Yes	Cone
27	Charron-Laycock	4-2 9/16x4 5/16	Yes	L	C-I	3		Pres	Gear	Vac	Ther	27	H	Gear		Cone
28	Cubitt	4-3 1/8x5 1/2	Yes	L	C-I	3		Spl		Grav		28				Cone
29	Daimler (light)	6-3 1/2x5 1/8	Yes	K	C-I	3	Rod	Spl	Multi	Press	Pump	29	H	Chain	No	Cone
30	Daimler (long)	6-3 1/2x5 1/8	Yes	K	C-I	3	Rod	Spl	Multi	Press	Pump	30	T	Chain	No	Cone
31	Daimler	6-4 5/16x5 1/8	Yes	K	C-I	3	Rod	Spl	Multi	Press	Pump	31	T	Chain	No	Cone
32	Dawson	4-2 3/4x4 3/4	Yes	I	Al	..		Spl	Gear	Grav	Ther	32	H			Cone
33	Deemster	4-2 7/16x3 1/2	No	L	C-I	2	Piston	Spl	Gear	Grav	Ther	33	T	Gear		Cone
34	Douglas	2-3 5/8x3 5/8	No	L	C-I	2	Piston	Spl	Vane	Grav	Ther	34	H	Chain	No	Cone
35	Duplex	4-2 5/8x4 5/16	No	L	C-I	2	Piston	Spl—	Gear	Grav	Ther	35	H	Chain	Yes	Cone
36	Enfield-Allday	4-2 1/2x4 5/8	No	L	C-I	3	Piston	Pres	Gear	Vac	Ther	36	H	Chain	Yes	Cone
37	Ensign	6-4 x5 1/2	Yes	I	Al	3 & S	Float	Pres	Gear	Pres	Pump	37	H	Worm		Multi
38	Galloway	4-2 9/16x4 5/16	Yes	L	C-I	3	Rod	Pres	Gear	Grav	Pump	38	H	Gear		Cone
39	Guy	8-2 13/16x4 15/16	Yes	L	C-I	2	Float	Pres	Gear	Vac	Pump	39	T	Chain	No	Cone
40	G.W.K.	4-2 5/8x3 15/16	Yes	L	C-I	3	Rod	Spl	Plunger	Grav	Ther	40	T	Gear		None
41	H.E.	4-2 15/16x4 3/4	Yes	L	C-I	3	Rod	Spl	Gear	Vac	Ther	41	H	Chain	Yes	Multi
42	Hillman	4-2 9/16x4 3/4	No	L	Al	3	Piston	Spl	Gear	Grav	Ther	42	H	Gear		Cone
43	Humber	4-2 9/16x4 3/4	Yes	L	C-I	2	Float	Spl	Gear	Grav	Ther	43	H	Chain	No	Cone
44	Humber (long)	4-2 9/16x4 3/4	Yes	L	C-I	2	Float	Spl	Gear	Grav	Ther	44	H	Chain	No	Cone
45	Humber	4-3 1/8x5 1/2	No	L	Al	3	Float	Pres	Gear	Vac	Ther	45	H	Chain	No	Cone
46	Hortsmann	4-2 9/16x3 15/16	Yes	H	C-I	2	Rod	Spl	Plunger	Grav	Ther	46	T	Chain	Yes	Disk
47	Lagonda	4-2 3/4x3 3/4	No	S	Al	2	Piston	Spl	Plunger	Grav	Ther	47	H	Chain	Yes	Cone
48	Lanchester	6-4 x5	No	I	Al	3 & S	Float	Pres	Gear	Vac	Pump	48	H	Gear		Disk
49	Leyland	8-3 1/2x5 1/2	Yes	I	Al	....					Pump	49	H			Disk
50	McKenzie	4-2 5/8x4 5/16	No	L	St	2	Piston	Pres	Gear	Grav	Ther	50	H	Chain	Yes	Cone
51	Meteorlite	4-2 5/8x4 5/16	No	L	C-I	2	Piston	Pres	Gear	Grav	Ther	51	H	Chain	Yes	Cone
52	Morris-Oxford	4-2 3/4x4	Yes	L	C-I	4	Rod	Spl	Plunger	Grav	Ther	52	T	Gear		Disk
53	Morris-Cowley	4-2 3/4x4	Yes	L	C-I	4	Rod	Spl	Plunger	Grav	Ther	53	T	Gear		Disk
54	Morris-Six	6-2 3/4x4	Yes	I	C-I	4	Rod	Spl	Plunger	Grav	Ther	54	T	Gear		Disk
55	Napier	6-4 x5	Yes	I	Al	3 & S	Piston	Pres	Gear	Pres	Pump†	55	H	Gear		Disk
56	Phoenix	4-2 3/4x3 15/16	No	L	C-I	3	Piston	Spl	Gear	Grav	Ther	56	T	Gear		Disk
57	Phoenix	4-3 3/8x5 5/16	Yes	I	C-I	3	Rod	Spl	Gear	Vac	Pump	57	H	Gear		Cone
58	Riley	4-2 5/8x4 5/16	Yes	L	Al	3 & S	Piston	Pres	Gear	Grav	Ther	58	H	Chain	No	Cone
59	Rolls-Royce	6-4 1/2x4 3/4	No	L	Al	6	Piston*	Pres	Plunger	Pres	Pump	59	H	Gear		Cone
60	Rover	2-3 3/8x3 7/16	Yes	L	C-I	2	Rod	C-S	Vane	Grav	None	60	....	Gear		Plate
61	Rover	4-2 15/16x5 1/8	Yes	L	C-I	3	Rod	Spl	Gear	Vac	Pump	61	H	Chain	No	Plate
62	Rubery-Lindsay	3-3 x3 1/2	No	I	C-I	3	Float	Pres	Gear	Grav	None	62	....	Gear		Cone
63	Ruston-Hornsby	4-3 1/8x5 1/8	Yes	L	C-I	2	Piston	Spl	Gear	Grav	Pump	63	H	Gear		Cone
64	Ruston-Hornsby	4-3 1/2x5 1/8	No	L	C-I	2	Piston	Spl	Gear	Grav	Pump	64	H	Gear		Cone
65	Ryner-Wilson	6-2 9/16x4 1/2	Yes	I	Al	..		Spl	Gear	Grav	Ther	65	H	Gear		Cone
66	Sheffield-Simplex	6-4 1/2x5	No	L	Al	4	Float	Pres	Gear	Pres	Pump	66	T	Chain	Yes	Multi
67	Singer	4-2 1/2x3 7/16	No	L	C-I	3	Piston	Spl	Gear	Vac	Ther	67	T	Gear		Cone
68	Sizaire-Berwick	4-3 3/4x6 5/16	No	L	Al	4	Rod	Pres	Gear	Vac	Pump	68	H	Gear		Disk
69	Standard	4-2 11/16x4 5/16	Yes	I	Al	3	Piston	Pres	Gear	Vac	Ther	69	T	Chain	Yes	Disk
70	Star	4-3 1/8x5 7/8	No	L	C-I	2	Piston	Pres	Gear	Vac	Pump	70	H	Chain	No	Disk
71	Star	4-3 3/4x5 7/8	No	L	C-I	3	Piston	Pres	Gear	Vac	Pump	71	H	Chain	No	Disk
72	Straker-Squire	6-3 1/8x5 1/8	No	I	Al	3 & S	Piston	Pres	Gear	Vac	Pump†	72	H	Gear		Disk
73	Sunbeam	4-3 1/8x5 7/8	No	L	C-I	4		Pres	Gear	Vac	Pump	73	H	Chain	No	Cone
74	Sunbeam	6-3 1/8x5 7/8	No	L	C-I	4		Pres	Gear	Vac	Pump	74	H	Chain	No	Cone
75	Swift	4-2 1/2x3 1/2	No	L	C-I	2	Piston	Pres	Gear	Grav	Ther	75	T	Chain	No	Cone
76	Swift	4-2 3/4x5 1/8	No	L	C-I	3	Piston	Pres	Gear	Grav	Ther	76	T	Chain	Yes	Cone
77	Turner	4-2 3/4x4 3/4	No	L	C-I	3	Piston	Spl	Gear	Grav	Ther	77	T	Chain	Yes	Cone
78	Vauxhall	4-3 3/4x5 1/2	No	L	C-I	3	Piston	Pres	Plunger	Pres	Ther	78	H	Chain	Yes	Multi
79	Vauxhall	4-3 7/8x5 7/8	No	L	Al	2	Float	Pres	Plunger	Pres	Ther	79	H	Chain	Yes	Multi
80	Vulcan	4-2 3/4x4 3/4	Yes	L	C-I			Spl		Grav		80		Gear		Disk
81	Vulcan	4-3 1/8x5 1/8	Yes	L	C-I	2	Float	Spl	Gear	Vac	Pump	81	H	Gear		Cone
82	Vulcan	4-3 1/2x5 1/8	No	L	C-I	3	Float	Spl	Gear	Vac	Pump	82	H	Gear		Cone
83	Warren-Lambert	4-2 5/8x3 3/4	No	L	C-I	3	Piston	Spl	Gear	Grav.	Ther	83	H	Gear		Cone
84	Waverly	4-3 x5	Yes	L	Al	2	Rod	Pres	Plunger	Grav	Ther	84	H	Gear		Cone
85	Westwood	4-2 3/4x4 3/4	Yes	I	C-I	3	Piston	Pres	Plunger	Grav	Ther	85	T	Chain	Yes	Cone
86	Wolseley	4-2 9/16x3 3/4	Yes	I	Al	2	Rod	Spl	Gear	Grav	Ther	86	H	Chain	No	Multi
87	Wolseley	4-3 1/8x5 1/8	Yes	I	Al	3	Rod	Spl	Gear	Vac	Pump	87	H	Chain	No	Multi
88	Wolseley	6-3 1/8x5 1/8	No	L	Al	3	Rod	Spl	Gear	Vac	Pump	88	H	Chain	Yes	Multi

ABBREVIATIONS—Battery Ignition, 28, 49, 86, 87. Top half of crank case integral with cylinders, 5, 10, 28, 40, 43, 44, 46, 49, 52, 53, 54, 55, 57, 63, 81, 84, 85, 86. Overhead camshafts, 3, 12, 16, 32, 37, 48, 49, 55, 57, 72, 86, 87. Tappet rods at side of cylinders, 1, 4, 7, 46, 54, 62, 65, 69, 85 cylinders cast in pairs, 17, 67; **Cylinder Shape—L**—L Head; **I**—I Head; **K**—Knight engine; **H**—Horizontal in side valves; **S**—Superimposed valves. **Piston Material—C. I.**—Cast Iron; **Al**—Aluminum; **St**—Steel; †—Cast Iron in skirt.
*Floating box in conn. rod.

Chassis Specifications.

Industries by M. W. Bourdon.

Gearset Mounting	No. of Gears	Gear Lever Position	Propeller Shaft	Propeller Shafts Universal Joints: Front	Propeller Shafts Universal Joints: Back	Final Drive	Rear Axle Ratio — to 1	Pedal Brake: Position	Pedal Brake: Type	Hand Brake: Position	Hand Brake: Type	Springs: Front	Springs: Rear	Weight of Chassis lb.	Wheel-base	Track	Wheels
Amid	4	C	Encl	Disk		Sp. B	4.5	Wh	Ext	Wh	Int	¼-E	¼-E	950	102	47	P-Stl
Unit-A	3	R	Encl	Block		Worm	4.5	Wh	Int	Trans	Disk	¼-E	¼-E	1400	106	46	Disk
Unit-A	3	R	Encl	Block		Worm	4.5	Wh	Int	Trans	Disk	¼-E	¼-E	1600	106	46	Disk
Amid	4	C	Encl	Star		Sp. B	4					Semi	Cant	....	....	....	P-Stl
Unit-E	3	R	Encl	Star		Sp. B	4.2	Wh	Int	Wh	Int	Semi	Cant	1900	120	52	Optl
Unit-E	4	R	Encl	Star		Sp. B	4.3	Wh	Int	Wh	Int	Semi	Cant	2250	120	53	Disk
Unit-S	3	C	Encl	Star†		Worm	3.69	Wh	Int	Wh	Int	Semi	Cant	....	135	56	Disk
Unit-E	4	R	Encl	Star		Sp. B	4	Wh	Int	Wh	Int	Semi	¾	2180	120	56	Disk
Unit-E	4	C	Open	Block	Block	Sp. B	3.93	Wh	Int	Wh	Int	Semi	Semi	2250	129	56	Wood
Amid	3	R	Encl	Star		Sp. B	4.25	Wh	Int	Wh	Int	Semi	Semi	1680	112	48	P-Stl
Amid	3	R	Open	Star	Block	Sp. B	4	Wh	Int	Wh	Int	Semi	Semi	1450	102	49	P-Stl
Unit-E	4	C	Open	Block	Block	Sp. B	4.15	Wh	Int	Wh	Int	Semi	Semi	1230	105	50	P-Stl
Amid	4	R	Open	Disk	Disk	Sp. B	....	Trans	Ext	Wh	Int	Semi	Semi	2020	104	54	Wood†
Amid	4	R	Encl	Block		Sp. B	3.43	Wh	Int	Trans	Ext	Semi	Semi	2460	129	54	Wire
Unit-E	4	R	Open	Disk	Disk	Bev	....					Semi	Semi	....	116	56	P-Stl
Amid	4	R	Open	Star	Block	Bev	3.5	Wh	Int	Wh	Int	Semi	Semi	....	118	56	Wire
Amid	4	R	Encl	Star		Sp. B	3.06	Wh	Int	Wh	Int	Semi	Cant	....	126	56	P-Stl
Unit-E	3	C	Open	Disk	Disk	Worm	4.4	Trans	Ext	Wh	Int	Semi	Semi	....	96	46	P-Stl
Amid	3	C	Open	Disk	Disk	Bev	4.4	Trans	Ext	Wh	Int	Semi	Semi	....	109	53	P-Stl
Amid	3	R	Open	Disk	Disk	Bev	4	Wh	Int	Wh	Int	Semi	Semi	1400	102	45	P-Stl
Amid	3	R	Open	Disk	Disk	Sp. B	4.3	Wh	Int	Trans	Int	Semi	Semi	1000	99	44	Disk
Amid	4	R	Encl	Star		Sp. B	4.3	Wh	Int	Wh	Int	Semi	Semi	2575	121	52	P-Stl
Amid	4	R	Encl	Star		Sp. B	3.6	Wh	Int	Wh	Int	Semi	Semi	3025	133	56	P-Stl
Unit-E	3	C	Open	Block	Disk	Bev	4.3	Wh	Int	Wh	Int	Semi	Semi	1350	96	45	P-Stl
Amid	4	R	Open	Star	Block	Sp. B	3.57	Trans	Ext	Wh	Int	Semi	Semi	2070	124	55	P-Stl
Amid	4	R	Encl	Star		Sp. B	4	Trans	Int	Wh	Int	Semi	¾	....	135	54	Wire
Amid	3	R	Open	Disk	Disk	Sp. B	4.5	Wh	Int	Wh	Int	Semi	Semi	....	98	45	P-Stl
	4	C				Worm	....					Semi	Semi	....	126	54	Disk
Amid	4	R	Open	Star†	Star†	Worm	3.5	Wh	Ext	Trans	Ext	Semi	¾	2900	128	56	Wire
Amid	4	R	Open	Block	Star†	Worm	3.8	Wh	Ext	Trans	Ext	Semi	¾	3100	141	56	Wire
Amid	4	R	Open	Block	Star†	Worm	3.8	Wh	Ext	Trans	Ext	Semi	¾	3400	146	56	Wire
Amid	3	R				Sp. B	4					Semi	Semi	....	105	51	P-Stl
Amid	3	R	Encl	Star		Bev	4.5	Wh	Int	Wh	Ext	Semi	¼	1120	91	46	P-Stl
Unit-E	3	R	Encl	Disk		Bev	4.6	Wh	Ext	Wh	Int	Semi	Coil	....	96	48	Optl
Amid	3	C	Encl	Disk		Sp. B	4.6	Wh	Int	Wh	Int	¼	¼	1240	106	48	Disk
Amid	3	C	Encl	Star		Sp. B	4.75	Wh	Int	Trans	Int	Semi	Cant	1120	108	48	P-Stl
Unit-E	3	R	Semi	Star	Star	Sp. B	3.9	Wh	Int	Wh	Int	Semi	Cant	3360	148	56	P-Stl
Unit-E	3	C	Semi	Disk	Disk	Bev	4.2	Wh	Int	Wh	Int	Semi	¼	....	102	49	D
Amid	4	R	Open	Star	Block	Sp. B	4.06	Wh	Int	Wh	Int	Semi	Semi	2800	130	56	Wire
Amid	†	R	Open	Disk	Disk	Int-P	4.25	Wh	Int	Wh	Int	¼	¼	1130	106	48	Wire
Amid	4	R	Encl	Star		Worm	4.2	Wh	Int	Wh	Int	Semi	¾	1960	114	50	P-Stl
Amid	3	C	Open	Star	Star	Worm	4.2	Wh	Int	Wh	Int	Semi	Semi	1460	108	48	P-Stl
Unit-E	4	R	Open	Disk	Block	Bev	4	Trans	Ext	Wh	Ext	Semi	Semi	1100	98	49	P-Stl
Unit-E	4	R	Open	Disk	Block	Bev	4.3	Trans	Ext	Wh	Ext	Semi	Semi	1230	106	55	P-Stl
Amid	4	R	Open	Disk	Block	Bev	4.3	Trans	Ext	Wh	Ext	Semi	Semi	1750	123	57	P-Stl
Unit-A	3	R	Encl	Disk		Bev	4	Wh	Ext	Wh	Int	Cant	Cant	950	112	48	Disk
Unit-E	3	C	Encl	Star		Worm	4.5	Trans	Ext	Wh	Int	Trans	¼	1250	108	46	P-Stl
Unit-E	3	R	Encl	Star†		Worm	Optl	Trans	Int	Wh	Int	Semi	Cant	3130	140	58	Wire
Amid	4					Bev	....										
Amid	3	R	Open	Disk	Disk	Worm	4.1	Wh	Int	Wh	Int	Semi	Semi	1240	102	48	P-Stl
Amid	3	C	Encl	Star	Block	Bev	4.5	Wh	Int	Wh	Int	Semi	Cant	1200	105	50	P-Stl
Unit-E	3	C	Encl	Star		Sp. B	4.75	Wh	Int	Wh	Int	Semi	¾	1200	102	48	P-Stl
Unit-E	3	C	Encl	Star		Sp. B	4.75	Wh	Int	Wh	Int	Semi	¾	1200	102	48	P-Stl
Unit-E	3	C	Encl	Star		Sp. B	4.75	Wh	Int	Wh	Int	Semi	¾	1300	102	48	P-Stl
Amid	4	C	Encl	Star	Block	Sp. B	3.3	Trans	Ext	Wh	Int	Semi	Cant	2700	138	56	Wire
Amid	3	R	Encl	Star		Worm	4.1					Semi	Semi	1620	96	50	P-Stl
Unit-E	3	C	Encl	Star		Sp. B	4.2	Wh	Int	Wh	Int	Semi	Cant	....	126	56	P-Stl
Amid	4	C	Open	Disk	Disk	Bev	4.3	Wh	Int	Wh	Int	Semi	Semi	1120	108	48	Disk
Amid	4	R	Encl	Star		Bev	3.25	Wh	Int	Wh	Int	Semi	Cant	3000	144	56	Wire
Unit-E	3	C	Open	Disk	Block	Worm	4.8	Wh	Int	Wh	Int	¼	¼	700	88	46	Disk
Amid	3	R	Open	Star	Block	Worm	4.6	Trans	Ext	Wh	Int	Semi	Semi	1680	116	50	P-Stl
Amid	3	R	Encl	Star		Bev	4.5	Wh	Int	Wh	Int	¼	¼	850	100	48	Disk
Unit-A	3	C	Encl	Disk		Sp. B	4.25	Wh	Int	Wh	Int	Semi	¾	2250	117	56	P-Stl
Unit-A	3	C	Encl	Disk		Sp. B	4.25	Wh	Int	Wh	Int	Semi	¾	2350	126	56	Disk
Amid	4	C	Encl	Star		Bev	4.7	Wh	Int	Wh	Int	Semi	Cant	......	123	56	Optl
Unit-S	4	R	Encl	Star		Sp. B	....	Wh	Int	Wh	Int	Semi	Cant	2800	150	56	Wire
Amid	3	R	Encl	Disk		Bev	4.3	Wh	Int	Wh	Int	Semi	Semi	1100	90	42	P-Stl
Amid	4	R	Open	Star†	Star†	Sp. B	4	Wh	Int	Trans	Int	Semi	Semi	....	141	57	Wire
Amid	3	R	Open	Disk	Disk	Worm	3.83	Trans	Ext	Wh	Int	Semi	Semi	1300	108	48	P-Stl
Amid	4	R	Open	Block	Block	Sp. B	3.9	Trans	Ext	Wh	Int	Semi	¾	2300	129	57	P-Stl
Amid	4	R	Open	Block	Block	Sp. B	3.9	Trans	Ext	Wh	Int	Semi	¾	2400	129	57	P-Stl
Amid	4	R	Encl	Star		Sp. B	4.15	Wh	Int	Wh	Int	Semi	Cant	1900	127	56	Wire
Amid	4	R	Open	Star	Block	Sp. B	3.59	Trans	Int	Wh	Int	Semi	Semi	....	124	57	P-Stl
Amid	4	R	Open	Star	Block	Sp. B	3.6	Trans	Int	Wh	Int	Semi	Semi	....	137	57	P-Stl
Amid	3	R	Open	Disk	Block	Bev	4.5	Trans	Ext	Wh	Int	Semi	Semi	1230	90	45	P-Stl
Amid	4	R	Open	Star	Block	Bev	4.26	Trans	Ext	Wh	Int	Semi	Semi	1570	108	48	P-Stl
Amid	4	R	Open	Disk	Disk	Worm	5	Wh	Int	Wh	Int	Semi	Semi	1570	108	51	P-Stl
Amid	4	R	Open	Star	Block	Sp. B	3.6	Trans	Int	Wh	Int	Semi	Semi	2900	130	56	Wire
Amid	4	R	Open	Star	Block	Bev	3	Trans	Int	Wh	Int	Semi	Semi	2650	114	54	Wire
Amid	4	C				Bev	4					Semi	Cant	....	108	48	
Amid	4	R	Open	Star	Block	Worm	4	Trans	Ext	Wh	Int	Semi	Semi	....	123	56	Wood
Amid	4	C	Open	Star	Block	Worm	4	Trans	Ext	Wh	Int	Semi	Semi	....	123	56	Wood
Unit-S	3	R	Encl	Disk		Bev	4.3	Wh	Int	Wh	Int	Semi	¼	950	93	44	Disk
Amid	3	R	Open	Disk	Disk	Sp. B	4.26	Wh	Int	Wh	Int	Semi	Dual-¼	1700	120	50	Disk
Amid	3	R	Open	Disk	Disk	Sp. B	4	Wh	Int	Wh	Int	Semi	Semi	1800	111	49	P-Stl
Unit-A	3	R	Semi	Disk	Block	Worm	5.2	Wh	Int	Wh	Int	¼	¼	1000	99	46	P-Stl
Amid	3	R	Semi	Disk	Block	Worm	4.8	Wh	Int	Wh	Int	¼	¼	1800	118	52	P-Stl
Amid	4	R	Open	Star	Block	Worm	4.6	Trans	Ext	Wh	Int	Semi	Cant	2460	138	54	Wire

Engine Lubrication—Circ—Circulating; Pres—Pressure; Spl—Splash; C-S—Circulating Splash. **Water Circulation**—†—Thermostatic Control. **Type of Radiator**—T—Tube; H—Honeycomb. **Gear Set Mounting**—Amid—Amidships; **Unit A**—Unit with Axle; **Unit E**—Unit with Engine; **Unit S**—Unit with Shaft. **Number of Gears**—†—Friction Disks. **Wheels**—P-Stl—Pressed Steel; *—Demountable Rims.

Non-Ferrous Metal Specifications

(Excerpts from Report of S. A. E. Standard Committee)

WHITE BEARING METALS

Specification No. 10, Babbitt

Composition in percentage:

Tin	90.00 to 92.00
Copper	4.00 to 5.00
Antimony	4.00 to 5.00
Lead, max.	0.35
Iron, max.	0.08
Arsenic, max.	0.10
Bismuth, max.	0.08
Zinc	None
Aluminum	None

This analysis applies to the metal in the ingot form. When finished bearings are purchased a maximum of 0.6 per cent lead is permissible in scraped samples provided a lead-tin solder has been used in bonding the bronze and the babbitt.

General Information

This babbitt is very fluid and may be used for bronze-backed bearings, particularly for thin linings such as are used in aircraft engines. It is also suitable for die castings.

Specification No. 13, Babbitt

Composition in percentage:

Tin	4.50 to 5.50
Antimony	9.25 to 10.75
Copper, max.	0.50
Lead	84.00 to 86.00
Arsenic, max.	0.20
Zinc	None
Aluminum	None

General Information

This is a cheap babbitt and serves successfully where the bearings are large and the service light. It should not be used as a substitute for a babbitt with a high tin content. It is also suitable for die castings.

ALUMINUM ALLOYS

Specification No. 30

Composition in percentage:

Aluminum, min.	90.00
Copper	7.00 to 8.50
Zinc, max.	0.20
Silicon, Iron, Zinc, Manganese and Tin, max.	1.70
Other Impurities.	None

General Information

The tensile strength of test-specimens about ½-in. diameter of this alloy cast in sand and tested without machining off the skin should be about 18,000 to 20,000 lb. per sq. in. and the elongation 1 to 2 per cent in 2 in.

This is a light alloy having a specific gravity of about 2.83 and is used more extensively in the automotive industry than all other light casting alloys combined. A shrinkage of 0.156 (5/32) in. per ft. should be allowed in pattern designs. This alloy is used for crankcases, oil-pans, steering-wheel spiders, differential carriers, transmission cases, camshaft housings, hub-caps and similar parts.

Specification No. 31

Composition in percentage:

Aluminum, min.	81.00
Copper	2.25 to 3.25
Zinc	12.50 to 14.50
Silicon, Iron, Manganese and Tin, max.	1.70
Other Impurities.	None

(*Continued on page* 327)

Specifications of Contin

(Compiled for Automotive Industries

Nationality and Make	Wheelbase (In.)	Track (In.)	No. of Cylinders	Valve Location	Cylinder Head	Bore and Stroke: Mm.	In.	Ratio	Piston Displacement (Cu. In.)	Camshaft Location	H.P. (Nominal)	Water Cooling	Lubricating System
BELGIAN													
Belga	110	49	4	L.	Fix.	65x120	2.56x4.73	1.8	97	C'case.	10	Ther.	Pres.
D'Aoust	106	49	4	L.	Fix.	65x140	2.56x5.52	2.1	113	C'case.	10	Ther.	Pres.
D'Aoust	126	55	4	I.	Det.	89x120	3.50x4.73	1.4	182	Head.	15	Pump.	Pres.
Excelsior	150	56	6	L.	Fix.	85x140	3.35x5.52	1.6	291	C'case.	30	Ther.	Pres.
F. N	135	55	4	L.	Fix.	90x150	3.54x5.91	1.6	231	C'case.	20	Pump.	Pres.
Metallurgique	146	56	4	L.	Fix.	100x160	3.94x6.30	1.6	305	C'case.	26	Pump.	Pres.
Metallurgique	137	56	4	L.	Fix.	90x140	3.54x5.52	1.5	216	C'case.	18	Pump.	Pres.
Metallurgique	126	52	4	L.	Fix.	80x130	3.15x5.12	1.6	160	C'case.	14	Ther.	Pres.
Miesse	126	56	4	I.	Det.	65x140	2.56x5.52	2.1	113	Head.	15	Pump.	Pres.
Miesse	140	56	8	I.	Det.	65x140	2.56x5.52	2.1	113	Head.	30	Pump.	Pres.
Minerva	137	56	4	Sl.	Det.	90x140	3.54x5.52	1.5	216	C'case.	20	Pump.	Pres.
Minerva	145	56	6	Sl.	Det.	90x140	3.54x5.52	1.5	324	C'case.	30	Pump.	Pres.
Nagant	137	55	4	L.	Fix.	80x150	3.15x5.91	1.8	184	C'case.	15	Pump.	Pres.
DUTCH													
Spyker	137	57	6	L.	Det.	95x135	3.74x5.32	1.4	351	C'case.	25	Pump.	Pres.
FRENCH													
Alba	114	49	4	L.	Fix.	65x130	2.56x5.12	2	105	C'case.	9	Ther.	Pres.
Aries	118	56	4	L.	Fix.	80x140	3.15x5.52	1.7	172	C'case.	15	Pump.	Pres.
Beck	105	52	4	I.	Det.	65x113	2.56x4.45	1.7	91	Head.	10	Pump.	Pres.
Bellanger	103	57	4	I.	Fix.	90x125	3.54x4.92	1.3	193	C'case.	17	Pump.	Pres.
Bellanger	147	57	8	I.	Fix.	90x125	3.54x4.92	1.3	386	C'case.	50	Pump.	Pres.
Bellanger	114	56	4	L.	Det.	88x127	3.46x5.00	1.4	188	C'case.	15	Ther.	Circ.
Belleville	133	53	6	L.	Int.	78x140	3.07x5.52	1.8	245	C'case.	16	Pump.	Pres.
Belleville	142	55	6	L.	Int.	88x150	3.46x5.91	1.7	333	C'case.	25	Pump.	Pres.
Belleville	155	56	6	L.	Int.	103x160	4.06x6.30	1.5	488	C'case.	50	Pump.	Pres.
Berliet	123	56	4	L.	Det.	90x130	3.54x5.12	1.4	200	C'case.	16	Pump.	Circ.
Bignan	112	52	4	L.	Fix.	92x130	3.62x5.12	1.4	210	C'case.	18	Pump.	Pres.
Bellee, Leon	125	54	4	L.	Int.	85x130	3.35x5.12	1.5	179	C'case.	15	Ther.	Pres.
Bellee, Leon	128	55	6	L.	Int.	83x110	3.27x4.33	1.3	159	C'case.	18	Ther.	Pres.
Brasier	129	55	4	L.	Int.	85x150	3.35x5.91	1.7	207	C'case.	18	Pump.	Pres.
Brasier	143	56	6	L.	Int.	90x140	3.54x5.52	1.5	325	C'case.	24	Pump.	Pres.
Buchet	92	48	4	L.	Fix.	60x100	2.36x3.94	1.6	68	....	6	Ther.	Pres.
Buchet	105	48	4	L.	Fix.	65x110	2.56x4.33	1.7	89	....	8	Ther.	Pres.
Bugatti	95	44	4	I.	Int.	65x100	2.56x3.94	1.5	81	Head.	6	Pump.	Pres.
Charron	90	41	4	L.	Fix.	58x100	2.28x3.94	1.7	64	C'case.	6	Ther.	Circ.
Charron	134	56	4	L.	Fix.	85x150	3.35x5.91	1.7	208	C'case.	15	Pump.	Circ.
Charron	132	55	4	L.	Det.	82x142	3.23x5.60	1.7	183	C'case.	18	Pump.	Pres.
Chenard-Walcker	112	52	4	L.	Fix.	70x130	2.75x5.12	1.8	120	C'case.	10	Ther.	Pres.
Chenard-Walcker	130	55	4	L.	Fix.	80x150	3.15x5.91	1.8	184	C'case.	15	Ther.	Pres.
Chenard-Walcker	120	55	4	L.	Fix.	75x150	2.95x5.91	2	161	C'case.	12	Ther.	Pres.
Citroen	114	48	4	L.	Det.	65x100	2.56x3.94	1.5	81	C'case.	10	Ther.	Pres.
Clayette	125	56	4	L.	Int.	85x140	3.35x5.52	1.6	193	C'case.	14	Pump.	Pres.
Clayette	138	56	6	L.	Int.	85x140	3.35x5.52	1.6	290	C'case.	18	Pump.	Pres.
Clement-Bayard	95	45	4	L.	Fix.	60x100	2.36x3.94	1.6	68	C'case.	10	Ther.	Pres.
Clement-Bayard	102	55	4	L.	Det.	85x115	3.35x4.53	1.3	160	C'case.	14	Ther.	Pres.
Corre	102	49	4	L.	Fix.	60x110	2.36x4.33	1.8	75	C'case.	10	Ther.	Pres.
Cottin-Desgouttes	133	55	4	L.	Int.	80x160	3.15x6.30	2	196	C'case.	14	Pump.	Pres.
Cottin-Desgouttes	133	55	4	L.	Int.	90x160	3.54x6.30	1.7	247	C'case.	18	Pump.	Pres.
Cottin-Desgouttes	133	55	4	L.	Int.	100x160	3.94x6.30	1.6	305	C'case.	23	Pump.	Pres.
Cottin-Desgouttes	141	55	4	L.	Int.	120x160	4.73x6.30	1.3	440	C'case.	32	Pump.	Pres.
Crespelle	135	55	4	L.	Fix.	80x120	3.15x4.73	1.5	147	C'case.	14	Pump.	Circ.
Dion Bouton	114	48	4	L.	Int.	70x120	2.75x4.73	1.7	111	C'case.	12	Pump.	Pres.
Dion Bouton	133	52	8	L.	Int.	70x120	2.75x4.73	1.7	222	C'case.	20	Pump.	Pres.
Delage	135	56	6	L.	Int.	80x150	3.15x5.91	1.8	276	C'case.	25	Pump.	Pres.
Delage	135	56	6	I.	Int.	80x150	3.15x5.91	1.8	276	C'case.	......	Pump.	Pres.
Delage	135	56	4	L.	Int.	80x150	3.15x5.91	1.8	184	C'case.	16	Pump.	Pres.
Delahaye	126	54	4	L.	Det.	85x130	3.35x5.12	1.5	179	C'case.	18	Pump.	Circ.
Delahaye	137	56	6	L.	Det.	85x120	3.35x4.73	1.5	248	C'case.	22	Pump.	Circ.
Darracq	138	54	8	L.	Det.	75x130	2.95x5.12	1.7	278	C'case.	20	Pump.	Pres.
Darracq	124	51	4	L.	Det.	85x130	3.35x5.12	1.5	179	C'case.	14	Pump.	Pres.
Delaugere	116	56	4	L.	Int.	70x140	2.75x5.52	2	131	C'case.	10	Pump.	Pres.
Delaunay	117	52	4	L.	Int.	85x140	3.35x5.52	1.5	193	C'case.	12	Pump.	Pres.
Delaunay	133	53	4	L.	Int.	100x140	3.94x5.52	1.4	267	C'case.	18	Pump.	Pres.
Deriot Flandrin	94	50	4	L.	Int.	70x130	2.75x5.12	1.8	122	C'case.	12	Pump.	Circ.
Farman	142	56	6	I.	Int.	100x140	3.94x5.52	1.4	401	C'case.	40	Pump.	Pres.
Fonck	122	55	4	I.	Det.	80x130	3.15x5.12	1.6	160	Head.	15	Pump.	Pres.
Fonck	143	55	8	I.	Det.	80x130	3.15x5.12	1.6	318	Head.	30	Pump.	Pres.
Gregoire	118	51	4	I.	Det.	75x130	2.95x5.12	1.7	139	Head.	15	Pump.	Pres.
Gamma	108	51	4	L.	Fix.	65x120	2.56x4.73	1.8	97	C'case.	10	Ther.	Circ.
G. N	95	41	2	L.	Fix.	84x 98	3.31x3.86	1.1	66	C'case.	6	Air.	Splash.
Hispano	145	56	6	I.	Int.	100x140	3.94x5.52	1.4	401	Head.	40	Pump.	Pres.
Hotchkiss	130	56	4	L.	Int.	95x140	3.74x5.52	1.4	242	C'case.	18	Pump.	Pres.
Hurtu	107	49	4	L.	Fix.	75x120	2.95x4.73	1.6	129	C'case.	12	Ther.	Pres.
Hurtu	118	51	4	L.	Fix.	76x130	2.99x5.12	1.7	144	C'case.	14	Ther.	Pres.
La Buire	117	52	4	L.	Fix.	75x150	2.95x5.91	2	161	C'case.	12	Pump.	Pres.
Lorraine-Dietrich	114	56	6	I.	Fix.	75x130	2.95x5.12	1.7	209	C'case.	15	Pump.	Pres.
Lorraine-Dietrich	131	56	6	L.	Fix.	90x160	3.54x6.30	1.7	370	C'case.	30	Pump.	Pres.
Majola	91	40	4	I.	Int.	59x 90	2.32x3.54	1.5	59	Head.	12	Ther.	Pres.
Majola	110	40	4	I.	Int.	65x105	2.56x4.13	1.6	84	Head.	20	Ther.	Pres.
M. J	114	56	4	I.	Int.	66x100	2.60x3.94	1.5	83	C'case.	12	Ther.	Pres.
Mathis	86	42	4	L.	Int.	58x100	2.28x3.94	1.7	64	C'case.	8	Ther.	Circ.
Mathis	94	43	4	L.	Int.	60x100	2.36x3.94	1.6	68	C'case.	10	Ther.	Pres.
Mors	125	54	4	Sl.	Det.	90x130	3.54x5.12	1.4	200	C'case.	15	Pump.	Circ.
Motobloc	128	52	4	L.	Fix.	80x120	3.15x4.73	1.5	147	C'case.	12	Pump.	Pres.
Motobloc	128	52	4	L.	Fix.	80x148	3.15x5.83	1.8	181	C'case.	15	Pump.	Pres.
Panhard	114	56	4	L.	Fix.	72x140	2.83x5.52	1.9	139	C'case.	12	Pump.	Circ.
Panhard	129	56	4	Sl.	Det.	85x140	3.35x5.52	1.6	193	C'case.	16	Pump.	Circ.
Panhard	136	56	4	Sl.	Det.	105x140	4.13x5.52	1.3	296	C'case.	20	Pump.	Circ.
Paquis	100	47	4	L.	Fix.	65x120	2.56x4.73	1.8	97	C'case.	10	Ther.	Circ.
Peugeot	90	36	4	L.	Fix.	50x 85	1.98x3.35	....	39	C'case.	8	Ther.	Pres.
Peugeot	98	47	4	L.	Fix.	66x105	2.60x4.13	1.6	88	C'case.	10	Pump.	Pres.
Peugeot	122	54	4	L.	Fix.	82x130	3.23x5.12	1.5	167	C'case.	14	Pump.	Pres.
Peugeot	144	57	6	Sl.	Fix.	95x140	3.74x5.52	1.4	424	C'case.	25	Pump.	Pres.
Philos	117	49	4	L.	Fix.	65x120	2.56x4.73	1.8	97	C'case.	10	Ther.	Pres.
Pilain	120	52	4	L.	Fix.	65x130	2.56x5.12	2	105	C'case.	10	Ther.	Pres.

ABBREVIATIONS: Valve Location; L. both valves on one side in L, I. valves in head, Sl. sleeve valve. **Lubricating System;** Pres. pressure feed to main and connecting rod bearings. Circ. pump with pressure delivery to main bearings only (shaft not drilled). **Starting and Lighting;** West. Westinghouse. **Clutch;** Disk, multiple disk. Plate, one to three plates. **Gearset Location;** Amid. amidship, Unit, unit mounting with engine. **Position of Levers;** R, right; L, left; C, center. **Final**

ental Passenger Car Chassis
by W. F. Bradley)

Carburetor Make	Fuel Feed	Ignition	Starting and Lighting	Clutch	Speeds	Gearset Location	Position of Levers	Final Drive	Tires (Mm.)	Wheels	Rear Springs	Brake Location
Solex	Grav	Mag	2-Unit	Cone	8	None	R	Bev	815x105	Disk	½-El	R
Zenith	Vac	Mag	2-Unit	Cone	4	Amid	R	Bev	760x 90	Wire	½-El	Tr.-R
Zenith	Vac	2 Mag	2-Unit	Disk	4	Unit	R	Bev	880x120	Wire	½-El	F.-R
2 Claudel	Vac	Mag	West	Cone	4	Amid	C	Sp. Bev	895x135	Wire	Cant	F.-R
Zenith	Pres	Mag	2-Unit	Disk	4	Unit	R	Sp. Bev	895x150	Wood	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Plate	4	Unit	C	Sp. Bev	895x135	Wire	½-El	F.-Tr.-R
Zenith	Vac	Mag	2-Unit	Plate	4	Unit	R	Sp. Bev	880x120	Wire	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Plate	4	Unit	R	Sp. Bev	820x120	Wire	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Disk	3	Unit	C	Sp. Bev	815x105	Wood	½-El	R
Zenith	Vac	Mag	2-Unit	Disk	3	Unit	C	Sp. Bev	895x135	Wood	½-El	F.-Tr.-R
Zenith	Vac	Mag	2-Unit	Disk	4	Amid	R	Sp. Bev	880x120	Wire	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit	Disk	4	Amid	R	Sp. Bev	880x120	Wire	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit	Disk	4	Amid	R	Bev	820x120	Wood	½-El	Tr.-R
Own	Pres	Mag	2-Unit	Disk	4	Unit	R	Sp. Bev	895x135	Wire	½-El	Tr.-R
Zenith	Grav	Mag	2-Unit	Cone	3	Amid	R	Bev	760x 90	Wood	¼-El	F.-R
Zenith	Vac	Mag	2-Unit	Disk	4	Unit	R	Bev	820x120	Disk	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Disk	3	Unit	C	Bev	765x105	Disk	Coil	Tr.-R
Zenith	Pres	Bat	2-Unit	Disk	3	Unit	C	Sp. Bev	810x190	Wood	Cant	F.-Tr.-R
Zenith	Pres	Bat	2-Unit	Disk	3	Unit	C	Sp. Bev	935x135	Steel	Cant	F.-Tr.-R
Jackson	Grav	Bat	2-Unit West	Disk	3	Unit	C	Sp. Bev	820x105	Wood	½-El	R
Own	Vac	Mag	2-Unit	Disk	4	Amid	R	Sp. Bev	880x120	Wire	Plat	Tr.-R
Own	Vac	Mag	2-Unit	Disk	4	Amid	R	Sp. Bev	880x120	Wire	Plat	Tr.-R
Own	Vac	Mag	2-Unit	Disk	4	Amid	R	Sp. Bev	935x135	Wire	Plat	Tr.-R
Own	Vac	Mag	1-Unit	Disk	3	Unit	C	Sp. Bev	820x120	Disk	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit	Plate	4	Unit	R	Sp. Bev	820x120	Wire	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Cone	4	Amid	R	Bev	815x105	Detach	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Cone	4	Amid	R	Bev	880x120	Disk	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Cone	4	Amid	R	Sp. Bev	880x120	Wire	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Cone	4	Amid	R	Sp. Bev	895x135	Wire	½-El	Tr.-R
Solex	Grav	Mag	2-Unit	Cone	4	Amid	R	Bev	710x 90	Disk	½-El	Tr.-R
Solex	Grav	Mag	2-Unit	Cone	4	Amid	R	Bev	760x 90	Disk	½-El	Tr.-R
Zenith	Pres	Mag	None	Disk	4	Amid	R	Bev	710x 90	Wire	¼-El	Tr.-R
Zenith	Grav	Mag	1-Unit	Cone	3	Amid	R	Bev	710x 90	Disk	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Cone	4	Amid	R	Sp. Bev	880x120	Wire	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Cone	4	Unit	R	Sp. Bev	820x120	Wire	Cant	Tr.-R
Solex	Vac	Mag	2-Unit	Cone	4	Amid	R	Int. Gr	760x 90	Disk	½-El	Tr.-R
Solex	Vac	Mag	2-Unit	Cone	4	Amid	R	Int. Gr	880x120	Wire	½-El	Tr.-R
Solex	Vac	Mag	2-Unit	Cone	4	Amid	R	Int. Gr	815x105	Disk	½-El	Tr.-R
Solex	Grav	Mag	2-Unit	Plate	3	Unit	C	Chev	710x 90	Disk	¼-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Cone	4	Amid	R	Bev	820x120	Disk	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Cone	4	Amid	R	Bev	835x135	Disk	½-El	Tr.-R
Solex	Grav	Delco	Delco	Plate	3	Amid	R	Sp. Bev	710x 90	Steel	½-El	Tr.-R
Solex	Grav	Delco	Delco	Plate	3	Unit	C	Sp. Bev	765x105	Steel	Trans	Tr.-R
Zenith	Grav	Mag	Lights only	Cone	4	Amid	R	Bev	710x 90	Disk	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Cone	4	Unit	R	Bev	880x120	Disk	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Cone	4	Unit	R	Bev	880x120	Disk	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Cone	4	Unit	R	Bev	880x120	Wire	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Cone	4	Unit	R	Bev	880x120	Wire	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit	Disk	4	Amid	R	Bev	820x120	Disk	½-El	Tr.-R
Zenith	Grav	Mag	2-Unit Own	Plate	4	Unit	R	Sp. Bev	760x 90	Disk	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit Own	Plate	4	Unit	R	Sp. Bev	880x120	Disk	Cant	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Disk	4	Unit	R	Sp. Bev	895x135	Wire	¾-El	F.-Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Disk	4	Unit	R	Sp. Bev		Wire	¾-El	F.-Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Disk	4	Unit	R	Sp. Bev	880x120	Wire	¾-El	F.-Tr.-R
Claudel	Vac	Mag	2-Unit Dynas	Cone	4	Unit	R	Sp. Bev	820x120	Wood	½-El	R
Claudel	Vac	Mag	2-Unit Dynas	Cone	4	Unit	R	Sp. Bev	880x120	Wood	½-El	R
Smith	Vac	Delco	2-Unit Delco	Plate	4	Unit	C	Sp. Bev	835x135	Disk	Cant	F.-R
Smith	Vac	Mag	2-Unit	Plate	4	Amid	R	Worm	820x120	Cone	Cant	Tr.-R
Zenith	Vac	Mag	1-Unit S.E.V.	Cone	4	Amid	R	Bev	815x105	Disk	½-El	Tr.-R
Own	Vac	Mag	2-Unit	Disk	4	Amid	R	Sp. Bev	815x105	Wire	Plat	Tr.-R
Own	Vac	Mag	2-Unit	Disk	4	Amid	R	Sp. Bev	880x120	Wire	Plat	Tr.-R
Zenith	Vac	Mag	1-Unit	Cone	4	Amid	R	Sp. Bev	765x105	Disk	Cant	Tr.-R
Zenith	Vac	Mag.&Bat.	2-Unit S.E.V.	Cone	4	Amid	C	Sp. Bev	880x120	Disk	Cant	Tr.-R
Cosette	Vac	Mag	2-Unit	Disk	3	Unit	L	Sp. Bev	820x120	Wire	½-El	Tr.-R
Cosette	Vac	2 Mags.	2-Unit	Disk	3	Unit	L	Sp. Bev	895x135	Wire	½-El	F.-Tr.-R
Zenith	Vac	Db. Del.	Delco	Cone	4	Amid	R	Sp. Bev	820x120	Wire	½-El	Tr.-R
Solex	Grav	Delco	Delco	Cone	4	Unit	R	Bevel	760x 90	Disk	½-El	Tr.-R
Zenith	Grav	Mag	Elec. Light	Plate	3		R	Chain	650x 65	Wire	¼-El	R
Own	Pres	Delco	2-Unit Delco	Disk	3	Unit	R	Sp. Bev	895x135	Wire	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit S.E.V.	Disk	4	Amid	R	Sp. Bev	880x120	Wire	Cant	Tr.-R
Solex	Grav	Mag	1-Unit	Cone	4	Amid	R	Bev	760x 90	Wood	½-El	Tr.-R
Solex	Grav	Mag	1-Unit	Cone	4	Amid	R	Bev	810x 90	Wood	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Cone	4	Unit	R	Bev	815x105	Disk	Cant	Tr.-R
Own	Vac	Delco	Delco	Disk	3	Unit	C	Sp. Bev	815x105	Steel	Cant	R
Own	Vac	Del.&Mag.	2-Unit	Disk	4	Amid	R	Sp. Bev	895x135	Wire	¾-El	Tr.-R
Claudel	Grav	Mag	Light only	Cone	3	Amid	R	Bev	710x 90	Disk	½-El	Tr.-R
Claudel	Grav	Mag	Light only	Cone	3	Amid	R	Bev	760x 90	Disk	½-El	Tr.-R
Vici	Vac	Mag	1-Unit	Cone	Fric.		R		760x 90	Disk	¼-El	R
Solex	Grav	Mag	2-Unit	Disk	3	Unit	C	Bev	710x 90	Disk	½-El	R
Solex	Grav	Mag	2-Unit	Disk	3	Unit	C	Bev	760x 90	Disk	½-El	R
Zenith	Vac	Mag	2-Unit	Band	4	Amid	R	Chev	820x120	Disk	½-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Disk	4	Unit	R	Bev	820x120	Disk	¾-El	Tr.-R
Zenith	Vac	Mag	2-Unit	Disk	4	Unit	R	Bev	835x135	Disk	¾-El	Tr.-R
Own	Vac	Mag	2-Unit	Plate	4	Unit	R	Sp. Bev	820x120	Wire	½-El	R
Own	Vac	Mag	2-Unit	Plate	4	Unit	R	Sp. Bev	880x120	Wood	½-El	R
Own	Vac	Mag	2-Unit	Plate	4	Unit	R	Sp. Bev	895x135	Wood	½-El	R
Zenith	Grav	Mag	Light	Cone	4	Amid	R	Bev	760x 90	Disk	½-El	R
Zenith	Grav	Mag	None	Cone	3	Unit	R	Worm	650x 65	Wire	¼-El	R
Zenith	Vac	Mag	2-Unit	Disk	4	Unit	C	Worm	710x 90	Wood	Cant	R
Zenith	Vac	Mag	2-Unit	Disk	4	Unit	R	Sp. Bev	820x120	Wire	Cant	R
2 Zenith	Vac	Mag	2-Unit	Disk	4	Unit	R	Sp. Bev	880x120	Wire	Cant	R
Zenith	Grav	Mag	2-Unit	Disk	3	Amid	R	Bev	760x 90	Disk	½-El	Tr.-R
Cox-Atmos	Grav	Mag	2-Unit	Cone	4	Unit	R	Sp. Bev	765x105	Disk	½-El	F.-R

Drive: Sp. Bev. spiral bevel. **Wheels:** Wood, detachable wood; Steel, spoked steel (Sankey type) Disk, steel disk (Michelin type). **Rear Springs:** El, elliptic; Cant. cantilever; Plat, platform (½ elliptic joined a transverse spring); Trans. transverse (Ford type). **Brake Location:** F. on front wheels; R. on rear wheels; Tr. on transmission.

Non-Ferrous Metal Specifications

(*Continued from page 326*)

General Information

The tensile strength of test-specimens about ½-in. diameter of this alloy cast in sand and tested without machining off the skin should be about 25,000 to 30,000 lb. per sq. in. with an elongation of more than 1 per cent in 2 in.

The specific gravity is about 3.0 and a shrinkage of 0.156 (5/32) in. per ft. should be allowed in pattern designs.

This alloy is used extensively in England for such parts as crankcases, oil-pans, steering-wheel spiders and transmission cases.

Specification No. 32

Composition in percentage:

Aluminum, min.	85.50
Copper	11.00 to 13.50
Zinc, max.	0.20
Silicon, Iron, Zinc, Manganese and Tin, max.	1.70
Other Impurities.	None

General Information

The tensile strength of test-specimens about ½-in. diameter of this alloy cast in sand and tested without machining off the skin should be about 19,000 to 23,000 lb. per sq. in. and the elongation will be practically nothing.

The specific gravity of this alloy is about 2.95 and a shrinkage of 0.156 (5/32) in. per ft. should be allowed in pattern designs. This alloy is used for manifolds, pumps, carbureters, cylinders and other parts which should be free from leaks and where the brittleness of the alloy is not objectionable.

Specification No. 33

Composition in percentage:

Aluminum	88.00 to 92.00
Copper	6.00 to 8.00
Zinc, max.	2.50
Iron, max.	1.50
Silicon, Manganese and Tin, max.	0.75
Other Impurities.	None

General Information

The tensile strength of test-specimens about ½-in. diameter of this alloy cast in sand and tested without machining off the skin should be about 19,000 to 21,000 lb. per sq. in. with an elongation of 1 to 2 per cent in 2 in.

This is a light alloy having a specific gravity of 2.83 to 2.86 and is used extensively in the automotive industry. A shrinkage of 0.156 (5/32) in. per ft. should be allowed in pattern designs.

This alloy is similar to Specification No. 30 and is used for crankcases, oil-pans, steering-wheel spiders, differential carriers, transmission cases, camshaft housings, hub-caps and similar parts.

CAST BRASS ALLOYS

Specification No. 40 (Old No. 27), Red Brass

Composition in percentage:

Copper	83.00 to 86.00
Tin	4.50 to 5.50
Lead	4.50 to 5.50
Zinc	4.50 to 5.50
Iron, max.	0.35
Antimony, max.	0.25
Aluminum	None

General Information

Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	27,000
Yield point, lb. per sq. in.	12,000
Elongation in 2 in. or proportionate gage length, per cent	16

This is a free-cutting brass with good casting and finishing properties.

(*Continued on page 328*)

Non-Ferrous Metal Specifications

(*Continued from page* 327)

Specification No. 43 (Old No. 29), Manganese Bronze

Composition in percentage:

Copper	53.00 to 62.00
Zinc	38.00 to 47.00
Lead, max.	0.15

This metal may be hardened by the addition of small amounts of tin, iron, manganese, aluminum or combination of these metals. The most importance should be placed on the following minima in physical requirements:

Ultimate strength, lb. per sq. in.	60,000
Yield point, lb. per sq. in.	30,000
Elongation in 2 in. or proportionate gage length, per cent	15

General Information

This alloy is intended for use in castings where strength and toughness are required. It is equivalent to the copper-zinc alloys commercially known as Cast Manganese Bronze or its equivalents, such as Cast Tobin Bronze and Cast Naval Bronze.

Specification No. 41 (Old No. 28), Yellow Brass

Composition in percentage:

Copper	62.00 to 65.00
Lead	2.00 to 4.00
Zinc	31.00 to 36.00
Tin, max.	1.00
Iron, max.	0.50
Aluminum	None
Other impurities	.025

General Information

Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	25,000
Yield point, lb. per sq. in.	12,000
Elongation in 2 in. or proportionate gage length, per cent	20

This alloy is intended for use in commercial castings where cheapness and good machining properties are the main considerations.

Specification No. 42, White Nickel Brass

Composition in percentage:

Copper	55.00 to 64.00
Nickel, min.	18.00
Iron, max.	0.35
Aluminum	None
Other Impurities.	0.25
Zinc	Remainder

General Information

Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	30,000
Elongation in 2 in. or proportionate gage length, per cent	20

This brass is intended for use for trimmings or other parts requiring a metallic-white finish. The higher the nickel content, the more permanent will be the color.

Bronze Alloys

Bearings or gears made of bronze alloys should be used only against hardened steel.

Specification No. 62 (Old No. 43), Hard Cast Bronze

Composition in percentage:

Copper	86.00 to 89.00
Tin	9.00 to 11.00
Lead, max.	0.20
Iron, max	0.06
Zinc	1.00 to 3.00

(*Continued on page* 329)

Specifications of Continental

Nationality and Make	Wheelbase (In.)	Track (In.)	No. of Cylinders	Valve Location	Cylinder Head	Bore and Stroke Mm.	Bore and Stroke In.	Bore and Stroke Ratio	Piston Displacement (Cu. In.)	Camshaft Location	H.P. (Nominal)	Water Cooling	Lubricating System
Renault	103	56	4	L	Fix	75x120	2.95x4.73	1.6	129	C'case	10	Ther	Circ
Renault	120	56	4	L	Fix	80x140	3.15x5.52	1.7	172	C'case	12	Ther	Circ
Renault	130	56	4	L	Fix	95x160	3.74x6.30	1.7	330	C'case	18	Ther	Circ
Renault	145	56	6	L	Fix	100x160	3.94x6.30	1.6	460	C'case	40	Ther	Circ
Rochet Schneider	129	53	4	L	Fix	80x130	3.15x5.12	1.6	160	C'case	12	Ther	Pres
Rochet Schneider	133	56	4	L	Fix	95x140	3.74x5.52	1.4	242	C'case	18	Ther	Pres
Rochet Schneider	141	57	6	L	Fix	100x130	3.94x5.12	1.3	374	C'case	30	Pump	Pres
Roland Pilain	111	51	4	L	Fix	70x125	2.75x4.92	1.7	115	C'case	10	Ther	Pres
Roland Pilain	133	54	4	L	Fix	95x140	3.74x5.52	1.4	242	C'case	18	Ther	Pres
Roy	128	53	4	L	Fix	85x130	3.35x5.12	1.5	179	C'case	14	Pump	Pres
S. C. A. P	110	51	4	L	Fix	76x130	2.99x5.12	1.7	144	C'case	14	Ther	Pres
Schneider, Th	125	55	4	L	Det	82.5x140	3.25x5.52	1.7	183	C'case	14	Pump	Pres
Schneider, Th	136	55	6	L	Det	82.5x140	3.25x5.52	1.7	275	C'case	30	Pump	Pres
Secq. Hoyau	114	54	4	L	Fix	60x110	2.36x4.33	1.8	75	C'case	10	Ther	Pres
Sigma	113	45	4	L	Fix	65x120	2.56x4.73	1.8	97	C'case	10	Ther	Circ
Sizaire-Naudin	130	54	4	L	Fix	75x130	2.95x5.12	1.7	139	C'case	12	Ther	Circ
Slim	132	55	4	I	Det	90x150	3.54x5.91	1.6	232	Head	20	Pump	Pres
Suere	94	47	8	L	Det	45x 90	1.77x3.54	2	70	C'case	12	Ther	Pres
Turcat-Mery	129	56	4	L	Fix	80x150	3.15x5.91	1.8	183	C'case	25	Pump	Pres
Unic	106	53	4	L	Fix	65x110	2.56x4.33	1.6	89	C'case	10	Ther	Pres
Unic	125	54	4	L	Fix	80x130	3.15x5.12	1.6	160	C'case	15	Pump	Pres
Vermorel	122	55	4	L	Fix	74x130	2.91x5.12	1.7	135	C'case	12	Ther	Circ
Vinot	117	53	4	L	Fix	80x130	3.15x5.12	1.6	159	C'case	14	Pump	Pres
Voisin	136	56	4	Sl	Det	95x140	3.74x5.52	1.4	242	C'case	18	Pump	Pres
Zebre	99	44	4	L	Fix	55x105	2.16x4.13	1.9	61	C'case	8	Ther	Pres
Zedel	117	48	4	L	Fix	82x130	3.23x5.12	1.5	167	C'case	13	Pump	Pres
ITALIAN													
Ansaldo	108	51	4	I	Det	70x120	2.75x4.73	1.7	111	Head	12	Pump	Pres
Bianchi	111	50	4	L	Fix	70x110	2.75x4.33	1.5	103	C'case	12	Pump	Pres
Bianchi	122	56	4	L	Fix	90x130	3.54x5.12	1.4	200	C'case	18	Pump	Pres
Bianchi	129	56	4	L	Fix	100x140	3.94x5.52	1.4	267	C'case	25	Pump	Pres
Bianchi	129	56	4	I	Fix	130x150	5.12x5.91	1.1	486	C'case	60	Pump	Pres
Chiribiri	102	49	4	L	Fix	65x120	2.56x4.73	1.8	97	C'case	12	Ther	Circ
Diatto	91	39	4	I	Fix	60x 90	2.36x3.54	1.5	62	Head	10	Pump	Pres
Diatto	99	43	4	I	Fix	68x100	2.67x3.94	1.4	88	Head	15	Pump	Pres
Diatto	112	55	4	L	Fix	85x120	3.35x4.73	1.4	165	C'case	25	Pump	Pres
Fiat	104	49	4	L	Det	65x110	2.56x4.33	1.6	89	C'case	10	Pump	Pres
Fiat	120	55	4	L	Det	75x130	2.95x5.12	1.7	139	C'case	15	Pump	Pres
Fiat	134	55	6	L	Det	75x130	2.95x5.12	1.7	210	C'case	20	Pump	Pres
Fast	128	56	4	I	Det	84x135	3.31x5.32	1.6	183	Head	15	Pump	Pres
Itala	120	56	4	L	Fix	80x130	3.15x5.12	1.6	159	C'casc	25	Pump	Pres
Itala	122	56	4	L	Fix	105x150	4.13x5.91	1.4	316	C'case	35	Pump	Pres
Isetta	146	55	8	I	Det	85x130	3.35x5.12	1.5	358	C'case	50	Pump	Pres
Lancia	133	52	4	L	Det	110x130	4.33x5.12	1.1	301	C'case	35	Pump	Pres
S. P. A	118	55	4	L	Fix	85x120	3.35x4.73	1.4	165	C'case	20	Pump	Pres
S. P. A	137	56	6	I	Det	85x130	3.35x4.73	1.5	247	Head	40	Pump	Pres
Scat	......	53	4	L	Fix	75x120	2.95x4.73	1.6	128	C'case	18	Pump	Pres
Scat	......	58	4	L	Fix	100x150	3.94x5.91	1.5	286	C'case	30	Pump	Pres
SPANISH													
Elizalde	130	56	4	I	Det	75x130	2.95x5.12	1.7	139	Head	16	Pump	Pres
Elizalde	140	56	4	I	Det	85x150	3.35x5.91	1.7	208	Head	20	Pump	Pres
SWISS													
Martini	134	56	4	L	Fix	90x150	3.54x5.91	1.6	233	C'case	18	Pump	Pres
Piccard-Pictet	......	56	4	Sl	Det	85x130	3.35x5.12	1.5	180	C'case	16	Pump	Pres
Piccard-Pictet	......	56	8	Sl	Det	85x130	3.35x5.12	1.5	360	C'case	32	Pump	Pres

ABBREVIATIONS: Valve Location; L. both valves on one side in L, I. valves in head, Sl. sleeve valve. **Lubricating System;** Pres. pressure feed to main and connecting rod bearings. Circ. pump with pressure delivery to main bearings only (shaft not drilled). **Starting and Lighting;** West. Westinghouse. **Clutch;** Disk, multiple disk, Plate, one to three plates. **Gearset Location;** Amid-amidship, Unit, unit mounting with engine. **Position of Levers;** R, right; L, left; C, center. **Final**

Automobile Records

Competitive

SPEEDWAY RECORDS REGARDLESS OF CLASS, NON-STOCK

1 mile	0:40.23	De Palma	Mercedes	Des Moines, Iowa	June 24, 1916
2 miles	1:09.57	Louis Chevrolet	Frontenac	Chicago, Ill.	Sept. 3, 1917
3 miles	1:54.81	Resta	Peugot	Des Moines, Iowa	June 24, 1916
4 miles	2:14.22	Louis Chevrolet	Frontenac	Chicago, Ill.	Sept. 3, 1917
5 miles	2:56.35	Resta	Peugot	Omaha, Neb.	July 15, 1916
10 miles	5:20.20	Milton	Duesenberg	Sheepshead Bay, N. Y.	June 14, 1919
15 miles	8:18.90	De Palma	Packard Special	Chicago, Ill.	Sept. 3, 1917
20 miles	10:50.20	De Palma	Packard Special	Chicago, Ill.	July 28, 1918
25 miles	14:12.72	De Palma	Packard Special	Chicago, Ill.	Sept. 3, 1917
50 miles	26:23.40	De Palma	Packard	Sheepshead Bay, N. Y.	June 14, 1919
75 miles	42:40.28	Louis Chevrolet	Frontenac	Chicago, Ill.	Sept. 3, 1917
100 miles	54:17.80	G. Chevrolet	Frontenac	Sheepshead Bay, N. Y.	July 4, 1919
150 miles	1:26:14.90	Mulford	Hudson	Chicago, Ill.	June 16, 1917
200 miles	1:55:11.05	Mulford	Hudson	Chicago, Ill.	June 16, 1917
250 miles	2:23:04.03	Aitken	Peugot	Sheepshead Bay, N. Y.	Sept. 30, 1916
300 miles	2:55:32.23	Anderson	Stutz	Sheepshead Bay, N. Y.	Oct. 9, 1915
350 miles	3:24:42.99	Anderson	Stutz	Sheepshead Bay, N. Y.	Oct. 9, 1915
400 miles	4:04:48.98	Resta	Peugot	Chicago, Ill.	June 26, 1915
450 miles	4:35:05.78	Resta	Peugot	Chicago, Ill.	June 26, 1915
500 miles	5:07:26.00	Resta	Peugot	Chicago, Ill.	June 26, 1915

Passenger Car Chassis—Continued

Carburetor Make	Fuel Feed	Ignition	Starting and Lighting	Clutch	Speeds	Gearset Location	Position of Levers	Final Drive	Tires (Mm.)	Wheels	Rear Springs	Brake Location
Own	Grav.	Mag.	2-Unit S.E.V.	Cone	3	Amid	C.	Sp. Bev.	760x 90	Disk	Trans.	Tr.-R
Own	Grav.	Mag.	2-Unit S.E.V.	Cone	4	Amid	R.	Sp. Bev.	815x105	Wood	½-El.	Tr.-R
Own	Pres.	Mag.	2-Unit S.E.V.	Cone	4	Amid	R.	Sp. Bev.	820x120	Wood	½-El.	Tr.-R
Own	Pres.	Mag.	2-Unit S.E.V.	Cone	4	Amid	R.	Sp. Bev.	920x120	Wood	Cant.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Cone	4	Amid	R.	Sp. Bev.	815x105	Disk	Cant.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Cone	4	Amid	R.	Sp. Bev.	880x120	Disk	Cant.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Cone	4	Amid	R.	Sp. Bev.	880x120	Disk	Cant.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Cone	4	Unit	R.	Bev.	765x105	Disk	½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Cone	4	Unit	R.	Bev.	880x120	Wire	½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Cone	4	Amid	R.	Bev.	815x105	Disk	½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Cone	4	Amid	R.	Bev.	815x105	Disk	½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Plate	4	Unit	R.	Sp. Bev.	875x105	Steel	½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Plate	4	Unit	R.	Sp. Bev.	880x120	Steel	Cant.	Tr.-R
Claudel	Vac.	Mag.	2-Unit	Plate	4	Amid	R.	Sp. Bev.	710x 90	Wire	½-El.	Tr.-R
Zenith	Grav.	Mag.		Cone	4	Unit	R.	Bev.	760x 90	Disk	½-El.	Tr.-R
Zenith	Grav.	Mag.	2-Unit	Cone	4	Amid	R.	Bev.	815x105	Disk	½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Plate	4	Unit	R.	Sp. Bev.	895x135	Disk	½-El.	F.-Tr.-R.
Zenith	Grav.	Delco	Delco	Cone	3	Unit	C.	Bev.	710x 90	Disk	½-El.	Tr.-R
Zenith	Grav.	Mag.	2-Unit	Cone	4	Unit	R.	Sp. Bev.	820x120	Disk	½-El.	Tr.-R
Own	Grav.	Mag.	None	Cone	4	Amid	R.	Sp. Bev.	815x105	Disk	¾-El.	Tr.-R
Own	Vac.	Mag.	S.E.V.	Cone	4	Amid	R.	Sp. Bev.	820x120	Wire	Dbl. Cnt.	Tr.-R
Zenith	Vac.	Mag.	2-Unit S.E.V.	Cone	4	Unit	C.	Bev.	815x105	Steel	Cnt.&¼.	Tr.-R
Zenith	Vac.	Mag.	1-Unit	Cone	4	Amid	R.	Sp. Bev.	820x120	Disk	½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Plate	4	Unit	R.	Sp. Bev.	880x120	Disk	Cant.	R.
Zenith	Grav.	Mag.	2-Unit	Plate	4	Unit	R.	Bev.	710x 90	Wire	Cant.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Disk	4	Amid	R.	Bev.	820x120	Steel	½-El.	Tr.-R
Zenith	Grav.	Mag.	2-Unit	Disk	3	Unit	C.	Sp. Bev.	760x 90	Wood	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Disk	4	Amid	R.	Bev.	765x105	Wire	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Disk	4	Amid	R.	Bev.	820x120	Wire	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Disk	4	Amid	R.	Bev.	880x120	Wire	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Disk	4	Amid	R.	Chain	920x120	Wire	½-El.	Tr.-R
Zenith	Grav.	Mag.	Lights only	Cone	4	Amid	R.	Bev.	710x 90	Disk	½-El.	R.
Zenith	Vac.	Mag.	2-Unit	Disk	4	Unit	R.	Bev.	650x 65	Disk	¼-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Disk	4	Unit	R.	Bev.	710x 90	Disk	¼-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Disk	4	Amid	R.	Sp. Bev.	820x120	Wire	¼-El.	Tr.-R
Own	Grav.	Mag.	2-Unit Fiat	Disk	4	Unit	R.	Sp. Bev.	760x 90	Steel	½-El.	R.
Own	Pres.	Mag.	2-Unit Fiat	Disk	4	Unit	R.	Sp. Bev.	820x120	Steel	½-El.	R.
Own	Pres.	Mag.	2-Unit Fiat	Disk	4	Unit	R.	Sp. Bev.	895x135	Steel	½-El.	R.
Zenith	Vac.	Mag.	2-Unit	Disk	3	Unit	R.	Bev.	820x120	Disk	½-El.	Tr.-R
Own	Pres.	Mag.	2-Unit	Disk	4	Amid	R.	Bev.	820x120		½-El.	Tr.-R
Own	Pres.	Mag.	2-Unit	Disk	4	Amid	R.	Bev.	895x135		½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit	Disk	4	Unit	C.	Sp. Bev.	895x135	Disk	½-El.	F.-Tr.-R.
Zenith	Pres.	Mag.	2-Unit	Disk	4	Amid	R.	Bev.	895x135	Disk	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Disk	4	Unit	R.	Sp. Bev.	820x120	Steel	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Disk	4	Unit	C.	Sp. Bev.	895x135	Steel	½-El.	F.-Tr.-R.
Zenith	Vac.	Mag.	2-Unit West	Plate	4	Amid	R.	Sp. Bev.	765x105	Metal	½-El.	Tr.-R
Zenith	Vac.	Mag.	2-Unit West	Plate	4	Amid	R.	Sp. Bev.	820x120	Metal	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Cone	4	Amid	R.	Bev.	820x120	Disk	Cant.	F.-Tr.-R.
Zenith	Pres.	Mag.	2-Unit	Cone	4	Amid	R.	Bev.	835x135	Wire	Cant.	F.-Tr.-R.
Zenith	Vac.	Mag.	2-Unit	Disk	4	Amid	R.	Bev.	880x120	Wood	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Plate	4	Unit	R.	Sp. Bev.	880x120	Wire	½-El.	Tr.-R
Zenith	Pres.	Mag.	2-Unit	Plate	4	Unit	R.	Sp. Bev.	895x135	Wire	½-El.	F.-Tr.-R.

Drive; Sp. Bev. spiral bevel. **Wheels;** Wood, detachable wood; Steel, spoked steel (Sankey type) Disk, steel disk (Michelin type). **Rear Springs;** El, elliptic; Cant. cantilever; Plat, platform (½ elliptic joined a transverse spring); Trans. transverse (Ford type). **Brake Location;** F. on front wheels; R. on rear wheels; Tr. on transmission.

Non-Competitive Records

STRAIGHTAWAY RECORDS REGARDLESS OF CLASS, NON-STOCK

½ mile	0:11.57	Milton	Duesenberg	Daytona	Apr. 27, 1920
1 kilo	0:14.40	Milton	Duesenberg	Daytona	Apr. 27, 1920
1 mile	0:23.07	Milton	Duesenberg	Daytona	Apr. 27, 1920
2 miles	0:46.24	Milton	Duesenberg	Daytona	Apr. 27, 1920
3 miles	1:12.18	Milton	Duesenberg	Daytona	Apr. 25, 1920
4 miles	1:36.14	Milton	Duesenberg	Daytona	Apr. 25, 1920
5 miles	2:00.04	Milton	Duesenberg	Daytona	Apr. 25, 1920
10 miles	4:09.31	De Palma	Packard Special	Daytona	Feb. 16, 1919
15 miles	6:48.75	De Palma	Packard Special	Daytona	Feb. 17, 1919
20 miles	8:54.20	De Palma	Packard Special	Daytona	Feb. 17, 1919

(Standing Start)

1 mile	0:38.83	De Palma	Packard Special	Daytona	Feb. 17, 1919

SPEEDWAY RECORDS REGARDLESS OF CLASS, NON-STOCK

¼ mile	0:06.91	Rader	Packard Special	Sheepshead Bay, N. Y.	July 28, 1917
½ mile	0:13.94	Rader	Packard Special	Sheepshead Bay, N. Y.	July 28, 1917
1 kilo	0:17.35	Rader	Packard Special	Sheepshead Bay, N. Y.	July 28, 1917
1 mile	0:28.76	Rader	Packard Special	Sheepshead Bay, N. Y.	July 27, 1919
2 miles	0:57.81	Rader	Packard Special	Sheepshead Bay, N. Y.	July 27, 1917
3 miles	1:26.61	Rader	Packard Special	Sheepshead Bay, N. Y.	July 27, 1917
4 miles	1:55.74	Rader	Packard Special	Sheepshead Bay, N. Y.	July 27, 1917
5 miles	2:24.65	Rader	Packard Special	Sheepshead Bay, N. Y.	July 27, 1917
10 miles	4:50.88	Rader	Packard Special	Sheepshead Bay, N. Y.	July 27, 1917

Non-Ferrous Metal Specifications

(*Continued from page* 328)

General Information

Good castings made of this bronze should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	30,000
Yield point, lb. per sq. in.	15,000
Elongation in 2 in. or proportionate gage length, per cent	14

This alloy is suitable wherever a strong general utility bronze is required. It may be used for severe working conditions where heavy pressures obtain, as in gears and bearings.

Specification No. 63, Leaded Gun Metal

Composition in percentage:

Copper	86.00 to 89.00
Tin	9.00 to 11.00
Phosphorus, max.	0.25
Zinc and Other Impurities, max.	0.50
Lead	1.00 to 2.50

General Information

Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	30,000
Yield point, lb. per sq. in.	12,000
Elongation in 2 in. or proportionate gage length, per cent	10

Combining strength with fair machining qualities, this general utility bronze is especially good for bushings subjected to heavy loads and severe working conditions.

Specification No. 65, Phosphor Gear Bronze

Composition in percentage:

Copper	88.00 to 90.00
Tin	10.00 to 12.00
Phosphorus	0.10 to 0.30
Lead, Zinc, and Other Impurities, max.	0.50

General Information

Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	35,000
Yield point, lb. per sq. in.	20,000
Elongation in 2 in. or proportionate gage length, per cent	10

This is a very hard bronze and may be used for gears and worm wheels where the requirements are severe.

Specification No. 66, Bronze Backing for Lined Bearings

Composition in percentage:

Copper	83.00 to 86.00
Tin	4.50 to 6.00
Lead	8.00 to 10.00
Zinc, max.	2.00
Impurities, max.	0.25

General Information

Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	25,000
Yield point, lb. per sq. in.	12,000
Elongation in 2 in. or proportionate gage length, per cent	10

This composition is recommended as an inexpensive but suitable alloy for bronze-backed bearings.

(*Continued on page* 384)

Exports of Passenger Automobiles for

	1907	1910	1912	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918	Calendar Year 1919	1920	Totals for All Years Inc. 1908, 1909, 1911
Europe:													
	8	25	100	134	314	4	......	......	......	......	12	13	672
Austria	$16,611	$26,178	$78,748	$91,781	$190,199	$2,310	......	......	......	......	$15,000	$7,927	$466,861
	......	2	13	16	20	18	6	1	......	......	25	12	54
Azores and Madeira Islands	......	$2,006	$7,886	$10,549	$10,771	$10,119	$2,272	$700	......	......	$12,078	$11,519	$69,145
	35	58	122	94	244	12	......	......	......	......	1,628	2,450	4,804
Belgium	$58,859	$147,375	$140,585	$85,679	$139,681	$15,191	......	......	......	......	$1,784,133	$2,888,057	$5,584,429
	......	2	28	17	43	......	......	......	......	......	1	17	117
Bulgaria	......	$1,890	$19,716	$11,457	$21,679	......	......	......	......	......	$3,220	$21,105	$82,377
	40	46	51	81	263	219	806	1,215	2	96	2,519	1,099	6,549
Denmark	$30,464	$46,024	$41,976	$77,149	$176,947	$156,296	$548,971	$932,768	$4,100	$155,416	$2,961,948	$1,349,134	$6,560,226
	......	......	24	51	106	17	......	......	......	......	187	82	471
Finland	......	......	$26,203	$53,568	$83,835	$9,163	......	......	......	......	$254,378	$123,859	$563,955
	111	246	574	818	1,427	451	2,087	1,367	1,169	495	866	582	10,895
France	$489,047	$771,869	$469,721	$615,086	$919,060	$252,909	$1,428,325	$836,557	$1,518,858	$331,144	$1,999,773	$933,234	$12,351,802
	66	100	288	845	1,411	16	......	......	......	......	......	37	2,975
Germany	$141,371	$265,218	$226,227	$764,389	$1,040,787	$17,364	......	......	......	......	......	$72,319	$3,045,597
	1	......	1	7	64	9	15	9	......	......	34	86	229
Gibraltar	$2,500	......	$1,673	$6,576	$33,030	$6,077	$16,165	$11,518	......	......	$27,493	$86,276	$200,521
	......	......	14	5	25	36	124	78	4	......	269	685	1,245
Greece	......	......	$9,355	$4,080	$28,256	$28,431	$118,398	$79,913	$6,580	......	$407,822	$876,220	$1,462,920
	......	......	......	......	......	......	......	......	......	......	......	2	2
Hungary	......	......	......	......	......	......	......	......	......	......	......	$3,500	$3,500
	......	......	......	2	5	3	......	11	15	25	74	31	166
Iceland and Faroe Islands	......	......	......	$1,016	$2,488	$2,128	......	$5,134	$11,396	$22,666	$58,526	$30,553	$133,907
	93	93	211	331	342	114	382	186	129	21	26	954	3,153
Italy	$249,192	$333,193	$193,037	$280,961	$241,466	$70,265	$217,240	$126,432	$78,228	$32,345	$59,531	$1,197,063	$3,451,618
	......	......	1	......	1	......	......	......	......	......	29	146	177
Malta, Gozo and Cyprus Is	......	......	$500	......	$422	......	......	......	......	......	$19,065	$129,504	$149,441
	19	33	103	111	141	96	439	485	......	......	1,160	3,103	9,750
Netherlands	$49,146	$76,957	$78,363	$94,163	$117,131	$131,801	$399,017	$612,495	......	......	$1,387,680	$2,626,862	$5,722,075
	1	22	78	78	145	125	732	922	97	187	1,835	3,200	7,449
Norway	$330	$20,669	$66,897	$66,689	$118,338	$89,357	$592,560	$944,002	$115,810	$398,266	$2,355,339	$4,025,685	$8,821,580
	......	......	......	......	......	......	......	......	......	......	......	232	232
Poland and Danzig	......	......	......	......	......	......	......	......	......	......	......	$237,139	$237,139
	......	9	15	73	59	14	204	283	223	26	320	540	1,754
Portugal	......	$11,429	$14,752	$58,931	$65,545	$18,255	$198,975	$271,421	$270,987	$38,228	$405,880	$843,837	$2,226,473
	......	......	31	38	28	......	2	......	......	......	310	173	631
Roumania	......	......	$22,543	$30,337	$17,018	......	$3,000	......	......	......	$277,884	$150,634	$537,443
	32	97	261	580	926	907	1,268	780	492	6	17	328	5,940
Russia in Europe	$27,638	$107,310	$254,047	$484,913	$898,458	$1,527,768	$3,142,616	$943,003	$1,136,500	$6,605	$8,426	$413,900	$9,206,223
	......	......	4	2	4	2	3	......	......	......	......	11	27
Serbia, Montenegro & Albania	......	......	$2,520	$1,160	$2,843	$2,950	$4,200	......	......	......	......	$10,431	$24,756
	10	12	174	186	83	71	364	1,125	1,205	459	1,458	3,796	9,020
Spain	$10,640	$18,330	$116,202	$127,621	$64,758	$59,555	$299,367	$1,195,887	$1,346,826	$610,844	$1,759,606	$5,576,482	$11,253,633
	53	45	169	256	324	137	238	390	95	1	1,546	5,396	8,754
Sweden	$63,051	$55,118	$127,729	$235,918	$253,588	$108,652	$180,869	$360,554	$111,377	$2,800	$2,021,948	$6,766,770	$10,405,373
	1	......	12	22	79	2	6	9	3	1	428	1,412	1,989
Switzerland	$750	......	$7,873	$24,965	$56,838	$1,244	$4,499	$9,248	$1,533	$1,646	$472,549	$1,781,037	$2,373,686
	1	......	22	13	35	......	......	......	......	......	68	486	637
Turkey in Europe	$2,000	......	$13,886	$9,814	$21,052	......	......	......	......	......	$52,504	$415,634	$524,626
		1,258	5,660	3,783	6,992	8,321	9,810	1,268	742	88	5,150	18,744	64,588
England		$2,391,984	$4,403,361	$2,893,785	$5,615,487	$6,849,145	$6,933,806	$1,444,346	$1,712,672	$134,102	$5,573,843	$20,978,357	$62,838,536
	739	12	22	6	25	143	158	4	150	......	25	528	1,089
Scotland	$1,414,056	$18,109	$28,901	$8,104	$46,948	$82,708	$124,138	$2,991	$217,000	......	$34,633	$603,617	$796,027
		1	34	6	2	159	60	......	......	......	914	902	3,598
Ireland		$5,500	$22,186	$5,538	$1.593	$157,091	$55,014	......	......	......	$897,065	$1,023,255	$5,219,664
North America:													
												......	1*
Bermuda	......	......	......	......	......	......	......	......	......	......	......	......	$1,800
	3	......	......	1	4	1	......	12	8	6	25	19	80
British Honduras	$4,020	......	......	$1,800	$3,929	$550	......	$5,774	$6,858	$4,650	$15,598	$12,993	$58,673
	611	3,102	6,288	6,723	4,377	4,127	10,017	14,421	12,985	1,625	8,826	8,046	87,450
Canada	$969,385	$3,340,326	$7,560,655	$8,229,324	$5,445,052	$3,723,125	$6,555,334	$11,143,740	$10,189,865	$1,461,776	$9,393,009	$10,869,891	$86,087,042
Central American States:													
	......	2	13	13	20	9	60	37	199	......	20	98	490
Costa Rica	......	$1,823	$12,603	$14,955	$17,877	$3,897	$28,325	$23,125	$85,070	......	$19,470	$116,291	$340,575
	4	16	19	10	26	10	24	35	34	2	125	169	519
Guatemala	$2,743	$22,094	$38,109	$14,892	$36,763	$12,012	$23,552	$36,174	$46,657	$1,815	$151,667	$223,149	$666,828
	......	......	3	4	4	31	34	42	16	6	22	44	208
Honduras	......	......	$7,114	$8,100	$3,826	$20,422	$22,652	$24,654	$12,292	$11,093	$14,549	$42,248	$167,812
	3	......	......	......	......	......	......	......	49	28	71	157	308
Nicaragua	$2,050	......	......	......	......	......	......	......	$32,031	$28,991	$61,923	$170,165	$295,060
	2	13	20	39	58	110	228	356	129	13	173	316	1,487
Panama	$1,170	$13,289	$14,271	$43,432	$51,906	$85,990	$170,964	$216,711	$93,329	$13,864	$164,698	$323,929	$1,226,844
	......	3	6	11	10	16	68	75	54	32	86	191	484
Salvador	......	$5,565	$10,658	$13,212	$13,323	$8,888	$54,598	$62,314	$68,297	$36,884	$124,996	$290,088	$714,132
	465	245	273	235	155	70	383	2,807	2,578	770	2,850	4,089	15,614
Mexico	$681,086	$459,077	$418,599	$423,123	$239,166	$66,830	$309,200	$1,642,011	$1,653,545	$793,614	$2,360,346	$3,525,210	$13,822,767
	3	15	14	9	5	17	21	48	27	68	138	96	299
Newfoundland and Labrador	$9,828	$18,285	$13,812	$10,353	$2,761	$11,681	$15,632	$38,910	$34,676	$72,887	$160,414	$139,584	$550,642
West Indies, British:													
			16	7	14	19	63	121	58	4	76	146	546
Barbados			$11,310	$5,973	$12,320	$8,699	$30,688	$62,364	$33,198	$3,300	$56,797	$124,483	$271,685
			53	62	66	80	273	335	236	43	121	421	2,748
Jamaica			$52,659	$59,131	$61,475	$61,622	$205,239	$202,375	$149,673	$39,701	$116,425	$401,789	$1,431,457
	35	102	31	43	47	59	128	204	161	19	182	450	1,331
Trinidad & Tobago	$56,059	$157,459	$31,343	$39,902	$49,079	$40,281	$87,167	$112,014	$100,571	$18,474	$137,564	$414,679	$1,029,049
			4	7	13	38	100	124	80	24	53	151	805
Other British			$1,960	$6,716	$11,061	$18,463	$51,612	$80,879	$50,009	$15,603	$35,966	$127,046	$741,763
	67	120	202	223	297	1,359	3,698	3,529	2,846	871	2,887	6,293	22,728
Cuba	$129,226	$187,392	$234,569	$242,686	$254,428	$745,695	$2,091,295	$2,545,071	$3,029,813	$1,295,485	$3,121,228	$7,096,895	$21,480,244
	......	......	5	4	3	3	9	18	152	13	27	66	301
Danish (Virgin Is. of U.S.)	......	......	$3,303	$2,131	$2,954	$1,375	$3,426	$9,114	$12,313	$9,194	$20,010	$46,925	$112,468
	1	1	13	7	11	28	131	191	248	99	173	593	1,521
Dominican Republic	$1,650	$4,000	$12,739	$5,382	$15,195	$14,609	$60,127	$96,173	$157,607	$87,290	$174,204	$577,560	$1,229,947
	......	......	3	19	13	24	21	32	12	2	13	69	210
Dutch	......	......	$1,647	$14,590	$9,605	$16,829	$10,945	$19,191	$7,435	$1,295	$7,369	$67,376	$156,858
	......	......	......	5	65	54	101	293	248	25	156	148	1,096
French	......	......	......	$3,877	$48,377	$34,906	$63,670	$154,990	$146,698	$21,561	$137,929	$129,703	$742,111
	......	1	2	38	2	......	10	29	102	22	179	202	587
Haiti	......	$1,510	$910	$24,499	$1,485	......	$3,788	$13,780	$54,613	$18,408	$158,594	$171,293	$448,880

*Year 1908.

the Years 1907 to 1920 Inclusive

	1907	1910	1912	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918	Calendar Year 1919	1920	Totals for All Years Inc. 1908, 1909, 1911
South America:	39	268	727	1,062	940	626	4,399	3,924	3,525	559	2,202	4,597	23,390
Argentina	$58,070	$174,677	$860,350	$1,181,735	$963,586	$294,129	$2,065,439	$2,336,001	$2,666,898	$708,853	$2,711,232	$5,828,057	$20,426,230
	2	......	......	2	4	10	26	141	152	4	14	24	379
Bolivia	$1,550	......	......	$1,493	$12,764	$5,462	$16,208	$100,151	$105,408	$8,548	$13,846	$39,634	$305,064
	52	64	554	987	299	81	272	873	1,575	442	3,273	3,251	11,983
Brazil	$57,037	$67,687	$662,883	$1,035,247	$264,992	$52,939	$157,968	$523,383	$1,000,011	$424,317	$2,580,304	$6,761,382	$13,917,488
	44	3	30	78	195	120	826	2,587	3,399	673	454	797	9,239
Chile	$52,905	$1,824	$39,873	$109,982	$160,194	$64,327	$530,211	$1,821,842	$3,576,511	$1,009,964	$700,997	$992,539	$9,097,916
	......	12	42	110	79	39	91	173	164	30	253	962	1,971
Colombia	......	$22,482	$35,386	$113,334	$69,620	$34,956	$58,525	$118,937	$121,422	$27,542	$298,383	$1,247,976	$2,164,618
	......	2	21	74	21	20	62	137	142	22	84	201	794
Ecuador	......	$2,168	$20,578	$55,372	$21,229	$11,233	$44,396	$106,478	$130,086	$29,471	$111,051	$288,884	$735,991
	......	......	......	......	......	......	......	......	......	......	4	......	4
Falkland Islands	......	......	......	......	......	......	......	......	......	......	$5,788	......	$5,788
	......	4	20	18	16	45	73	146	180	18	49	130	707
Guiana, British	......	$5,952	$17,306	$114,313	$11,364	$24,311	$33,933	$65,989	$100,546	$18,472	$39,369	$92,665	$430,508
	......	......	......	......	7	9	15	23	16	......	7	10	87
Dutch	......	......	......	......	$3,948	$4,492	$7,181	$11,797	$17,775	......	$3,872	$12,706	$54,027
	......	......	1	1	......	......	1	1	8	1	3	3	19
French	......	......	$580	$558	......	......	$1,000	$498	$3,632	$318	$2,167	$5,264	$14,017
	5	1	......	......	......	5	6	40	13	......	13	102	186
Paraguay	$2,394	$1,200	......	......	......	$2,308	$2,256	$20,192	$5,025	......	$5,780	$64,967	$104,679
	8	4	13	70	36	24	59	400	784	257	599	1,297	3,565
Peru	$6,428	$5,004	$10,833	$55,646	$31,362	$20,658	$40,388	$295,558	$913,699	$395,753	$662,528	$1,249,546	$3,701,516
	1	20	177	209	183	45	285	1,165	2,232	418	1,844	4,090	10,777
Uruguay	$625	$23,666	$235,097	$273,253	$167,269	$25,706	$150,540	$612,838	$1,177,463	$307,221	$1,757,623	$4,055,458	$8,952,700
	1	......	26	104	126	227	518	542	160	38	293	881	2,936
Venezuela	$1,000	......	$28,180	$109,499	$102,073	$143,086	$314,156	$327,507	$97,485	$56,021	$300,888	$820,040	$2,299,935
Asia:	......	......	......	15	28	9	16	10	8	......	29	52	168
Aden	......	......	......	$7,998	$20,990	$6,706	$9,166	$7,968	$6,879	......	$25,197	$50,387	$136,079
	16	8	78	89	114	122	264	509	833	409	1,158	1,774	5,427
China	$15,255	$13,785	$98,730	$90,459	$143,619	$119,635	$191,932	$383,371	$818,659	$402,275	$1,414,844	$2,356,699	$6,100,364
	......	......	......	......	......	......	......	53	28	38	36	62	209
***Kwantung (leased territory)**	......	......	......	......	......	......	......	$27,121	$12,338	$29,335	$28,995	$68,491	$172,230
	......	1	......	7	2	2	7	5	2	3	11	595	638
Chosen (Korea)	......	$10,270	......	$6,095	$1,795	$1,800	$4,780	$3,832	$1,300	$2,295	$9,272	$311,457	$356,204
	45	26	253	439	437	315	2,289	3,603	73	27	2,624	12,014	22,313
British India	$26,067	$22,372	$203,740	$355,573	$379,954	$274,680	$1,638,262	$2,644,085	$53,428	$42,756	$2,891,943	$13,865,679	$22,544,250
	9	21	120	387	262	77	376	855	287	49	499	2,334	5,342
Straits Settlements	$4,754	$20,955	$86,668	$319,247	$216,659	$70,210	$239,715	$585,820	$202,221	$53,934	$572,320	$2,638,794	$5,064,913
	......	4	25	39	82	25	239	110	11	......	102	440	1,091
Other British East Indies	......	$2,875	$20,882	$31,245	$73,175	$20,208	$168,685	$80,033	$17,740	......	$114,609	$540,146	$1,089,513
	67	33	120	278	290	105	1,064	3,206	1,272	1,078	,1820	4,765	14,310
Dutch East Indies	$36,629	$21,768	$70,055	$198,378	$208,722	$87,306	$753,128	$2,642,330	$1,302,800	$1,359,811	$2,369,241	$6,500,062	$15,705,307
	......	......	......	......	......	......	8	18	18	12	37	537	630
French East Indies	......	......	......	......	......	......	$3,033	$17,967	$21,175	$18,069	$43,918	$568,961	$673,123
	9	2	4	7	11	2	15	38	117	86	144	214	654
Hongkong	$7,372	$3,788	$2,740	$6,673	$13,043	$1,475	$10,858	$35,255	$91,228	$86,006	$188,121	$341,191	$791,067
	15	12	118	312	96	28	153	652	2,139	1,514	2,805	2,796	10,714
Japan	$19,242	$26,759	$143,610	$364,507	$100,995	$29,210	$120,061	$481,748	$2,040,897	$1,608,516	$2,890,034	$2,983,497	$10,890,235
	......	......	......	......	......	......	......	......	2	8	4	128	142
Persia	......	......	......	......	......	......	......	......	$1,048	$4,625	$2,275	$169,518	$177,466
	2	3	......	1	12	551	683	1,072	5	3	49	76	2,457
Russia in Asia	$1,884	$1,760	......	$1,160	$14,998	$1,477,809	$529,385	$1,324,060	$8,425	$11,734	$52,145	$124,235	$3,547,595
	4	4	13	56	37	13	41	31	65	27	71	82	455
Siam	$1,569	$6,407	$8,933	$35,934	$26,219	$10,317	$32,082	$15,915	$60,220	$22,005	$70,210	$92,457	$391,757
	......	1	1	1	7	1	......	......	......	6	119	1,010	1,150
Turkey in Asia	......	$1,200	$650	$824	$5,662	$1,000	......	......	......	$3,965	$116,347	$807,796	$945,996
Oceania, British:	62	437	2,597	2,083	3,099	2,169	5,335	5,055	4,307	1,582	3,905	8,882	40,773
Australia	$57,731	$268,274	$2,260,320	$1,896,990	$2,615,896	$1,768,479	$4,147,302	$3,792,571	$3,410,557	$1,492,899	$4,016,751	$9,936,869	$36,685,352
	69	77	953	958	1,065	938	2,672	3,554	1,818	639	2,959	6,671	22,905
New Zealand	$120,533	$55,236	$946,736	$990,837	$974,708	$784,206	$2,055,843	$2,558,118	$1,453,311	$607,807	$3,314,891	$8,150,277	$22,510,425
	......	......	75	3	9	2	28	19	30	7	23	28	242
Other British	......	......	$73,932	$2,396	$6,014	$2,081	$18,227	$11,062	$20,863	$5,955	$17,264	$31,065	$213,273
	......	1	3	11	46	8	92	22	12	3	11	13	222
French	......	$900	$2,920	$14,005	$45,184	$7,482	$56,789	$12,330	$7,612	$3,368	$11,118	$14,255	$275,964
	......	......	......	1	......	1	7	12	12	7	8	22	70
German	......	......	......	$350	......	$5,000	$3,208	$5,847	$11,029	$4,935	$6,285	$16,165	$52,815
	2	130	401	517	614	407	861	1,019	1,714	603	2,381	3,452	12,510
Philippine Islands	$1,205	$175,626	$557,368	$577,040	$697,175	$425,001	$859,450	$686,731	$1,373,204	$616,437	$2,629,348	$3,932,108	$12,955,541
Africa:	......	......	......	......	......	......	......	......	......	......	......	5	5
Abyssinia	......	......	......	......	......	......	......	......	......	......	......	$2,416	$2,416
	......	......	......	......	......	......	......	......	......	......	......	24	24
Belgian Kongo	......	......	......	......	......	......	......	......	......	......	......	$16,325	$16,325
	......	......	......	4	32	42	63	240	202	43	357	753	1,736
British Africa, West	......	......	......	$2,688	$18,319	$20,899	$35,361	$144.838	$115,772	$37,351	$393,405	$913,814	$1,682,447
	2	75	331	1,279	1,618	695	2,859	3,423	2,142	541	3,019	6,688	22,835
South	$1,817	$61,185	$306,606	$1,157,895	$1,437,883	$731,278	$2,040,977	$2,378,380	$1,706,136	$530,951	$3,462,330	$7,795,194	$21,760,665
	......	11	22	14	49	120	237	94	112	14	82	373	1,135
East	......	$10,463	$14,998	$12,802	$34,430	$75,188	$137,245	$55,681	$75,778	$14,445	$80,954	$432,819	$856,317
	......	1	3	10	15	27	51	31	15	......	6	154	315
Canary Islands	......	$850	$2,066	$6,426	$6,956	$12,015	$32,935	$24,525	$5,378	......	$10,162	$200,745	$305,288
	2	1	5	16	22	1	25	38	21	6	230	3,607	3,980
Egypt	$887	$998	$2,872	$10,156	$11,437	$695	$18,352	$22,113	$17,300	$20,850	$165,244	$1,453,898	$1,839,701
	1	11	30	10	19	......	2	41	121	89	198	365	912
French Africa	$950	$18,188	$20,164	$7,297	$17,273	......	$1,155	$13,315	$50,550	$52,757	$144,023	$297,191	$644,688
	......	......	......	5	19	7	20	......	......	......	7	30	88
German Africa	......	......	......	$3,175	$14,136	$4,865	$7,760	......	......	......	$3,721	$21,948	$55,605
	......	......	......	......	......	......	......	3	......	......	......	5	8
Italian Africa	......	......	......	......	......	......	......	$1,200	......	......	......	$3,075	$4,275
	......	......	......	1	......	......	......	1	12	......	......	1	15
Liberia	......	......	......	$805	......	......	......	$975	$4,220	......	......	$1,205	$7,205
	......	......	......	......	......	......	7	1	2	......	......	4	14
Madagascar	......	......	......	......	......	......	$2,532	$808	$1,659	......	......	$4,205	$9,204
	......	......	......	......	63	25	52	87	35	......	237	364	863
Morocco	......	......	......	......	$29,497	$10,847	$20,574	$39,670	$17,718	......	$162,016	$340,490	$620,812
	1	7	16	20	24	6	56	7	9	12	18	244	423
Portuguese Africa	$2,110	$5,302	$13,096	$16,102	$21,563	$7,301	$38,510	$5,429	$9,673	$8,598	$16,636	$282,203	$429,192
Grand Total													526,592
													$517,614,256

*Previous to 1918 listed as British, French and Japanese China.

Export Specifications of American Passenger Cars

Name and Model	Boxing Charge	Cubic Contents Car Boxed	Cubic Contents Chassis Boxed	Magneto	Extra Charge	Right Hand Drive?	Extra Charge	Wheel Options	Extra Charge	Color Options	Extra Charge	Tire Sizes	Rim Type	Tire Type
Allen 43	$70	312	208	Bosch	$35	Yes	None	Wire & Disc	$100-$100	5		32x4	S.S.	Fabric
Amco	75	334	169	Yes	35	Yes	$15					31x4	S.S.	
American 6	80	359		Bosch	75	Yes	30	Wire & Disc	100-150	3	None	610x105	S.S.	Cord
Anderson	100	382	295	Bosch	45	Yes	25	Wire & Disc	125-160	Yes	$100	33x4	S.S.	Fabric
Apperson 820	100	415	370			Yes	50	Wire	125	None		34x4½	S.S.	Cord
Apperson Anniv.	100	415	370			Yes	50	Wire & Disc	None	None		34x4½	S.S.	Cord
Auburn 6-39H	100	364	290	Bosch	55	Yes		Wire & Disc	150-150	3	None	880x120		Fabric
Beggs	85	375			50	Yes	25					33x4	S.S.	
Bell	75	334	171		35	Yes	15					31x4	S.S.	
Bour Davis	95	380			75	Yes	None					33x4½		
Briscoe	50	300		Splitdorf	35	Yes	None	Wire	65	2		31x4		Fabric
Buick 49, 50	Yes	578	131			Yes				4		880x120	S.S.	Fabric
Buick 44 to 47	Yes	548	320			Yes				4		34x4½	S.S.	Fabric
Cadillac 59		630	243			Yes		Wire		12	Yes	895x135	S.S.	Opt.
Champion Spec	60			Yes	40	Yes	5	Wire	150	None		32x4	S.S.	Fabric
Chandler	85	382	338	Bosch	None	Yes	None	Wire	Yes	1			S.S.	Fabric
Chevrolet 490	63	191	95	Berling		Yes		Wire		Yes	Yes	815x120	S.S.	Fabric
Chevrolet FB		313	145	Simms		Yes		Wire		Yes		815x120	S.S.	Fabric
Climber	125	333	246		60	Yes	75	Wire & Disc	75-100	All	None	33x4	S.S.	Fabric
Climber	125	347	249	Bosch	None	Yes	75	Wire & Disc	75-100	All	None	32x4½	S.S.	Fabric
Cole	100	462	336			Yes	None	Wire & Disc	125-150	5	75	880x135	S.S.	Cord
Columbia	70	340	225	Bosch	55	Yes	None	Wire & Disc	75-150	All		815x105	Opt.	Cord
Comet	85	385			60	Yes	25					33x4		
Crow Elkhart S55		335		Eisemann	85	Yes		Wire & Disc	100-150	10	None	33x4	S.S.	Fabric
Crow Elkhart L55		335		Eisemann	85	Yes		Wire & Disc	100-150	10		33x4	S.S.	Fabric
Cunningham V	Yes	640		None		No		Wire & Disc	None—75	Yes	None			Cord
Davis 51-57	100	390				Yes	None	Wire & Disc	125-160	2		635x105	S.S.	Cord
Dixie-Flyer	63	304		Eisemann		Opt		Wire	120	All	45		S.S.	Cord
Dodge Brothers				Simms	25	Yes	25				None		S.S.	Opt.
Dorris 6-80	125			Bosch		No		Wire & Disc	225-140	Yes	Yes	33x5	S.S.	Cord
Dort				Bosch		Yes	None	Wire	Yes	None		30x3½		Fabric
Elgin		340		Bosch	50	Yes	35	Disc	None	None		33x4	S.S.	Fabric
Essex	Yes	318				Yes		Wire	Yes	2		815x105	S.S.	Fabric
Ford		273	129	Yes	None	No						30x3½	C.	Fabric
Franklin	85	389				No		Wire	60	Yes	100	32x4	S.S.	Cord
Gardner		307		Yes		Yes		Wire	175	None		32x3½	S.S.	Fabric
Grant		344	290	Bosch	50	Yes	None	Wire	100					Fabric
Haynes	90	500	400	Simms	70	Yes	30	Wire & Disc	150-200	3	100	34x4½	S.S.	Cord
Holmes	100		400	Eisemann	None	No		Wire	145	1	75		S.S.	Cord
Hudson Super 6	Yes	393	370			Yes		Wire	Yes	2		880x120	S.S.	Fabric
Huffman	75	373	322			Yes	None	Wire	135	3	None		S.S.	Fabric
Hupmobile	70	322		Splitdorf		Yes		Wire	100	2		815x105	S.S.	Fabric
Jackson 6	80	390		Bosch	35	Yes	25	Wire & Disc	100-100	5		33x4	S.S.	Fabric
Jordan M	100	372	295	Bosch	50	Yes	50	Wire & Disc	125-150	1		32x4	S.S.	Cord
Jordan F	100	400	340	Bosch	50	No		Wire & Disc	125-150	1	None	32x4½	S.S.	Cord
Kissel	110	466	404	Bosch	50	Yes	None	Wire & Disc	– 70	1	100	32x4½	S.S.	Cord
Kline Kar	90	630	450	Bosch	70	Yes	30	Wire & Disc	125-125	Yes			S.S.	Fabric
Lexington	90		329	Bosch	75	Yes		Wire & Disc	125-150	None		32x4	S.S.	Cord
Liberty 6	75	280	246	Splitdorf	Yes	Yes	Yes	Wire		5		32x4		Opt.
Locomobile	125	465		Berling	None	No		Wire	250	18		35x5	S.S.	Cord
Maibohm	110	314		Bosch	50	Opt	25	Wire & Disc	100-150	4		32x4	S.S.	Cord
Marmon 34	110	526	433	Simms		Yes		Wire	None	None		815x120	S.S.	Cord
McFarlan	135	375		Berling	None	Yes	None	Wire & Disc	None	All		35x5	S.S.	Cord
Mercer	115	365		Eisemann	None	Yes		Wire	128	7	None	32x4½	S.S.	Cord
Metz 6	80	355	244	Bosch	50	Opt	50	Wire & Disc	100	1		32x4	Opt	Fabric
Mitchell	65	374	215	Bosch	75	Yes	None	Wire	80	1	None	815x105	Opt	Fabric
Moon 6-42	85	410	300	Bosch	None	Yes	None	Wire & Disc	100-115	2	None	815x105	S.S.	Fabric
Moon 6-68	95	418	300	Splitdorf	50	Yes	None	Wire & Disc	110-115	2	None	32x4½	S.S.	Cord
Nash 681	60			Bosch	40	Opt	25	Wire	100	2	None	875x105	Opt	Opt
Nash 682	60			Bosch	40	Opt	25	Wire	100	1		875x105	S.S.	Cord
National	100	539	449	Bosch				Wire & Disc	125-125	3	None	32x4½	S.S.	Cord
Noma 1D		423				No		Wire & Disc		None		32x4½	S.S.	Cord
Oakland		478		Remy		Yes		Wire				880x120	S.S.	Fabric
Oldsmobile		358				Yes		Wire & Disc			Yes	880x120	S.S.	Fabric
Overland		278	128	Bosch	51	Yes		Wire				30x3½	C.	Fabric
Packard Six	80	483		Delco		No		Wire	Yes	2	Yes	33x4½	S.S.	Cord
Packard Twin 6	110	532		Delco		No		Wire & Disc		1		35x5		Cord
Paige		358		Bosch	55	Yes	None	Wire & Disc	90-110	All	35			Fabric
Paterson	100					Yes		Wire & Disc	100-125	3	None	33x4	S.S.	
Peerless		390	262					Wire	207	All	50	34x4½	S.S.	Cord
Piedmont 4-30	60	280	180	Splitdorf	50	Yes	10	Wire	100	All	25	32x3½	S.S.	Fabric
Pierce Arrow 6	130	527	437			No	None	Wire & Disc	75-75	All	None	35x4½	S.S.	Cord
Pilot	90	370		No		Yes	None	Wire & Disc	105			32x4	S.S.	Fabric
Porter 45				Berling	None	Yes	None	Wire	280	All	None	35x5	S.S.	Cord
Pullman	75		190		35		15					31x4		
Premier 6D	90	396	325	No		Yes	150	Wire & Disc	135-170	3	None	32x4½	S.S.	Cord
Reo T6	100	347			None	No					None	33x4	S.S.	Cord
Revere	85	384		Bosch	None	No		Wire	None	All	None	32x4½	S.S.	Cord
Roamer	90			Bosch	None	Yes	25	Wire & Disc	None—75	All	None	820x120	S.S.	Opt.
Rock Falls	250			Bosch		No		Disc	150	All		35x5	S.S.	Cord
Saxon	75	276			45		25					32x4		
Sayers	90	350		Bosch	75	Yes	55	Wire & Disc	125-150	3	30	33x4	S.S.	Fabric
Scripps Booth		309		Bosch		Yes		Wire & Disc			Yes	880x120	S.S.	Fabric
Seneca L	65	280	148	Simms	35	Yes	10	Wire & Disc	85-75	5		30x3½	S.S.	Opt.
Severin H	85	418		Bosch	None	Yes	None	None		5	None	32x4	S.S.	Fabric
Skelton	None			Simms	None	Yes		Wire			None		S.S.	Fabric
Stephens 6	90	410		Bosch	60	Yes	30	Wire	150	2		32x4	S.S.	Cord
Stevens-Duryea E	Yes			Berling		No		Wire	250	Yes	100	35x5	S.S.	Cord
Studebaker LS	Yes	266		Opt	Yes	Yes	Yes	Wire	Yes	2	None	815x105	S.S.	Opt.
Studebaker BS	Yes	347		Opt	Yes	Yes	Yes	Wire	Yes			820x120	S.S.	Opt.
Studebaker SS	Yes	331		Opt	Yes	Yes	Yes	Wire	Yes			815x105	S.S.	Opt.
Stutz	125	444				Yes		Wire	None	2			S.S.	Cord
Templar	100	410	336	Simms		Yes		Wire	125	4		660x115	S.S.	Fabric
Velie 34	85	376	185	Splitdorf	45	Opt	None	Wire	105	2	None	32x3½	S.S.	Cord
Velie 38	85	376	185	Splitdorf	45	Opt	None	Wire & Disc	105-150	2	None	32x4	S.S.	Fabric
Vogue	100	360		Bosch	55	Yes		Wire & Disc	100-150	1		32x4	S.S.	Fabric
Willys-Knight 20	51	331	315	Bosch	50	Yes	None	Wire & Disc	50			33x4	S.S.	Fabric
Westcott C38	110	388		Bosch	100	Yes	None	Wire & Disc	125-150	2	50	33x4	S.S.	Cord
Westcott C48	110	413				No		Wire & Disc	175-200	2	50	33x4½	S.S.	Cord
Wasp 201				Bosch		No		Wire	None	All	None	33x5	S.S.	Cord
Winther 6	75	350		Bosch		Opt	150	Wire		All		33x4	S.S.	Cord
Winton 25	85			Bosch	75	Yes	75	Wire		All			S.S.	Cord

Imports of Passenger Cars for Nine Years

	1911	1912	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31 1918	Calendar Year 1919	Total for all years
Europe:											
Austria-Hungary	2 $13,000	2 $10,600	....	2 $6,000	....	....	....	....	....	....	6 $29,600
Belgium	12 $33,335	8 $30,300	3 $11,000	12 $17,900	1 $1,436	....	....	....	....	....	36 $93,971
France	140 $594,096	77 $317,075	14 $55,660	12 $41,735	2 $5,470	....	1 $2,500	....	....	4 $10,468	250 $1,027,004
Germany	39 $160,942	36 $153,972	7 $21,557	5 $18,640	2 $7,100	....	....	....	....	....	89 $362,211
Italy	16 $50,100	6 $25,500	4 $16,000	2 $4,500	6 $16,700	....	....	....	....	....	33 $112,800
Netherlands	13 $49,620	4 $13,000	4 $9,000	1 $4,000	3 $9,530	....	....	....	....	....	25 $85,150
Norway	....	....	....	....	1 $2,000	....	....	....	....	1 $4,000	2 $6,000
Russia in Europe	....	....	....	1 $775	....	....	....	....	....	....	1 $775
Spain	....	....	....	....	1 $1,250	....	1 $1,500	....	....	....	2 $2,750
United Kingdom:											
England	307 $1,105,595	158 $547,162	67 $138,770	29 $75,777	22 $57,074	2 $5,774	1 $1,500	....	1 $7,300	1 $1,460	582 $1,940,412
Scotland	2 $8,000	3 $7,000	....	1 $1,200	9 $13,050	2 $6,120	....	....	....	....	17 $35,370
Ireland	1 $1,500	....	....	1 $720	....	....	....	....	....	....	2 $2,220
North America:											
Canada	126 $246,115	208 $427,901	266 $460,214	466 $848,219	295 $471,203	330 $465,100	1,000 $1,351,586	237 $288,904	162 $193,784	1,578 3,443,892	4,668 $8,196,918
Panama	2 $1,300	1 $800	1 $4,500	1 $900	2 $2,902	....	7 $10,220	2 $2,250	2 $1,550	12 $11,450	30 $35,872
Salvador	1 $3,000	1 $3,250	2 $3,300	1 $2,500	....	....	....	....	....	....	5 $12,050
Mexico	13 $40,151	13 $34,124	12 $30,940	7 $18,238	34 $38,751	50 $51,250	11 $8,530	14 $9,305	6 $5,900	19 $7,734	179 $244,923
Newfoundland & Labrador	....	....	1 $1,500	....	....	....	....	....	....	....	1 $1,500
West Indies:											
Jamaica	20 $52,965	6 $24,050	2 $3,060	1 $1,500	1 $1,000	....	2 $3,500	....	....	2 $3,333	34 $89,408
Other British	2 $3,450	....	....	....	....	....	....	....	1 $125	4 $3,650	7 $7,225
Trinidad and Tobago	....	....	....	....	....	1 $500	....	....	....	....	1 $500
Cuba	8 $18,150	10 $19,666	....	2 $2,300	2 $1,709	10 $21,460	12 $19,582	7 $12,902	4 $15,600	29 $89,945	84 $201,314
Danish	....	....	....	....	....	....	1 $400	....	....	....	1 $400
Dominican Republic	....	....	....	....	....	....	1 $500	....	1 $1,400	....	2 $1,900
Dutch West Indies	....	....	....	....	....	....	....	....	....	1 $1,500	1 $1,500
Haiti	....	....	....	....	....	....	....	....	1 $425	....	1 $425
Virgin Islands of U. S.	....	....	....	....	....	....	....	....	....	1 $900	1 $900
South America:											
Argentina	3 $11,500	....	....	....	....	5 $19,000	....	....	....	....	8 $30,500
Brazil	3 $4,790	....	....	....	1 $800	....	....	....	....	....	4 $5,590
Colombia	1 $1,500	....	....	....	....	1 $2,660	....	....	....	....	2 $4,160
Peru	....	....	....	....	....	....	....	....	....	1 $6,235	1 $6,235
Venezuela	....	....	....	....	1 $750	....	....	....	....	....	1 $750
Asia:											
British India	1 $5,000	....	....	....	....	....	....	....	....	....	1 $5,000
China	....	....	....	1 $3,000	....	....	....	....	....	....	1 $3,000
Japan	....	1 $4,000	1 $2,988	1 $600	....	....	....	....	....	1 $1,500	4 $9,088
Oceania, French	....	1 $750	....	....	1 $2,000	1 $600	....	....	....	....	3 $3,350
Philippine Islands	....	....	....	1 $500	1 $1,000	1 $1,200	....	....	....	1 $500	4 $3,200
Australia	....	....	....	2 $5,491	1 $2,000	....	....	....	....	....	3 $7,491
New Zealand	....	....	....	....	....	....	....	....	....	1 $3,888	1 $3,888
Totals	711 $2,404,109	587 $1,619,150	384 $758,489	549 $1,054,495	386 $635,725	403 $573,664	1,037 $1,399,818	260 $313,361	178 $226,084	1,656 $3,590,455	6,091 $12,575,350

Trend in Truck Design as Revealed by 1921 Specifications

Thirty per cent increase in number of 2½ ton models. Marked tendency toward the four-speed gear box. Worm drive still predominates and shows a gain at expense of internal gear and chain drive. Disk clutch, vacuum fuel feed, pressed steel frame and block-cast cylinders gain in popularity.

By Herbert Chase

JUDGED by the number of models listed (and all figures given in this review refer to the number of models listed in tables compiled by CLASS JOURNAL publications) the most popular size of truck in 1921 is the 1½-ton, as was the case also in 1920. There has been an increase of about 14 per cent in the number of models of this size. The 2½-ton job is second in popularity, and the number of models of this size listed shows a 30 per cent increase. The 3½-ton is a close third in number of models, but the percentage gain in this size is only 17.

Among the outstanding tendencies revealed by the accompanying table and chart is that toward a more general use of the four-speed gearset. This tendency has been increasing rapidly since 1917-18, when it was given impetus by the design of war trucks which incorporated this feature and demonstrated its utility. Over 57 per cent of all models listed now have four-speed transmissions. The remaining models nearly all have three speeds, though there are a few which have two, five, or more than five gear changes.

Pneumatic tire equipment has become standard on trucks of one ton and less capacity and is increasing, at least as optional equipment on many larger sizes. The use of electric starting and lighting has increased slightly, its use being much more frequent on the light pneumatic tired trucks, but is not confined to this type.

The use of wood wheels still predominates, but the ratio of wood to metal is now less than 2 to 1, whereas last year it was over 3 to 1, indicating, of course, that the metal wheel is increasing in popularity.

Both the number and percentage of models using the worm gear final drive have increased at the expense of the internal gear and chain types. The bevel gear and double reduction types also show an increase, though the percentage of models using these types is not large.

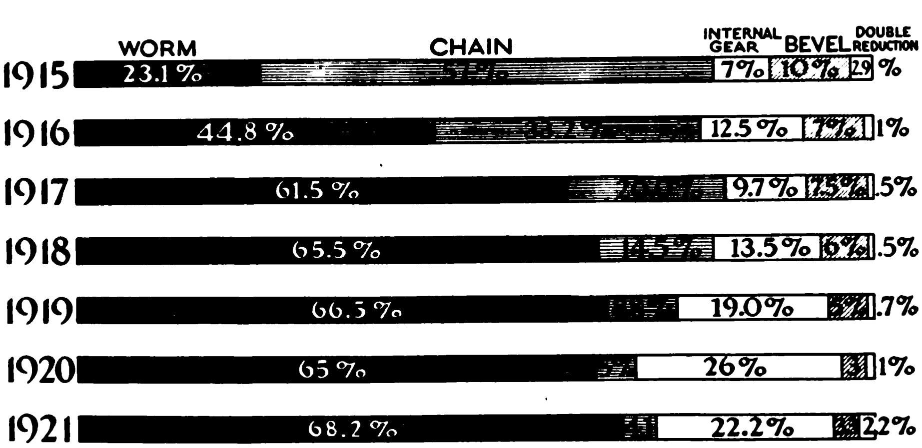
The number of models of trucks in which the gearset is mounted amidship is almost the same as the number in which a unit powerplant is employed. Some regard the latter type as less accessible than the former, but the use of unit construction cuts down the number of parts required, so that there appears to be little choice between the two types. The practice of making the gearset a unit with the rear axle has been entirely abandoned.

The cone clutch, which six years ago was used on more than 40 per cent of truck models, is now used by less than 6 per cent. The disk and plate types have become increasingly popular and are now used on over 94 per cent of the models listed, by far the majority of these using the multiple disk type. A large proportion of the latter run dry, fewer than formerly using the wet plate type.

Practice in respect to the engine type shows no very marked change. For many years past the four-cylinder engine has been used on over 95 per cent. of the models offered, and in 1921 it is employed in 99 per cent. There are still many advocates of pair-cast cylinders, over 28 per cent of the models listed using this type of construction, as against 69.7 per cent block-cast and 1.8 per cent separately cast. Block casting has shown a steady increase for many years, and the greater facility in machining and greater rigidity which this construction affords appears to be largely responsible for the increase.

Thermo-syphon cooling reached the height of its popularity in 1919 when it was employed on 24 per cent of the models. At present 16 per cent are using this system of cooling, while 84 per cent use pump circulation, which is more positive in action, while the higher water velocity enables the use of a smaller and lighter radiator.

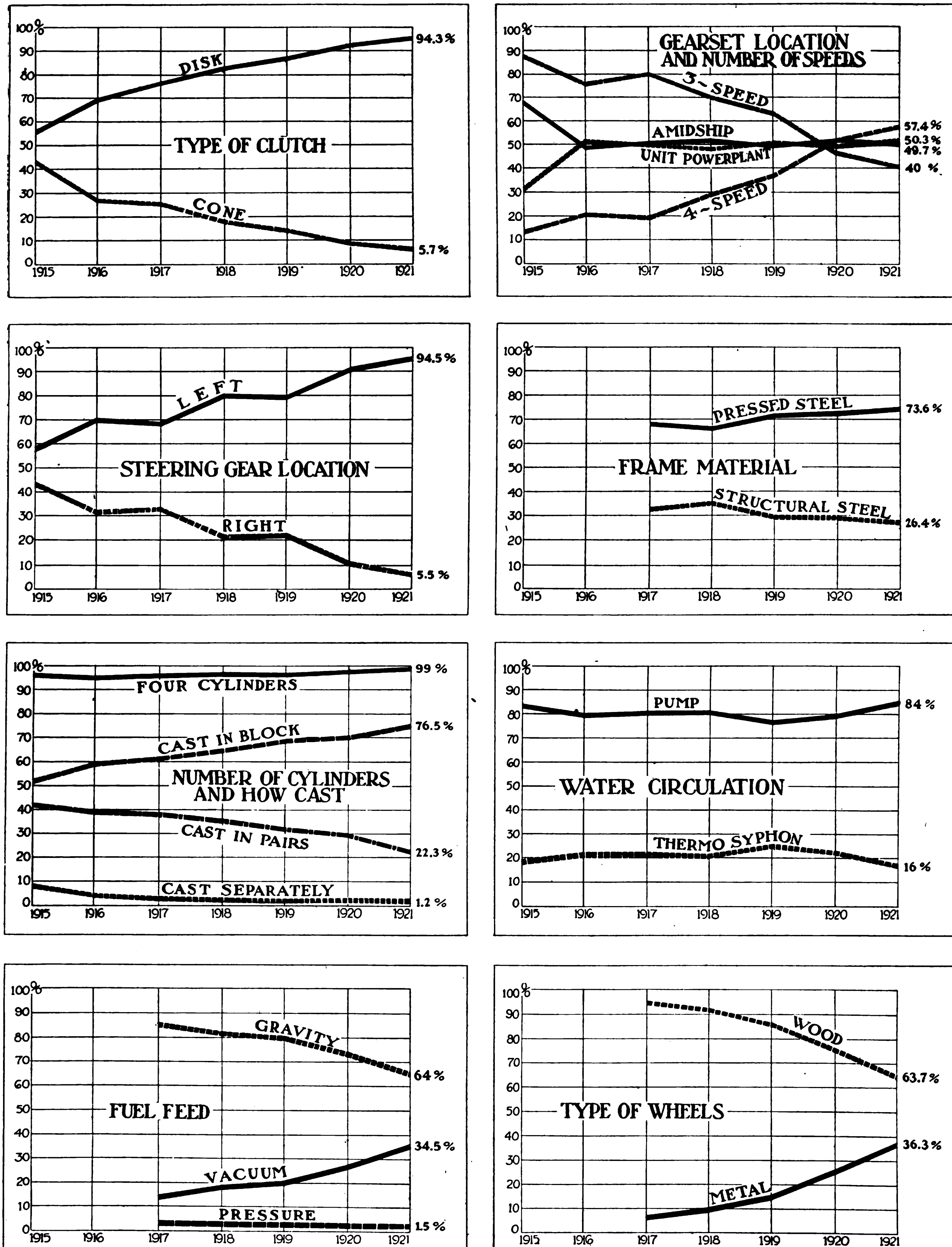
Gravity fuel feed systems have declined in popularity since 1919, when 79 per cent of models used this system. It is still the most used, with 64 per cent of the installations, but the use of vacuum feed is rapidly increasing and is now applied to 34.5 per cent of the models listed. Gravity feed will no doubt continue in the majority as long as space for a gravity tank can be provided, for the vacuum and pressure systems (the latter of which has almost disappeared) involves the use of elements which are not otherwise required.



Trend of design with respect to final drive

(Continued on page 348)

TENDENCIES IN TRUCK DESIGN FOR 1921



Specifications of

Name and Model	Tons Capacity	Wheelbase, Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	WHEELS Make	WHEELS Type	ENGINE Make	No. Cyl., Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	RADIATOR CASE Make	RADIATOR CASE Type	RADIATOR CORE Make	RADIATOR CORE Type	IGNITION Type	IGNITION Make	IGNITION Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	Extra Cost $
Acason H	2½	150	Savg.	p-stl.	s-flex.	sol*	36x4	36x4d	Sth.	mt.	Wau.	4-4⅜x5½-30.6	2	cent.	Natl.	cst.	Natl.	cel.	sing.	Eismn.	hand.	lghtg.	Vesta.	50
Acason L	3½	180	Savg.	p-stl.	s-flex.	sol*	36x5	36x5d	Sth.	mt.	Wau.	4-4⅜x5½-30.6	2	cent.	Natl.	cst.	Natl.	cel.	sing.	Eismn.	hand.	lghtg.	Vesta.	50
Acme G	¾	130	Savg.	p-stl.	s-flex.	pnu.	35x5	35x5	Bim.	wd*	Cont.	4-3¾x5 -22.5	4	ther.	G&O.	sht.	G&O.	cel.	sing.	Eismn.	hand.	lghtg.	G&D.	....
Acme B	1	130	Savg.	p-stl.	s-flex.	sol.	34x3½	34x5	Bim*	wd.	Cont.	4-3¾x5 -22.5	4	ther.	G&O.	sht.	G&O.	cel.	sing.	Eismn.	hand.	s&l.	G&D.	125
Acme F	1½	141	Savg*	p-stl.	s-flex.	sol.	34x3½	34x5	Bim.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	own.	cst.	G&O.	fin.	sing.	Eismn.	hand.	s&l.	Delco.	125
Acme A	2	148	P&B*	p-stl.	s-flex.	sol.	36x4	36x7	Bim.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	G&O.	fin.	sing.	Eismn.	hand.	s&l.	Delco.	185
Acme C	3½	168	Smh*	p-stl.	s-flex.	sol.	36x5	40x10	Bim.	wd.	Cont.	4-4½x5½-32.4	2	cent.	own.	cst.	G&O.	fin.	sing.	Eismn.	hand.	s&l.	Delco.	185
Acme E	5	180	Smh*	p-stl.	s-flex.	sol.	36x6	40x12	Sth.	mt.	Cont.	4-4¾x6 -36.1	2	cent.	own.	cst.	G&O.	fin.	sing.	Eismn.	hand.	lghtg.	Delco.	35
Akron Multi-Truck 20	1	133	Hyd.	p-stl.	flex.	pnu.	34x5	34x5	Bim.	wd.	Hink.	4-4 x5½-25.6	4	cent.	Fed.	prs.	Fed.	cel.	sing.	West.	hand.	sl&i.	West.	....
American 25	2½	158	Shar.	p-stl.	rigid.	sol*	36x4	36x4d	Sth.	mt.	Wsc.	4-4 x6 -25.6	4	cent.	G&O.	cst.	G&O.	fin.	sing.	Eismn.	auto.	opt.	......	....
American 40	4	158	Detrt.	p-stl.	rigid.	sol*	36x5	36x5d	Sth.	mt.	Wsc.	4-4½x6 -32.4	4	cent.	G&O.	cst.	G&O.	fin.	sing.	Eismn.	auto.	opt.	......	....
Armleder 20	1	148	Smh.	p-stl.	flex.	sol*	34x3½	34x5	Crn.	wd.	Buda.	4-3¾x5½-22.5	4	cent.	own.	cst.	Long.	fin.	sing.	Bosch.	hand.	s&l-2.	West.	....
Armleder HW	2½	148	Smh.	p-stl.	flex.	sol*	36x4	36x7	Crn.	wd.	Buda*	4-4¼x5½*-28.9*	4	cent.	Long.	cst.	Long.	fin.	sing.	Bosch.	hand.	s&l-2.	West.	....
Armleder KW	3½	156	own.	rol-I.	s-flex.	sol.	36x5	36x5d	Crn.	wd.	Buda*	4-4½x6* -32.4*	4	cent.	own.	cst.	Long.	fin.	sing.	Bosch.	hand.	s&l-2.	West.	....
Atco B	1½	132	own.	rol-c.	s-flex.	pnu*	34x5	36x6	Sth.	mt.	Buda.	4-3¾x5½-22.5	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	s&l-2.	West.	150
Atco B1	1½	132	own.	rol-c.	s-flex.	pnu.	34x5	36x6	Stn.	wd.	Buda.	4-3¾x5½-22.5	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	s&l-2.	West.	150
Atco A	2½	150	P&B.	p-stl.	s-flex.	sol*	36x4	36x8	Sth.	mt.	Buda.	4-4¼x5½-28.9	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	lghtg.	Eismn.	100
Atlas (York) Dispatch 21	1	130	Prsb.	p-stl.	s-flex.	pnu.	32x4½	32x4½	E&O.	wd.	Lyc.	4-3½x5 -19.6	4	ther.	Jstn.	......	Jstn.	cel.	sing.	A-Knt	hand.	sl&i.	Bijur.	none
Atterbury 20R	1½	144	Savg.	p-stl.	flex.	sol.	34x3½	34x5	Arch.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	own.	cst.	Lng.	fin.	sing.	Berlg.	fixed.	lghtg.	Delco.	none
Atterbury 7CX	2½	153	Savg.	p-stl.	flex.	sol.	36x4	36x4d	Arch.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	Lng.	fin.	sing.	Berlg.	fixed.	none.	......	....
Atterbury 7D	3½	167	Savg.	p-stl.	flex.	sol.	36x5	40x5d	Arch.	wd.	Cont.	4-4½x5½-32.4	2	cent.	own.	cst.	Lng.	fin.	sing.	Berlg.	fixed.	none.	......	....
Atterbury 8E	5	167	Savg.	p-stl.	flex.	sol.	36x5	40x6d	Stn.	mt.	Cont.	4-4¾x6 -36.1	2	cent.	own.	cst.	Lng.	fin.	sing.	Berlg.	hand.	none.	......	....
Autocar XXI-UF	2	97	own.	p-stl.	s-flex.	sol*	34x4	34x5	H&D.	wd.	own.	2-4¾x4½-18.1	1	cent.	own.	sht.	own.	fin.	sing.	Bosch.	hand.	lghtg.	Delco.	none
Autocar XXI-UG	2	120	own.	p-stl.	s-flex.	opt.	34x4	34x5	H&D.	wd.	own.	2-4¾x4½-18.1	1	cent.	own.	sht.	own.	fin.	sing.	Bosch.	fixed.	none.	......	....
Autocar XXVI-Y	3½	120	own.	p-stl.	s-flex.	sol.	34x5	36x10	H&D.	wd.	own.	4-4¼x5½-28.9	4	cent.	own.	cst.	G&O.	fin.	sing.	Bosch.	fixed.	none.	......	....
Autocar XXVI-B	3½	156	own.	p-stl.	s-flex.	sol.	34x5	36x10	H&D.	wd.	own.	4-4¼x5½-28.9	4	cent.	own.	cst.	G&O.	fin.	sing.	Bosch.	hand.	none.	......	....
Available H-1½	1½	145	own.	rol-c.	s-flex.	sol*	36x3½	36x5	Crn.	wd.	Her.	4-4 x5½-25.6	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	West.	150
Available H-2½	2½	152	own.	rol-c.	s-flex.	sol*	36x4	36x8	Crn.	wd.	Her.	4-4 x5½-25.6	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	West.	150
Available H-3½	3½	176	own.	rol-c.	s-flex.	sol.	36x5	40x5d	Crn.	wd.	Her.	4-4½x5½-32.4	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	West.	150
Available H-5	5	190	own.	rol-c.	s-flex.	sol.	36x6	40x12	Sth.	mt.	Her.	4-4¾x6 -36.1	2	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	West.	150
Available H-7	7	190	own.	rol-c.	s-flex.	sol.	36x6	40x14	Sth.	mt.	Her.	4-5 x6 -40.0	2	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	West.	150
Avery	1	129	own.	p-stl.	rigid.	pnu.	34x5	34x5	own.	wd.	own.	6-3 x4 -21.6	6	ther.	own.	cst.	Pfx.	cel.	sing.	K-W.	hand.	sl&i.	West.	none
Bell E	1½	136	own.	rol-c.	rigid.	sol.	34x3½	34x5	Bim.	wd.	Buda.	4-3¾x5½-16.9	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	......	none.	100
Bell O	2½	156	own.	rol-c.	rigid.	sol.	34x4	34x7	Bim.	wd.	Buda.	4-4¼x5½-28.9	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	......	none.	100
Bessemer G	1	124	P&B.	p-stl.	flex.	pnu.	35x5	35x5	Way.	wd.	Cont.	4-3¾x5 -29.4	4	ther.	own.	cst.	Stn.	cel.	sing.	Bosch.	hand.	......	Eismn.	....
Bessemer H2	1½	144	P&B.	p-stl.	flex.	sol.	36x3½	36x5	Way.	wd.	Cont.	4-3¾x5 -22.5	4	ther.	own.	cst.	Stn.	cel.	sing.	Bosch.	hand.	......	Eismn.	....
Bessemer J2	2½	156	P&B.	p-stl.	flex.	sol.	36x4	36x4	Way.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	Stn.	cel.	sing.	Bosch.	hand.	......	Eismn.	....
Bessemer K2	4	175	Pgh.	p-stl.	flex.	sol.	36x6	36x10	Sth.	mt.	Cont.	4-4½x5½-32.4	4	cent.	own.	cst.	......	......	sing.	Bosch.	hand.	......	none.	....
Bethlehem K	1	125	Drt.	p-stl.	flex.	pnu.	34x4½	35x5	Way.	wd.	own.	4-3½x5 -19.6	4	ther.	H&K.	prs.	Lvgn.	cel.	sing.	Bosch.	hand.	s&l-2.	G&D.	none
Bethlehem G	2	135	Drt.	p-stl.	flex.	sol*	34x3½	34x6	Way.	wd.	own.	4-4 x5½-25.6	4	ther.	own.	cst.	Lvgn.	cel.	sing.	Bosch.	hand.	s&l-2.	G&D.	none
Bethlehem H	3	143	Drt.	p-stl.	flex.	sol*	36x4	36x8	Sth.	mt.	own.	4-4 x5½-25.6	4	ther.	own.	cst.	Lvgn.	cel.	sing.	Bosch.	hand.	s&l-2.	G&D.	none
Bethlehem J	4	162	Drt.	p-stl.	flex.	sol*	36x5	36x5d	Sth.	mt.	own.	4-4½x5½-32.4	4	ther.	own.	cst.	Lvgn.	cel.	sing.	Bosch.	hand.	s&l-2.	G&D.	none
Bellstrom B-21	4	140	own.	r-stl.	s-flex.	sol.	36x7	36x7	Clrk.	mt.	Hink.	4-4½x5½-32.4	4	cent.	own.	cst.	Lng.	tube.	sing.	Eismn.	hand.	s&l.	Rem.	80
Bellstrom A-20	4	135	own.	rol-c.	rigid.	pnu.	40x8	40x8	Clrk.	mt.	Wsc.	4-5¾x7 -52.9	2	cent.	own.	cst.	Lng.	fin.	dual.	Eismn.	hand.	s&l.	L-N.	....
Bellstrom 30	1½	140	own.	p-stl.	s-flex.	sol.	34x3½	34x6	own.	mtl.	Buda.	4-3¾x5½-22.5	4	cent.	own.	cst.	......	fin.	sing.	Eismn.	hand.	s&l-2.	G&D.	150
Bellstrom 50	2½	150	own.	p-stl.	s-flex.	sol.	36x4	36x8	own.	mtl.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	......	fin.	sing.	Eismn.	hand.	s&l-2.	G&D.	150
Bellstrom 70	3½	160	own.	p-stl.	s-flex.	sol.	36x5	36x10	own.	mtl.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst.	......	fin.	sing.	Eismn.	hand.	s&l-2.	G&D.	150
Bridgeport A	1½	144	own.	rol-c.	flex.	sol*	34x3	34x6	Arch.	wd.	Buda.	4-3¾x5½-22.5	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	......	......	....
Bridgeport B	2½	156	own.	rol-c.	flex.	sol*	36x4	36x7	Arch.	wd.	Buda.	4-4¼x5½-28.9	4	cent.	own.	cst.	G&O.	cel.	sing.	Eismn.	hand.	none.	......	....
Bridgeport C	4	170	own.	p-stl.	......	sol.	36x5	36x5d	Arch.	wd.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst.	G&O.	cel.	sing.	Eismn.	hand.	none.	......	....
Bridgeport D	6	172	own.	p-stl.	......	sol.	36x6	36x6d	Arch.	wd.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst.	G&O.	cel.	sing.	Eismn.	hand.	......	......	....
Brinton F	2½	150	own.	rol-c.	rigid.	sol.	36x4	36x7	Sth.	mtl.	Cont.	4-4⅛x5¼-27.2	4	g-p.	Chgo.	cst.	Chgo.	tube.	sing.	Bosch.	fixed.	none.	......	....
Brockway S4	1½	140	own.	p-stl.	s-flex.	opt.	36x3½	36x5	H&D.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	hand.	s&l.	Dneto.	....
Brockway K5	2½	152	own.	p-stl.	s-flex.	sol.	36x4	36x7	H&D.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	hand.	......	Dneto.	....
Brockway R4	3½	164	own.	p-stl.	s-flex.	sol.	36x5	36x5d	Sth.	mt.	Cont.	4-4½x5½-32.4	2	cent.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	hand.	s&l.	Dneto.	....
Brockway T	5	174	own.	p-stl.	s-flex.	sol.	36x6	40x6d	Sth.	mt.	Cont.	4-4¾x6 -36.1	2	cent.	Long.	cst.	Long.	fin.	sing.	Eismn.	hand.	s&l.	none.	....
Capitol G1½	1½	144	own.	rol-c.	s-flex.	pnu.	35x5	38x7	Ames.	wd.	Wsc.	4-3¾x5 -22.5	4	cent.	G&O.	cst.	G&O.	fin.	sing.	Eismn.	hand.	sl&i-2.	West.	none
Capitol H2½	2½	156	own.	rol-c.	s-flex.	sol.	36x4	36x8	......	wd.	Wsc.	4-4¼x6 -28.9	4	cent.	G&O.	cst.	G&O.	fin.	sing.	Bosch.	hand.	none.	......	....
Capitol K2½	2½	156	own.	rol-c.	s-flex.	pnu.	36x6	42x9	......	wd.	Wsc.	4-4¼x6 -28.9	4	cent.	G&O.	cst.	G&O.	fin.	sing.	Bosch.	hand.	sl&i-2.	West.	none
Capitol M3½	3½	168	own.	rol-c.	s-flex.	sol.	36x5	36x10	Sth.	mt.	Wsc.	4-4¼x6 -28.9	4	cent.	G&O.	cst.	G&O.	fin.	sing.	Bosch.	hand.	sl&i-2.	West.	170
Chevrolet G	¾	120	own.	p-stl.	rigid.	pnu.	31x4	34x4½	own.	wd.	own.	4-3 11/16x4-22.5	4	cent.	Har.	prs.	Har.	cel.	dbl.	Remy.	hand.	sl&i-2.	Aut-L	....
Chevrolet T	1	125	own.	rol-c.	rigid.	pnu.	33x4	35x5	own.	wd.	own.	4-3 11/16x5¼-22.5	4	cent.	Har.	prs.	Har.	cel.	dbl.	Remy.	hand.	sl&i-2.	Aut-L.	....
Chicago C1½	1½	144	own.	rol-c.	flex.	sol*	36x3½	36x5	Stn.	wd.	Her.	4-3¾x5¼-22.5	4	cent.	own.	cst.	Brem.	fin.	sing.	Bosch.	fixed.	......	......	....
Chicago C2½	2½	156	own.	rol-c.	s-flex.	sol*	36x4	36x7	......	cst.	Her.	4-4 x5½-25.6	4	cent.	own.	cst.	Brem.	fin.	sing.	Bosch.	fixed.	......	......	....

ABBREVIATIONS—Types of Construction

- *—other options
- **amid**—amidships
- **auto**—automatic
- **bevl**—bevel
- **cel**—cellular
- **cent**—centrifugal
- **chn**—chain
- **cst**—cast
- **ctr**—center
- **cylinders cast, 2 in pairs**
- **cylinders cast, 4 in block**
- **cylinders cast, 3 in threes**
- **cylinders cast, 1 singly**
- **cyl-ends**—cylinder-ends
- **d**—dual
- **d-d**—dry-disk
- **d-p**—dry-plate
- **dplx**—from both motor & driveshaft
- **d-rd**—double reduction
- **d-s**—drive-shaft
- **elec**—electric
- **ext-d-s**—external drive-shaft
- **ext-f-w**—external front wheel
- **ext-g**—external gear
- **ext-jst** — external jack-shaft
- **ext-r-w**—external rear wheel
- **fab**—fabric
- **fin**—finned tube
- **flex**—flexible
- **f-m**—fabric & metal
- **fric**—friction
- **g-p**—gear pump
- **grv**—gravity
- **gset**—from gearset
- **hyd**—hydraulic
- **ind-c**—individual clutch
- **int-g**—internal gear
- **int-g-4** — internal gear drive on 4 wheels
- **int-r-w**—internal rear wheel
- **jst**—unit with jackshaft
- **l**—left
- **l-b**—loose ball
- **lghtg**—lighting only
- **mtr**—unit with motor
- **mt**—metal (wheels)
- **mtl**—metal (universal joint)
- **opt**—optional
- **pist**—piston pump
- **plan**—planetary
- **pln**—plain tube
- **pnu**—pneumatic
- **pres**—pressure
- **prog**—progressive
- **prs**—pressed steel
- **p&s**—pneumatics in front solids in rear
- **p-stl**—pressed steel
- **r**—right
- **r&c**—right & center
- **r-rd**—radius rods
- **rol-c**—rolled channel
- **rol-i**—rolled I-beam
- **selec**—selective
- **s-flex**—semi-flexible
- **s-fr**—sub-frame
- **sht**—sheet
- **s&l**—starting & lighting
- **sl&i-2**—starting, lighting & ignition, 2 unit
- **sol**—solid
- **sprgs**—springs
- **sq-t**—square tube
- **start**—starting only
- **suct**—suction
- **t-arm**—torque arm
- **ther**—thermo-syphon
- **t-p**—two-point
- **t-t**—torsion tube
- **vac**—vacuum
- **wat-tube**—water tube
- **wd**—wood
- **w-d**—multiple disk in oil
- **w-p**—plate in oil
- **wr**—wire
- **zz-t**—zig-zag tube

ABBREVIATIONS—Makers of Parts.

- *Other Options
- **A-Knt**—Atwater-Kent
- **Al-Ch**—Allis-Chalmers
- **Amer** — American Magneto Co.
- **Arch**—Archibald
- **Aut-L**—Auto-Lite
- **Auto**—Auto Wheel Co.
- **B-Beck**—Borg & Beck
- **BCA**—Bearings Co. of Am.
- **Berlg**—Berling
- **Bim**—Bimel
- **Bl&Fl**—Blood & Flexite
- **B-Lipe**—Brown-Lipe
- **Blood**—Blood Bros.
- **Bl&P**—Blood & Peters
- **Bl&Sp**—Blood & Spicer
- **B-M**—Bucyrus Mach. Tool
- **Brem**—Bremer
- **Cart**—Carter carburetor
- **Cas**—G. M. Castle
- **CAS**—C. A. S. products
- **C-D**—Curran-Detroit Radiator Co.
- **Chgo**—Chicago Mfg. Co.
- **Chic**—Chicago Standard
- **Chmp**—Champion Auto Spring Co.
- **Clrk**—Clark Equip. Co.
- **Cocn**—Corcoran Radiator Co.
- **Col**—Columbia Axle Co.
- **Cont**—Continental motor
- **Conn**—Connecticut
- **Crn**—Crane & MacMahon
- **Crn-S**—Crane & MacMahon and Standard
- **Day**—Dayton wheel
- **Detlaf**—Detlaff
- **Det** — Detroit Wheel & Rim
- **Detrt**—Detroit G. & M.
- **Dtl**—Disteel Wheel Co.
- **Ditw**—Ditwiler Mfg. Co.
- **Dnet**—Dyneto

Gasoline Trucks

ENGINE									TRANSMISSION										BRAKES		CONTROL			UNIVERSALS		
GOVERNOR			SPEED		FUEL SYS.		CLUTCH		GEARSET				FINAL DRIVE								STEER'G GEAR					
Type	Make	Drive	Motor in r.p.m.	Truck in m.p.h.	Carburetor Make	Fuel Feed	Type	Make	Type	Make	Placed	Speeds	Type	Rear Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Foot	Hand	Placed	Make	Levers	Type	Make	Name and Model
cent.	Wau.	motor.	1200	18	Schblr.	vac.	d-d.	Detlaf.	ind-c.	Cotta.	amid.	4	worm.	Timkn	7.75	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Acason H
cent.	Wau.	motor.	1200	14	Schblr.	vac.	d-d.	Detlaf.	ind-c.	Cotta.	amid.	4	worm.	Timkn	8.75	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Acason L
none.			1700	30	Rayfld.	vac.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	3	worm.	Timkn	6.25	sprgs.	sprgs.	Drt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Acme
cent.	Dplx.	gset.	1700	22	Rayfld.	vac.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	3	worm.	Timkn	7.20	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Acme B
cent.	Dplx.	gset.	1500	19	Zenith.	vac.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	3	worm.	Timkn	8.75	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Acme F
cent.	Dplx.	gset.	1500	17	Rayfld.	vac.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	4	worm.	Timkn	9.25	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Acme A
cent.	Dplx.	motor.	1200	13	Rayfld.	vac.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	4	worm.	Timkn	10.33	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Acme C
cent.	Cont.	motor.	1250	12	Rayfld.	vac.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	4	worm.	Timkn	11.66	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Acme E
			1509	30	Stmbg.	grv.	d-d.	War.	selec.	Warner.	mtr.	3	bevl.	Eaton.	5.12½	sprgs.	sprgs.	Stn.	int-.	int-r-w.	l.	Jacox.	ctr.	fab		Akron Multi-Truck 20
suct.	own.	motor.	1600	18	Stmbg.	grv.	d-d.	Detlaf.	selec.	Covert.	mtr.	4	worm.	Thorn.	8.66	sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Acme.	American 25
suct.	Pierce.	motor.	1600	15	Stmbg.	grv.	d-d.	Cotta.	selec.	Covert.	amid.	4	worm.	Wis.	10.00	sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Acme.	American 40
none.					Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn	7.25	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Armleder 20
none.					Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Timkn	9.25	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Armleder HW
none.					Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Timkn	10.3	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Armleder KW
none.			1200	20	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Wis*.	7.25	sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	Therm.	Atco B
none.			1200	20	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Torbn.	7.00	sprgs.	sprgs.	GCS.	ext-r-w.	int-r-w.	l.	Ross.	ctr.			Atco B1
cent.	Pierce.	motor.	1200	16	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Wis.	8.67	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Atco A
none.					Marvl.	grv.	d-p.	B-Beck.	selec.	own.	mtr.	3	worm.	own.			sprgs.	Iron.	ext-r-w.	ext-d-s.	l.	C.A.S.	ctr.	mtl	Sterl.	Atlas (York) Dispatch 21
cent.	Simp.	motor.	1525	20	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn	7.75	sprgs.	sprgs.	Sp-p.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Atterbury 20R
suct.	Mnrch.		1300	16	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	8.50	sprgs.	sprgs.	Sp-p.	int-r-w.	int-r-w.	r.	Gem.	r.	mtl	Spicer.	Atterbury 7CX
suct.	Mnrch.		1200	14	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	10.33	sprgs.	sprgs.	Sp-p.	int-r-w.	int-r-w.	r.	Gem.	r.	mtl	Spicer.	Atterbury 7D
suct.	Cont.	motor.	1100	12	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	11.66	r-rd.	sprgs.	Sp-p.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Atterbury 8E
none.					Stmbg.	grv.	d-p.	own.	prog.	own.	amid.	3	d-rd.	own.	8.30	sprgs.	sprgs.	Rowl*.	ext-r-w.	int-r-w.	l.	own.	r.	mtl	Spicer.	Autocar XXI-UF
none.					Stmbg.	grv.	d-p.	own.	prog.	own.	amid.	3	d-rd.	own.	8.30	sprgs.	sprgs.	Rowl*.	ext-r-w.	int-r-w.	r.	own.	r.	mtl	Spicer.	Autocar XXI-UG
cent.	Dplx.	motor.	1800	16	Stmbg.	grv.	d-p.	own.	selec.	own.	amid.	4	d-rd.	own.	8.70	sprgs.	sprgs.	Rowl*.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Sp&Sn.	Autocar XXVI-Y
cent.	Dplx.	motor.	1800	16	Stmbg.	grv.	d-p.	own.	selec.	own.	amid.	4	d-rd.	own.	8.70	sprgs.	sprgs.	Rowl*.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&Sn.	Autocar XXVI-B
cent.	Pierce.	motor.	1175	18	Stmbg.	vac.	d-d.	B-Lipe.	ind-c.	Cotta.	amid.	4	worm.	Timkn	7.25	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Available H-1½
cent.	Pierce.	motor.	1155	16	Stmbg.	vac.	d-d.	B-Lipe.	ind-c.	Cotta.	amid.	4	worm.	Timkn	7.50	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Available H-2½
cent.	Pierce.	motor.	1130	13	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.33	r-rd'.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Available H-3½
cent.	Pierce.	motor.	1175	12	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	11.66	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Available H-5
cent.	Pierce.	motor.	1175	10	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	bevel.	Savg.	14.00	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Available H-7
cent.	own.	motor.	1400	20	Stmbg.	vac.	d-d.	own.	selec.	own.	amid.	3	int-g.	Torbn.		sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	own.	Avery
none.			1200	15	Stmbg.	vac.	d-p.	B-Beck.	selec.	Detrt.	mtr.	3	int-g.	Russl.		sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Unvsl.	Bell E
cent.	Dplx.	motor.	1100	18	Stmbg.	vac.	d-p.	B-Beck.	selec.	Detrt.	mtr.	3	int-g.	Russl.		sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Unvsl.	Bell O
none.				20	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Torbn.	8.00	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Arvac.	Bessemer G
cent.	none.	motor.		18	Stmbg.	grv.	d-p.	B-Beck.	selec.	Baker.	amid.	3	int-g.	Torbn.	8.00	r-rd.	sprgs.	S-P.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Arvac.	Bessemer H2
cent.	Pierce.	motor.	1220	16	Stmbg.	grv.	d-p.	B-Beck.	selec.	Baker.	amid.	4	int-g.	Torbn.	12.00	r-rd.	sprgs.	S-P.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Arvac.	Bessemer J2
cent.	Pierce.	motor.	1250	13	Stmbg.	grv.	d-p.	B-Beck.	selec.	Baker.	amid.	4	int-g.	Torbn.	10.25	r-rd.	sprgs.	S-P.	ext-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Arvac.	Bessemer K2
none.			2400	47	Zenith.	grv.	d-p.	B-Beck.	selec.	Drt.	mtr.	3	int-g.	Col.	6.80	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Bethlehem K
cent.	Pierce.	motor.	1200	19	Zenith.	grv.	d-p.	B-Beck.	selec.	Drt.	mtr.	3	int-g.	Russl.	7.70	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Unvsl.	Bethlehem G
cent.	Pierce.	motor.	1200	16	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Russl.	9.40	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Unvsl.	Bethlehem H
cent.	Pierce.	motor.	1200	14	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	4	int-g.	Torbn.	10.20	sprgs.	sprgs.	Math.	int-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	Unvsl.	Bethlehem J
cent.	Hink.	motor.	1200	19	Stmbg.	grv.	d-d.	Detlaf.	selec.	own.	amid.	3	int-g.	Clrk.	6.50	sprgs.	sprgs.	Drt.	ext-r-w.	i&e-f&r.	l.	Jacox.	ctr.	mtl	own.	Bellstrom B-21
none.			1400	28	Stmbg.	grv.	w-d.	M&E.	selec.	Cotta.	amid.	3	int-g.	Clrk.	5.76	sprgs.	sprgs.	Drt.	ext-r-w.	i&e-f&r.	l.	Wol.	ctr.	mtl	M&E.	Bellstrom A-20
cent.		motor.	1400	20	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	own.	7.00	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.		ctr.	mtl	own.	Bellstrom 30
cent.		motor.	1300	17	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	own.	7.75	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.		ctr.	mtl	own.	Bellstrom 50
cent.		motor.	1200	14	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	own.	9.00	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.		ctr.	mtl	own.	Bellstrom 70
cent.	Pierce.	motor.	1250	38	Stmbg.	grv.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	3	worm.	Wis.		sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Bridgeport A
cent.	Pierce.	motor.	1250	13	Stmbg.	grv.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	4	worm.	Shel.		sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	l.	mtl	Hart.	Bridgeport B
cent.	Pierce.	motor.	1250	13	Stmbg.	grv.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	4	worm.	Wis.		sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Bridgeport C
cent.	Pierce.	motor.	1250	..	Stmbg.	grv.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	4	worm.	S-P.		sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Bridgeport D
cent.	Pierce.	motor.	1200	18	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn		r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Brinton F
hyd.	Pharo.	motor.	1260	18	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	7.80	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Brockway S4
hyd.	Pharo.	motor.	1100	15	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	7.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Brockway K5
hyd.	Pharo.	motor.	1150	14	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	8.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Brockway R4
hyd.	Pharo.	motor.	1100	12	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Brockway T
cent.	Dplx.	motor.	1300	24	Stmbg.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	mtr.	4	worm.	Wis.	6.20	sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Capitol G1½
cent.	Dplx.	motor.	1150	14	Stmbg.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	mtr.	4	worm.	Wis.	8.66	sprgs.	sprgs.	Sp-P	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Capitol H2½
cent.	Dplx.	motor.	1150	20	Stmbg.	grv.	d-d.	Detlaf	ind-c.	Cotta.	mtr	4	worm.	Wis.	7.25	sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Capitol K2½
cent.	Dplx.	motor.	1150	14	Stmbg.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	mtr.	4	worm.	Wis.	9.00	sprgs.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Capitol M3½
					Zenith.	grv.	cone.		selec.		mtr.	3	bevel.		6.33	sprgs.	sprgs.	own.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	own.	Chevrolet G
	Murch.			25	Zenith.	grv.	cone.	own.	selec.	own.	mtr.	3	worm.	own.	7.00	sprgs.	sprgs.	own.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	Own.	Chevrolet T
cent.	Simp.	motor.	1150	18	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn	7.75	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Peters.	Chicago C1½
cent.	Simp.	motor.	1150	16	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	8.50	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Peters.	Chicago C2½

ABBREVIATIONS—Makers of Parts—(Con)—

Dplx—Duplex governor
Drt—Detroit Pressed Steel Co.
Dtr—Detroit Products
Dtrt—Detroit lubricator
Dun—Dunbar Mfg. Co.
Dund—Dundore Mfg. Co.
Dunk—Dunkirk Axle Corp.
Dur—Durston Gear Corp.
Elyr—Elyria Steel Products Co.
E&M—English & Mersick
E&O—Eberly & Orris
Eism—Eisemann
Ens—Ensign carburetor
Eric—Ericsson Mfg. Co.
Eurk—Eureka
Fed—Fedders
GB&S—Golden, Belknap & Schwartz
G&D—Gray & Davis
G&O—G & O Mfg. Co.
GCS—Garden City springs
Gem—Gemmer
G-Lees—Grant-Lees
Godn—Gordan Radiator Co.
Har—Harrison
Hart—Hartford
Harv—Harvey
Hay—Hayes Wheel Co.
H&D—Hoopes Bros. & Darlington
H&K—Hale & Kilburn
Her—Hercules
Hghy—Highway Engine Co.
Hink—Hinkley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Int—Interstate
Iron—Iron City
Jacox—Jackson-Church-Wilcox
Jck—Jackson Auto Rad.
Jmst—Jamestown Car Parts
Jns—Phineas Jones & Co.
John—Johnson Co.
K&B—Kinsler & Bennet
Kel—Kelsey Wheel Co.
Kug—Kueng Radiator Co.
K.W.—K.W. Ignition Co.
Laur—Lauraine Magneto
Lavn—Lavine
LeR—Le Roi engine
Lght—Light Mfg. Co.
Liggt—Liggett Spring & Axle Co.
L-N—Leece-Neville Co.
Lng—Long
Lvgn—Livingston
Lyc—Lycoming
Marm—Maremont Mfg. Co.
McCn—McCanna
M&E—Merchant & Evans
McC—McCord
Mech—Mechanics Machine
Merl—Merrill Spring Co.
Mnrch—Monarch
Mod—Modine Mfg. Co.
Morg—Morgan Mfg. Co.
Math—Mather
Munc—Muncie
MWC—Motor Wheel Corp.
Natl—National Can Co.
Natn—National Axle Co.
N-E—North East
Own&Sp—Own & Spicer
P&B—Parish & Bingham
Pfx—Perfex radiator
Pgh—Pittsburgh Pressed Steel
Phro—Pharo Mfg. Co.
Pitt — Pittsburgh Model Engine Co.
Prsh—Parish Mfg. Co.
Prud—Prudden
Rayfld—Rayfield
Rowl—Wm. H. Rowland
Roy — Royer Wheel Co.
R-T—Rome-Turney
Russl—Russel Axle Co.
Sag—Saginaw
Sal—Salisbury
Savg—Savage Arms
Sch—Schwarz Wheel Co.
Schblr—Schebler
Shar—Sharon Pressed Steel Co.
Shel—Sheldon
Slm—Simms Magneto Co.
Simp—Simplex
S-K—Slick Knox Steel Co.
Smh—A. O. Smith
Sn & Ac—Snead & Acme
Sn&Sp—Snead & Spicer
S-P—Standard Parts Co.
Sp&Fl—Spicer & Flexite
Spltf—Splitdorf
Sp-P—Spring Perch Co.
Sp&Pet—Spicer & Peters
Stan—Standard radiator
Stand — Standard Steel Spring Co.
Sterl—Sterling bearings
Stmbg—Stromberg
Stn—Standard Wheel Co.
Sth—Smith steel wheel
S-W—Sparks-Withington
Th&Ba Thermoid & Baker
Th&Bl—Thermoid & Blood
Therm—Thermoid
Th—Sp—Thermoid & Spicer
Till—Tillotson
Timkn—Timken
Torbn—Torbensen
Trav—Traverse City Iron Works
T-S—Turner-Seymour
Tuth—Tuthill
Unv—Universal
Unvsl—Universal Mach.
U.P.—U. P. Products Co.
U.S.—U. S. Spring Co.
Wab — Wabash Radiator Co.
Warn—Warner
Wau—Waukesha
Way—Wayne Wheel Co.
Wed—Weidley
West—Westinghouse
We-W — Western Wheel Co.
Wis—Wisconsin Parts
Wol—Wohlrab
W-S—West Steel Castings Co.
Wsc—Wisconsin engine
Yng—Youngstown Pressed Steel Co.

Specifications of Gas

Name and Model	Tons Capacity	Wheelbase, Inches	Frame Make	Frame Material	Frame Type	Tires Kind	Tires Size in Ins. Front	Tires Size in Ins. Rear	Wheels Make	Wheels Type	Engine Make	No. Cyl. Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	Cooling Water Circ.	Radiator Case Make	Radiator Case Type	Radiator Core Make	Radiator Core Type	Ignition Type	Ignition Make	Spark Advance	Elec. System Type	Elec. System Make	Extra Cost $
Chicago C3½	3½	168	own	rol-c	s-flex	sol	36x5	36x10	Stn	cst	Her	4-4½x5½-32.4	4	cent	own	cst	Brem	fin	sing	Bosch	fixed			
Chicago D5	5	167	own	rol-c	s-flex	sol	36x6	40x12	Stn	cst	Her	4-4½x5½-32.4	4	cent	own	cst	Brem	fin	sing	Bosch	fixed			
Climber A	1½	146	Savg	p-stl	s-flex	pnu*	36x6	38x7	Roy	wd	H-S	4-3½x5 -19.6	4	ther	Chgo	cst	Chgo	fin	sing	A-Knt	hand	sl&i-2	West	none
Clydesdale 32C	1	144	P&B	p-stl	s-flex	sol*	34x3½	34x5	Bim	wd	own	4-3¾x5 -22.5	4	cent	own	cst	own	pln	sing	Bosch	hand	sl&i	West	150
Clydesdale 42C	1½	146	P&B	p-stl	flex	sol	36x3½	36x5	Bim	wd	own	4-3¾x5 -22.5	4	cent	own	cst	own	pln	sing	Bosch	hand	sl&i	West	150
Clydesdale 65C	2½	163	P&B	p-stl	flex	sol	36x4	36x7	Sth	mt	own	4-4¼x5½-29.0	4	cent	own	cst	own	pln	sing	Bosch	hand	sl&i	West	150
Clydesdale 65EC	2½	163	P&B	p-stl	flex	sol	36x4	36x7	Sth	mt	own	4-4½x5½-32.4	4	cent	own	cst	own	pln	sing	Bosch	hand	sl&i	West	160
Clydesdale 90C	3½	190	P&B	p-stl	flex	sol	36x5	40x10	Sth	mt	own	4-4½x5½-32.4	4	cent	own	cst	own	pln	sing	Bosch	hand	sl&i	West	160
Clydesdale 120C	5	204	P&B	p-stl	flex	sol	36x6	40x12	Sth	mt	own	4-4¾x6 -36.1	2	cent	own	cst	own	pln	sing	Bosch	hand	sl&i	West	170
Commerce T	¾	127	Drt	rol-c		pnu	34x4½	34x4½	Bim	wd	Cont	4-3¾x5 -22.5	4	ther	Long	cst	Long	fin	sing	Eismn	hand	s&l	Bijur	none
Commerce 12	1	130	Drt	p-stl	flex	pnu	35x5	35x5	Bim	wd	Cont	4-3¾x5 -22.5	4	ther	Long	cst	Long	fin	sing	Eismn	hand	s&l	Bijur	none
Commerce 16	1½	137	Drt	p-stl	flex	pnu	35x5	36x6	Bim	wd	Cont	4-3¾x5 -22.5	4	ther	Long	cst	Long	fin	sing	Eismn	hand	s&l	Bijur	none
Concord A		140	P&B	p-stl		sol	36x3½	36x6	Sth	mt	Buda	4-4 x5½-25.6	4	cent	own		own	fin	sing	Eismn		none		
Concord AX		150	P&B	p-stl		sol	36x3½	36x6	Sth	mt	Buda	4-4 x5½-25.6	4	cent	own		own	fin	sing	Eismn		none		
Concord B		150	P&B	p-stl		sol	36x4	36x8	Sth	mt	Buda	4-4¼x5½-28.9	4	cent	own		own	fin	sing	Eismn		none		
Concord BX		170	P&B	p-stl		sol	36x4	36x8	Sth	mt	Buda	4-4¼x5½-28.9	4	cent	own		own	fin	sing	Eismn		none		
Cook 41	2	95	own	p-stl	flex	pnu	36x6	38x7	Crn	wd	Her	4-4 x5½-25.6	4	cent	Chgo	cst	Chgo	fin	sing	Berlg	hand	lghtg	G&D	none
Corbitt E	1	130	own	rol-c	s-flex	sol	34x3½	34x4	Bim	wd	Cont	4-3¾x5 -22.5	4	ther	McC	cst	McC	fin	sing	Eismn	hand	sl&i-2	G&D	150
Corbitt D	1½	140	own	rol-c	s-flex	sol	36x3½	36x5	Bim	wd	Cont	4-3¾x5 -22.5	4	ther	McC	cst	McC	fin	sing	Eismn	hand	sl&i-2	G&D	150
Corbitt C	2	148	own	rol-c	s-flex	sol	36x3½	36x7	Bim	wd	Cont	4-4⅛x5½-27.2	4	cent	McC	cst	McC	fin	sing	Eismn	hand	lghtg	Eismn	75
Corbitt B	2½	152	own	rol-c	s-flex	sol	36x4	36x7	Bim	wd	Cont	4-4⅛x5½-27.2	4	cent	McC	cst	McC	fin	sing	Eismn	hand	lghtg	Eismn	75
Corbitt A	3½	178	own	rol-c	s-flex	sol	36x5	36x10	Sth	mt	Cont	4-4½x5½-32.4	2	cent	McC	cst	McC	fin	sing	Eismn	hand	lghtg	Eismn	75
Corbitt AA	5	178	own	rol-c	rigid	sol	36x6	40x6d	Sth	mt	Cont	4-4¾x6 -36.1	2	cent	McC	cst	McC	fin	sing	Eismn	hand	lghtg	Eismn	none
Day-Elder A	1	128	Savg	p-stl	s-flex	sol*	34x3½	34x4	Jns	wd	Cont	4-3¾x5 -22.5	4	ther	Bush	cst	Bush	fin	sing	Eismn	hand	lghtg*	Eism*	
Day-Elder B	1½	144*	Savg	p-stl	s-flex	sol*	34x3½	34x5	Jns	wd	Cont	4-3¾x5 -22.5	4	ther	Bush	cst	Bush	fin	sing	Eismn	hand	lghtg*	Eism*	
Day-Elder D	2	144*	Savg	p-stl	s-flex	sol*	36x4	36x7	Jns	wd	Cont	4-4⅛x5½-27.3	4	cent	Bush	cst	Bush	fin	sing	Eismn	hand	lghtg*	Eism*	
Day-Elder C	2½	150*	Savg	p-stl	s-flex	sol*	36x4	36x7	Jns	wd	Buda	4-4¼x5 -29.0	4	cent	Bush	cst	Bush	fin	sing	Eismn	hand	lghtg*	Eism*	
Day-Elder F	3½	165*	Savg	p-stl	s-flex	sol*	36x5	36x5d	Jns	wd	Cont	4-4½x5½-32.4	2	cent	Bush	cst	Bush	fin	sing	Eismn	hand	lghtg*		
Day-Elder E	5	170	Savg	p-stl	s-flex	sol*	36x5	36x6d	Jns	wd	Buda	4-4½x6 -32.4	4	cent	Bush	cst	Bush	fin	sing	Eismn	hand	lghtg	Eism*	105
Dearborn F	1½	124	Savg	p-stl	s-flex	sol*	34x4	34x5	Crn	wd	Buda	4-3¾x5½-22.5	4	ther	Chgo	cst	Chgo	fin	sing	Bosch	hand	none		
Dearborn 48	2	148	Cas	rol-c	s-flex	pnu	35x5	34x7	Crn	wd	Buda	4-3¾x5½-22.5	4	ther	Chgo	cst	Chgo	fin	sing	Bosch	hand	none		
Defiance D	1½	140	Drt	p-stl	flex	pnu	35x5	36x6	Crn	wd	Hghy	4-3¾x5 -22.5	4	cent	Pfx	cst	Pfx	cel	sing	Eismn	hand	s&l-2	Aut-L	150
Defiance E	2	140	Drt	p-stl	flex	pnu	35x5	38x7	Crn	wd	Hghy	4-3¾x5 -22.5	4	cent	Pfx	cst	Pfx	cel	sing	Eismn	hand	s&l-2	Aut-L	150
DeKalb E2	2	134	Prsh	p-stl	flex	sol*	34x3½	36x5	Sch	wd	Cont	4-4⅛x5½-27.2	4	cent	Jck	sht	Jck	pln	sing	Eismn	hand	none		
DeKalb E2½	2½	136	Prsh	p-stl	flex	sol*	36x4	36x6	Sch	wd	Cont	4-4⅛x5½-27.2	4	cent	Jck	sht	Jck	pln	sing	Eismn	hand	none		
Dependable A	1	134	Cas	p-stl	flex	pnu	34x5	36x6	Bim	wd	H-S	4-3½x5 -19.6	4	ther	Lng	cst	Lng	cel	sing	Spltf	hand	s&l	Aut-L	none
Dependable C	1½	128	Prsh	p-stl	flex	sol*	34x3½	34x5	Bim	wd	Buda	4-3¾x5½-22.5	4	cent	Lng	cst	Lng	fin	sing	Spltf	hand	s&l	West	
Dependable D	2	128	Prsh	p-stl	flex	sol	34x5	36x6	Bim	wd	Buda	4-4 x5½-25.6	4	cent	Lng	cst	Lng	fin	sing	Spltf	hand	s&l	West	
Dependable E	2½	157	Prsh	p-stl	flex	sol*	36x4	36x7	Bim	wd	Buda	4-4¼x5½-29.0	4	cent	Lng	cst	Lng	fin	sing	Spltf	hand	s&l	West	
Dependable G	3½	160	Cas	p-stl	flex	sol	36x6	38x7	Bim	wd	Buda	4-4½x6 -32.4	4	cent	Lng	cst	Lng	fin	sing	Spltf	hand	s&l	West	
Diamond-T T	1½	144	Smh	p-stl		sol	36x3½	36x5		wd	Hink	4-3¾x5½-32.4	4	cent	G&O	cst	G&O	fin	sing	Bosch	hand			
Diamond-T U	2	160	Smh	p-stl	s-flex	sol	36x4	36x7		wd	Hink	4-4 x5½-25.6	4	cent	G&O	cst	G&O	fin	sing	Bosch	hand			
Diamond-T K	3½	170	Smh	p-stl	s-flex	sol	36x5	36x5d		wd	Hink	4-4¼x5½-29.0	4	cent	G&O	cst	G&O	fin	sing	Bosch	hand			
Diamond-T EL	5	180	Smh	p-stl	s-flex	sol	36x6	40x6d		wd	Hink	4-4½x5½-32.4	4	cent	G&O	cst	G&O	fin	sing	Bosch	hand			
Diamond-T S	5	180	Smh	p-stl		sol	36x6	40x6d		wd		4-4¾x6 -36.1	4	cent	G&O	cst	G&O	fin	sing	Bosch	hand			
Dodge Brothers	¾	114	Drt	p-stl	flex	pnu	33x4	34x4	Kel	wd	own	4-3⅞x4½-24.3	4	cent	McC	cst	McC	pln	sing	N-E	auto	sl&i	N-E	
Dorris K-4	2		Smh	p-stl	flex	sol	36x4	36x7	Sth	wd	own	4-4¼x5½-29.0	4	cent	own	cst	McC	fin	sing	Bosch	hand	s&l	West	175
Dorris K-7	3½	174	Smh	p-stl	flex	sol	36x5	36x10	Sth	mt	own	4-4¼x5½-29.0	4	cent	own	cst	McC	fin	sing	Bosch	hand	s&l	West	175
Douglas	1½	128	own	p-stl		sol*	36x5	37x8	Sth	wd	Weid	4-3¾x5½-22.5	4	cent	Chgo	cst	Chgo	sq-t	sing	Eismn	hand	sl&i-2	West	100
Douglas	3	144	own	p-stl		opt	36x6	37x8	own	wd	Buda	4-4¼x5½-29.0	4	cent	Chgo	cst	Chgo	sq-t	sing	Eismn	hand	sl&i-2	West	100
Duplex A	2½	145	P&B	p-stl	rigid	pnu	35x5	38x7	Prud	wd	Hink	4-4 x5½-25.6	4	cent	Mod	cst	Mod	fin	sing	West	hand	s&l-2	West	none
Duplex E	3½	130	P&B	p-stl	rigid	sol	36x8	36x8	Prud	wd	Buda	4-4¼x5½-29.0	4	cent	Long	prs	Long	p-t	sing	Eismn	hand	none		
Duty 21	2	134	own	rol-c	s-flex	sol	34x3½	34x5	Stn	wd	Gray	4-3½x5 -19.6	4	ther	Eurk	cst	Eurk	cel	sing	Spltf	hand	none		
Eagle 100-2	2	130	own	p-stl	flex	sol*	34x3½	34x6	Stn	wd	Buda	4-3¾x5½-22.5	4		own	cst	own	cel	sing	Eismn	hand			
Elmira C	½	105	own	rol-c	s-flex	pnu	28x3	28x3	Mott	wr	LeR	4-3⅛x4½-15.6	4	ther	Cocn	pst	Cocn	zz-t	sing	Spltf	hand	lghtg	W-L	none
Erie A	2½	150	own	p-stl	s-flex	sol*	36x4	36x4d	Way	wd	Buda	4-4¼x5½-29.0	4	cent	own	cst	McC	fin	sing	Bosch	hand	lghtg		none
Facto 1921	2½	156		p-stl		sol*	36x4*	36x8*	Sth	mt	Buda	4-4¼x5½-29.0	4		Bush		Bush	fin		Spltf				
Fageol (Cal.)	1½	136	own	rol-c	s-flex	sol*	34x3½	34x6	Stn	mt	Wau	4-3¾x5¼-22.5	4	cent	own	cst	Mod	fin	sing	Spltf	hand	lghtg	Spltf	
Fageol (Cal.)	2½	144	own	rol-c	s-flex	sol*	34x4	36x7	Stn	mt	Wau	4-4¼x5¾-29.0	2	cent	own	cst	Mod	cel	sing	Spltf	hand	lghtg	Spltf	
Fageol (Cal.)	3½	172	own	p-stl		sol*	36x5	36x5d	Stn	mt	Wau	4-4½x6¾-32.6	2	cent	own	cst	Mod	cel	sing	Spltf	hand	lghtg	Spltf	
Fageol (Cal.)	5	174	own	p-stl		sol	36x6	40x6d	Stn	mt	Wau	4-4½x6¾-32.4	2	cent	own	cst	Mod	zz-t	sing	Spltf	hand	lghtg	Spltf	
Fageol (Ohio) Md	2½	150	own	rol-c	flex	sol*	36x4	36x4	Stn	mt	Wau	4-3⅜x5¼-18.2	2	cent	own	cst	Mod	cel	sing	Laur	hand	none		cent
Fageol (Ohio) Hd	3½	172	own	p-stl	s-flex	sol*	36x5	40x5d	Stn	mt	Wau	4-4¼x6¾-29.0	2	cent	own	cst	Mod	cel	sing	Laur	hand	none		cent
Federal SD	1	132	Drt	p-stl	s-flex	pnu	35x5	36x6	Drt	mt	Cont	4-3¾x5 -22.5	4	cent	own	pst	Long	fin	sing	Eismn	fixed	lghtg	Aut-L	none
Federal TE	1½	144	Drt	p-stl	s-flex	sol	36x3½	36x5	Auto	wd	Cont	4-4⅛x5¼-27.2	4	cent	own	pst	Long	fin	sing	Eismn	fixed	none		
Federal UE	2	156	Drt	p-stl	s-flex	sol	36x4	36x7	Auto	wd	Cont	4-4⅛x5¼-27.2	4	cent	own	pst	Long	fin	sing	Eismn	fixed	none		
Federal WE	3½	156	Drt	p-stl	s-flex	sol	36x5	36x5d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	own	pst	Long	fin	sing	Eismn	fixed	none		
Federal XE	5	156	Russl	rol-c	s-flex	sol	36x6	40x6d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	own	pst	Long	fin	sing	Eismn	fixed	none		
Ford TT	1	123		p-stl	flex	pnu	30x3½	32x4½	Hay*	wd	own	4-3¾x4 -22.5	4	ther	own	pst	own	fin	dual	own	hand	sl&i-2	own	70
F.W.D. B	3	124	own	p-stl	s-flex	sol	36x6	36x6	Sch	wd	Wsc	4-4¾x5½-36.1	2	cent	McC	cst	McC	pln	sing	Eismn	hand	s&l-2	N-E	
Fulton A	¾	130	Shar	p-stl	flex	pnu	35x5	35x5	H&D	wd	H-S	4-3½x5 -19.6	4	ther	Lvgn	cst	Lvgn	cel	sing	Berlg	hand	s&l-2	West	none
Fulton C	2	137	Shar	p-stl	flex	sol	34x4	34x6	H&D	wd	H-S	4-3½x5 -19.6	4	ther	T-S	cst	G&O	cel	sing	Berlg	hand	s&l-2	West	178
Garford 25B	1½	135	own	p-stl	s-flex	sol	36x3½	36x4		wd	Buda	4-3¾x5½-22.5	4	cent	own	cst		fin	sing	Spltf	hand	s&l-2	West	
Garford 70H	2	144	own	p-stl	s-flex	sol	36x4	36x7		wd	Buda	4-4¼x5½-29.0	4	cent	own	cst		fin	sing	Spltf	hand	s&l-2	West	
Garford 68	5	128	own	p-stl	s-flex	sol	36x6	40x6d	Sth	mt	Wsc	4-4¾x5½-36.1	2	cent	own	cst		fin	sing		hand	none		
Garford 77D	3½	162	own	p-stl	s-flex	sol	36x5	36x5d	Sth	mt	Buda	4-4½x6 -32.4	4	cent	own	cst		fin	sing	Spltf	hand	s&l-2	West	
Garford 68D	5	162	own	p-stl	s-flex	sol	36x6	40x6d	Sth	mt	Buda	4-5 x6½-40.0	4	cent	own	cst		fin	sing	Spltf	hand			
Gary I	1½	144	P&B	p-stl	flex	pnu*	35x5	38x7	MWC	wd	Buda	4-4⅛x5½-27.2	4	cent	own	cst	Chgo	fin	sing	Eismn	hand	none		
Gary J	2½	148	P&B	p-stl	flex	pnu*	36x6	40x8	MWC	wd	Buda	4-4¼x5½-29.0	4	cent	own	cst	Chgo	fin	sing	Eismn	hand	none		
Gary KT	3½	162	P&B	p-stl	flex	sol	36x5	40x5d	MWC	wd	Buda	4-4½x6 -32.4	4	cent	own	cst	Chgo	fin	sing	Eismn	hand	none		
Gary M	5	182	P&B	p-stl	flex	sol	36x6	40x6d	Day	mt	Buda	4-5 x6½-40.0	4	cent	own	cst	Chgo	fin	sing	Eismn	hand	none		
G.M.C. 16	¾	132	Sth	p-stl	s-flex	pnu	35x5	35x5		wd	Cont	4-3¾x5 -22.5	4	cent	McC	prs	McC	fin	sing	Eismn	hand	sl&i	Delco	
G.M.C. 31	1½	130	Sth	p-stl	s-flex	sol	36x3½	36x5	opt	wd	Cont	4-3¾x5 -22.5	4	cent	McC	cst	McC	fin	sing	Eismn	hand	lghtg	Eismn	
G.M.C. 41	2	158	Sth	p-stl	s-flex	sol	36x4	36x7	own	wd	Cont	4-4⅛x5¼-27.2	4	cent	McC	cst	McC	fin	sing	Eismn	hand	lghtg	Eismn	
G.M.C. 71	3½	187	own	rol-c	s-flex	sol	36x5	40x5d	own	mt	Cont	4-4½x5½-32.4	2	cent	McC	cst	McC	fin	sing	Eismn	hand	lghtg	Eismn	
G.M.C. 101	5	187	own	rol-c	s-flex	sol	36x6	40x6d		wd	Cont	4-4½x5½-32.4	2	cent	McC	cst	McC	fin	sing	Eismn	hand	lghtg	Eismn	
Graham Bros. A	1½	133	Drt	p-stl	flex	pnu	35x5	36x6	Ditl	pst	Cont	4-3¾x5 -22.5	4	ther	Yng	prs	Yng	fin	sing	Eismn	hand	lghtg	Eismn	
Gramm-Bernstein 10	1	128	own	p-stl	s-flex	pnu	33x5	33x5		wd		4-3½x5 -19.6	4	ther	own			fin	sing		hand	sl&i	Eismn	75
Gramm-Bernstein 15	1½	138	own	p-stl	flex	opt	36x3½	36x5	Bim	wd	Cont	4-3¾x5 -22.5	4	ther	own	cst	Long	fin	sing	N-E	hand	sl&i-2	N-E	80
Gramm-Bernstein 65	1½	138	own	p-stl	flex	opt	36x3½	36x5	Bim	wd	Cont	4-3¾x5 -22.5	4	ther	own	cst	Long	fin	sing	N-E	hand	sl&i-2	N-E	80
Gramm-Bernstein 20	2	144	own	p-stl	flex	opt	36x4	36x7	Bim	wd	Cont	4-4⅛x5½-27.3	4	cent	own	cst	Long	fin	sing	N-E	hand	sl&i-2	N-E	80
Gramm-Bernstein 25	2½	150	own	p-stl	flex	opt	36x4	36x4d	Sth	mt	Hink	4-4¼x5½-29.0	4	cent	own	cst	Long	fin	dual	Eismn	hand	sl&i-2	N-E	100

For abbreviations see page 336.

oline Trucks—*Continued*

ENGINE									TRANSMISSION										BRAKES		CONTROL			UNIVERSALS		
GOVERNOR			SPEED		FUEL SYS.		CLUTCH		GEARSET				FINAL DRIVE								STEER'G GEAR					
Type	Make	Drive	Motor in r.p.m.	Truck in m.p.h.	Carburetor Make	Fuel Feed	Type	Make	Type	Make	Placed	Speeds	Type	Rear Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Foot	Hand	Placed	Make	Levers	Type	Make	Name and Model
cent.	Simp.	motor	1150	14	Stmbg.	grv.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn	10.33	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Peters.	Chicago C3½
cent.	Simp.	motor	1150	12	Stmbg.	grv.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn	13.66	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Peters.	Chicago D5
none			1500	20	Stmbg.		d-p*	Munc*	selec.	Muncie	mtr.	3	int-g.	Torbn.	8.40	sprgs.	sprgs.	Liggt.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Climber A
cent.	own.	motor	1300	18	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	3	worm.	S-P.		r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Clydesdale 32C
cent.	own.	motor	1410	17	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	3	worm.	Timkn		r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Clydesdale 42C
cent.	own.	motor	1410	16	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn		r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Clydesdale 65C
cent.	own.	motor	1500	15	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	worm.	Timkn		r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Clydesdale 65EC
cent.	own.	motor	1310	15	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn		r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Clydesdale 90C
cent.	own.	motor	1380	14	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn		r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Clydesdale 120C
none			2200	40	Zenith.	vac.	cone.	Detrt.	selec.	Detrt.	mtr.	3	bevel.	Sal.	5.14	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Jacox.	ctr.	mtl	Spicer.	Commerce T
none			2200	40	Zenith.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	int-g.	Torbn.	7.00	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Jacox.	ctr.	mtl	Spicer.	Commerce 12
none			2200	40	Zenith.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	int-g.	Torbn.	7.00	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Jacox.	ctr.	mtl	Spicer.	Commerce 16
suct.	Mnrch.	motor			Zenith.	grv.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	worm.	Timkn	8.75	sprgs.	sprgs.	Perf.	int-r-w.	int-r-w.	l.	Ross.		mtl	Spicer.	Concord A
suct.	Mnrch.	motor			Zenith.	grv.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	worm.	Timkn	8.75	sprgs.	sprgs.	Perf.	int-r-w.	int-r-w.	l.	Ross.		mtl	Spicer.	Concord AX
suct.	Mnrch.	motor			Zenith.	grv.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	worm.	Timkn	9.25	sprgs.	sprgs.	Perf.	int-r-w.	int-r-w.	l.	Ross.		mtl	Spicer.	Concord B
suct.	Mnrch.	motor			Zenith.	grv.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	worm.	Timkn	9.25	sprgs.	sprgs.	Perf.	int-r-w.	int-r-w.	l.	Ross.		mtl	Spicer.	Concord BX
none			2500	35	Stmbg.	grv.	d-p.	B-Beck.	ind-c.	Cotta	mtr.	4	int-g.	Hero.	8.30	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Blood.	Cook 41
cent.	Simp.	motor	1200	18	Stmbg.	grv.	d-d.	Fuller	selec.	Fuller	mtr.	3	worm.	Shel.	6.50	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Corbitt E
cent.	Simp.	motor	1200	18	Stmbg.	vac.	d-d.	Fuller	selec.	Fuller	mtr.	3	worm.	Shel.	8.67	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Corbitt D
cent.	Simp.	motor	1200	16	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	3	worm.	Shel.	8.75	sprgs	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Corbitt C
cent.	Simp.	motor	1200	16	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	worm.	Shel.	8.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Corbitt B
cent.	Pierce.	motor	1050	14	Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	worm.	Shel.	11.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Corbitt A
cent.	Cont.	motor	1000	12	Stmbg.	vac.	d-d.	Detlaf.	selec.	B-Lipe	amid.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Corbitt AA
none			1225	16	Zenith.	grv.	d-d.	Covert	selec.	Covert	mtr.	3	worm.	Shel.	7.80	sprgs.	sprgs.	Iron.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Hart.	Day-Elder A
none			1225	15	Zenith.	grv.	d-d.	Covert	selec.	Covert	mtr.	3	worm.	Shel.	8.75	sprgs.	sprgs.	Iron.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Hart.	Day-Elder B
suct.	Mnrch.	motor	1260	14	Zenith.	grv.	d-d.	Covert	selec.	Covert	mtr.	4	worm.	Shel.	8.66	sprgs.	sprgs.	Iron.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Hart.	Day-Elder D
suct.	Mnrch.	motor	1392	14	Zenith.	grv.	d-d.	Covert	selec.	Covert	mtr.	4	worm.	Shel.	8.75	sprgs.	sprgs.	Iron.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Hart.	Day-Elder C
suct.	Mnrch.	motor	1318	12	Zenith.	grv.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Iron.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Hart.	Day-Elder F
suct.	Mnrch.	motor	863	10	Zenith.	grv.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Hart.	Day-Elder E
none			1300	16	Stmbg.	vac.	d-d.	Fuller	selec.	Fuller	mtr.	3	worm.	Wsc.	8.25	sprgs.	sprgs.	Marm.	int-r-w.	int-r-w.	l.	Ditw.	ctr.	mtl	Hart.	Dearborn F
none							d-d.	Fuller	selec.	Fuller	mtr.	3	worm.	Wsc.	9.66	sprgs.	sprgs.	Marm.	int-r-w.	int-r-w.	l.	Ditw.	ctr.	mtl	Hart.	Dearborn 48
none			1600	25	Stmbg.	vac.	d-p.	B-Beck.	selec.	G-Lees.	mtr.	3	int-g.	Torbn.	7.00	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	B-M.	ctr.	mtl	Arvac.	Defiance D
none			1750	25	Stmbg.	vac.	d-p.	B-Beck.	selec.	G-Lees.	mtr.	3	int-g.	Torbn.	8.00	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	B-M.	ctr.	mtl	Arvac.	Defiance E
none			1500	18	Master.	grv.	d-d.	Fuller	selec.	Fuller	mtr.	3	worm.	Timkn	8.50	r-rd.	t-arm.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	DeKalb E2
none			1500	14	Master.	grv.	d-d.	Fuller	selec.	Fuller	mtr.	3	worm.	Timkn	9.33	r-rd.	t-arm.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	DeKalb E2½
none			1800	30	Zenith.	vac.	d-p.	B-Beck.	selec.	Muncie	mtr.	3	worm.	Dunk.	6.20	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Wol.	ctr	mtl	Acme.	Dependable A
suct.	Mnrch.		1250	18	Zenith.	vac.	d-d.	Fuller	selec.	Fuller	mtr.	4	worm.	Wis.	8.25	sprgs.	sprgs.	Stand.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Acme.	Dependable C
suct.	Mnrch.		1600	17	Zenith.	vac.	d-d.	Fuller	selec.	Fuller	mtr.	3	worm.	Wis.	8.66	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Acme.	Dependable D
suct.	Mnrch.		1250	14	Zenith.	vac.	d-d.	Fuller	selec.	Fuller	amid.	4	worm.	Wis.	8.66	sprgs.	sprgs.	Stand.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Acme.	Dependable E
suct.	Mnrch.		1600	15	Zenith.	vac.	d-d.	Fuller	selec.	Fuller	amid.	4	worm.	Wis.	10.00	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Acme.	Dependable G
cent.		motor	1700		Stmbg.	vac.	d-d.	Covert	selec.	Covert	mtr.	3	worm.	Wis.	8.25	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Gem.	ctr.		Spicer.	Diamond-T T
cent.		motor	1800		Stmbg.	vac.	d-d.	Covert	selec.	Covert	mtr.	4	worm.	Timkn	7.75	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.		ctr.		Spicer.	Diamond-T U
cent.		motor			Stmbg.	vac.	d-d.	Covert	selec.	Covert	amid.	4	worm.	Timkn	8.75	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Gem.	ctr.	f-m	Sn&Sp.	Diamond-T K
cent.		motor			Stmbg.	vac.	d-d.	Covert	selec.	Covert	amid.	4	worm.	Timkn	11.66	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Gem.	ctr.	f-m	Sn&Sp.	Diamond-T EL
cent.	Pierce.	motor	1100		Stmbg.	vac.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn	11.66	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Gem.	ctr.	f-m	Sn&Sp.	Diamond-T S
none					Stewrt.	vac.	d-d.	own	selec.	own.	mtr.	3	bevel.	own.	4.16	t-arm.	t-arm.	own.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	own.	Dodge Brothers
cent.	own.	motor	1090	13	Stmbg.	grv.	d-d.	Warner	selec.	Warner	amid.	4	worm.	Timkn	7.75	sprgs.	sprgs.	Rowl.	int-r-w.	int-r-w.	l.	Ross.	r.	mtl	Spicer.	Dorris K-4
cent.	own.	motor	1090	11	Stmbg.	grv.	d-d.	Warner	selec.	Warner	amid.	4	worm.	Timkn	10.30	sprgs.	sprgs.	Rowl.	int-r-w.	int-r-w.	l.	Ross.	r.	mtl	Spicer.	Dorris K-7
suct.	Pierce.	motor	2200	12	Schblr.	vac.	d-d.	B-Beck.	selec.		mtr.	3	worm.	Wis.	8.00	sprgs.	sprgs.	r.	int-r-w.	ext-r-w.	l.		ctr.	mtl	Arvac.	Douglas
suct.	Pierce.	motor	2400		Schblr.	vac.	d-d.		selec.	Fuller	mtr.	4	worm.	Wis.	9.00	sprgs.	sprgs.		ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Arvac.	Douglas
none			1300	25	Stmbg.	grv.	d-d.	Covert	selec.	Covert	mtr.	3	worm.	Shel.	5.50	sprgs.	sprgs.	Penn.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Peters.	Duplex A
cent.	Dplx.	motor	1200	12	Schblr.	vac.	d-d.	B-Lipe	selec.	B-Lipe	mtr.	8	int-g.	own.	8.00	r-rd.	r-rd.	Tuth.	ext-d-s.	ext-r-w.	l.	Wol.	r.	mtl	Peters.	Duplex E
none					Zenith.	grv.	d-d.	Covert	selec.	Covert	mtr.	3	int-g.	Rusl.	8.20	sprgs.	sprgs.	Chmp.	ext-r-w.	int-r-w.	l.	Ditw.	ctr.	mtl	Acme.	Duty 21
			1600		Zenith.	grv.	d-d.	Covert	selec.	Covert	mtr.	3	int-g.	Rusl.	8.80	sprgs.	sprgs.	Chmp.			l.	Lavn.		mtl	M&E.	Eagle 100-2
none			3000	30	Holley.	vac.	d-p.	B-Beck.	selec.	Covert.	mtr.	3	bevel.	own.	4.40	r-rd.	r-rd.	own.	ext-r-w.	ext-r-w.	l.	own.	ctr.	fab	Therm.	Elmira C
cent.	Pierce.	motor		12	Stmbg.	grv.	d-d.	Fuller	selec.	Fuller	amid.	4	worm.	Shel.		r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Erie A
			1300	18	Zenith.		d-d.		selec.		amid.	4	worm.	Timkn	7.75						l.		ctr.	mtl	Spicer.	Facto 1921
cent.	Wau.	motor	1500	26	Zenith.	vac.	d-p.	B-Beck.	selec.	own.	mtr.	5	worm.	S-P.	7.75	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Unvsl.	Fageol (Cal.)
cent.	Wau.	motor	1100	21	Zenith.	grv.	d-d.	B-Lipe	selec.	own.	amid.	5	worm.	Timkn	7.75	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&Th.	Fageol (Cal.)
cent.	Wau.	motor	1000	14	Zenith.	vac.	d-d.	B-Lipe	selec.	own.	amid.	5	worm.	Timkn	10.33	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&Th.	Fageol (Cal.)
cent.	Wau.	motor	1000	14	Zenith.	vac.	d-d.	B-Lipe	selec.	own.	amid.	5	worm.	Timkn	8.42	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&Th.	Fageol (Cal.)
cent.	Wau.	motor	1200	22	Zenith.	vac.	d-d.	Detlaf.	selec.	own.	amid.	5	worm.	Timkn	7.75	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&Th.	Fageol (Ohio) Md
cent.	Wau.	motor	1100	20	Zenith.	vac.	d-d.	Detlaf.	selec.	own.	amid.	5	worm.	Timkn	8.75	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&Th.	Fageol (Ohio) Hd
hyd.	Pharo.	motor	1447	25	Zenith.	vac.	d-p.	B-Beck.	selec.	own.	amid.	3	worm.	Timkn	6.20	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Peters.	Federal SD
hyd.	Pharo.	motor	1200	15	Zenith.	grv.	d-p.	B-Beck.	selec.	Detrt.	amid.	4	worm.	Timkn	8.50	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Federal TE
hyd.	Pharo.	motor	1125	13	Zenith.	grv.	d-p.	B-Beck.	selec.	Detrt.	amid.	4	worm.	Timkn	9.25	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Federal UE
hyd.	Pharo.	motor	1150	12	Zenith.	grv.	d-p.	B-Beck.	selec.	Warner	amid.	4	worm.	Timkn	10.33	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Federal WE
hyd.	Pharo.	motor	1150	10	Zenith.	grv.	d-p.	B-Beck.	selec.	Warner	amid.	4	worm.	Timkn	13.66	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Federal XE
none			1800	18	own.	grv.	w-d.	own.	plan.	own.	mtr.	2	worm.	own.	7.25	t-td.	t-t.	own.	ext-d-s.	int-r-w.	l.	own.	l.	mtl	own.	Ford TT
cent.	Pierce.	motor	1350	16	Stmbg.	grv.	w-d.	M&E.	ind-c.	Cotta.	amid.	3	bevl-4.	own.	8.90	sprgs.	sprgs.	Tuth.	ext-d-s.	ext-r-w.	r.	Ross.	r.	mtl	Blood.	F.W.D. B
none			2200	35	Carter.	grv.	d-p.	B-Beck.	selec.	Dur.	mtr.	3	bevel	Col.	6.80	sprgs.	sprgs.	Rowl.	ext-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Spicer.	Fulton A
none			2200	25	Carter.	grv.	d-d.	Covert.	selec.	Covert.	mtr.	3	int-g.	Rusel.	10.20	sprgs.	sprgs.	Rowl.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	Spicer.	Fulton C
none					Stmbg.	vac.	d-d.	B-Lipe	selec.	own.	amid.	3	worm.	Timkn	7.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l*	Ross.	ctr.	f-m	Sn&Sp.	Garford 25B
cent.	Simp.	motor	1085	15	Stmbg.	grv.	d-d.	B-Lipe	selec.	own.	amid.	4	worm.	Timkn	7.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Garford 70H
cent.	Simp.	motor	1057	11	Rayfld.	grv.	d-d.	B-Lipe	selec.	own.	jst.	4	chn.	own.	11.44	r-rd.		S-P.	ext-d-s.	int-r-w.	r.	Ross.	r.	mtl	Spicer.	Garford 68
cent.	Simp.	motor	1144	14	Stmbg.	grv.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn	8.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Garford 77D
cent.	Simp.	motor			Stmbg.	grv.	d-d.		selec.	own.	amid.	4	worm.	Timkn	8.80	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Garford 68D
suct.	McCn.	motor	1250	18	Mas.	grv.	d-d.	Fuller	selec.	Fuller	amid.	3	worm.	Timkn	7.25	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Gary I
suct.	McCn.	motor	1200	15	Mas.	grv.	d-d.	Fuller	selec.	Fuller	amid.	4	worm.	Timkn	8.50	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Gary J
suct.	McCn.	motor	1050	12	Mas.	grv.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn	10.33	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Gary KT
suct.	McCn.	motor	980	10	Mas.	grv.	d-d.	B-Lipe	selec.	B-Lipe	amid.	4	worm.	Timkn	11.70	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Gary M
suct.	Mnrch.	motor	1150	20	Marvl.	grv.	d-d.	own.	selec.	own.	amid.	3	bevel.	own.	6.00	r-rd.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	own.	ctr.	mtl	Unvsl.	G.M.C. 16
suct.	Mnrch.	motor	1300	15	Marvl.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn	9.25	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	own.	G.M.C. 31
suct.	Mnrch.	motor	1210	14	Marvl.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn	9.25	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	own.	G.M.C. 41
suct.	Mnrch.	motor	1210	12	Marvl.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn	12.00	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	own.	G.M.C. 71
suct.	Mnrch.	motor	1150	10	Marvl.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn	13.67	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	own.	G.M.C. 101
suct.	Mnrch.	motor	1200	25	Stmbg.	grv.	d-d.	Fuller	selec.	Fuller	mtr.	3	int-g.	Torbn.	7.00	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Hart.	Graham Bros. A
			2400	45		grv.	d-p.		selec.		mtr.	3	bevel.			sprgs.	sprgs.		ext-r-w.	ext-d-s.	l.		ctr.	fab		Gramm-Bernstein 10
none			1350	21	Stmbg.	grv.	d-d.	Fuller	selec.	Fuller	amid.	3	int-g.	Clrk.	7.60	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Gramm-Bernstein 15
none			1500	20	Stmbg.	grv.	d-d.	Fuller	ind-c.	own.	amid.	3	worm.	S-P.	7.80	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Gramm-Bernstein 65
cent.	Pierce.	motor	1350	18	Stmbg.	grv.	d-d.	Fuller	ind-c.	own.	amid.	4	worm.	Shel.	7.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Gramm-Bernstein 20
cent.	Hink.	motor	1250	17	Stmbg.	vac.	d-d.	own.	ind-c.	own.	amid.	4	worm.	S-P.	7.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Gramm-Bernstein 25

For abbreviations see page 336.

Specifications of Gas

Name and Model	Tons Capacity	Wheelbase, Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	WHEELS Make	WHEELS Type	ENGINE Make	No. Cyl. Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	RADIATOR CASE Make	RADIATOR CASE Type	RADIATOR CORE Make	RADIATOR CORE Type	IGNITION Type	IGNITION Make	IGNITION Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	Extra Cost $
Gramm-Bernstein 35	3½	156	own	p-stl	flex	opt	36x5	40x5d	Sth	mt	Hink	4-4½x5½-32.4	4	cent	own	cst	Long	fin	dual	Eismn	hand	sl&i-2	N-E	100
Gramm-Bernstein 50	5	168	own	p-stl	flex	opt	36x6	40x6d	Sth	mt	Cont	4-4¾x6 -36.1	2	cent	own	cst	Long	fin	dual	Eismn	hand	sl&i-2	N-E	100
Grant 17	1½	140	Savg	p-stl	rigid	pnu	35x5	38x7	Roy	wd	Cont	4-3¾x5 -22.5	4	ther	Mod	cst	Mod	cel	sing	Spltf	hand	s&l-2	Remy	....
Hahn CD	1½	140	P&B	p-stl	flex	sol*	36x3½	36x5	Sch*	wd*	Cont	4-4⅛x5½-27.3	4	cent	own	cst	own	fin	sing	Bosch*	hand	s&l	Delco	150
Hahn EE	2½	162	Prsh	p-stl	flex	sol*	36x4	36x8	Sch*	wd*	Cont	4-4½x5½-32.4	2	cent	own	cst	Chgo	fin	sing	Bosch*	hand	sl&i	Delco	150
Hahn F	3½	165	Savg*	p-stl	flex	sol*	36x5	36x10	Bim*	wd*	Cont	4-4½x5½-32.4	2	cent	own	cst	Chgo	fin	sing	Bosch	hand	s&l	Delco	150
Hahn J4	1	132	Prsh	p-stl	flex	pnu*	34x5	34x5	Scn*	wd	Cont	4-3¾x5 -22.5	4	cent	own	cst	Cngo	fin	sing	Bosch	hand	s&l	Delco	155
Hahn EF	5	180	Prsh	p-stl	flex	sol	36x6	40x12	....	mtl	Cont	4-4¾x6 -36.2	2	cent	own	cst	Cngo	fin	sing	Bosch	hand	lghtg	Delco	70
Halfur E	1	136	P&B	p-stl	s-flex	pnu	35x5	35x5	Stn	wd	Hink	4-4 x5½-25.6	4	cent	own	cst	G&O	fin	sing	Bosch	hand	s&l-2	West	200
Halfur B	2½	168	P&B	p-stl	s-flex	sol*	35x5	36x7	Sth	mt	Hink	4-4¼x5½-29.0	4	cent	own	cst	G&O	fin	sing	Bosch	hand	s&l-2	West	200
Hall	1½	....	own	p-stl	....	pnu	34x5	38x7	....	mt	Cont	4-3¾x5 -22.5	4	cent	own	....	own	fin	....	Bosch	....	s&l	Delco	....
Hall	2½	168	own	rol-c	rigid	sol	36x4	36x6	Sth	mt	Cont	4-4⅛x5½-27.3	4	cent	Lng	cst	Lng	fin	sing	Bosch	fixed	lghtg	Bosch	....
Hall	3½	168	own	rol-c	rigid	sol	36x5	36x5d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	Lng	cst	Lng	fin	sing	Bosch	fixed	lghtg	Bosch	....
Hall	5	168	own	rol-c	rigid	sol	36x5	40x6d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	Lng	cst	Lng	fin	sing	Bosch	fixed	lghtg	Bosch	....
Hall	7	147	own	rol-c	rigid	sol	36x5	40x6d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	Lng	cst	Lng	fin	sing	Bosch	fixed	lghtg	Bosch	....
Harvey Wea	1½	132	own	p-stl	flex	sol	34x3½	34x5	Crn	wd	Buda	4-4⅛x5½-27.2	4	cent	Chgo	cst	Chgo	fin	sing	Bosch	fixed	....	....	....
Harvey Wfa	2½	150	own	rol-c	rigid	sol	36x4	36x7	Crn	wd	Buda	4-4¼x5½-29.0	4	cent	Chgo	cst	Chgo	fin	sing	Eismn	auto	....	....	....
Harvey Wha	3½	160	own	rol-c	rigid	sol	36x5	36x5d	Crn	wd	Buda	4-4½x6 -32.4	4	cent	Chgo	cst	Chgo	fin	sing	Eismn	auto	....	....	....
Harvey Wka	5	160	own	rol-c	rigid	sol	36x6	40x6d	Sth	mt	Buda	4-4½x6 -32.4	4	cent	Chgo	cst	Chgo	fin	sing	Eismn	auto	....	....	....
Hawkeye K	1½	148½	own	rol-c	s-flex	sol*	34x3½	34x5	Bim	wd	Buda	4-3¾x5½-22.5	4	cent	own	cst	Idl	cel	sing	Eismn	hand	s&l-2	opt	150
Hawkeye M	2	148½	own	rol-c	s-flex	sol*	36x4	36x6	Bim	wd	Buda	4-4¼x5½-29.0	4	cent	own	cst	Idl	cel	sing	Eismn	hand	s&l-2	opt	150
Hawkeye N	3½	174	own	rol-c	s-flex	sol*	36x5	36x10	Clrk	mt	Buda	4-4½x6 -32.4	4	cent	own	cst	Idl	cel	sing	Eismn	hand	s&l-2	West	....
Hendrickson I	2½	155	own	rol-c	rigid	opt	36x4	36x7	Stn	mt	Buda	4-4¼x5½-29.0	4	cent	Chgo	cst	Chgo	fin	sing	Spltf	hand	none	....	....
Hendrickson J	3½	175	own	rol-c	rigid	opt	36x5	36x5d	Stn	mt	Buda	4-4¼x5½-29.0	4	cent	Chgo	cst	Chgo	fin	sing	Spltf	hand	none	....	....
Higrade A18	1	115	own	p-stl	flex	pnu	35x5	35x5	Prud	wd	Cont	4-3½x5 -19.6	4	ther	own	cst	Pfx	cel	sing	Eismn	hand	s&l	none	....
Higrade B20	1½	130	own	p-stl	flex	pnu	35x4	36x6	Det	wd	Cont	4-4⅛x5½-27.2	4	cent	own	prs	C-D	fin	sing	Eismn	hand	s&l	....	....
Huffman C	1½	140	Hyd	p-stl	s-flex	sol	34x3½	34x	Roy	wd	Buda	4-3¾x5½-22.5	4	ther	Lvgn	cst	Lvgn	zz-t	sing	Eismn	hand	none	....	....
Huffman B	1½	140	Hyd	p-stl	s-flex	sol	34x3½	34x6	Roy	wd	Cont	4-3¾x5 -22.5	4	ther	Lvgn	cst	Lvgn	zz-t	sing	Eismn	hand	none	....	....
Independent F	1½	140	Shar	p-stl	s-flex	opt	36x3½	36x5	Sth	mt	Cont	4-3¾x5 -22.5	4	cent	Lng	cst	Lng	fin	sing	Eismn	fixed	....	....	....
Independent H	2½	148	Shar	p-stl	s-flex	opt	36x4	36x4d	Sth	mt	Cont	4-4⅛x5½-27.2	4	cent	Lng	cst	Lng	fin	sing	Eismn	fixed	....	....	....
Independent K	3½	160	Shar	p-stl	s-flex	sol	36x5	36x5d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	Lng	cst	Lng	fin	sing	Eismn	fixed	....	....	....
Indiana 12	1½	134	own	rol-c	s-flex	sol*	34x3½	34x5	Bim	wd	Wau	4-3¾x5½-22.5	4	cent	McC	cst	McC	fin	sing	Eismn	hand	s&l	West	175
Indiana 20	2	150	own	rol-c	s-flex	sol*	36x4	36x7	Day	mt	own	4-4⅛x5½-27.2	2	cent	McC	cst	McC	fin	sing	Eismn	hand	s&l	West	175
Indiana 25	2½	156	own	rol-c	s-flex	sol*	36x4	36x8	Day	mt	own	4-4⅛x5½-27.2	2	cent	McC	cst	McC	fin	sing	Eismn	hand	s&l	West	175
Indiana 35	3½	160	own	rol-c	s-flex	sol*	36x5	36x5d	Sth	mt	own	4-4⅜x5½-30.6	2	cent	McC	cst	McC	fin	sing	Eismn	hand	s&l	West	175
Indiana 51	5	170	own	rol-c	s-flex	sol*	36x5	40x6d	Sth	mt	Wau	4-5 x6½-40.0	2	cent	McC	cst	McC	fin	sing	Eismn	hand	s&l	West	175
Inland D	2	132	own	rol-c	....	sol	34x5	34x6	Bim	wd	Wsc	4-4 x5 -25.6	4	cent	Lng	cst	Lng	fin	sing	Spltf	hand	none	....	....
International S	¾	124	P&B	p-stl	s-flex	pnu	34x5	34x5	own	wd	Lyc	4-3½x5 -19.6	4	ther	Lng	prs	Lng	fin	sing	Conn	hand	s&l	Auto	....
International H	¾	115	P&B	p-stl	s-flex	opt	36x3½	36x3½	own	wd	own	4-3½x5½-19.6	4	cent	own	prs	own	fin	sing	Bosch	hand	....	....	....
International F	1	128	P&B	p-stl	s-flex	opt	36x3½	36x4	own	wd	own	4-3½x5½-19.6	4	cent	own	prs	own	fin	sing	Bosch	hand	....	....	....
International K	1½	128	P&B	p-stl	s-flex	opt	36x3½	36x5	own	wd	own	4-3½x5½-19.6	4	cent	own	prs	own	fin	sing	Bosch	hand	....	....	....
International G	2	138	P&B	p-stl	s-flex	opt	36x4	36x6	own	wd	own	4-4¼x5 -29.0	4	ther	own	prs	own	fin	sing	Spltf	hand	....	....	....
International L	3½	160	P&B	p-stl	s-flex	sol	36x5	40x10	own	wd	own	4-4¼x5 -29.0	4	ther	own	prs	own	fin	sing	Spltf	hand	....	....	....
Jackson 4WD	3½	150	Cas	p-stl	s-flex	sol	36x7	36x7	Stn	wd	Cont	4-4½x5½-32.4	2	cent	Lng	cst	Lng	fin	sing	Aut-L	hand	sl&i	Aut-L	....
Jumbo 15	1½	144½	Drt	p-stl	s-flex	sol	36x3½	36x5	....	wd	Buda	4-3¾x5½-22.5	4	cent	own	cst	G&O	fin	sing	N-E	hand	sl&i-2	N-E	none
Jumbo 20	2	144½	Drt	p-stl	s-flex	pnu	35x5	38x7	....	wd	Buda	4-3¾x5½-22.5	4	cent	own	cst	G&O	fin	sing	N-E	hand	sl&i-2	N-E	none
Jumbo 25	2½	152½	Drt	p-stl	s-flex	sol	36x4	36x7	Day	mt	Buda	4-4¼x5½-29.0	4	cent	own	cst	G&O	fin	sing	N-E	hand	lghtg	N-E	none
Jumbo 30	3	152½	Drt	p-stl	s-flex	pnu	36x6	42x9	Clrk	mt	Buda	4-4¼x5½-29.0	4	cent	own	cst	G&O	fin	sing	N-E	hand	lghtg	N-E	none
Jumbo 35	3½	165	Drt	p-stl	s-flex	sol	36x5	36x10	Clrk	mt	Buda	4-4½x6 -32.4	4	cent	own	cst	G&O	fin	sing	Eismn	hand	lghtg	N-E	none
Jumbo 40	4	165	Drt	p-stl	s-flex	pnu	38x7	44x10	Clrk	mt	Buda	4-4 x6 -32.4	4	cent	own	cst	G&O	fin	sing	Eismn	hand	lghtg	N-E	none
J. & J. D	2	134	own	rol-c	flex	sol	34x4	34x6	Bim	wd	Wsc	4-4 x5 -25.6	4	cent	own	cst	Chgo	fin	sing	Amer	hand	lghtg	....	none
Kalamazoo G2	1½	144	own	rol-c	flex	sol*	36x4	36x5	Bim*	wd*	Cont	4-3¾x5 -22.5	4	cent	own	cst	G&O	fin	sing	Bosch	hand	s&l-2	Dneto	none
Kalamazoo H2	2½	160	own	rol-c	flex	sol	36x4	36x8	Sth	mt	Wsc	4-4 x6 -25.6	4	cent	own	cst	G&O	fin	sing	Bosch	hand	s&l-2	Dneto	none
Kalamazoo K2	3½	160	own	rol-c	flex	sol	36x5	36x10	Sth	mt	Wsc	4-4⅛x6 -27.8	4	cent	own	cst	G&O	fin	sing	Bosch	hand	s&l-2	Dneto	none
Karavan A	2½	148	own	rol-c	s-flex	sol*	36x4	36x8	Sth	mt	Buda	4-4¼x6 -29.0	4	cent	own	cst	Fed	fin	sing	Berlg	hand	s&l-2	West	200
Kearns H	¾	118	Shar	p-stl	s-flex	pnu	32x4½	32x4½	Way	wd	Lght	4-3¼x4½-16.9	4	ther	G&O	prs	G&O	cel	sing	Berlg	hand	s&l-2	Dneto	none
Kearns N	1½	136	P&B	p-stl	s-flex	sol*	34x3½	34x6	E&O	wd	H-S	4-3½x5 -19.6	4	ther	Bush	cst	Bush	cel	sing	Berlg	hand	none	....	....
Kelly-Springfield K34	1½	144	own	p-stl	flex	sol	36x3½	36x6	Crn	wd	own	4-3¾x5½-22.5	4	cent	Long	prs	Lng	fin	sing	Eismn	fixed	s&l-2	West	275
Kelly-Springfield K36	2½	144	own	p-stl	s-flex	sol	36x4	36x4d	Crn	wd	own	4-3¾x5½-22.5	4	cent	Long	prs	Lng	fin	sing	Eismn	fixed	s&l-2	West	275
Kelly-Springfield K40	3½	150	own	p-stl	flex	sol	36x5	40x5d	Crn	wd	own	4-4½x6½-32.4	2	cent	Long	prs	Lng	fin	sing	Eismn	auto	s&l-2	West	275
Kelly-Springfield K42	3½	156	own	p-stl	s-flex	sol	36x5	40x5d	Smh	mt	own	4-4½x6½-32.4	2	cent	Long	prs	Lng	fin	sing	Eismn	hand	s&l-2	West	275
Kelly-Springfield K41	3½	156	own	p-stl	s-flex	sol	36x5	40x5d	Clk	wd	own	4-4½x6½-32.4	2	cent	Long	prs	Lng	fin	sing	Eismn	hand	s&l-2	West	275
Kelly-Springfield K50	5	150	own	p-stl	flex	sol	36x6	40x6d	Sth	mt	own	4-4½x6½-32.4	2	cent	Long	prs	Lng	fin	sing	Eismn	auto	s&l-2	West	275
Kelly-Springfield K60	6	150	own	p-stl	flex	sol	36x6	40x7d	Sth	mt	own	4-4½x6½-32.4	2	cent	Long	prs	Lng	fin	sing	Eismn	auto	s&l-2	West	275
Keystone 40	2	144	own	rol-c	s-flex	pnu	34x5	38x7	Way	wd	Buda	4-3¾x5½-22.5	4	cent	own	cst	McC	fin	sing	Berlg	hand	....	....	....
K-Z	2½	150	own	rol-c	s-flex	sol	36x4	36x8	Int	mt	Cont	4-4⅛x5½-27.2	4	cent	Chgo	cst	Chgo	fin	sing	Bosch	fixed	none	....	....
K-Z	3½	156	own	rol-c	s-flex	sol	36x5	40x10	....	mt	Her	4-4½x5½-32.4	4	cent	Chgo	cst	Chgo	fin	sing	Bosch	fixed	none	....	....
Kissel GU	1½	152	Smh	p-stl	rigid	sol	36x3½	36x5	Prud	wd	own	4-3⅞x5½-24.0	4	cent	McC	cst	McC	fin	sing	Eismn	hand	sl&i-2	Eismn	150
Kissel F	2½	168	Smh	p-stl	rigid	sol	36x4	36x7	Prud	wd	own	4-4¼x5½-29.0	4	cent	McC	cst	McC	fin	sing	Eismn	hand	sl&i-2	Eismn	150
Kissel HD	4	168	Smh	p-stl	rigid	sol	36x5	36x5	Sth	mt	own	4-4¼x5½-29.0	4	cent	McC	cst	McC	fin	sing	Eismn	hand	sl&i-2	Eismn	150
Kleiber AA	1	130	own	rol-c	....	sol*	34x3½	34x5	own	wd	Cont	4-4⅛x5½-27.2	4	cent	own	cst	R-T	fin	sing	Bosch	hand	lghtg	none	....
Kleiber A	1½	143	own	rol-c	s-flex	sol*	36x3½	36x6	own	wd	Cont	4-4⅛x5½-27.2	4	cent	own	cst	R-T	fin	sing	Bosch	hand	lghtg	none	....
Kleiber BB	2	153	own	rol-c	s-flex	sol*	36x4	36x7	Sth	wd	Cont	4-4⅛x5½-27.2	4	cent	own	cst	R-T	fin	sing	Bosch	hand	lghtg	none	....
Kleiber B	2½	160	own	rol-c	s-flex	sol	36x4	36x8	Sth	mt	Cont	4-4½x5½-32.4	2	cent	own	cst	R-T	fin	sing	Bosch	hand	lghtg	none	....
Kleiber C	3½	163	own	rol-c	s-flex	sol	36x5d	36x5d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	own	cst	R-T	fin	sing	Bosch	hand	lghtg	none	....
Kleiber D	5	180	own	rol-c	s-flex	sol	36x6	40x12	Sth	mt	Buda	4-5 x6½-40.0	4	cent	own	cst	R-T	fin	sing	Bosch	hand	none	....	....
Koehler C	1½	131	P&B	p-stl	s-flex	sol	34x3	34x5	Way	wd	H-S	4-3½x5 -19.6	4	ther	own	cst	Godn	cel	sing	Eismn	fixed	none	....	....
Koehler M	2½	162	P&B	p-stl	s-flex	sol	36x4	36x7	Way	wd	Her	4-4 x5½-25.6	4	cent	own	cst	Godn	cel	sing	Eismn	fixed	none	....	....
Koehler MT	5	129	P&B	p-stl	....	sol	35x4	36x7	Way	wd	Her	4-4 x5½-25.6	4	cent	own	cst	Lng	fin	sing	Eismn	fixed	none	....	....
Lange B	2	136	own	rol-c	rigid	opt	36x4	36x5	H&D	wd	Cont	4-4 x3½-25.6	4	ther	own	sht	Mod	cel	sing	Bosch	hand	....	none	....
Larrabee U	1½	138	Savg	p-stl	s-flex	sol	34x3½	34x6	H&D	wd	Cont	4-3¾x5 -22.5	4	ther	own	cst	Bush	fin	sing	Bosch	hand	sl&i-2	G&D	200
Larrabee K	2½	....	Savg	p-stl	s-flex	sol	36x4	36x7	H&D	wd	Cont	4-4⅛x5½-27.2	4	cent	own	cst	Bush	fin	sing	Bosch	hand	sl&i-2	Dneto	200
Larrabee L	3½	....	Savg	p-stl	s-flex	sol	36x5	36x5d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	own	cst	Bush	fin	sing	Bosch	hand	lghtg	Eismn	140
Larrabee W	5	....	Savg	p-stl	s-flex	sol	36x6	40x6d	Sth	mt	Cont	4-4¾x6 -36.1	2	cent	own	cst	Bush	fin	sing	Bosch	hand	sl&i-2	Dneto	....
Lion L	1½	132	Prsh	p-stl	....	pnu	35x5	35x5	....	wd	Buda	4-3¾x5½-22.5	4	ther	G&O	prs	....	sq-t	sing	Eismn	hand	....	....	....
Lone Star 9	1½	134½	own	rol-c	s-flex	pnu	32x3½	32x4	....	wd	Gray	4-3½x5 -19.0	4	ther	own	....	own	fin	sing	Delco	hand	s&l	....	none
L.M.C. 2-20	2½	164	own	rol-c	s-flex	sol	36x4	36x4d	Bim	wd	Cont	4-4⅛x5½-27.2	4	cent	Lng	cst	Lng	fin	sing	Bosch	hand	none	....	....
Luverne E	1½	140	....	rol-c	....	....	36x6	38x7	....	....	H-S	4-3¼x5 -16.9	....	....	....	cst	....	....	sing	Bosch	....	s&l	Dneto	....
Luedinghaus K	2	145*	P&B	p-stl	s-flex	sol*	36x4	36x7	Bim*	wd	Wau	4-4¼x5½-29.0	2	cent	own	cst	Brem	fin	sing	Spltf	hand	none	....	....
Luedinghaus	1	130	....	rol-c	....	pnu	35x5	35x5	....	wd	H-S	4-3½x5 -19.6	4	Ther	....	cst	....	fin	....	West*	....	s&l	West*	....
Luedinghaus	1½	144	....	p-stl	....	sol*	34x3½	34x5	....	wd	Wauk	4-3¾x5½-22.5	....	cent	....	....	....	fin	sing	Spltf	hand	....	....	....

For abbreviations see page 336.

oline Trucks—*Continued*

ENGINE									TRANSMISSION										BRAKES		CONTROL			UNIVERSALS		
GOVERNOR			SPEED		FUEL SYS.		CLUTCH		GEARSET				FINAL DRIVE								STEER'G GEAR					
Type	Make	Drive	Motor in r.p.m.	Truck in m.p.h.	Carburetor Make	Fuel Feed	Type	Make	Type	Make	Placed	Speeds	Type	Rear Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Foot	Hand	Placed	Make	Levers	Type	Make	Name and Model
cent.	Hink.	motor.	1200	16	Stmbg.	vac.	d-d.	own.	ind-c.	own.	amid.	4	worm.	S-P.	8.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	L.	Ross.	ctr.	fab	own.	Gramm-Bernstein 30
cent.	Cont.	motor.	1150	13	Stmbg.	vac.	d-d.	own.	ind-c.	own.	amid.	4	worm.	S-P.	9.50	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	L.	Ross.	ctr.	fab	own.	Gramm-Bernstein 57
cent.	Pierce.	d-s.	1500	30	Cart.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	int-g.	Torbn.	5.50	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Jacox.	ctr.	mtl	Peters.	Grant 1
cent.	Pierce.	motor.	1400	25	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn		sprgs.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Hahn CD
cent.	Pierce.	motor.	1400	32	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn		r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Hahn EE
cent.	Pierce.	motor.	1400	32	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Hahn F
cent.	Pierce.	motor.	1400		Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.		worm.	Shel.	7.75	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Hahn J4
cent.	Pierce.	motor.	1200		Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.		worm.	Timkn	10.25	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Hahn EF
cent.	Hink.	motor.	1200	25	Stmbg.	vac.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn	4.70	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	Peters.	Halfur E
cent.	Hink.	motor.	1200	20	Stmbg.	vac.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn	5.60	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	Peters.	Halfur B
	Simp.				Zenith.		d-d.	Fuller.		Fuller.			worm.	Timkn				Dtr*				Gem.				Hall
cent.	Dplx.	dplx.	1200	18	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn		sprgs.	sprgs.	Dtr*.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	Spicer.	Hall
cent.	Dplx.	dplx.		15	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		sprgs.	sprgs.	Dtr*.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	Spicer.	Hall
cent.	Dplx.	dplx.		15	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		sprgs.	sprgs.	Dtr*.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	Spicer.	Hall
cent.	Dplx.	dplx.		15	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	chn.	Timkn		sprgs.	sprgs.	Dtr*.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	Spicer.	Hall
suct.	Mnrch.	motor.	1200	18	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	7.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Harvey Wea
suct.	Mnrch.	motor.	1200	16	Stmbg.	grv.	d-d.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Harvey Wfa
suct.	Mnrch.	motor.	1000	14	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Harvey Wha
suct.	Mnrch.	motor.	1000	13	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Harvey Wka
cent.	Dplx.	motor.	1175	16	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.60	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Hart.	Hawkeye K
cent.	Dplx.	motor.	1175	14	Zenith.		d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Clrk.	8.00	sprgs.	sprgs.	Dtr.	ext-d-s.	int-r-w.	L.	Ross.	ctr.	mtl	Hart.	Hawkeye M
cent.	Simp.	motor.	1175	12	Zenith.	grv.	d-d.	Fuller.	selec.	Cotta.	amid.	4	int-g.	Clrk.	10.00	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Hart.	Hawkeye N
suct.	McCn.		1000	15	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Timkn	7.75	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	L.	Ross.	ctr.	fab	Ther.	Hendrickson I
suct.	McCn.		1000		Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.		4	worm.	Timkn	10.3	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	L.	Ross.	ctr.	fab	Ther.	Hendrickson J
none.					Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	7.75	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	L.	Lavn.	ctr.	mtl	Blood.	Higrade A18
none.						vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Wis.	7.75	sprgs.	sprgs.	Dtr.	int-r-w.	int-r-w.	L.	Lavn.	ctr.	mtl	Blood.	Higrade B20
suct.	Mnrch.	motor.	1500	18	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Torbn.	8.00	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Lavn.	ctr.	mtl	Hart.	Huffman C
suct.	Mnrch.	motor.	1500	18	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.		8.66	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	L.	Lavn.	ctr.	mtl	Hart.	Huffman B
cent.		motor.	1500	18		grv.	d-d.	Fuller.	prog.	Fuller.	mtr.	3	worm.	Wis.	8.25	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Independent F
cent.		motor.	1300	14		grv.	d-d.	Fuller.	prog.	Fuller.	mtr.	3	worm.	Wis.	9.66	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Independent H
cent.		motor.	1300	14		grv.	d-d.	Fuller.	prog.	Fuller.	mtr.	4	worm.	Wis.	10.00	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Independent K
cent.	Wau.	motor.	1300	18	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	3	worm.	Shel.	7.80	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Wol.	ctr.	f-m	Sn&Ac.	Indiana 12
cent.	Pierce.	motor.	1160	16	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Wol.	ctr.	f-m	Sn&Sp.	Indiana 20
cent.	Pierce.	motor.	1160	16	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Wol.	ctr.	f-m	Sn&Sp	Indiana 25
cent.	Pierce.	motor.	1150	12	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.25	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Wol.	ctr.	f-m	Sn&Sp.	Indiana 35
cent.	Wau.	motor.	1000	12	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.21	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Wol.	ctr.	f-m	Sn&Sp.	Indiana 51
none.			1600	18	Schblr.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Torbn.	9.00	sprgs.	sprgs.	Math.	ext-.	int.	L.	Lavn.	ctr.	mtl	Unvsl.	Inland D
none.			1500	35	Ens.	vac.	d-d.	Muno.	selec.	Muno.	mtr.	3	int-g.	Torbn.	6.30	sprgs.	sprgs.	Stand.	ext-r-w.	int-r-w.	L.	CAS.	ctr.	fab	Snead.	International S
cent.	own.	motor.	1275	20	Ens.	grv.	d-d.	own.	selec.	own.	amid.	3	int-g.	own.	6.80	sprgs.	sprgs.	Stand.	int-r-w.	int-r-w.	L.	own.	ctr.	mtl	own.	International H
cent.	own.	motor.	1275	17	Ens.	grv.	d-d.	own.	selec.	own.	amid.	3	int-g.	own.	7.90	sprgs.	sprgs.	Stand.	int-r-w.	int-r-w.	L.	own.	ctr.	mtl	own.	International F
cent.	own.	motor.	1275	15	Ens.	grv.	d-d.	own.	selec.	own.	amid.	3	int-g.	own.	8.96	sprgs.	sprgs.	Stand.	int-r-w.	int-r-w.	L.	own.	ctr.	mtl	own.	International K
cent.	own.	motor.	1150	13	Ens.	grv.	d-d.	own.	selec.	own.	amid.	3	int-g.	own.	8.96	sprgs.	sprgs.	Stand.	int-r-w.	int-r-w.	L.	own.	ctr.	mtl	own.	International G
cent.	own.	motor.	1125	12	Ens.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	int-g.	own.	10.90	sprgs.	sprgs.	Stand.	int-r-w.	int-r-w.	L.	own.	ctr.	mtl	own.	International L
cent.	Pierce.	motor.	1027	12	Stmbg.	vac.	d-p.	B-Beck.	selec.	own.	amid.	4	bevl.	own.	9.17	sprgs.	sprgs.	S-P.	int-r-w.	ext-d-s.	L.	Ross.	ctr.	mtl	Spicer.	Jackson 4WD
none.			1500	22	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.20	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Jacox.	ctr.	mtl	Arvac.	Jumbo 15
none.			1500	22	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.60	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Jacox.	ctr.	mtl	Arvac.	Jumbo 20
cent.	Dplx.	Dplx.	1250	15	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Clrk.	9.00	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Jacox.	ctr.	mtl	Arvac.	Jumbo 25
cent.	Dplx.	Dplx.	1250	15	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Clrk.	9.00	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Jacox.	ctr.	mtl	Arvac.	Jumbo 30
cent.	Simp.	motor.	1000	12	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	int-g.	Clrk.	9.00	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Jacox.	ctr.	mtl	Spicer.	Jumbo 35
cent.	Simp.	motor.	1000	12	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	int-g.	Clrk.	10.00	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Jacox.	ctr.	mtl	Spicer.	Jumbo 40
suct.	Mnrch.	motor.	1400	16	Zenith.	grv.	d-d.	M&E.	selec.	cotta.	mtr.	4	int-g.	Russl.	8.80	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	L.	Lavn.	ctr.	mtl	Unvsl.	J. & J. D
cent.	Pierce.	motor.	1500	16	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Wis.	8.50	r-rd.		Shel.	int.	int-r-w.	L.	Ross.	ctr.	mtl	Acme*.	Kalamazoo G2
cent.	Pierce.	motor.	1100	13	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Shel.	8.75	r-rd.		Shel.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Acme*.	Kalamazoo H2
cent.		motor.	1100	11	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Shel.	10.00	r-rd.		Shel.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Acme*.	Kalamazoo K2
cent.	Dplx.	Dplx.	1100	15.2	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Karavan A
suct.	Mnrch.	motor.	1500	25	Zenith.	grv.	d-p.	B-Beck.	selec.	G-Lees.	mtr.	3	int-g.	Torbn.	12.00	sprgs.	sprgs.	Math.	int-r-w.	ext-r-w.	L.	Lavn.	ctr.	mtl	M&E.	Kearns H
cent.	Pierce.	motor.	1400	18	Zenith.	grv.	d-p.	B-Beck.	selec.	G-Lees	mtr.	3	int-g.	Torbn.	8.00	sprgs.	sprgs.	Math.	int-r-w.	ext-r-w.	L.	Lavn.	ctr.	mtl	M&E.	Kearns N
cent.	Pierce.	motor.	1300	17	Zenith.	grv.	d-p.	B-Beck.	selec.	Covert.	amid.	3	worm.	Shel.	8.66	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	L.	Gem.	ctr.	f-m	Bl&Sp.	Kelly-Springfield K34
cent.	Pierce.	motor.	1300	14	Zenith.	grv.	cone.	own.	selec.	Covert.	amid.	3	worm.	Shel.	10.30	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	Spicer.	Kelly-Springfield K36
cent.	Pierce.	motor.	1300	14	Zenith.	grv.	cone.	own.	selec.	Covert.	amid.	3	chn.	own.	10.49	r-rd.		S-P.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	own.	Kelly-Springfield K40
cent.	Pierce.	motor.	1300	15	Zenith.	grv.	d-p.	B-Beck.	selec.	Covert.	amid.	4	worm.	S-P.	10.25	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	L.	Gem.	ctr.	f-m	Bl&P.	Kelly-Springfield K42
cent.	Pierce.	motor.	1300	15	Zenith.	grv.	d-p.	B-Beck.	selec.	Covert.	amid.	4	int-g.	Clrk.	10.00	r-rd.	sprgs.	S-P.	ext-r-w.	int-r-w.	L.	Gem.	ctr.	f-m	Bl&P.	Kelly-Springfield K41
cent.	Pierce.	motor.	1300	12	Zenith.	grv.	cone.	own.	selec.	Covert.	amid.	3	chn.	own.	12.24	r-rd.		S-P.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	own.	Kelly-Springfield K50
cent.	Pierce.	motor.	1300	12	Zenith.	grv.	cone.	own.	selec.	Covert.	amid.	3	chn.	own.	12.39	r-rd.		S-P.	int-r-w.	int-r-w.	L.	Gem.	ctr.	mtl	own.	Kelly-Springfield K60
cent.	Pierce.	motor.	1350	17	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Russl.	8.90	sprgs.	sprgs.	Rowl.	ext-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Keystone 40
suct.	McCn.	motor.	1200	14	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	9.25	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	L.	Lavn.	ctr.	fab	Therm.	K-Z.
suct.	McCn.	motor.	1300	12	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.33	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	L.	Lavn.	ctr.	fab	Therm.	K-Z.
cent.	Pierce.	motor.	1237	17	Stmbg.	vac.	d-d.	Warn.	selec.	Warn.	mtr.	3	worm.	Shel.	7.80	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	L.	Jacox.	ctr.	mtl	Spicer.	Kissel GU
cent.	Pierce.	motor.	1290	15	Stmbg.	vac.	d-d.	Warn.	selec.	Warn.	amid.	4	worm.	Timkn	8.50	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Kissel F
cent.	Pierce.	motor.	1315	12	Stmbg.	vac.	d-d.	Warn.	selec.	Warn.	amid.	4	worm.	Shel.	11.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Kissel HD
cent.	Pierce.	motor.			Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn		sprgs.	sprgs.	own.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Spicer.	Kleiber AA
cent.	Pierce.	motor.			Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn		sprgs.	sprgs.	own.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Spicer.	Kleiber A
cent.	Pierce.	motor.			Stmbg.	grv.	w-d.	M&E.	selec.	B-Lipe.	amid.	4	worm.	Timkn		sprgs.	sprgs.	own.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Spicer.	Kleiber BB
cent.	Pierce.	motor.			Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		sprgs.	sprgs.	own.	int-f-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Kleiber B
cent.	Dplx.	motor.			Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		r-rd.	sprgs.	own.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Kleiber C
cent.	Dplx.	motor.			Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		r-rd.	sprgs.	own.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Spicer.	Kleiber D
cent.	Dplx.	motor.	1200	18	Zenith.	grv.	d-d.	Mech.	selec.	Mech.	mtr.	3	int-g.	Torbn.	7.00	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	L.	own.	ctr.	mtl	K&B.	Koehler C
cent.	Dplx.	motor.	1200	14	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	9.25	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	L.	Lavn.	ctr.	mtl	Spicer.	Koehler M
cent.	Simp.	motor.	1200	14	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	9.25	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	L.	Lavn.	ctr.	mtl	Spicer.	Koehler MT
cent.	Pierce.	motor.	1250	17	Stmbg.	grv.	d-d.	M&E.	selec.	own.		3	chn.	own.	9.22	r-rd.	t-t.	Iron.	ext-j-s.	int-r-w.	L.	Gem.	ctr.	mtl	M&E.	Lange B
cent.	Simp.	motor.	1360	18	Schblr.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	7.80	sprgs.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	mtl	Unvsl.	Larrabee U
cent.	Simp.	motor.	1225	15	Schblr.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.75	sprgs.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	f-m	Sn&Sp.	Larrabee K
cent.	Simp.	motor.	1200	12	Schblr.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.33	sprgs.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	f-m	Sn&Sp.	Larrabee L
cent.	Cont.	motor.	1150	10	Schblr.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Merl.	int-r-w.	int-r-w.	L.	Ross.	ctr.	f-m	Sn&Sp.	Larrabee W
suct.	Mnrch.		1500	30	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn		sprgs.	sprgs.	Shel.		int-r-w.	L.	Ross.	ctr.	mtl		Lion L
none.			1000	15	Stmbg.	vac.	d-p.	B-Beck.		Fuller.	mtr.	3	int-g.	Peru.	6.00	sprgs.		Drt.		ext-r-w.	L.	Ditw.	ctr.	fab	Therm.	Lone Star 9
cent.	Pierce.	motor.	1150	14	Stmbg.	vac.	d-p.	B-Beck.	selec.	Detrt.	amid.	4	int-g.	Russl.	8.80	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	L.	Lavn.	ctr.	f-m	Th&Ba.	L.M.C. 2-20
					Zenith.			B-Beck.		Detrt.	mtr.			Torbn.								Lavn.				Luverne E
cent.		motor.	1239	16	Schblr.	grv.	d-p.	B-Beck.	selec.	Detrt.	mtr.	3	worm.	Wsc.	8.66	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	L.	Lavn.	ctr.	mtl	Spicer.	Luedinghaus K
				25	Scheb.		d-p.	B-Beck.	selec.	G-Lees.	mtr.	3	worm.	Emp.					int-r-w.	int-r-w.						Luedinghaus
				16	Scheb.		d-p.	B-Beck.	selec.	Dtr.	mtr.	3	worm.	Wis.		r-rd.	sprgs.	Tuth.								Luedinghaus

For abbreviations see page 336.

Specifications of Gas

Name and Model	Tons Capacity	Wheelbase, Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	WHEELS Make	WHEELS Type	ENGINE Make	No. Cyl. Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	RADIATOR CASE Make	RADIATOR CASE Type	RADIATOR CORE Make	RADIATOR CORE Type	IGNITION Type	IGNITION Make	Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	Extra Cost $
MacDonald.........A	15	opt.	.....	rol-c..	rigid..	opt...	40x7	40x14	Sth...	mt....	Buda..	4-4½x6 -32.4	4	cent..	own...	cst....	Mod...	zz-t..	sing..	Spltf..	hand..	none...	.....	....
Mack.........AB	1½	162*	own..	p-stl..	flex...	sol....	36x4	36x3½	Sch...	wd....	own...	4-4 x5 -25.6	2	cent..	own...	sht....	own...	cel...	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack.........AB	1½	162*	own..	p-stl..	flex...	sol....	36x4	36x3½d	Sch...	wd....	own...	4-4 x5 -25.6	2	cent..	own...	sht....	own...	cel...	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack.........AB	2	162*	own..	p-stl..	flex...	sol....	36x4	36x4d	Sch...	wd....	own...	4-4 x5 -25.6	2	cent..	own...	sht....	own...	cel...	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack.........AB	2	162	own..	p-stl..	flex...	sol....	36x4	36x4d	Sch...	wd....	own...	4-4 x5 -25.6	2	cent..	own...	sht....	own...	cel...	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack.........AC	3½	168*	own..	p-stl..	flex...	sol....	36x5	40x5d	Sch...	wd....	own...	4-5 x6 -40.0	2	cent..	own...	cst....	own...	ring..	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack Tractor.........AB	5	120	own..	p-stl..	flex...	sol....	36x4	36x4d	Sch...	wd....	own...	4-4 x5 -25.6	2	cent..	own...	sht....	own...	cel...	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack.........AC	5	168*	own..	p-stl..	flex...	sol....	36x6	40x6d	Sch...	wd....	own...	4-5 x6 -40.0	2	cent..	own...	cst....	own...	ring..	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack.........AC	6½	168*	own..	p-stl..	flex...	sol....	36x6	40x12	Sch...	wd....	own...	4-5 x6 -40.0	2	cent..	own...	cst....	own...	ring..	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack Tractor.........AC	7	119	own..	p-stl..	flex...	sol....	36x5	40x5d	Sch...	wd....	own...	4-5 x6 -40.0	2	cent..	own...	cst....	own...	ring..	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack.........AC	7½	168*	own..	p-stl..	flex...	sol....	36x7	40x7d	Sch...	wd....	own...	4-5 x6 -40.0	2	cent..	own...	cst....	own...	ring..	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack Tractor.........AC	10	119	own..	p-stl..	flex...	sol....	36x6	40x6d	Sch...	wd....	own...	4-5 x6 -40.0	2	cent..	own...	cst....	own...	ring..	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack Tractor.........AC	13	119	own..	p-stl..	flex...	sol....	36x6	40x12	Sch...	wd....	own...	4-5 x6 -40.0	2	cent..	own...	cst....	own...	ring..	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Mack Tractor.........AC	15	119	own..	p-stl..	flex...	sol....	36x7	40x7d	Sch...	wd....	own...	4-5 x6 -40.0	2	cent..	own...	cst....	own...	ring..	sing..	Spltf..	hand..	s&l-2..	L-N...	250
Maccar.........L2	1½	150	Prsh..	p-stl..	s-flex..	sol....	36x4	36x6	Day..	mt....	Cont..	4-4⅛x5¼ -27.2	4	cent..	own...	cst....	Bush..	fin...	sing..	Eismn.	hand..	none...	.....	....
Maccar.........H2	2½	162	Prsh..	p-stl..	s-flex..	sol....	36x4	36x4d	Day..	mt....	Cont..	4-4½x5½ -32.4	2	cent..	own...	cst....	Bush..	fin...	sing..	Eismn.	hand..	none...	.....	....
Maccar.........M2	3½	174	Prsh..	p-stl..	s-flex..	sol....	36x5	36x5d	Day..	mt....	Wsc..	4-4½x6 -32.4	4	cent..	own...	cst....	Bush..	fin...	sing..	Eismn.	hand..	none...	.....	....
Maccar.........G	5	186	Prsh..	p-stl..	s-flex..	sol....	36x5	40x6d	Day..	mt....	Cont..	4-4¾x6 -36.1	4	cent..	own...	cst....	Bush..	fin...	sing..	Eismn.	hand..	none...	.....	....
Master.........JW	1½	142	P&B..	p-stl..	s-flex..	sol....	34x3½	34x5	Prud..	wd....	Buda..	4-4⅛x5¼ -27.2	4	cent..	own...	cst....	Chgo..	fin...	sing..	Eismn.	fixed.	lghtg*.	.....	....
Master.........D	2½	144	P&B..	p-stl..	s-flex..	sol....	34x4	36x7	Walk..	mt....	Buda..	4-4¼x5½ -29.0	4	cent..	own...	cst....	Chgo..	fin...	sing..	Eismn.	fixed.	lghtg*.	.....	....
Master.........W	2½	144	P&B..	p-stl..	s-flex..	sol....	34x4	36x7	Prud..	wd....	Buda..	4-4¼x5½ -29.0	4	cent..	own...	cst....	Chgo..	fin...	sing..	Eismn.	fixed.	lghtg*.	.....	....
Master.........A	3½	158	P&B..	p-stl..	s-flex..	sol....	36x5	40xdd	Prud..	wd....	Buda..	4-4½x6 -32.4	4	cent..	own...	cst....	Chgo..	fin...	sing..	Eismn.	hand..	lghtg*.	.....	....
Master.........B	5	170	P&B..	p-stl..	s-flex..	sol....	36x6	40x6d	Sth...	wd....	Buda..	4-4¾x6¾-36.1	4	cent..	own...	cst....	Chgo..	fin...	sing..	Eismn.	auto..	lghtg*.	.....	....
Master.........E	3½	158	P&B..	p-stl..	s-flex..	sol....	35x5	40x5d	Walk..	mt....	Buda..	4-4½x6 -32.4	4	cent..	own...	cst....	Chgo..	fin...	sing..	Eismn.	auto..	lghtg*.	.....	....
Master.........F	5	170	P&B..	p-stl..	s-flex..	sol....	35x5	40x6d	Walk..	mt....	Buda..	4-4¾x6¾-36.1	4	cent..	own...	cst....	Chgo..	fin...	sing..	Eismn.	fixed.	lghtg*.	.....	....
Master Tractor.........T	6	110	P&B..	p-stl..	s-flex..	sol....	34x4	36x4d	Prud..	wd....	Buda..	4-4¼x5½-29 0	4	cent..	own...	cst....	Chgo..	fin...	sing..	Eismn.	fixed.	lghtg*.	.....	....
Maxwell	1½	124	.....	p-stl..	rigid..	sol*...	32x3	32x4	.....	wd....	own...	4-3⅝x4½-21.0	4	ther..	own...	pra....	own...	fin...	sing..	.....	hand..	lghtg..	.....	none
Menges.........B	2½	155	.....	rol-c..	.....	sol....	36x4	36x7	.....	mt....	Hink..	4-4½x5½-32 4	...	cent..	own...	.....	.....	.....	.....	Bosch	.....	.....	.....	....
Menominee.........HT	1	130	own..	rol-c..	s-flex..	sol....	34x3½	36x5	Stn...	wd....	Wsc...	4-3¾x5 -22.5	4	cent..	own...	cst....	G&O..	fin...	sing..	Eismn.	hand..	lghtg..	Eismn.	....
Menominee.........H	1½	144	own..	rol-c..	s-flex..	sol....	36x3½	36x5	Stn...	wd....	Wsc...	4-4 x5 -25.6	4	cent..	own...	cst....	G&O..	fin...	sing..	Eismn.	hand..	lghtg..	Eismn.	....
Menominee.........D	2	144	own..	rol-c..	s-flex..	sol....	36x4	36x4d	Stn...	wd....	Wsc...	4-4 x6 -25.6	4	cent..	own...	cst....	G&O..	fin...	sing..	Eismn.	hand..	lghtg..	Eismn.	....
Menominee.........G	3½	160	own..	rol-c..	rigid..	sol....	36x5	36x5d	Sth...	mt....	Wsc...	4-4½x6 -32.4	4	cent..	own...	cst....	G&O..	fin...	sing..	Eismn.	hand..	lghtg..	opt....	....
Menominee.........J3	5	160	own..	rol-c..	rigid..	sol....	36x6	40x6d	Sth...	mt....	Wsc...	4-4¾x6 -36.1	2	cent..	own...	cst....	G&O..	fin...	sing..	Eismn.	hand..	lghtg..	opt....	....
Moline.........10	1½	130	Hyd..	p-stl..	flex...	pnu...	34x5	36x6	.....	wd....	own...	4-3½x5 -19.6	4	ther..	own...	cst....	Mod...	cel...	sing..	Spltf..	fixed..	.....	.....	....
Moreland.........20N	1	132	Smh..	p-stl..	rigid..	pnu...	35x5	36x6	Drt...	mt....	Cont..	4-3¾x5 -22.5	1	cent..	own...	.....	Mod...	fin...	sing..	Berlg..	hand..	.....	none...	....
Moreland.........20B	1½	150	Smh..	p-stl..	rigid..	sol....	36x3½	36x6	Sth...	mt....	Cont..	4-4⅛x5¼-27.2	1	cent..	own...	cst....	Mod...	fin...	sing..	Berlg..	hand..	.....	none...	....
Moreland.........20C	2½	168	Smh..	p-stl..	rigid..	sol....	36x4	36x8	Sth...	mt....	Cont..	4-4½x5½-48.4	2	cent..	own...	cst....	Mod...	fin...	sing..	Berlg..	hand..	.....	none...	....
Moreland.........20G	3½	186	Smh..	p-stl..	rigid..	sol....	36x5	40x5d	Sth...	mt....	Cont..	4-4¾x6 -36.1	2	cent..	own...	cst....	Mod...	fin...	sing..	Berlg..	hand..	.....	none...	....
Moreland.........20J	5	186	Smh..	p-stl..	rigid..	sol....	36x6	40x6d	Sth...	mt....	Cont..	4-4¾x6 -36.1	2	cent..	own...	cst....	Mod...	fin...	sing..	Berlg..	hand..	.....	none...	....
Mutual.........2B	2	152	S-K...	p-stl..	s-flex..	sol....	36x4	36x8	Sth...	mt....	Wsc...	4-4 x6 -25.6	4	cent..	G&O..	cst....	G&O..	fin...	sing..	Bosch	hand..	s&l-2..	West..	....
Mutual.........2BP	2½	152	S-K...	p-stl..	s-flex..	pnu...	38x7..	42x9..	Day..	mt....	Wsc...	4-4 x6 -25.6	4	cent..	G&O..	cst....	G&O..	fin...	sing..	Bosch	hand..	s&l-2..	West..	....
Napoleon.........9	1	132½	Trav..	rol-c..	s-flex..	sol*...	35x5*	35x5*	Roy...	wd....	Gray..	4-3½x5 -19.6	4	ther...	G&O..	cst....	G&O..	fin...	sing..	Eismn.	hand..	sl&i-..	G&D..	none
Napoleon.........11	1½	132½	Trav..	rol-c..	s-flex..	sol*...	35x5*	36x6*	Roy...	wd....	Gray..	4-3½x5 -19.6	4	ther...	G&O..	cst....	G&O..	fin...	sing..	Eismn.	hand..	sl&i-..	G&D..	none
Napoleon.........7	¾-1	121	.....	rol-c..	.....	pnu...	33x4	33x4	.....	wd....	H-S...	4-3½x5 -19.6	4	ther...	Lvgn..	.....	Lvgn..	fin...	sing..	Eismn.	hand..	s&l	.....	none
Nash.........2018	1	130	Smh..	p-stl..	s-flex..	sol....	34x3	34x4	.....	wd....	own...	4-3¾x5¼-22 5	4	cent..	Lng...	cst....	Lng...	fin...	sing..	Eismn.	hand..	sl&i-2.	Aut-L.	none
Nash.........3018	2	144	Smh..	p-stl..	s-flex..	sol....	34x4	34x6	.....	wd....	own...	4-3¾x5¼-22.5	4	cent..	Lng...	cst....	Lng...	fin...	sing..	Eismn.	hand..	sl&i-2.	Aut-L.	none
Netco.........D	2	144	P&B..	p-stl..	s-flex..	sol*...	36x4*	36x7*	Arch..	wd....	Cont..	4-4⅛x5¼-27.2	4	cent..	own...	cst....	E&M.	fin...	sing..	Eismn.	fixed	lghtg..	Eismn.	175
Netco.........H	2½	168	P&B..	p-stl..	s-flex..	sol*...	36x4*	36x8*	Arch..	wd....	Cont..	4-4½x5½-32.4	2	cent..	own...	cst....	E&M.	fin...	sing..	Eismn.	fixed.	lghtg..	Eismn.	175
New York.........M	1½	144	own..	rol-c..	s-flex..	sol....	36x3½	36x5	Arch..	wd....	Cont..	4-4⅛x5¼-27.2	4	cent..	Kells.	sht....	Kells.	cel...	sing..	Bosch	fixed.	none...	.....	....
New York.........N	2½	144	own..	rol-c..	s-flex..	sol....	36x4	36x4d	Arch..	wd....	Cont..	4-4⅛x5¼-27.2	4	cent..	Kells.	sht....	Kells.	cel...	sing..	Bosch	fixed.	none...	.....	....
Niles.........E	2	140	Svg...	p-stl..	flex...	sol*...	36x4*	36x7*	H&D.	wd....	Cont..	4-4⅛x5¼-27.2	4	cent.	Mod.	cst....	Mod.	sq-t...	sing..	Eismn.	hand..	lghtg..	Eismn.	none
Noble.........A21	1	130	Shar..	p-stl..	s-flex..	pnu...	34x4½	35x5	Bim...	wd....	Lyc...	4-3½x5 -19.6	4	ther...	Lng...	pra....	Lng...	fin...	sing..	West.	hand..	s&l-2..	West..	....
Noble.........B30	1½	156	Shar..	p-stl..	s-flex..	sol*...	36x3½	36x5	Bim...	wd....	Buda..	4-3¾x5¼-22.5	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Eismn.	hand..	s&l-2	West..	150
Noble.........D50	2½	162	Shar..	p-stl..	s-flex..	sol*...	36x4	36x8	Bim...	wd....	Buda.	4-4¼x5½-29.0	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Eismn.	hand..	s&l-2..	West..	150
Noble.........E70	3½	182	Shar..	p-stl..	s-flex..	sol....	36x5	36x10	Bim...	wd*...	Buda..	4-4½x6 -32.4	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Eismn.	hand..	lghtg..	West..	90
Norwalk.........25E	1	130	P&B..	p-stl..	rigid..	sol....	34x3½	34x4	E&O..	wd....	Lyc...	4-3½x5 -19.6	4	ther...	Stan..	cst....	Stn...	cel...	sing..	Delco.	hand..	sl&i..	Dneto.	....
Norwalk.........35E	1½	143	P&B..	p-stl..	rigid..	sol....	34x3½	34x5	E&O..	wd....	Lyc...	4-3½x5 -19.6	4	ther...	Stan..	cst....	Stn...	cel...	sing..	Delco.	hand..	sl&i..	Dneto.	....
Northway.........B2	2	161	Drt...	p-stl..	s-flex..	sol*...	36x4	36x4d	Clrk..	mt....	own...	4-4 x6 -25 6	4	cent..	own...	cst....	G&O..	zz-t..	sing..	Wag..	hand..	sl&i-..	West..	none
Northway.........B3	3½	160	Drt...	p-stl..	s-flex..	sol....	36x5	40x5d	Clrk..	mt....	own...	4-4 x6 -25.6	4	cent..	own...	cst....	G&O..	zz-t..	sing..	Wag..	hand..	sl&i-..	West..	none
Nye Tractor.........B	8	....	own..	rol-c..	rigid..	sol....	40x7	none..	We-W.	wd....	Buda..	4-3¾x5¼-22.5	4	cent..	Idl....	pra....	Idl....	cel...	sing..	Spltf..	t-p....	none...	.....	....
Nye Tractor.........C	5	....	own..	rol-c..	rigid..	sol....	40x6	none..	We-W.	wd....	Buda..	4-3¼x5¼-16.9	4	ther...	Idl....	pra....	Idl....	cel...	sing..	Spltf..	t-p....	none...	.....	....
Ogden.........A1	1½	136	Cas...	p-stl..	flex...	opt...	36x3½	36x5	Stn...	wd....	Cont..	4-3¾x5 -22.5	4	ther...	Chgo..	cst....	Chgo..	fin...	sing..	Bosch	hand..	.....	.....	....
Ogden.........E	2½	160	Cas...	p-stl..	flex...	opt...	36x4	36x8	Stn...	wd....	Cont..	4-4⅛x5¼-27.2	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Bosch	hand..	.....	.....	....
Orleans.........A	1½	144	own..	rol-c..	s-flex..	sol*...	36x3½	36x5	Sth...	mt....	Her...	4-3¾x5¼-22.5	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Eismn.	hand..	lghtg..	.....	....
Orleans.........B	2½	166	own..	rol-c..	s-flex..	sol*...	36x4	36x7	Sth...	mt....	Her...	4-4 x5½-25.6	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Eismn.	hand..	none...	.....	....
O.K.........HI	1½	150	Hyd..	p-stl..	s-flex..	pnu...	36x6	36x6	Bim...	wd....	Buda..	4-3¾x5¼-22.5	4	cent..	Chgo..	cst....	R-T...	fin...	sing..	Eismn.	hand..	s&l....	West..	....
O.K.........KI	1½	150	Hyd..	p-stl..	s-flex..	pnu...	36x3½	36x7	Bim...	wd....	Buda..	4-4 x5½-25.6	4	cent..	Chgo..	cst....	R-T...	fin...	sing..	Eismn.	hand..	s&l....	West..	100
O.K.........LI	2½	150	Hyd..	p-stl..	s-flex..	sol....	36x4	36x8	Bim...	wd....	Buda..	4-4¼x5½-29.0	4	cent..	Chgo..	cst....	R-T...	fin...	sing..	Eismn.	hand..	s&l....	West..	100
O.K.........MI	3½	160	Hyd..	p-stl..	s-flex..	sol....	36x5	36x5-d	Bim...	wd....	Buda..	4-4½x6 -32.4	4	cent..	Chgo..	cst....	R-T...	fin...	sing..	Eismn.	hand..	s&l....	West..	100
Old Hickory.........W	1	135	own..	rol-c..	s-flex..	sol*...	36x3½	36x4	Stn...	wd....	Cont..	4-3¾x5 -22.5	4	ther...	own...	cst....	Lng...	fin...	sing..	Eismn.	hand..	none...	.....	....
Old Reliable.........A	1½	136	Smh..	p-stl..	s-flex..	sol*...	34x4	36x6	Crn...	wd....	Wsc...	4-4 x5 -25.6	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Bosch	hand..	lghtg..	Vesta.	....
Old Reliable.........B	2½	160	own..	rol-c..	rigid..	sol....	34x4	36x4d	Crn...	wd....	Wsc...	4-4¼x6 -29.0	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Bosch	hand..	lghtg..	Vesta.	....
Old Reliable.........C	3½	160	own..	rol-c..	rigid..	sol....	36x5	36x5d	Crn...	wd....	Wsc...	4-4¼x6 -29.0	4	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Bosch	hand..	lghtg..	Vesta.	....
Old Reliable.........D	5	168	own..	rol-c..	rigid..	sol....	36x6	40x6d	Crn...	wd....	Wsc...	4-4¾x6 -36.1	2	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Bosch	hand..	lghtg..	Vesta.	....
Old Reliable....K, L, M	7	136	own..	rol-c..	rigid..	sol....	36x6	40x7d	Crn...	wd....	Wau..	4-4¾x6½-36.1	2	cent..	Chgo..	cst....	Chgo..	fin...	sing..	Bosch	hand..	none...	.....	....
Oldsmobile-Economy..T	1	128	Smh..	p-stl..	rigid..	pnu...	35x5	35x5	Auto..	wd....	own...	4-3 11/16x5¼-22.5	4	cent..	own...	prs....	own...	sq-t...	dual..	Aut-L.	hand..	sl&i-2.	Aut-L.	none
Oneida.........A-9	1½	135	Drt...	p-stl..	s-flex..	sol....	36x3½	36x5	MWC.	wd....	own...	4-3¾x5¼-22.5	4	cent..	own...	cst....	Mod...	fin...	sing..	Spltf..	hand..	s&l....	West..	....
Oneida.........B-10	2	160	Drt...	p-stl..	s-flex..	sol....	36x4	36x7	MWC.	wd....	own...	4-4 x5½-25.6	4	cent..	own...	cst....	Mod...	fin...	sing..	Spltf..	hand..	s&l....	West..	...
Oneida.........C-9	2½	160	own..	p-stl..	s-flex..	sol*...	36x4	36x7	MWC.	wd....	own...	4-4 x5½-25.6	4	cent..	own...	cst....	Mod...	cel...	sing..	Spltf..	hand..	s&l....	West..	110
Oneida.........D-9	3½	170	own..	p-stl..	s-flex..	sol*...	36x5	36x10	Sth...	mt....	own...	4-4½x5½-32.4	4	cent..	own...	cst....	Mod...	cel...	sing..	Spltf..	hand..	s&l....	West..	110
Oneida.........E-9	5	180	own..	p-stl..	s-flex..	sol*...	36x6	40x12	Sth...	mt....	own...	4-4½x5½-32.4	4	cent..	own...	cst....	Mod...	cel...	sing..	Spltf..	hand..	s&l....	West..	110
Packard.........E-C	2	144	own..	rol-c..	flex...	sol....	36x4	36x7	.....	wd....	own...	4-4¼x5½-28.9	4	cent..	Fed...	cst....	Fed...	fin...	dual..	Spltf..	hand..	sl&i-2.	Bijur..	220
Packard.........E-X	3	144	own..	rol-c..	flex...	pnu...	36x6	40x8	.....	mt....	own...	4-4¼x5½-28.9	4	cent..	Fed...	cst....	Fed...	fin...	dual..	Spltf..	hand..	sl&i-2.	Bijur..	220
Packard.........E-D	4	156	own..	rol-c..	flex...	sol....	36x5..	36x5d	.....	mt....	own...	4-4½x5½-32.4	4	cent..	Fed...	cst....	Fed...	fin...	dual..	Spltf..	hand..	sl&i-2.	Bijur..	220
Packard.........E-Y	5	156	own..	rol-c..	flex...	pnu...	38x7	44x10	.....	mt....	own...	4-5 x5½-40.0	4	cent..	Fed...	cst....	Fed...	fin...	dual..	Spltf..	hand..	sl&i-2.	Bijur..	220
Packard.........E-F	6	156	own..	rol-c..	flex...	pnu...	36x6	40x6d	.....	mt....	own...	4-5 x5½-40.0	4	cent..	Fed...	cst....	Fed...	fin...	dual..	Spltf..	hand..	sl&i-2.	Bijur..	220
Paige.........52-19	1½	140	Hyd..	p-stl..	s-flex..	sol....	34x3½	34x6	Sch...	wd....	Hink..	4-4 x5½-25.6	4	cent..	own...	cst....	Natl..	fin...	sing..	Bosch	hand..	s&l....	G&D..	'xtra
Paige.........54-20	2½	150	Hyd..	p-stl..	s-flex..	sol....	34x4	34x8	Day..	mt....	Hink..	4-4¼x5½-29.0	4	cent..	Natl..	cst....	Natl..	fin...	sing..	Bosch	hand..	s&l-2..	G&D..	'xtra
Paige.........51-18	3½	160	Hyd..	p-stl..	s-flex..	sol....	36x5	36x5d	Day..	mt....	Hink..	4-4½x5½-32.4	4	cent..	Natl..	cst....	Natl..	fin...	sing..	Bosch	hand..	s&l-2..	G&D..	'xtra
Parker.........F-20	2	150	Smh..	p-stl..	flex...	sol....	34x4	36x4d	Bim...	wd....	Wsc...	4-4 x6 -25.6	4	cent..	own...	cst....	Brem.	pln...	sing..	Bosch	hand..	s&l-2..	West..	none
Parker.........J-20	3½	160	Smh..	p-stl..	flex...	sol....	36x5	40x5d	Sth...	mt....	Wsc...	4-4½x6 -32.4	4	cent..	own...	cst....	Brem.	pln...	sing..	Bosch	hand..	s&l-2..	West..	none
Parker.........M-20	5	160	Smh..	p-stl..	flex...	sol....	36x6	40x6d	Sth...	mt....	Wsc...	4-4¾x6 -36.1	2	cent..	own...	cst....	Brem.	pln...	sing..	Bosch	hand..	s&l-2..	West..	none
Piedmont.........4-30	1½	132	P&B..	p-stl..	rigid..	pnu...	34x4	34x4	E&O..	wd....	Lyc...	4-3½x5 -19.6	4	ther ..	Stan..	cst....	Stan..	cel...	sing..	Delco.	hand..	sl&i-1.	Dneto.	none

For abbreviations see page 336.

oline Trucks—*Continued*

Engine: Governor Type	Governor Make	Governor Drive	Speed: Motor in r.p.m.	Speed: Truck in m.p.h.	Fuel Sys.: Carburetor Make	Fuel Feed	Clutch Type	Clutch Make	Transmission: Gearset Type	Gearset Make	Gearset Placed	Speeds	Final Drive Type	Rear Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Brakes: Foot	Brakes: Hand	Control: Steer'g Gear Placed	Steer'g Gear Make	Levers	Universals Type	Universals Make	Name and Model
cent.	......	motor.	1200	9	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	int-g.	own.	17.50	sprgs.	sprgs.	Morg.	ext-f-w.	ext-d-s.	l.	own.	ctr.	mtl	own.	MacDonald A
cent.	own.	motor.	1160	17	Schblr.	grv.	d-d.	own.	selec.	own.	mtr.	4	d-rd.	own.	7.60	sprgs.	sprgs.	Math*	int-r-w.	ext-d-s.	l.	own.	ctr.	mtl	Spicer.	Mack AB
cent.	own.	motor.	1160	19	Schblr.	grv.	d-d.	own.	selec.	own.	mtr.	4	hn.	own.	6.99	r-rd.	none.	Math*	ext-d-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack AB
cent.	own.	motor.	1160	19	Schblr.	grv.	d-d.	own.	selec.	own.	mtr.	4	chn.	own.	6.99	r-rd.	none.	Math*	ext-d-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack AB
cent.	own.	motor.	1160	17½	Schblr.	grv.	d-d.	own.	selec.	own.	mtr.	4	d-rd.	own.	7.60	sprgs.	sprgs.	Math*	int-r-w.	ext-d-s.	l.	own.	ctr.	mtl	Spicer.	Mack AB
cent.	own.	motor.	1000	14	Schblr.	grv.	d-p.	own.	selec.	own.	jst.	3	chn.	own.	8.49	r-rd.		Math*	ext-j-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack AC
cent.	own.	motor.	1160	12	Schblr.	grv.	d-d.	own.	selec.	own.	mtr.	4	chn.	own.	10.53	r-rd.		Math*	ext-d-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack Tractor AB
cent.	own.	motor.	1000	13	Schblr.	grv.	d-p.	own.	selec.	own.	jst.	3	chn.	own.	9.00	r-rd.		Math*	ext-j-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack AC
cent.	own.	motor.	1000	10	Schblr.	grv.	d-p.	own.	selec.	own.	jst.	3	chn.	own.	10.50	r-rd.		Math*	ext-j-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack AC
cent.	own.	motor.	1000	11	Schblr.	grv.	d-p.	own.	selec.	own.	jst.	3	chn.	own.	10.76	r-rd.		Math*	ext-j-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack Tractor AC
cent.	own.	motor.	1000	10	Schblr.	grv.	d-p.	own.	selec.	own.	jst.	3	chn.	own.	11.58	r-rd.		Math*	ext-j-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack AC
cent.	own.	motor.	1000	10	Schblr.	grv.	d-p.	own.	selec.	own.	jst.	3	chn.	own.	11.58	r-rd.		Math*	ext-j-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack Tractor AC
cent.	own.	motor.	1000	9½	Schblr.	grv.	d-p.	own.	selec.	own.	jst.	3	chn.	cwn.	12.92	r-rd.		Math*	ext-j-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack Tractor AC
cent.	own.	motor.	1000	8	Schblr.	grv.	d-p.	own.	selec.	own.	jst.	3	chn.	own.	14.10	r-rd.		Math.	ext-j-s.	int-r-w.	l.	own.	ctr.	mtl	Spicer.	Mack Tractor AC
cent.	Pierce.	motor.	1250	17	Zenith*.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	8.75	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Maccar L2
cent.	Pierce.	motor.	1200	16	Zenith*.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	7.75	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Maccar H2
cent.	Pierce.	motor.	1200	15	Zenith*.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	8.75	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Maccar M2
1-b.	Cont.	motor.	1050	12	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.25	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Maccar G
suct.	McCn.	motor.	1200	15	Master.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn	7.75	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Master JW
suct.	McCn.	motor.	1200	16	Master.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	d-rd.	Torbn.	8.00	sprgs.	sprgs.	Dtr.	ext-d-s.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Master D
suct.	McCn.	motor.	1200	15	Master.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	8.50	sprgs.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Master W
cent.	Pierce.	motor.	1100	12	Master.	vac.	w-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.33	sprgs*.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Master A
cent.	Pierce.	motor.	1000	10	Master.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.25	sprgs*.	sprgs.	Dtr.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Master B
cent.	Pierce.	motor.	1100	12	Master.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	d-rd.	Walkr.	11.50	sprgs*.	sprgs.	Dtr.	ext-d-s.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Master E
cent.	Pierce.	motor.	1000	10	Master.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	d-rd.	Walkr.	11.50	sprgs*.	sprgs.	Dtr.	ext-d-s.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Master F
suct.	McCn.	motor.	1200	15	Master.	vac.	d-d.	Fuller*.	selec.	Fuller*.	mtr.	4	int-g.	Torbn.	8.60	sprgs.	sprgs.	Dtr.	ext-d-s.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Master Tractor T
none.			1800	25		grv.	cone.	own.	selec.	own.	mtr.	3	worm.	own.	7.25	sprgs.	sprgs.		int-r-w.	int-r-w.	l.	own.	ctr.	fab	own.	Maxwell
......					Stmbg.		d-d.	Fuller.					worm.	Wsc.		t-arm.	t-arm.	Dplx.			l.	Ross.				Menges B
suct.	Mnrch.	motor.	.....	20	Stmbg.	grv.	d-d.	Detlaf.	ind-c.	Cotta.		3	worm.	Timkn	6.20	r-rd.	sprgs.	Tuth.	int.	int.	l.	Ross.	ctr.	f-m	Sp&O.	Menominee HT
suct.	Mnrch.	motor.	.....	16	Stmbg.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	mtr.	3	worm.	Timkn	7.10	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&O	Menominee H
suct.	Mnrch.	motor.	.....	18	Stmbg.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	mtr.	4	worm.	Timkn	7.75	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&O	Menominee D
suct.	Mnrch.	motor.	.....	16	Stmbg.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	amid.	4	worm.	Timkn	10.30	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Menominee G
suct.	Mnrch.	motor.	.....		Stmbg.	grv.	w-d.	Detlaf.	ind-c.	Cotta.	amid.	4	worm.	Timkn	11.66	r-rd.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Menominee J3
......	Phro.	motor.	1800	25	Till.	grv.	d-p.		selec.	own.	mtr.	3	int-g.	Torbn.	8.00	sprgs.	sprgs.	Math.	int-r-w.	ext-r-w.	l.	Ross.	ctr.	mtl	Arvac.	Moline 10
......				22	Master.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn		r-rd.	r-rd.	U.S.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Moreland 20N
......				26	Master.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn		r-rd.	r-rd.	U.S.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Moreland 20B
......				21	Master.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn		r-rd.	r-rd.	U.S.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Moreland 20C
......	Cont.	motor.	1050	23	Master.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn		r-rd.	r-rd.	U.S.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Moreland 20G
......	Cont.	motor.	1000	13	Master.	grv.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn		r-rd.	r-rd.	U.S.	int-r-w.	int-r-w.	l.	Ross.	ctr.	fab	own.	Moreland 20J
cent.	Dplx.	Dplx.	1015	14	Stmbg.	grv.	w-d.	H-Shaw	ind-c.	Cotta.	amid.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Mutual 2B
cent.	Dplx.	Dplx.	1240	20	Stmbg.	grv.	w-d.	H-Shaw	ind-c.	Cotta.	amid.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Mutual 2BP
none.			1800	31	Schblr.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	6.00	sprgs.	sprgs.	Math.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	Unval.	Napoleon 9
none.			1800	25	Schblr.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.50	sprgs.	sprgs.	Math.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	Unval.	Napoleon 11
......				28	Scheb.	grv.	d-p.	B-Beck.	selec.	Muncie.	mtr.	3	int-g.		6.00				ext-r-w.	int-r-w.	o.			mtl	Hartf.	Napoleon 7
cent.	Dplx.	motor.	1500	22	Stmbg.	grv.	d-p.	B-Beck.	selec.	Detrt.	mtr.	3	int-g.	Clrk.	6.80	sprgs.	sprgs.	Math.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	own.	Nash 2018
cent.	Dplx.	motor.	1500	17	Stmbg.	grv.	d-p.	B-Beck.	selec.	Detrt.	mtr.	4	int-g.	Clrk.	9.00	sprgs.	sprgs.	Math.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	own.	Nash 3018
none.			.....	24	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Netco D
none.			.....	24	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	Netco H
cent.	Pierce.	motor.	.....	18	Stmbg.	grv.	d-p.	B&B.	ind-c.	Cotta.	mtr.	3	worm.	Timkn		r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Hart.	New York M
cent.	Pierce.	motor.	.....	15		grv.	d-p.	B&B.	ind-c.	Cotta.	mtr.	3		Timkn		r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Hart.	New York N
suct.	Mnrch	motor.	1200	15	Stmbg.	grv.	d-p.	B&B.	selec.	Covert.	amid.	3	worm.	Timkn	8.50	r-rd.		Iron.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Blood.	Niles E
none.			1500	26	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	6.00	sprgs.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	M&E.	Noble A21
cent.	Amer.	motor.	1290	18	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm	Shel.	7.75	sprgs.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	M&E.	Noble B30
cent.	Amer.	motor.	1080	15	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Shel.	8.75	sprgs.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	M&E.	Noble D50
cent.	Amer.	motor.	972	12	Stmbg.	grv.	d-d.	Fuller.	selec.	Warner	amid.	4	worm.	Shel.	8.75	sprgs.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	M&E.	Noble E70
......			2200	30	Zenith.	vac.	d-d.	B&B.	selec.	G-Lees.	mtr.	3	worm.	Chic.	7.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	CAS.	ctr.	mtl	Unval.	Norwalk 25E
......			2200	35	Zenith.	vac.	d-d.	B&B.	selec.	G-Lees.	mtr.	3	worm.	Shel.	8.20	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	CAS.	ctr.	mtl	Unval.	Norwalk 35E
cent.	Pierce.	motor.	1300	18	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Shel.	7.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Northway B2
cent.	Pierce.	motor.	1350	16	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Shel.	10.25	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Northway B3
cent.	Pierce.	motor.	1100	4½	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	chn.	own.	40.00	s-fr.	s-fr.	none.	ext-d-s.	ext-d-s.	l.	own.	ctr.	f-m	own.	Nye Tractor B
cent.	Pierce.	motor.	1100	4½	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	chn.	own.	40.00	s-fr.	s-fr.	none.	ext-d-s.	ext-d-s.	l.	own.	ctr.	f-m	own.	Nye Tractor C
cent.	Pierce.	motor.	.....	15	Ray.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	8.75	sprgs.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	M&E.	Ogden A1
cent.	Pierce.	motor.	.....	15	Ray.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.75	sprgs.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	M&E.	Ogden E
none.					Mast.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	mtr.	3	worm.	Wis.	7.25	r-rd.	t-arm.	Marm.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Orleans A
none.					Mast.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	amid.	4	worm.	Wis.	8.50	r-rd.	t-arm.	Marm.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Orleans B
none.			2200	35	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.		3	worm.	Wis.	7.25	sprgs.	sprgs.		int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	O K HI
none.			1600	21	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.		4	worm.	Wis.	13.20	sprgs.	sprgs.		int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	O K KI
none.			1600	20	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.		4	worm.	Wis.	13.90	sprgs.	sprgs.		int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	O K LI
none.			1600	17	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.		4	worm.	Wis.	17.00	sprgs.	sprgs.		int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Hart.	O K MI
cent.	Pierce.	motor.	1200	18	Stmbg.	vac.	d-p.	B&B.	selec.	G-Lees.	mtr.	3	worm.	Timkn	7.75	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Blood.	Old Hickory W
suct.	Mnrch.	motor.	1135	15	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	7.75	sprgs.	sprgs.	Chgo.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Old Reliable A
suct.	Mnrch.	motor.	1135	15	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Shel.	7.75	sprgs.	sprgs.	Chgo.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Old Reliable B
suct.	Mnrch.	motor.	988	12	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Shel.	8.75	r-rd.	sprgs.	Chgo.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Old Reliable C
suct.	Mnrch.	motor.	1075	15	Stmbg.	vac.	w-d.	Unv.	selec.	own.	amid.	4	worm.	Shel.	10.25	r-rd.	sprgs.	Chgo.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Old Reliable D
suct.	Wau.	motor.	995	14	Stmbg.	grv.	w-d.	Unv.	selec.	own.	jst.	4	chn.	own.	10.00	r-rd.	sprgs.	Chgo.	int-r-w.	ext-d-s.	l.	Ross.	l.	mtl	Hart.	Old Reliable K, L, M
none.			2000	35	Zenith.	vac.	cone.	own.	selec.	Warn*.	mtr.	3	int-g.	Torbn.	6.50	sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	l.	Jacox.	r.	mtl	Spicer.	Olds-Economy T
cent.	own.	motor.	1400	27	Stmbg.	vac.	d-d.	own.	selec.	Fuller.	mtr.	3	worm.	own.		sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&Pet	Oneida A-9
cent.	own.	motor.	1500	22	Stmbg.	vac.	d-d.	own.	selec.	Fuller.	mtr.	3	worm.	own.		r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&Pet	Oneida B-10
cent.	own.	motor.	1400	20	Stmbg.	vac.	d-d.	own.	selec.	own.	amid.	4	worm.	own.		r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	own.	ctr.	f-m	own.	Oneida C-9
cent.	own.	motor.	1350	14	Stmbg.	vac.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn		r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	own.	ctr.	f-m	own.	Oneida D-9
cent.	own.	motor.	1350	14	Stmbg.	vac.	d-d.	own.	selec.	own.	amid.	4	worm.	Timkn		r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	own.	ctr.	f-m	own.	Oneida E-9
cent.	own.	motor.	1000	15	own.	pres.	d-d.	own.	selec.	own.	amid.	4	worm.	own.	7.25	r-rd.	t-arm.	Sp-P.	ext-d-s.	int-r-w.	l.	own.	l&c.	f-m	own&Sp	Packard E-C
cent.	own.	motor.	1800	28	own.	pres.	d-d.	own.	selec.	own.	amid.	4	worm.	own.	7.25	r-rd.	t-arm.	Sp-P.	ext-d-s.	int-r-w.	l.	own.	l&c.	f-m	own&Sp	Packard E-X
cent.	own.	motor.	1000	12	own.	pres.	d-d.	own.	selec.	own.	amid.	4	worm.	own.	9.00	r-rd.	t-arm.	Sp-P.	ext-d-s.	int-r-w.	l.	own.	l&c.	f-m	own&Sp	Packard E-D
cent.	own.	motor.	1600	25	own.	pres.	d-d.	own.	selec.	own.	amid.	4	worm.	own.	9.00	r-rd.	t-arm.	Sp-P.	ext-d-s.	int-r-w.	l.	own.	l&c.	f-m	own&Sp	Packard E-Y
cent.	own.	motor.	1000	11	own.	pres.	d-d.	own.	selec.	own.	amid.	4	worm.	own.	10.66	r-rd.	t-arm.	Sp-P.	ext-d-s.	int-r-w.	l.	own.	l&c.	f-m	own&Sp	Packard E-F
cent.		motor.	1400	18	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	7.75	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Paige 52-19
cent.	Simp.	motor.	1250	15	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.75	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Paige 54-20
cent.	Simp.	motor.	1200	12	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.33	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Paige 51-18
suct.	Mnrch.	motor.	1050	15	Stmbg.	grv.	d-d.	B-Lipe.	selec.	Fuller.	amid.	4	worm.	own.	7.75	r-rd.	sprgs.	Tuth.	ext-d-s.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Parker 20-F
suct.	Mnrch.	motor.	1050	15	Stmbg.	grv.	d-d.	B-Lipe.	selec.	Warn.	amid.	4	worm.	own.	8.75	r-rd.	sprgs.	Tuth.	ext-d-s.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Parker 20-J
cent.	Simp.	motor.	1050	12	Stmbg.	grv.	d-d.	B-Lipe.	selec.	Warn.	amid.	4	worm.	Timkn	10.25	r-rd.	sprgs.	Tuth.	ext-d-s.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Parker 20-M
none.			2200	20	Cart.	vac.	d-p.	B-Beck.	selec.	G-Lees.	mtr.	3	worm.	Dunk.		sprgs.	sprgs.	S-P.	ext-r-w.	int-r-w.	l.	Lavn.	r.	mtl	Spicer.	Piedmont 4-30

For abbreviations see page 336.

Specifications of Gas

Name and Model	Tons Capacity	Wheelbase, Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	WHEELS Make	WHEELS Type	ENGINE Make	No. Cyl, Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	RADIATOR CASE Make	RADIATOR CASE Type	RADIATOR CORE Make	RADIATOR CORE Type	IGNITION Type	IGNITION Make	Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	Extra Cost $
Pierce-Arrow	2	150	......	p-stl.	s-flex.	sol.	36x4	36x4d	......	mt.	own.	4-4x 5½-25.6	4	cent.	......	cst.	......	fin.	t-p.	Delco.	hand.	sl&i-2.	Delco.	125
Pierce-Arrow	3½	162	......	p-stl.	s-flex.	sol.	36x5	36x5d	......	mt.	own.	4-4½x6¾-32.4	4	cent.	......	cst.	......	fin.	t-p.	Delco.	hand.	sl&i-2.	Delco.	125
Pierce-Arrow	5	168	......	p-stl.	s-flex.	sol.	36x5	40x6d	......	mt.	own.	4-4½x6¾-32.4	4	cent.	......	cst.	......	fin.	t-p.	Delco.	hand.	sl&i-2.	Delco.	125
Pioneer AA	1	130	Cas.	p-stl.	......	pnu.	33x5	33x5	Bim.	wd.	GB&S.	4-3¾x4½-22.5	4	ther.	Wab.	sht.	Wab.	cel.	sing.	Bosch.	hand.	s&l-2.	A-L.	none
Pittsburger B	2½	160	own.	p-stl.	s-flex.	sol*.	36x5	36x7	Sth.	mt.	Cont.	4-4⅛x5¼-27.3	4	cent.	own.	cst.	G&O.	fin.	sing.	Bosch.	hand.	none.	......	....
Pony	¾	92	own.	rol-c.	s-flex.	pnu.	28x3	28x3	Prud.	wd.	own.	4-2¾x4 -12.1	4	ther.	own.	......	own.	cel.	sing.	A-Knt	auto.	none.	......	....
Ranger TK	2	136	Drt.	rol-c.	rigid.	pnu.	36x6	38x7	Crn.	wd.	Wsc.	4-3¾x5 -22.5	4	cent.	Bush.	cst.	Bush.	fin.	sing.	Spltf.	hand.	......	......	....
Rainier R-11	¾	125	Prsh.	p-stl.	s-flex.	pnu.	35x5	35x5	Way.	wd.	Cont.	4-3½x5 -19.6	4	ther.	Har.	prs.	Har.	cel.	sing.	Eismn.	fixed.	lghtg.	......	....
Rainier R-19	1	135	Prsh.	p-stl.	s-flex.	sol.	34x3½	34x4	Way.	wd.	Cont.	4-3½x5 -19.6	4	ther.	Har.	prs.	Har.	cel.	sing.	Eismn.	fixed.	lghtg.	......	....
Rainier R-16	1½	147	Prsh.	p-stl.	s-flex.	sol.	34x3½	34x5	Way.	wd.	Cont.	4-3¾x5 -22.5	4	ther.	Har.	prs.	Har.	cel.	sing.	Eismn.	fixed.	lghtg.	......	....
Rainier R-18	2	147	Prsh.	p-stl.	s-flex.	sol.	34x4	34x6	Way.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	E&M.	cst.	E&M.	fin.	sing.	Eismn.	hand.	lghtg.	......	....
Rainier R-20	2½	165	Prsh.	p-stl.	s-flex.	sol.	34x4	34x7	Way.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	E&M.	cst.	E&M.	fin.	sing.	Eismn.	hand.	lghtg.	......	....
Rainier R-15	3½	170	Prsh.	p-stl.	s-flex.	sol.	36x5	36x5d	Way.	wd.	Cont.	4-4½x5½-32.4	2	cent.	E&M.	cst.	E&M.	fin.	sing.	Eismn.	hand.	lghtg.	......	....
Rainier R-17	5	175	Prsh.	p-stl.	s-flex.	sol.	36x6	36x6d	Way.	mtl.	Cont.	4-4¾x6 -36.1	2	cent.	E&M.	cst.	E&M.	fin.	sing.	Eismn.	hand.	lghtg.	......	....
Reliance 20B	2½	156	Savg.	p-stl.	flex.	sol.	36x4	36x4d	Stn.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	Bush.	pln.	sing.	Eismn.	hand.	lghtg.	Eismn.	none
Reliance 10A	1½	150	Savg.	p-stl.	flex.	sol.	36x3½	36x5	Stn.	wd.	Buda.	4-4 x5½-25.6	4	cent.	own.	cst.	Bush.	pln.	sing.	Eismn.	hand.	lghtg.	Eismn.	none
Roe F	¾	128	own.	p-stl.	......	pnu.	34x4½	34x4½	Prud.	wd.	own.	4-4⅛x4½-27.2	2	cent.	own.	prs.	own.	fin.	......	......	hand.	......	......	....
Republic 10E	1	124	Drt.	p-stl.	s-flex.	pnu.	35x5	35x5	MWC.	wd.	Cont.	4-3¾x5 -22.5	4	ther.	own.	cst.	G&O.	cel.	sing.	Bosch.	fixed.	lghtg.	Delco.	....
Republic 11X	1½	144	Drt.	p-stl.	s-flex.	sol.	34x3½	34x5	MWC.	wd.	Cont.	4-3¾x5 -22.5	4	ther.	own.	cst.	G&O.	cel.	sing.	Bosch.	fixed.	s&l.	Aut-L.	275
Republic 19	2½	144	Drt.	p-stl.	s-flex.	pnu.	36x4	36x7	MWC.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	G&O.	cel.	sing.	Bosch.	hand.	s&l.	West.	275
Republic 20	3½	165	Drt.	p-stl.	s-flex.	pnu.	36x5	36x10	Sth.	mt.	Cont.	4-4½x5½-32.4	2	cent.	own.	cst.	G&O.	fin.	sing.	Bosch.	hand.	lghtg.	West.	165
Riker B	3	150	Prsh.	p-stl.	rigid.	sol.	36x5	36x5d	Day.	mt.	own.	4-4¼x6 -29.0	2	cent.	own.	cst.	McC.	fin.	dual.	Berlg.	......	s&l.	West.	....
Riker BB	4	150	Prsh.	p-stl.	rigid.	sol.	36x5	36x6d	Day.	mt.	own.	4-4¼x6 -29.0	2	cent.	own.	cst.	McC.	fin.	dual.	Berlg.	......	s&l.	West.	....
Rock Falls 14	....	150	Smh.	p-stl.	......	pnu.	35x5	35x5	Mut.	wd.	Cont.	6-3¾x5 -33.75	6	cent.	......	prs.	S-W.	ss-t.	sing.	Bosch.	hand.	s&l.	West.	none
Rowe CW	1½	133	own.	rol-c.	s-flex.	pnu.	36x6	36x6	H&D.	wd.	Wsc.	4-3¾x5 -22.5	4	cent.	E&M*	sht.	E&M*	cel.	sing.	Bosch.	hand.	none.	......	....
Rowe CDW	2	140	own.	rol-c.	s-flex.	sol.	34x4	36x3½	H&D.	wd.	Wsc.	4-4 x5 -25.4	4	cent.	E&M*	sht.	E&M*	cel.	sing.	Bosch.	hand.	none.	......	....
Rowe GSW	3	158	own.	rol-c.	s-flex.	sol.	34x5	36x5d	H&D.	wd.	Wsc.	4-4 x6 -25.4	4	cent.	E&M*	sht.	E&M*	cel.	sing.	Bosch.	hand.	none.	......	....
Rowe GPW	3	170	own.	rol-c.	s-flex.	pnu.	38x7	42x9	H&D.	wd.	Pitt.	8-3¼x5 -33.8	4	cent.	E&M*	sht.	E&M*	cel.	sing.	A Knt	hand.	sl&i-2.	West.	none
Rowe HW	4	158	own.	rol-c.	s-flex.	sol.	36x5	36x6d	H&D.	wd.	Wsc.	4-4¼x6 -29.0	4	cent.	E&M*	sht.	E&M*	cel.	sing.	Bosch.	hand.	none	......	....
Rowo FW	5	170	own.	rol-c.	s-flex.	sol.	36x6	40x6d	H&D.	wd.	Wsc.	4-4½x6 -32.4	4	cent.	E&M*	sht.	E&M*	cel.	sing.	Bosch.	hand.	none.	......	....
Rumely A	1½	144	Hyd.	p-stl.	s-flex.	sol.	36x3½	36x5	MWC.	wd.	Buda.	4-3¾x5½-22.5	4	cent.	Mod.	cst.	Mod.	fin.	sing.	Spltf.	hand.	none.	......	....
Sandow G	1	120	Savg.	p-stl.	flex.	sol.	34x3½	34x5	Stn.	wd.	Cont.	4-3¾x5 -22.5	4	ther.	own.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	lghtg.	Vesta.	125
Sandow CG	1½	135	Elyr.	p-stl.	s-flex.	sol.	34x4	34x6	Stn.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	own.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	lghtg.	Vesta.	125
Sandow J	2½	165	Elyr.	p-stl.	rigid.	sol.	36x4	36x7	Stn.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	Vesta.	125
Sandow M	3½	175	Elyr.	p-stl.	rigid.	sol.	36x5	36x5d	Stn.	wd.	Cont.	4-4½x5½-32.4	2	cent.	own.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	Vesta.	125
Sandow L	5	175	Elyr.	p-stl.	rigid.	sol.	36x6	40x6d	Stn.	wd.	Cont.	4-4½x5½-32.4	2	cent.	own.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	......	......	125
Sanford W25	2½	156	P&B.	p-stl.	s-flex.	sol*.	36x4	36x4d	H&D.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	McC.	fin.	sing.	Eismn.	hand.	lghtg.	Vesta.	150
Sanford W35	3½	174	P&B.	p-stl.	s-flex.	sol.	36x5	36x5d	H&D.	wd.	Cont.	4-4½x5½-32.4	2	cent.	own.	cst.	McC.	fin.	sing.	Eismn.	hand.	lghtg.	Vesta.	150
Sanford W50	5	174	P&B.	p-stl.	s-flex.	sol.	36x5	40x6d	Sth.	mt.	Cont.	4-4¾x6 -36.1	2	cent.	own.	cst.	McC.	fin.	sing.	Eismn.	hand.	lghtg.	Vesta.	150
Schacht	2	156	own.	rol-c.	flex.	sol.	36x4	36x7	Crn.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	Brem.	fin.	sing.	Bosch.	hand.	......	......	....
Schacht	2½	156	own.	rol-c.	flex.	sol.	36x4	36x4d	Crn.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	Brem.	fin.	sing.	Bosch.	hand.	......	......	....
Schacht	3½	168	own.	rol-c.	flex.	sol.	36x5	36x5d	Crn.	wd.	Buda.	4-4¼x6 -29.0	4	cent.	own.	cst.	Brem.	fin.	sing.	Bosch.	hand.	......	......	....
Schacht	5	168	own.	rol-c.	flex.	sol.	36x5	40x6d	Crn.	wd.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst.	Brem.	fin.	sing.	Bosch.	hand.	......	......	....
Selden 1½A	1½	137½	own.	p-stl.	s-flex.	sol.	34x3½	34x5	Arch.	wd.	Cont.	4-3¾x5 -22.5	4	ther.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	fixed.	s&l-2.	N-E.	....
Selden 2½A	2½	145	own.	p-stl.	s-flex.	sol.	36x4	36x7	Stn.	mt.	Cont.	4-4⅛x5¼-27.3	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l-2.	N-E.	....
Selden 3½A	3½	162	own.	p-stl.	s-flex.	sol.	36x5	36x10	Stn.	mt.	Cont.	4-4½x5½-32.4	2	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l-2.	N-E.	....
Selden 5A	5	164	own.	p-stl.	s-flex.	sol.	36x6	40x12	Stn.	mt.	Cont.	4-4¾x6 -36.1	2	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l-2.	N-E.	....
Seneca M20	½	108	P&B.	p-stl.	flex.	pnu.	30x3½	30x3½	Day.	wd.	LeR.	4-3⅛x4½-15.6	4	ther.	Kug.	prs.	Kug.	cel.	sing.	Conn.	hand.	sl&i.	Al-Ch.	none
Service 220	1-1½	137	own.	p-stl.	flex.	sol.	34x3½	34x5	Bim.	wd.	Buda.	4-3½x5¼-19.6	4	ther.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l.	West.	230
Service 31	1½-2	150	own.	p-stl.	flex.	sol.	36x3½	36x6	Bim.	wd.	Buda.	4-4 x5½-25.6	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l.	West.	230
Service 36	1½-2	150	own.	p-stl.	flex.	pnu.	35x5	38x7	Bim.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l.	West.	230
Service 51	2½-3	160	own.	p-stl.	flex.	sol*.	36x4	36x7	Bim.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l.	West.	230
Service 71	3½-4	171	own.	p-stl.	flex.	sol*.	36x5	36x5d	Stn.	mt.	Buda.	4-4¼x5½-29.0	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l.	West.	230
Service 76	3½-4	171	own.	p-stl.	flex.	sol.	36x5	36x5d	Stn.	mt.	Buda.	4-4½x6 -32.4	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l.	West.	230
Service 101	5-6	171½	own.	p-stl.	flex.	sol.	36x6	40x6d	Stn.	mt.	Buda.	4-4½x6 -32.4	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	s&l.	West.	230
Service 15	¾-1	132	own.	p-stl.	......	pnu.	34x4½	35x5	......	wd.	Mid-w	4-3⅝x5 -21.03	4	cent.	......	sht.	......	fin.	sing.	Remy.	hand.	s&l.	Remy.	none
Signal NF	1	132	Drt.	p-stl.	s-flex.	pnu.	34x5	36x6	Kel.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	McC.	cst.	McC.	fin.	sing.	Eismn.	fixed.	none.	......	....
Signal H	1½	146	Savg.	p-stl.	s-flex.	sol.	34x4	36x6	Crn.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	McC.	cst.	McC.	fin.	sing.	Eismn.	fixed.	none.	......	....
Signal J	2½	150	Savg.	p-stl.	s-flex.	sol.	34x4	36x8	Crn.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	McC.	cst.	McC.	fin.	sing.	Eismn.	fixed.	none.	......	....
Signal M	3½	168	Savg.	p-stl.	s-flex.	sol.	36x5	40x5d	Crn.	wd.	Cont.	4-4½x5½-32.4	2	cent.	McC.	cst.	McC.	fin.	sing.	Eismn.	fixed.	none.	......	....
Signal R	5	180	Savg.	p-stl.	s-flex.	sol.	36x6	40x6d	Sth*.	mt*.	Cont.	4-4¾x6 -36.1	2	cent.	McC.	cst.	McC.	fin.	sing.	Eismn.	hand.	none.	......	....
Southern 10	1	136	P&B.	p-stl.	s-flex.	opt.	34x4½	34x4	Roy.	wd.	Buda.	4-3¾x5 -22.5	4	ther.	own.	cst.	R-T.	fin.	sing.	Bosch.	fixed.	none.	......	....
Southern 15	1½	146	P&B.	p-stl.	s-flex.	opt.	36x6	34x4	Roy.	wd.	Cont.	4-3¾x5½-22.5	4	ther.	own.	cst.	R-T.	fin.	sing.	Bosch.	fixed.	none.	......	....
Southern 20	2	150	own.	rol-c.	s-flex.	opt.	36x6	40x8	Roy.	wd.	Buda.	4-4 x5½-25.6	4	cent.	own.	cst.	R-T.	fin.	sing.	Bosch.	fixed.	none.	......	....
Standard 1K	1	134	Prsh.	p-stl.	s-flex.	pnu.	36x6	36x6	......	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	fixed.	none.	......	....
Standard 76	2½	140	own.	rol-c.	s-flex.	sol*.	36x4	36x7	......	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	fixed.	none.	......	....
Standard 66	3½	160	P&B.	p-stl.	s-flex.	sol.	36x5	36x5d	......	wd.	Cont.	4-4½x5½-32.4	2	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	fixed.	none.	......	....
Standard 5K	5	164	Smh.	p-stl.	s-flex.	sol.	36x6	40x6d	Day.	mt.	Cont.	4-4¾x6 -36.1	2	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	none.	......	....
Sterling	1½	142	own.	p-stl.	......	sol*.	36x3½	36x5	Prud*.	wd*.	own.	4-4 x5½-25.6	2	cent.	own.	cst.	......	cel.	sing.	Eismn.	hand.	s&l-2.	West.	....
Sterling	2½	156	own.	p-stl.	flex.	sol*.	36x4	36x4	Prud*.	wd*.	own.	4-4⅜x5½-30.6	2	cent.	own.	cst.	......	cel.	sing.	Eismn.	hand.	s&l-2.	West.	....
Sterling	3½	162	own.	p-stl.	flex.	sol*.	36x5	40x5d	Prud*.	wd*.	own.	4-4½x6½-32.4	2	cent.	own.	cst.	......	cel.	sing.	Eismn.	hand.	s&l-2.	West.	....
Sterling	5	168	own.	p-stl.	flex.	sol*.	36x6	40x6d	Prud*.	wd*.	own.	4-5 x6½-40.0	2	cent.	own.	cst.	......	cel.	sing.	Eismn.	hand.	s&l-2.	West.	....
Sterling	5	174	own.	p-stl.	flex.	sol.	36x6	40x6d	Sth.	mt.	own.	4-5 x6½-40.0	2	cent.	own.	cst.	......	cel.	sing.	Eismn.	hand.	sl&i.	West.	....
Sterling	7½	174	own.	p-stl.	flex.	sol.	36x6	40x7d	Sth.	mt.	own.	4-5 x6½-40.0	2	cent.	own.	cst.	......	cel.	sing.	Eismn.	hand.	sl&i.	West.	....
Stewart 11	¾	110	Hyd.	p-stl.	rigid.	pnu.	32x4	32x4	Way.	wd.	LeR.	4-3⅛-4½-15.6	4	ther.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	fixed.	sl&i-2.	Eismn.	none
Stewart 12	1	130	Hyd.	p-stl.	rigid.	pnu.	35x5	35x5	Way.	wd.	H-S.	4-3½x5 -19.6	4	ther.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	hand.	sl&i-2.	Eismn.	none
Stewart 9	1½	140	Hyd.	p-stl.	rigid.	sol.	34x3½	34x5	Way.	wd.	Cont.	4-3¾x5 -22.5	4	ther.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	fixed.	none.	......	....
Stewart 7	2	156	Hyd.	p-stl.	rigid.	sol.	34x4	34x7	Clrk.	mt.	Cont.	4-4⅛x5¼-27.2	4	cent.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	fixed.	none.	......	....
Stewart 7x	2½	156	Hyd.	p-stl.	rigid.	sol.	34x4	34x7	Clrk.	mt.	Buda.	4-4¼x5½-29.0	4	cent.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	hand.	none.	......	....
Stewart 10	3½	165	Hyd.	p-stl.	rigid.	sol.	36x5	36x5d	Clrk.	mt.	Cont.	4-4½x5½-32.4	2	cent.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	fixed.	none.	......	....
Stewart 10x	3½	165	Hyd.	p-stl.	rigid.	sol.	36x5	36x5d	Clrk.	mt.	Buda.	4-4½x6 -32.4	4	cent.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	hand.	none.	......	....
Stoughton A	1	130	Drt.	p-stl.	flex.	pnu.	34x4½	35x5	Bim.	wd.	Wau.	4-3¾x5½-22.5	4	cent.	own.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	s&l.	West.	....
Stoughton B	1½	140½	......	p-stl.	flex.	sol.	36x3½	36x5	Bim.	wd.	Wau.	4-3¾x5½-22.5	4	cent.	own.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	lghtg.	Vesta.	110
Stoughton D	2	140½	Drt.	p-stl.	flex.	sol.	36x4	36x7	Bim.	wd.	Her.	4-4 x5½-25.6	4	cent.	own.	cst.	Chgo.	fin.	sing.	Eismn.	hand.	lghtg.	Vesta.	110
Sullivan E	2	150	P&B.	p-stl.	s-flex.	sol*.	36x4	36x7	Way.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	Bush.	fin.	sing.	Bosch.	hand.	......	......	....
Sullivan H	3½	170	P&B.	p-stl.	s-flex.	sol.	36x5	36x5d	Way.	wd.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst.	R-T.	fin.	sing.	Bosch.	hand.	......	......	....
Super-Truck 50	2½	156	P&B.	p-stl.	flex.	sol.	36x4	36x8	Prud.	wd.	Wsc.	4-4 x6 -25.6	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	Vesta.	50
Super-Truck 70	3½	164	P&B.	p-stl.	flex.	sol.	36x	40x5d	Sth.	mt.	Wsc.	4-4¼x6 -29.0	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Splt.	hand.	lghtg.	Vesta.	50
Super-Truck 100	5	164	P&B.	p-stl.	flex.	sol.	36x5	40x12	Sth.	mt.	Wsc.	4-4¾x6 -36.1	2	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Splt.	hand.	lghtg.	Vesta.	50
Texas 1921	¾	115	P&B.	p-stl.	rigid.	pnu.	33x4	33x4	Stn.	wd.	Lyc.	4-3½x5 -19.6	4	ther.	Jmst.	prs.	Jmst.	cel.	sing.	Conn.	hand.	s, l & i.	Bijur.	....
Tiffin F15	1½	135	P&B.	p-stl.	flex.	sol.	36x3½	36x5	Sth.	mt.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	B&O.	fin.	sing.	Bosch*	hand.	s&l-2.	West.	175
Tiffin F25	2½	148	P&B.	p-stl.	flex.	sol.	36x4	36x3½d	Sth.	mt.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	B&O.	fin.	sing.	Bosch*	hand.	s&l-2.	West.	175
Tiffin F35	3½	160	own.	rol-c.	s-flex.	sol.	36x5	40x5d	Sth.	mt.	Cont.	4-4½x5½-32.4	2	cent.	own.	cst.	B&O.	fin.	sing.	Bosch*	hand.	s&l-2.	West.	175

For abbreviations see page 336.

oline Trucks—*Continued*

Engine: Governor Type	Governor Make	Governor Drive	Speed Motor in r.p.m.	Speed Truck in m.p.h.	Fuel Sys. Carburetor Make	Fuel Feed	Clutch Type	Clutch Make	Transmission: Gearset Type	Gearset Make	Gearset Placed	Speeds	Final Drive Type	Rear Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Brakes Foot	Brakes Hand	Control: Steer'g Gear Placed	Steer'g Gear Make	Levers	Univer-sals Type	Univer-sals Make	Name and Model
cent.	own.	motor.	1400	18	Stmbg.	pres.	d-d.		selec.		amid.	4	worm.		9.66	sprgs.	sprgs.		int-r-w.	int-r-w.	l.		ctr.	f-m		Pierce-Arrow
cent.	own.	motor.	1200	16	Stmbg.	pres.	d-d.		selec.	own.	amid.	4	worm.	own.	8.00	r-rd.	t-arm.		ext-d-s.	int-r-w.	l.		ctr.	f-m		Pierce-Arrow
cent.	own.	motor.	1200	14	Stmbg.	pres.	d-d.		selec.	own.	amid.	4	worm.	own.	10.00	r-rd.	t-arm.		ext-d-s.	int-r-w.	l.		ctr.	f-m		Pierce-Arrow
none.			1000	22	Zenith.	vac.	d-d.	Drt.	selec.	G-Lees.	mtr.	3	worm.	Iron.	6.00	sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Wol.	ctr.	fab	On&No	Pioneer AA
suct.	Mnrch.	motor.	1264	15	Stmbg.	vac.	d-d.	B-Lipe.	prog.	B-Lipe.	mtr.	4	worm.	Shel.	8.75	r-rd.	sprgs.	Iron.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Pittsburger B
none.			1500	30	Stmbg.	grv.					amid.	3	chn.	own.	4.00	r-rd.		Tuth.	int-r-w.	int-d-s.	l.	own.	ctr.	mtl	own.	Pony
cent.	Dplx.	motor.	1600	12	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn	9.25	r-rd.	sprgs.	Stand.	int-r-w.	int-r-w.	l.	Ditw.	ctr.	mtl	Unvsl.	Ranger TK
suct.	Mnrch.	motor.		25	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn		sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Spicer.	Rainier R-11
suct.	Mnrch.	motor.		20	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.		sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Spicer.	Rainier R-19
suct.	Mnrch.	motor.		18	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.		sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Spicer.	Rainier R-16
cent.	Pierce.	motor.		16	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.		sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Rainier R-18
cent.	Pierce.	motor.		16	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		r-rd.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Rainier R-20
cent.	Pierce.	motor.		15	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		r-rd.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Rainier R-15
cent.	Pierce.	motor.		15	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		r-rd.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Rainier R-17
cent.	Pierce.	motor.	1000	14	Stmbg.	grv.	d-d.	Fuller.	ind-c.	Cotta.	amid.	4	ext-g.	Badg.	7.50	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Pet.	Reliance 20B
cent.	Pierce.	motor.	1000	18	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	3	ext-g.	Badg.	6.60	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Pet.	Reliance 10A
					John.	grv.	d-d.	own.	selec.	own.	amid.	3	bevel.	own.	4.70	sprgs.	t-arm.	Penn.	int-r-w.		l.	own.	ctr.	f-m	own.	Reo F
			1500	25	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Torbn.	6.28	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Jacox.	ctr.	mtl	Hart.	Republic 10E
suct.	own.	motor.	1350	17	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Torbn.	8.00	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Jacox.	ctr.	mtl	Hart.	Republic 11X
cent.	Phro.	motor.	1125	15	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Torbn.	8.00	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Jacox.	ctr.	mtl	Hart.	Republic 19
cent.	Phro.	motor.	1200	13	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Torbn.	10.26	sprgs.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Jacox.	ctr.	mtl	Hart.	Republic 20
1-b.	own.	motor.	1350	14	B&B.	grv.	cone.	own.	selec.		amid.	4	worm.	own.	10.00	r-rd.	t-arm.	Sp-P.	ext-d-s.	int-r-w.	l.	Ross.	r.	mtl	own.	Riker B
1-b.	own.	motor.	1350	14	B&B.	grv.	cone.	own.	selec.		amid.	4	worm.	own.	10.00	r-rd.	t-arm.	Sp-P.	ext-d-s.	int-r-w.	l.	Ross.	r.	mtl	own.	Riker BB
none.			2200	50	Rayfld.	vac.	d-p.	B-Beck.	selec.	G-Lees.	mtr.	3	bevel.	Col.	4.45	sprgs.	t-arm.	Tuth.	int-r-w.	ext-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Rock Falls 14
cent.	Simp.	motor.	1500	24	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	6.50	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer*	Rowe CW
cent.	Simp.	motor.	1500	20	Zenith.	grv.	d-d.	B-Lis.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer*	Rowe CDW
cent.	Simp.	motor.	1400	19	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer*	Rowe GSW
none.	Simp.		2000	32	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer*	Rowe GPW
cent.	Simp.	motor.	1400	17	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	8.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer*	Rowe HW
cent.	Simp.	motor.	1300	17	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer*	Rowe FW
cent.	Pierce.	motor.	1100	15	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	7.80	sprgs.	sprgs.	Mth.	int-r-w.	int-r-w.	l.	Gem.	l.	mtl	Blood.	Rumely A
none.			1400	18	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	7.87	sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Sandaw G
none.			1300	16	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.		sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Sandow CG
suct.	Mnrch.	motor.	1100	15	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	9.25	sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Spicer*	Sandow J
suct.	Mnrch.	motor.	1100	15	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn		r-rd.	sprgs.	GCS.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Spicer*	Sandow M
suct.	Mnrch.	motor.	1250	12	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	11.66	r-rd.	sprgs.	GCS.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Spicer*	Sandow L
cent.	Pierce.	motor.	1260	16	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.70	sprgs.	sprgs.	Shel.	int-r-w	int-r-w	l.	Ross.	ctr.	f-m	Sp&Fl.	Sanford W25
cent.	Pierce.	motor.	1150	14	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.70	sprgs.	sprgs.	Shel.	int-r-w	int-r-w	l.	Ross.	ctr.	f-m	Sp&Fl.	Sanford W35
cent.	Cont.	motor.	1000	11	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Shel.	int-r-w	int-r-w	l.	Ross.	ctr.	f-m	Sp&Fl.	Sanford W50
cent.	Dplx.	motor.	900		Schblr.	grv.	cone.	own.	selec.	own.	amid.	3	worm.	own.	9.66	r-rd.	t-arm.	Nat.	ext-d-s.	int-r-w	l.	own.	ctr.	mtl	M&E.	Schacht
cent.	Dplx.	motor.	900		Schblr.	grv.	cone.	own.	selec.	own.	amid.	3	worm.	own.	10.33	r-rd.	t-arm.	Nat.	ext-d-s.	int-r-w	l.	own.	ctr.	mtl	M&E.	Schacht
cent.	Dplx.	motor.	900		Schblr.	grv.	cone.	own.	selec.	own.	amid.	4	worm.	own.	10.33	r-rd.	t-arm.	Nat.	ext-d-s.	int-r-w	l.	own.	ctr.	mtl	M&E.	Schacht
cent.	Dplx.	motor.	900		Schblr.	grv.	cone.	own.	selec.	own.	amid.	8	worm.	own.	14.33	r-rd.	t-arm.	Nat.	ext-d-s.	int-r-w	l.	own.	ctr.	mtl	M&E.	Schacht
cent.	Pierce.	motor.	1235	18	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn	7.00	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	r.	Lavn.	Ctr.	mtl	Spicer.	Selden 1½A
cent.	Pierce.	motor.	1200	16	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	7.75	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	r.	Gem.	r&c.	mtl	Spicer.	Selden 2½A
cent.	Pierce.	motor.	1125	14	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	8.75	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	r.	Gem.	r&c.	mtl	Spicer.	Selden 3½A
cent.	Cont.	motor.	1135	13	Stmbg.	grv.	d-d.	Detlaf.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.30	r-rd.	sprgs.	Sp-P.	int-r-w.	int-r-w.	l.	Gem.	l&c.	mtl	Spicer.	Selden 5A
none.			2200	42	Schblr.	vac.	d-p.	B-Beck.	selec.	Warren.	mtr.	3	bevel.	Peru.	4.75	sprgs.	t-arm.	Math.	ext-r-w.	int-r-w.	l.	Ditw.	ctr.	mtl	Unvsl.	Seneca M20
none.			1700	18	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn	7.75	r-rd.	sprgs.	opt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Arvac.	Service 220
none.			1400	15	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn	7.75	sprgs.	sprgs.	opt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&o.	Service 31
none.			1400	15	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn	7.00	sprgs.	sprgs.	opt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&o.	Service 36
none.			1400	15	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn	7.75	sprgs.	sprgs.	opt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&o.	Service 51
none.			1400	13	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn	8.75	r-rd.	sprgs.	opt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&o.	Service 71
none.			1250	14	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn	7.80	r-rd.	sprgs.	opt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&o.	Service 76
none.			1250	11	Stmbg.	grv.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.25	r-rd.	sprgs.	opt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Sp&o.	Service 101
none.			1600	30	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	bevel.	Eaton.	5.62	sprgs.	sprgs.		int-r-w.	int-r-w.	l.	own.	ctr.	fab	own.	Service 15
cent.	Pierce.	motor.	1400	20	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	3	worm.	Timkn	9.25	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Unvsl.	Signal NF
cent.	Pierce.	motor.	1100	15	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	3	worm.	Timkn	9.25	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Unvsl.	Signal H
cent.	Pierce.	motor.	1100	15	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	9.25	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Signal J
cent.	Pierce.	motor.	1200	12	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	12.00	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Signal M
cent.	Cont.	motor.	1200	12	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	11.66	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Signal R
cent.	Pierce.	motor.	1400	20	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Fred.	7.75	sprgs.	sprgs.	Shel.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	BCA.	Southern 10
cent.	Pierce.	motor.	1400	18		vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	8.25	sprgs.	sprgs.	Shel.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	BCA.	Southern 15
cent.	Pierce.	motor.	1400	15	Zenith.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	9.00	sprgs.	sprgs.	Shel.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	BCA.	Southern 20
suct.	Mnrch.	motor.	1200	17	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn	7.20	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer*	Standard 1K
suct.	Mnrch.	motor.	1200	15	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	8.50	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Standard 76
suct.	Mnrch.	motor.	1000	12	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.33	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Standard 66
suct.	Mnrch.	motor.	1300	10	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	13.66	r-rd.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Standard 5K
cent.	Wau.	motor.	1000	18	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	7.00	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Sterling
cent.	Wau.	motor.	1000	16	Zenith.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn	7.70	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Sterling
cent.	Wau.	motor.	1000	15	Zenith.	vac.	w-d.	H-S.	ind-c.	own.	amid.	3	worm.	Timkn	8.75	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Unvsl*	Sterling
cent.	Wau.	motor.	1000	15	Zenith.	vac.	w-d.	H-S.	ind-c.	own.	amid.	3	worm.	Timkn	8.80	r-rd.	sprgs.	Math.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Unvsl*	Sterling
cent.	Wau.	motor.	1000	18	Zenith.	vac.	w-d.	H-S.	ind-c.	own.	amid.	6		own.	7.40	r-rd.		Math.	int-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Unvsl.	Sterling
cent.	Wau.	motor.	1000	16	Zenith.	vac.	w-d.	H-S.	ind-c.	own.	amid.	6	chn.	own.	7.26	r-rd.		Math.	int-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Unvsl.	Sterling
none.			1400	22	Zenith.	grv.	d-p.	B-Beck.	selec.	Dur.	mtr.	3	int-g.	Clrk.	6.60	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	CAS.	ctr.	mtl	Hart.	Stewart 11
none.			1200	30	Zenith.	grv.	d-p.	B-Beck.	selec.	Dur.	mtr.	3	int-g.	Clrk.	6.75	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Hart.	Stewart 12
			1250	18	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.60	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Hart.	Stewart 9
cent.	Pierce.	motor.	1100	14	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	9.00	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Hart.	Stewart 7
cent.	Pierce.	motor.	1200	14	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Clrk.	9.00	sprgs.	sprgs.		ext-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Hart.	Stewart 7x
cent.	Pierce.	motor.	1120	12	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Clrk.	10.00	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Hart.	Stewart 10
cent.	Pierce.	motor.	1100	12	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Clrk.	10.00	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Ross.	ctr.	mtl	Hart.	Stewart 10x
cent.	Wau.	motor.	1300	30	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	5.00	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	fab	Therm.	Stoughton A
cent.	Wau.	motor.	1230	17	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	7.80	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	fab	Snead*	Stoughton B
cent.	Dplx.	motor.	1230	17	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	8.66	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	fab	Snead*	Stoughton D
			1200	16	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn	7.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Sullivan E
cent.	Pierce.	motor.	1350	14	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	10.33	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Sullivan H
cent.	Simp.	motor.	1100	13½	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Shel.	8.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	fab	Therm.	Super-Truck 50
cent.	Simp.	motor.	1100	11	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Super-Truck 70
cent.	Simp.	motor.	1000	11	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Shel.	10.25	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Super-Truck 100
none.			1200	30	Cart.	vac.	d-p.	B-Beck.	selec.	G-Lees.	mtr.	3	bevel.		15.46	sprgs.	t-arm.	Shel.	ext-r-w.	int-r-w.	l.	CAS.	ctr.	mtl	Unvsl.	Texas 1921
cent.	Pierce.	motor.	1100	14	Schblr.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	7.75	r-rd.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Peters.	Tiffin F15
cent.	Pierce.	motor.	1100	13	Schblr.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Shel.	8.70	r-rd.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Peters.	Tiffin F23
cent.	Pierce.	motor.	1000	13	Schblr.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	amid.	4	worm.	Shel.	8.75	r-rd.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Peters.	Tiffin F55

For abbreviations see page 336.

Specifications of Gas

Name and Model	Tons Capacity	Wheelbase, Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	WHEELS Make	WHEELS Type	ENGINE Make	No. Cyl., Bore and Stroke N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	RADIATOR CASE Make	RADIATOR CASE Type	RADIATOR CORE Make	RADIATOR CORE Type	IGNITION Type	IGNITION Make	Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	Extra Cost $
Tiffin F50	5	168	own.	rol-i.	rigid	sol.	36x6	40x6d	Sth.	mt.	Cont.	4-4¾x6 -36.1	2	cent.	own.	cst.	B&O.	fin.	sing.	Bosch*	hand.	s&l-2.	West.	175
Tiffin F60	6	168	own.	rol-i.	rigid	sol.	36x6	40x12	Sth.	mt.	Cont.	4-4¾x6 -36.1	2	cent.	own.	cst.	B&O.	fin.	sing.	Bosch*	hand.	s&l-2.	West.	175
Titan Ts	2½	156	Smh.	p-stl.	flex	sol*	34x4	36x4d	Bim.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst-a.	McC.	fin.	sing.	Eismn.	hand.	lghtg.	West.	none
Titan Ht	3½	156	Smh.	p-stl.	flex	sol*	34x4	36x6d	Day.	mt.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst-a.	own.	fin.	sing.	Eismn.	hand.	lghtg.	West.	none
Titan Hd	6	156	Smh.	p-stl.	flex	sol.	36x5	40x6d	Clrk.	mt.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst-a.	McC.	fin.	sing.	Eismn.	hand.	lghtg.	West.	none
Tower J	1½	142	Elyr.	p-stl.	s-flex	pnu.	35x5	35x5	Roy.	wd.	Cont.	4-4⅛-5¼-27.2	4	cent.	own.	cst.	Brem.	fin.	sing.	Eismn.	hand.	none.		
Tower H	2½	146	Drt.	p-stl.	s-flex	sol.	36x4	36x7	Prud.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	own.	cst.	Brem.	fin.	sing.	Eismn.	hand.	none.		
Tower G	3½	165	Drt.	p-stl.	s-flex	sol.	36x5	36x5d	Sth.	mt.	Cont.	4-4½x5½-32.4	4	cent.	own.	cst.	Brem.	fin.	sing.	Eismn.	hand.	none.		
Traffic C	2	132	own.	rol-c.	s-flex	sol.	34x4	34x5	Bim.	wd.	Cont.	4-3¾x5 -22.5	2	cent.	own.	cst.	Brem.	fin.	sing.	Eismn.	hand.	none.		
Transport 20	1	130	Drt.	p-stl.	flex	sol.	34x3½	34x4	MWC.	wd.	Buda.	4-3¾x5¼-22.5	4	ther.	own.	cst.	own.	cel.	sing.	Bosch.	hand.	none.		
Transport 30	1½	140	Drt.	p-stl.	flex	sol.	36x3½	36x5	MWC.	wd.	Cont.	4-3¾x5 -22.5	4	ther.	own.	cst.	Mod.	cel.	sing.	Eismn.	hand.	l&i.		125
Transport 50	2½	150	Drt.	p-stl.	flex	sol.	36x4	36x3	MWC.	wd.	Buda.	4-4¼x5½-29.0	4	ther.	own.	cst.	Mod.	cel.	sing.	Eismn.	hand.	l&i.		125
Transport 70	3½	170		p-stl.		sol.	36x5	36x10	Clrk.	mt.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst.	Mod.	cel.	sing.	Eismn.	hand.	l&i.		125
Triangle AA	¾	115	Mas.	rol-c.	s-flex	pnu.	35x5	35x5	Roy.	wd.	H-S.	4-3¼x5 -16.9	4	cent.			Mod.	cel.	sing.	Eismn.	hand.			
Triangle A	1½	144	Mas.	rol-c.	s-flex	sol*	34x3½	34x6	Roy.	wd.	Wau.	4-3¾-5¼-22.5	4	ther.	Pfx.	pst.	Pfx.	zz-t.	sing.	N-E.	hand.	sl&i.	N-E.	
Triangle B	2½	150	Mas.	rol-c.	s-flex	sol*	36x4	36x7	Roy*	wd*	Wau.	4-4 x5½-25.6	4	cent.	Pfx.	prs.	Pfx.	zz-t.	sing.	Eismn.	hand.	s&l-2.	N-E.	125
Triangle C	2	147	Mas.	rol-c.	s-flex	sol*	36x4	36x6	Roy.	wd.	Wau.	4-3¾x5¼-22.5	2	cent.	Pfx.	prs.	Pfx.	zz-t.	sing.	Eismn.	hand.	lghtg.		100
Twin City BW	2	150	own.	rol-c.	rigid	sol*	36x4	36x7	Bim.	wd.	Buda.	4-4 x5½-25.6	4	cent.	Pfx.	prs.	Pfx.	zz-t.	sing.	Eismn.	hand.	s&l.	N-E.	125
Twin City AW	3½	168	own.	rol-c.	rigid	sol.	36x5	40x5d	Sth.	mt.	own.	4-4¼x6 -29.0	4	cent.	own.	cst.	Mod.	cel.	sing.	Bosch.	hand.	s&l-2.		
													4	cent.	own.	cst.	Mod.	cel.	sing.	Bosch.	hand.	s&l-2.		
Ultimate A	2	156	P&B.	p-stl.	flex	sol*	36x3½*	36x5*	Jns.	wd.	Buda.	4-4 x5½-25.6	4	cent.	own.	cst.	Bush.	fin.	sing.	Eismn.	hand.			
Ultimate AJ	2	156	P&B.	p-stl.	flex	pnu.	35x5	38x7	Jns.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	Bush.	fin.	sing.	Eismn.	hand.	s&l.	West.	
Ultimate B&BL	3	154	P&B.	p-stl.	flex	sol*	36x4*	36x4d*	Jns.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	Bush.	fin.	sing.	Eismn.	hand.			
Union F	2½	155	own.	p-stl.	s-flex	sol*	36x5	36x8	Prud.	wd.	Wsc.	4-4 x6 -29.0	4	cent.	own.	cst-a.	G&O.	fin.	sing.	Eismn.	hand.	s&l-2.	L-N.	300
Union H	4	174	own.	p-stl.	s-flex	sol.	36x6	36x10	Sth.	mt.	Wsc.	4-4½x6 -32.4	4	cent.	own.	cst-a.	G&O.	fin.	sing.	Eismn.	hand.	s&l-2.	L-N.	300
Union J	6	193	own.	p-stl.	rigid	sol.	36x6	40x14	Sth.	mt.	Wsc.	4-5 x6 -40.0	2	cent.	own.	cst-a.	G&O.	fin.	sing.	Eismn.	hand.	s&l-2.	L-N.	300
United A	1½	145	own.	p-stl.	s-flex	sol*	34x3½	34x5	Prud.	wd.	Buda.	4-3¾x5½-22.5	4	cent.	own.	cst.	G&O.	fin.	sing.	Eismn.	hand.	s&l-2.	West.	185
United B	2½	151	own.	p-stl.	s-flex	sol*	36x4	36x7	Prud.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	G&O.	fin.	sing.	Eismn.	hand.	s&l-2.	West.	185
United C	3½	157	own.	p-stl.	s-flex	sol.	36x5	36x5d	Clrk.	mt.	Buda.	4-4¼x5½-29.0	4	cent.	own.	cst.	G&O.	fin.	sing.	Eismn.	hand.	s&l-2.	West.	185
United V	5	160	own.	p-stl.	s-flex	sol.	36x5	40x6d	Clrk.	mt.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst.	G&O.	fin.	sing.	Eismn.	hand.	s&l-2.	West.	185
U.S. N	1½	144	own.	p-stl.	s-flex	sol*	36x3½	36x5	Sch.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	sl&i-2.	Eismn.	
U.S. R	3	156	own.	p-stl.	s-flex	sol.	36x4	36x4d	Sch.	wd.	Hink.	4-4 x5½-25.6	4	cent.	Lng.	cst.	Long.	fin.	sing.	Eismn.	hand.	sl&i-2.	Eismn.	
U.S. S	4	168	own.	p-stl.	s-flex	sol*	36x5	36x5d	Sch.	wd.	Hink.	4-4½x5½-32.4	4	cent.	Lng.	cst.	Long.	fin.	sing.	Eismn.	hand.	sl&i-2.	G&D.	
U.S. T	6	172	own.	p-stl.	s-flex	sol.	36x6	40x6d	Sth.	mt.	Buda.	4-4¾x6½-36.1	4	cent.	Lng.	cst.	Long.	fin.	sing.	Eismn.	hand.	sl&i-2.	Opt.	
U.S. NC	2	144	own.	p-stl.	s-flex	pnu.	35x5	38x7	Sch.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	sl&i-2.	Eismn.	
U.S. NW	1½	144	own.	p-stl.	s-flex	solid.	36x3½	36x5	Sch.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	sl&i-2.	Eismn.	
U.S. NP	2	144	own.	p-stl.	s-flex	pnu.	35x5	38x7	Sch.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Lng.	cst.	Lng.	fin.	sing.	Eismn.	hand.	sl&i-2.	Eismn.	
Velie 46	1½	133	Dun.	p-stl.	s-flex	sol.	36x3½	36x5	Bim.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	own.	cst.	McC.	fin.	sing.	Berlg.	hand.	none.		
Victor	1½	138	own.	rol-c.		pnu*	37x5	36x6	opt.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Mod.	cst.	Mod.	zz-t.	sing.	Eismn.	hand.	lghtg.		100
Vim 29	½	108		p-stl.	flex	pnu.	31x4	31x4		wd.		4-3⅛x4½-15.6	4	ther.		sht.		fin.	sing.	West.	hand.	sl&i-2.	West.	none
Vim 31	1	125		p-stl.	flex	pnu.	35x5	35x5		wd.		4-3¾x5½-22.5	4	cent.		cst.		fin.	sing.		hand.	sl&i-2.	West.	none
Vim 22	2	142		p-stl.	flex	sol.	36x4	36x6		mt.		4-3¾x5½-22.5	4	g-p.		cst.		fin.	sing.		hand.			
Vim 23	3	175		p-stl.	flex	sol.	36x5	36x5d		mt.		4-4¼x5½-29.0	4	g-p.		cst.		fin.	sing.		hand.			
Vulcan 25	2½	148	own.	p-stl.	s-flex	sol.	36x4	36x8	Sth.	mt.	Wsc.	4-4¼x6 -29.0	4	cent.	own.	cst.	Lng.	fin.	sing.	Eismn.	hand.	lghtg.	Eismn.	
Vulcan 25P	3	160	own.	p-stl.	s-flex	sol.	36x6	40x8	Sth.	mt.	Wsc.	4-4¼x6 -29.0	4	cent.	own.	cst.	Lng.	fin.	sing.	Eismn.	hand.	lghtg.	Eismn.	
W. J. B	2½	150	Hyd.	p-stl.	rigid	sol*	36x4	36x8	Arch.	wd.	Buda.	4-4¼x5½-29.0	4	cent.	Bush.	cst.	Bush.	fin.	sing.	Eismn.	hand.	lghtg.	Eismn.	150
Waltham E	1½	140	Cas.	p-stl.		pnu.	36x6	38x7		wd.	Buda.	4-3¾x5¼-22.5	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Apollo	hand.	lghtg.	Bijur.	
Ware A	5	135		p-stl.		pnu*				wd.	own.	8-3⅜x5 -37.0	4	cent.		pst.		p-t.	sing.		hand.	sl&i.		
Walter S	5	168	Shar.	p-stl.	flex	sol.	36x5	40x6d	Day.	mt.	Wau.	4-4½x6¼-32.4	4	cent.	Bush.	cst.	Bush.	fin.	sing.	Sim.	hand.	s&l.	West.	
Ward-LaFrance 2B	2½	170*	own.	p-stl.	flex	sol.*	36x4	36x7	H&D*	wd.*	Wau.	4-4⅜x5¾-30.6	2	cent.	own.	cst.	Lng.	fin.	sing.	Bosch.	hand.	lghtg.	West.	125
Ward-LaFrance 4A	3½	162*	own.	p-stl.	flex	sol.*	36x5	36x5d	Sth.	mt.	Wau.	4-4½x6¼-32.5	2	cent.	own.	cst.	Lng.	fin.	sing.	Bosch.	hand.	lghtg.	West.	125
Ward-LaFrance 5A	5	164*	own.	p-stl.	flex	sol.	36x6	36x6d	Sth.	mt.	Wau.	4-5 x6½-40.0	2	cent.	own.	cst.	Lng.	fin.	sing.	Bosch.	hand.	lghtg.	West.	125
Watson B	1	128	Prsh.	p-stl.	s-flex	pnu.	34x4½	34x4½	H&D.	wd.	Wau.	4-3¾x5¼-22.5	4	cent.	G&O.	pst.	G&O.	cel.	sing.	Conn.	hand.	sl&i-2.	Dneto.	none
Watson N	3½	168	Prsh.	p-stl.	rigid	sol.	36x5	36x10	Crn.	wd.	Cont.	4-4½x5½-32.4	2	cent.	own.	cst.	R-T.	fin.	sing.	Sim.	hand.	none.		
Western W1½	1½	144	own.	rol-c.	s-flex	opt.	36x3½	36x5	Prud.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	Vesta.	150
Western L1½	1½	144	Savg.	p-stl.	s-flex	opt.	36x3½	36x5	Prud.	wd.	Buda.	4-3¾x5 -22.5	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	Vesta.	150
Western W2½	2½	154	own.	rol-c.	s-flex	sol.	36x4	36x7	Prud.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	Vesta.	150
Western L2½	2½	154	Savg.	p-stl.	s-flex	sol.	36x4	36x7	Prud.	wd.	Buda.	4-4¼x6 -29.0	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	Vesta.	150
Western W3½	3½	164	own.	rol-c.	s-flex	sol.	36x5	40x5d	Prud.	wd.	Buda.	4-4½x6 -32.4	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Bosch.	hand.	lghtg.	Vesta.	150
White 15	¾	133½	own.	p-stl.		pnu.	34x5	34x5		wd.	own.	4-3¾x5⅛-22.5	4	cent.		sht-b.		cel.	dual.		auto.			
White 20	2	157½	own.	p-stl.		sol*	36x4	36x4d		mt.	own.	4-3¾x5½-22.5	4	cent.		sht-b.		cel.	dual.		auto.			
White 40	3-3½	174		rol-i.		sol.	36x5	40x5d		mt.	own.	4-3¾x5¾-22.5	4	cent.				fin.	dual.		auto.			
White 45	5	174		rol-i.		sol.	36x6	40x6d		mt.	own.	4-4¼x5¾-29.0	4	cent.				fin.	dual.		auto.			
White Hickory E	1	124	P&B.	p-stl.	s-flex	pnu.	34x5	34x5	Bim.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	fixed.	lghtg.	Vesta.	
White Hickory H	1½	144	P&B.	p-stl.	s-flex	sol.	36x3½	36x5	Bim.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	fixed.	lghtg.	Vesta.	
White Hickory K	2½	150	P&B.	p-stl.	s-flex	sol.	36x4	36x7	Bim.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	fixed.	lghtg.	Vesta.	
White Hickory M	3½	156	Shar.	p-stl.	s-flex	sol.	36x5	36x5d	Sth.	mt.	Cont.	4-4½x5½-32.4	2	cent.	Chgo.	cst.	Chgo.	fin.	sing.	Eismn.	fixed.	lghtg.	Vesta.	
Wichita K	1	144	own.	p-stl.	s-flex	sol*	36x3	36x4		wd.	own.	4-3½x5 -19.6	4	ther.		cst.		cel.	sing.		hand.	none.		
Wichita L	1½	144	own.	p-stl.	s-flex	sol*	36x3½	36x5		wd.		4-3¾x5¼-22.5	4	cent.		cst.		cel.	sing.		hand.	none.		
Wichita M	2	144	own.	p-stl.		sol*	36x3½	36x6		wd.		4-3¾x5¼-22.5	4	cent.		cst.		fin.	sing.		hand.	none.		
Wichita R	2½	144	own.	p-stl.	s-flex	sol*	36x4	36x7		mt.		4-3¾x5¼-22.5	4	cent.		cst.		fin.	sing.		hand.	none.		
Wichita Rx	2½	160	own.	p-stl.		sol*	36x4	36x8		mt.		4-4¼x6 -29.0	4	cent.		cst.		fin.	sing.		hand.	none.		
Wichita O	3½	165	own.	p-stl.	s-flex	sol*	36x5	36x5		mt.		4-4¼x6 -29.0	4	cent.		cst.		fin.	sing.		hand.	none.		
Wichita S	5	165	own.	p-stl.	s-flex	sol.	36x6	40x6d		mt.		4-4½x6 -32.4	4	cent.		cst.		fin.	sing.		hand.	none.		
Wilcox AA	1	130	Smh.	p-stl.	flex	sol*	36x4	36x4	Crn.	wd.	Buda.	4-3¾x5½-22.5	4	cent.	own.	cst.	Lng.	fin.	sing.	Bosch.	hand.	lghtg.	West.	none
Wilcox B	1½	144	Smh.	p-stl.	flex	sol*	36x4	36x5	Sth.	mt.	own.	4-4¼x5 -29.0	2	cent.	own.	cst.	Lng.	fin.	sing.	Bosch.	hand.	none.		
Wilcox D	2½	150	Smh.	p-stl.	flex	sol*	36x4	36x3½	Crn.	mt.	own.	4-4¼x5 -29.0	2	cent.	own.	cst.	Lng.	fin.	sing.	Bosch.	hand.	none.		
Wilcox E	3½	162	Smh.	p-stl.	flex	sol*	36x5	36x5d	Sth.	mt.	Buda.	4-4½x6 -32.4	4	cent.	own.	cst.	Lng.	fin.	sing.	Bosch.	hand.	none.		
Wilcox F	5	162	Smh.	p-stl.	flex	sol.	36x5	40x6d	Sth.	mt.	Buda.	4-4¾x6½-36.1	4	cent.	own.	cst.	Lng.	fin.	sing.		hand.	none.		
Winther 751	¾-1	135	own.	rol-c.	s-flex	pnu.	34x4½	34x4½	Auto.	wd.	H-S.	4-3½x5 -19.6	4	ther.	own.	cst.	Brem.	pln.	sing.	West.	hand.	s&l-2.	West.	none
Winther 39	1½	140	own.	rol-c.	s-flex	sol.	34x3½	34x5	own.	mt.	Wsc.	4-3¾x5 -22.5	4	cent.	own.	cst.	Brem.	pln.	sing.	Eismn.	hand.	s&l-2.	West.	100
Winther 49	2	147	own.	rol-c.	s-flex	sol.	34x4	34x4d	own.	mt.	Wsc.	4-4 x5 -25.6	4	cent.	own.	cst.	Brem.	pln.	sing.	Eismn.	hand.	s&l-2.	West.	155
Winther 70	3½	150	own.	rol-c.	s-flex	sol.	36x5	36x5d	Clrk.	mt.	Wsc.	4-4 x6 -25.6	4	cent.	own.	cst.	Brem.	pln.	sing.	Eismn.	hand.	s&l-2.	West.	150
Winther 109	5	162	own.	rol-c.	s-flex	sol.	36x6	40x5d	Clrk.	mt.	Wsc.	4-4½x6 -32.4	4	cent.	own.	cst.	Brem.	pln.	sing.	Eismn.	hand.	s&l-2.	West.	180
Winther 140	7	162	own.	rol-c.	s-flex	sol.	36x6	40x7	Clrk.	mt.	Wsc.	4-5 x6 -40.0	4	cent.	own.	cst.	Brem.	pln.	sing.	Eismn.	hand.	s&l-2.	West.	180
Winther 430	1½	132	own.	rol-c.	s-flex	sol.	32x4	32x4	own.	mt.	Wsc.	4-3¾x5 -22.5	4	cent.	own.	cst.	Brem.	pln.	sing.	Eismn.	hand.	s&l-2.	West.	180
Winther 450	2½	150	own.	rol-c.	s-flex	sol.	34x5	36x6	own.	mt.	Wsc.	4-4 x5 -25.6	2	cent.	own.	cst.	Brem.	pln.	sing.	Eismn.	hand.	s&l-2.	West.	150
Witt-Will N	1½	122	Prsh.	p-stl.	s-flex	sol*	36x3½	36x5	Arch.	wd.	Cont.	4-3¾x5 -22.5	4	cent.	Brem.	cst.	Brem.	fin.	sing.	Eismn.	auto.	none.		
Witt-Will P	2½	144	Prsh.	p-stl.	s-flex	sol*	36x3½	36x7	Arch.	wd.	Cont.	4-4⅛x5¼-27.2	4	cent.	Brem.	cst.	Brem.	fin.	sing.	Eismn.	auto.	none.		
Yellow Cab M2	¾	116½		p-stl.		pnu.	33x4½	33x4½		wd.	Cont.	4-3¾x5 -22.5	4	ther.					sing.	Bosch.	fixed.	lghtg.		
Yellow Cab M4	1	130		p-stl.		pnu.	35x5	35x5		wd.	Cont.	4-3¾x5 -22.5	4	ther.					sing.	Bosch.		none.		

For abbreviations see page 336.

oline Trucks—*Continued*

ENGINE									TRANSMISSION										BRAKES		CONTROL			UNIVERSALS		
GOVERNOR			SPEED		FUEL SYS.		CLUTCH		GEARSET				FINAL DRIVE								STEER'G GEAR					
Type	Make	Drive	Motor in r.p.m.	Truck in m.p.h.	Carburetor Make	Fuel Feed	Type	Make	Type	Make	Placed	Speeds	Type	Rear Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Foot	Hand	Placed	Make	Levers	Type	Make	Name and Model
suct.	Cont.	motor	1000	11	Schblr.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	amid.	4	worm.	Shel.	10.25	r-rd.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Peters.	Tiffin F50
suct.	Cont.	motor	1000	11	Schblr.	grv.	d-d.	Detlaf.	ind-c.	Cotta.	amid.	4	worm.	Shel.	10.25	r-rd.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Peters.	Tiffin F60
cent.	Simp.	motor	1150	25	Stmbg.	grv.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	4	int-g.	Clrk.		r-rd.	sprgs.	Math	int-r-w.	ext-d-s.	l.	Wol.	ctr.	mtl	M&E.	Titan TS
cent.	Simp.	motor	1050	15	Stmbg.	grv.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	4	int-g.	Day.		r-rd.	sprgs.	Math	int-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	M&E.	Titan HI
cent.	Simp.	motor	1000	12	Stmbg.	grv.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	4	int-g.	Clrk.		r-rd.	sprgs.	Math.	int-r-w.	ext-d-s.	l.	Lavn.		mtl	Unvsl.	Titan HD
none			1602	25	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller	mtr.	3	worm.	Timkn	7.25	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Tower J
cent.	Pierce.	motor	1296	15	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn	9.25	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Tower H
cent.	Pierce.	motor	1259	13	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Timkn	10.33	r-rd.	sprgs.	Dtr.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Blood.	Tower G
			2000	25	Cart.	grv.	d-d.	Covert.	selec.	Covert.	mtr.	3	int-g.	Rusal	7.00	sprgs.	sprgs.	Drt.	ext-r-w.	int-r-w.	l.	own.	ctr.	f-m	Sn&Un.	Traffic C
cent.	Simp.	d-s.	1432	20	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.25	sprgs.	sprgs.	Drt.	ext-r-w.	int-r-w.	l.	Jacox.	l.	fab	Snead.	Transport 20
cent.	Simp.	d-s.	1276	18	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.60	sprgs.	sprgs.	Drt.	ext-r-w.	int-r-w.	l.	Jacox.	l.	mtl	Hart.	Transport 30
cent.	Simp.	d-s.	1180	15	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Clrk.	8.15	sprgs.	sprgs.	Drt.	ext-r-w.	int-r-w.	l.	Jacox.	l.	mtl	Hart.	Transport 50
cent.	Dplx.		1100	12	Stmbg.	grv.		B-Beck.	ind-c.	Cotta.	mtr.	4	int-g.	Clrk.	10.00				ext-r-w.	int-r-w.	l.	Jacox.	ctr.			Transport 70
none					Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	6.00	sprgs.	sprgs.	Dtr.	ext-d-s.	ext-r-w.	l.	Gem.	ctr.	mtl	Unvsl.	Triangle AA
cent.	Wau.	motor	1100	18	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.00	sprgs.	sprgs.	Dtr.	ext-d-s.	ext-r-w.	l.	Gem.	ctr.	mtl	Unvsl.	Triangle A
cent.	Wau.	motor	1000	16	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Clrk.	9.00	sprgs.	sprgs.	Dtr.	ext-d-s.	ext-r-w.	l.	Gem.	ctr.	mtl	Unvsl.	Triangle B
cent.	Wau.	motor	1200	16	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	8.00	sprgs.	sprgs.	Dtr.	ext-d-s.	ext-r-w.	l.	Gem.	ctr.	mtl	Unvsl.	Triangle C
cent.	Simp.	motor	1100	14	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	8.00	sprgs.	sprgs.	Math	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Arvac.	Twin City BW
cent.	own.	motor	1000	11	Schblr.	vac.	d-p.	B-Beck.	selec.	Fuller.	amid.	4	worm.	Timkn	10.33	r-rd.	sprgs.	Math	int-r-w.	int-r-w.	l.	Ross.	ctr.	m-f	Fl&Sp.	Twin City AW
cent.	Pierce.	motor	1100	20	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	6.50	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Ultimate A
none			1100	40	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	6.50	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Ultimate AJ
cent.	Pierce.	motor	1100	16	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Shel.	ext-r-w.	ext-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Ultimate B&BL
cent.	Dplx.	motor	1100	15	Schblr.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Rusal.	7.80	sprgs.	sprgs.	Math	ext-r-w.	int-r-w.	l.	Ross.	r&c.	mtl	U.P.	Union F
cent.	Dplx.	motor	1100	12	Schblr.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	int-g.	Torbn.	10.25	sprgs.	sprgs.	Math	int-r-w.	ext-d-s.	l.	Ross.	r&c.	mtl	U.P.	Union H
cent.	Dplx.	motor	1100	10	Schblr.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	4	int-g.	Rusal.	10.10	sprgs.	sprgs.	Math.	int-r-w.	ext-d-s.	l.	Ross.	r&c.	mtl	M&E.	Union J
cent.	Simp.	motor	1124	15	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.60	sprgs.	sprgs.		ext-r-w.	int-r-w.	l.	Jacox.	r&c.	mtl	Blood.	United A
cent.	Simp.	motor	1059	14	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	4	int-g.	Clrk.	8.15	sprgs.	sprgs.		ext-r-w.	int-r-w.	l.	Jacox.	ctr.	f-m	Th&Bl.	United B
cent.	Simp.	motor	1120	12	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	4	int-g.	Clrk.	10.00	sprgs.	sprgs.		ext-r-w.	int-r-w.	l.	Lavn.	ctr.	f-m	Th&Bl.	United C
cent.	Simp.	motor	1155	10	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	amid.	4	int-g.	Clrk.	12.50	sprgs.	sprgs.		int-r-w.	int-r-w.	l.	Ross.	ctr.	f-m	Th&Bl.	United V
none			1400	19	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	int-g.	Clrk.	7.60	sprgs.	sprgs.	Shel.	ext-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Blood.	U.S. N
cent.	Hink.	motor	1400	17	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.70	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	f-m	Bl&Fl.	U.S. R
cent.	Hink.	motor	1200	12	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	f-m	Bl&Fl.	U.S. S
cent.	Simp.	motor	950	11	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.25	sprgs.	sprgs.	Shel.	int-r-w.	ext-d-s.	l.	Lavn.	ctr.	f-m	Bl&Fl.	U.S. T
none			1730	25	Stmbg.	vac.	d-d.	B-lipe.	selec.	B-lipe.	mtr.	3	int-g.	Clrk.	7.60	sprgs.	sprgs.	Shel.	ext-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Blood.	U.S. NC
none			1400	19	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	7.80	sprgs.	sprgs.	Shel.	ext-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Blood.	U.S. NW
none			1730	25	Stmbg.	vac.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	7.80	sprgs.	sprgs.	Shel.	ext-r-w	int-r-w.	l.	Lavn.	ctr.	mtl	Blood.	U.S. NP
suct.	Mnrch.	motor	1350	18	Stmbg.	grv.	d-p.	B-Beck.	selec.	Dur.	mtr.	3	int-g.	Torbn.	8.00	sprgs.	sprgs.	Math.	ext-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Arvac.	Velie 46
none					Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Fred.		sprgs.	sprgs.	Tuth.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Acme.	Victor
						grv.	d-p.		selec.		mtr.	3	worm.		5.50	sprgs.	sprgs.		int-r-w.	int-r-w.	l.		ctr.	mtl		Vim 29
						grv.	d-p.		selec.		mtr.	3	worm.		6.50	sprgs.	sprgs.		int-r-w.	int-r-w.	l.		ctr.	mtl		Vim 31
cent.		motor				grv.	d-p.		selec.		mtr.	4	worm.		7.75	sprgs.	sprgs.		int-r-w.	int-r-w.	l.		ctr.	mtl		Vim 22
cent.						grv.	d-p.		selec.		amid.	4	worm.		7.75	sprgs.	sprgs.		int-r-w.	int-r-w.	l.		ctr.	mtl		Vim 23
cent.	Pierce.	motor	1250	15	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Vulcan 25
cent.	Pierce.	motor	1350	21	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.75	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Vulcan 25P
cent.	Pierce.	motor	1270	16	Zenith.	grv.	d-d.	B-Lipe*	selec.	B-Lipe*	amid.	4	worm.	Timkn	8.50	sprgs.	sprgs.	S-P.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	W. J. B
			1200	20	Zenith.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	7.50	sprgs.	sprgs.	Drt.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Waltham E
cent.	Pierce.	motor				grv.	w-p.	H-S.	ind-c.		u-jst.	2														Ware A
cent.	Wau.	motor	1000	15	Stmbg.	grv.	d-d.	B-Lipe.	selec.	Warner.	amid.	4	int-g.	own.	9.00	sprgs.	sprgs.	Perf.	ext-d-s.	ext-r-w.	l.	Ross.	ctr.	f-m	M&E.	Walter S
cent.	Wau.	motor	1100	18	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	6.80	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Ward-LaFrance 2B
cent.	Wau.	motor	1000	14	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	7.80	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Ward-LaFrance 4A
cent.	Wau.	motor	1000	14	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn	8.80	r-rd.	sprgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	M&E.	Ward-LaFrance 5A
cent.	Wau.	motor	1200	25	John.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Dunk.	6.20	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	M&E.	Watson B
cent.	Pierce.	motor	1100	13	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Wis.	9.00	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Watson N
suct.	Mnrch.	motor	1087	18	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Wis.	7.25	sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Acme.	Western W1½
suct.	Mnrch.	motor	1087	18	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Wis.	7.25	sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Acme.	Western L1½
suct.	Mnrch.	motor	1070	16	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Wis.	8.25	sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Acme.	Western W2½
suct.	Mnrch.	motor	1070	16	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Wis.	8.25	sprgs.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Acme.	Western L2½
suct.	Mnrch.	motor	1000	14	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr	4	worm.	Wis.	10.00	r-rd.	sprgs.	GCS.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	Acme.	Western W3½
none			1400		own.	grv.	w-p.	own.	selec.	own.	amid.	4	bevel.	own.		r-rd.	sprgs.		ext-r-w.	int-r-w.	l.	own.	ctr.	mtl	own.	White 15
none			1400		own.	grv.	w-p.	own.	selec.	own.	amid.	4	d-rd.	own.		r-rd.	sprgs.		ext-r-w.	int-r-w.	l.	own.	ctr.	mtl	own.	White 20
cent.	own.	motor	1600	15	own.	vac.	w-p.	own.	selec.	own.	mtr.	4	d-rd.	own.		r-rd.	sprgs.		ext-d-s.	int-r-w.	l.	own.	ctr.	mtl	own.	White 40
cent.	own.	motor	1600	15	own.	vac.	w-p.	own.	selec.	own.	mtr.	4	d-rd.	own.		r-rd.	sprgs.		ext-d-s.	int-r-w.	l.	own.	ctr.	mtl	own.	White 45
cent.	Dplx.	motor	1310	22	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn	6.20	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	M&E.	White Hickory E
cent.	Dplx.	motor	1190	15	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn	8.50	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Arvac.	White Hickory H
cent.	Dplx.	motor	1110	14	Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	worm.	Timkn	8.50	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w	l.	Lavn.	ctr.	mtl	M&E.	White Hickory K
cent.	Dplx.	motor			Stmbg.	vac.	d-d.	Fuller.	selec.	Fuller.	amid.	4	worm.	Timkn	10.33	r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	ctr.	mtl	M&E.	White Hickory M
none			1000	15		grv.	cone.	own.	selec.		amid.	4	worm.		7.80	sprgs.	sprgs.		int.	int.	r.		ctr.	fab	own.	Wichita K
cent.		motor	1000	15		grv.	cone.	own.	selec.		amid.	4	worm.		8.66	sprgs.	sprgs.		int-r-w.	int-r-w.	r.		ctr.	fab	own.	Wichita L
cent.		motor	1000	13		grv.	cone.	own.	selec.		amid.	4	worm.		8.66	sprgs.	sprgs.		int-r-w.	int-r-w.	r.		ctr.	fab	own.	Wichita M
cent.		motor	1000	13		grv.	cone.	own.	selec.		amid.	4	worm.		8.75	sprgs.	sprgs.		int-r-w.	int-r-w.	r.		ctr.	fab	own.	Wichita R
cent.		motor		12		grv.	cone.		selec.		amid.	4	worm.		8.75	sprgs.	sprgs.		int-r-w.	int-r-w.	r.		ctr.	fab	own.	Wichita RX
cent.		motor	1000	11		grv.	cone.		selec.		amid.	4	worm.		11.75	sprgs.	sprgs.		int-r-w.	int-r-w.	r.		ctr.	fab	own.	Wichita O
cent.		motor		10		grv.	cone.		selec.		amid.	4	worm.		14.00	sprgs.	sprgs.		int-r-w.	int-r-w.	r.		ctr.	fab	own.	Wichita S
cent.	Dplx.	motor	1500	20	Stmbg.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Wis.	7.75	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Wilcox AA
cent.	Dplx.	motor	1100	18	Stmbg.	grv.	cone.	own.	selec.	own.	amid.	4	worm.	Wis.	9.50	sprgs.	sprgs.	Shel.	int-f-w.	int-r-w.	l.	own.	ctr.	mtl	Hart.	Wilcox B
cent.	Dplx.	motor	1100	16	Stmbg.	grv.	cone.	own.	selec.	own.	amid.	4	worm.	Wis.	8.97	sprgs.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	Hart.	Wilcox D
cent.	Dplx.	motor	1000	12	Stmbg.	grv.	cone.	own.	selec.	own.	amid.	4	worm.	Wis.		r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	Hart.	Wilcox E
cent.	Dplx.	motor	200	10	Stmbg.	grv.	cone.	own.	selec.	own.	amid.	4	worm.	Wis.		r-rd.	sprgs.	Shel.	int-r-w.	int-r-w.	l.	own.	ctr.	mtl	Hart.	Wilcox F
none			2500	40	Stmbg.	vac.	d-d.			Warner.	mtr.	3	int-g.	Torbn.	6.60	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	Pet.	Winther 751
none			1600	23	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	7.00	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	Pet-Arv	Winther 39
none			1500	17	Mast.	vac.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	int-g.	Clrk.	9.00	sprgs.	sprgs.	Mth.	ext-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Blood.	Winther 49
none			1300	16	Mast.	vac.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	int-g.	Clrk.	10.00	sprgs.	sprgs.	Mth.	ext-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Blood.	Winther 70
cent.	Dplx.	motor	1100	12	Mast.	vac.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	int-g.	Clrk.	12.50	sprgs.	sprgs.	Mth.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Blood.	Winther 109
cent.	Dplx.	motor	925	10	Mast.	vac.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	int-g.	Crlk.	12.50	sprgs.	sprgs.	Mth.	int-r-w.	int-r-w.	r.	Ross.	ctr.	mtl	Blood.	Winther 140
none			1600	17	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	9.00	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	Pet.	Winther 430
none			1500	16	Stmbg.	grv.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	int-g.	Clrk.	10.40	sprgs.	sprgs.	Drt.	ext-r-w.	ext-d-s.	l.	Lavn.	ctr.	mtl	Pet.	Winther 450
cent.	Pierce.	motor	1500	25	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn	7.00	sprgs.	sprgs.	Del.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Witt-Will N
cent.	Pierce.	motor	1500	20	Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn	7.75	sprgs.	sprgs.	Del.	int-r-w.	int-r-w.	l.	Ross.	ctr.	mtl	Spicer.	Witt-Will P
					Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	bevel.	Timkn		sprgs.	t-arm.		int-r-w.	ext-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Yellow Cab M2
					Zenith.	grv.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn		sprgs.	sprgs.		int-r-w.	int-r-w.	l.	Gem.	ctr.	mtl	Spicer.	Yellow Cab M4

For abbreviations see page 336.

Specifications of Gas

Received Too Late to Classify

Name and Model	Tons Capacity	Wheelbase, Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	WHEELS Make	WHEELS Type	ENGINE Make	No. Cyl. Bore and Stroke N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	RADIATOR CASE Make	RADIATOR CASE Type	RADIATOR CORE Make	RADIATOR CORE Type	IGNITION Type	IGNITION Make	IGNITION Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	ELEC. SYSTEM Extra Cost $
Birch	1	132	own	p-stl	...	sol	32x3½	32x4	...	wd	...	4-3½x5 -19.6	4	ther	...	...	...	...	dual	Conn	...	s&l	Aut-L.	...
Briscoe 234	1	121	P&B	prs	s-flex	pnu	33x4	34x4½	Hay	wd	own	4-3⅜x5 -18.2	4	ther	Pfx	cst	Pfx	zz-t	dual	Conn	hand	sl&i	Aut-L.	none
Clark Trucktractor TB	1¼	78	own	rol-c	s-flex	sol	25x10	20x7	Clrk	mt	LeR	4-3⅛x4½-15.6	4	ther	Fed	pst	Fed	cel	sing	Eismn.	t-p	none	...	...
Clark Trucktractor MAA	1¼	78	own	rol-c	s-flex	sol	28x3½	20x3½	Clrk	mt	LeR	4-3⅛x4½-15.6	4	ther	Fed	pst	Fed	cel	sing	Eismn.	t-p	none	...	...
Clark Trucktractor L	1¼	78	own	rol-c	s-flex	sol	20x3½	28x3½d	Clrk	mt	LeR	4-3⅛x4½-15.6	4	ther	Fed	pst	Fed	cel	sing	Eismn.	t-p	none	...	...
Dart S	1½	140	Savg	p-stl	s-flex	sol	34x3½	30x6	Bim	wd	Buda	4-3¾x5⅛-22.5	4	ther	own	cst	...	cel	sing	Eismn.	hand	s&l*	Bijur*	200
Dart M	2½	150	Savg	p-stl	s-flex	sol	36x4	36x7	Bim	wd	Buda	4-4¼x5½-29.0	4	cent	own	cst	...	cel	sing	Eismn.	hand	s&l*	Bijur*	200
Dart W	3½	160	Savg	p-stl	s-flex	sol	36x5	36x10	Bim	wd	Buda	4-4½x6 -32.4	4	cent	own	cst	...	cel	sing	Eismn.	hand	s&l*	Bijur*	200
Denby 12	1	124	Drt	p-stl	...	pnu	35x5	36x6	Hay	wd	Cont	4-3¾x5 -22.5	4	ther	Lng	fin	...	...	sing	Eismn.	...	...	...	...
Denby 33	1½	136	Drt	p-stl	...	pnu	35x5	38x7	Hay	wd	Cont,	4-3¾x5 -22.5	4	ther	Lng	...	...	...	sing	Eismn.	...	...	Bijur	...
Denby 134	2	144	Drt	p-stl	...	sol	36x3½	36x6	Hay	wd	Cont	4-3¾x5 -22.5	4	ther	Lng	fin	...	...	sing	Eismn.	...	...	...	...
Denby 25	3	149½	Drt	p-stl	...	sol	36x4	36x7	Sth	mt	Cont	4-4⅛x5¼-27.2	4	cent	Lng	fin	...	...	sing	Eismn.	...	...	...	...
Denby 27	4	170	Drt	p-stl	...	sol	36x5	36x5d	Sth	mt	Cont	4-4½x5½-32.4	2	cent	Lng	fin	...	...	sing	Eismn.	...	...	...	...
Denby 210	5	170	Drt	p-stl	...	sol	36x6	40x6d	Clrk	mt	Cont	4-4½x5½-32.4	2	cent	Lng	fin	...	...	sing	Eismn.	...	...	...	...
Patriot Revere	¾	129	...	p-stl	...	pnu	35x5	35x5	...	wd	Cont	4-3¾x5 -22.5	4	ther	...	...	...	...	...	...	...	s&l	A-Knt	...
Patriot Lincoln	1½	140	...	p-stl	...	sol*	34x3½	34x5	...	wd	Hink	4-4 x5¼-25.6	...	cent	...	fin	...	cst	sing	...	...	s&l	...	...
Patriot Washington	2½	156	...	p-stl	...	sol*	36x4	36x7	...	wd	Hink	4-4½x5½-32.5	...	cent	...	fin	...	cst	sing	...	...	s&l	...	...
Schwartz A	1	130	P&B	p-stl	s-flex	pnu	33x4½	33x4½	Sch	wd	Lyc	4-3½x5 -19.6	2	ther	own	cst	...	cel	sing	West	hand	sl&i	G&D	none
Schwartz BW	1½	146	P&B	p-stl	s-flex	sol*	34x3½	34x7	Sch	wd	Buda	4-3¾x4½-22.5	2	cent	own	cst	Fed	cel	sing	Bosch	hand	lghtg	G&D	none
Schwartz CW	2½	150	P&B	p-stl	s-flex	sol	36x4	36x8	Sch	wd	Buda	4-4¼x5½-29.0	2	cent	own	cst	Fed	cel	sing	Bosch	hand	lghtg	G&D	none
Schwartz DW	5	170	P&B	p-stl	s-flex	sol	36x6	40x12	Sth	mt	Buda	4-4½x6 -32.4	2	cent	own	cst	Fed	cel	sing	Bosch	hand	lghtg	G&D	none
Towmotor Tractor A	...	70	P&B	p-stl	rigid	sol	22x3½	22x3½d	West	mt	Wei	4-3½x5½-19.6	4	cent	own	cst	S-W	p-t	sing	Delco	hand	sl&i	Delco	none
Traylor E	4	168	...	p-stl	rigid	sol	36x5	40x10d	...	mt	Buda	4-4½x6 -32.4	4	cent	G&O	fin	G&O	cst	sing	Spltf	auto	...	...	...
Traylor B	1¼	132	...	p-stl	rigid	sol	34x3½	34x5	Sch	wd	Buda	4-3¾x5⅛-22.5	4	ther	G&O	...	G&O	cst	sing	Spltf	auto	...	...	...
Traylor C	2	138	...	p-stl	rigid	sol	36x4	36x7	Sch	wd	Buda	4-4 x5½-25.6	4	cent	G&O	fin	G&O	cst	sing	Spltf	auto	...	...	...
Traylor D	3	150	...	p-stl	rigid	sol	36x4	36x8*	Sch	wd	Buda	4-4¼x5½-29.0	4	cent	G&O	fin	G&O	cst	sing	Spltf	auto	...	...	...

Steam Trucks

Name and Model	Capacity in Pounds	Wheelbase in Inches	FRAME Material	FRAME Construction	TIRES Kind	TIRES Size in Inches Front	TIRES Size in Inches Rear	Wheels	BOILER Location	BOILER Type	BOILER Heating Surface in Sq. in.	BOILER Horsepower	BURNER Type	BURNER Regulation	PRESSURE Normal in Lbs.	PRESSURE Maximum in Lbs.	WATER Water Capacity in Gal.	CONDENSER Type	CONDENSER Circulation
Steamobile	10,000	157	I-beam	...	solid	36x6	42x9	c-st	under hood	Wat-tube	...	40	atomiz	auto	...	700	40	flat	natural

ABBREVIATIONS—Types of Construction

*—other options
amid—amidships
auto—automatic
bevl—bevel
cel—cellular
cent—centrifugal
chn—chain
cst—cast
ctr—center
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
cyl-ends—cylinder-ends
d—dual
d-d—dry-disk
d-p—dry-plate
dplx—from both motor & driveshaft
d-rd—double reduction
d-s—drive-shaft
elec—electric
ext-d-s—external drive-shaft
ext-f-w—external front wheel
ext-g—external gear
ext-jst — external jack-shaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
flex—flexible
f-m—fabric & metal
fric—friction
g-p—gear pump
grv—gravity
gset—from gearset
hyd—hydraulic
ind-c—individual clutch
int-g—internal gear
int-g-4 — internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l-b—loose ball
lghtg—lighting only
mtr—unit with motor
mt—metal (wheels)
mtl—metal (universal joint)
opt—optional
pist—piston pump
plan—planetary
pln—plain tube
pnu—pneumatic
pres—pressure
prog—progressive
prs—pressed steel
p&s—pneumatics in front solids in rear
p-stl—pressed steel
r—right
r&c—right & center
r-rd—radius rods
rol-c—rolled channel
rol-i—rolled I-beam
selec—selective
s-flex—semi-flexible
s-fr—sub-frame
sht—sheet
s&l—starting & lighting
sl&i-2—starting, lighting & ignition, 2 unit
sol—solid
sprgs—springs
sq-t—square tube
start—starting only
suct—suction
t-arm—torque arm
ther—thermo-syphon
t-p—two-point
t-t—torsion tube
vac—vacuum
wat-tube—water tube
wd—wood
w-d—multiple disk in oil
w-p—plate in oil
wr—wire
zz-t—zig-zag tube

ABBREVIATIONS—Makers of Parts.

*Other Options
A-Knt—Atwater-Kent
Al-Ch—Allis-Chalmers
Amer — American Magneto Co.
Arch—Archibald
Aut-L—Auto-Lite
Auto—Auto Wheel Co.
B-Beck—Borg & Beck
BCA—Bearings Co. of Am.
Berlg—Berling
Bim—Bimel
Bl&Fl—Blood & Flexite
B-Lipe—Brown-Lipe
Blood—Blood Bros.
Bl&P—Blood & Peters
Bl&Sp—Blood & Spicer
B-M—Bucyrus Mach. Tool
Brem—Bremer
Cart—Carter carburetor
Cas—G. M. Castle
CAS—C. A. S. products
C-D—Curran-Detroit Radiator Co.
Chgo—Chicago Mfg. Co.
Chic—Chicago Standard
Chmp—Champion Auto Spring Co.
Clrk—Clark Equip. Co.
Cocn—Corcoran Radiator Co.
Col—Columbia Axle Co.
Cont—Continental motor
Conn—Connecticut
Crn—Crane & MacMahon
Crn-S—Crane & MacMahon and Standard
Day—Dayton wheel
Detlaf—Detlaff
Det — Detroit Wheel & Rim
Detrt—Detroit G. & M.
Ditl—Disteel Wheel Co.
Ditw—Ditwiler Mfg. Co.
Dnet—Dyneto

Trend in Truck Design

(Continued from page 334)

Location of the steering gear at the left is approaching universal adoption, but a little over 5 per cent still have right hand drive. For what reason it is retained by even this number is not apparent, except in the case of cars for export to certain countries, or where a change from a model long manufactured with right hand drive would involve expense not commensurate with the advantage gained, a reason often applying or said to apply in the case of manufacturers who continue a practice long since abandoned by a very large majority of builders.

Pressed steel frames are now employed in the case of about three out of every four models. One in four employs structural steel, due it may be assumed, in most cases at least, to the expense of die equipment, for the structural steel frame seems to offer no advantage except easier length

oline Trucks—*Continued*

Received Too Late to Classify

ENGINE									TRANSMISSION										BRAKES		CONTROL			UNIVERSALS		
GOVERNOR			SPEED		FUEL SYS.		CLUTCH		GEARSET				FINAL DRIVE								STEER'G GEAR					
Type	Make	Drive	Motor in r.p.m.	Truck in m.p.h.	Carbureter Make	Fuel Feed	Type	Make	Type	Make	Placed	Speeds	Type	Rear Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Foot	Hand	Placed	Make	Levers	Type	Make	Name and Model
......	......	......	......	....	Stmbg	grv	d-d	Fuller	selec	Fuller	......	...	int-g	Clrk	......	......	......	......	......	......	....	......	....	...	......	Birch
none	......	......	2400	29	Buick	grv	cone	own	selec	own	mtr	3	int-g	Russl	8.20	sprgs	sprgs	Aloy	int-r-w	int-r-w	l	Lavn	ctr	mtl	Unvsl	Briscoe T34
cent	LeR	motor	1500	12	......	grv	d-d	Fuller	selec	Fuller	mtr	3	int-g	Clrk	11.77	sprgs	sprgs	Mth	......	ext-d-s	r	Ross	ctr	mtl	Acme	Clark Trucktractor TB
cent	LeR	motor	1500	12	Stmbg	grv	d-d	Fuller	selec	Fuller	mtr	3	int-g	Clrk	11.77	sprgs	sprgs	Mth	......	ext-d-s	r	Ross	ctr	mtl	Acme	Clark Trucktractor MAA
cent	LeR	motor	1500	12	Stmbg	grv	d-d	Fuller	selec	Fuller	mtr	3	int-g	Clrk	11.77	sprgs	sprgs	Mth	......	ext-d-s	r	Ross	ctr	mtl	Acme	Clark Trucktractor L
none	none	......	1200	25	Zenith	vac	d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn	7.00	sprgs	sprgs	S-P	int-r-w	int-r-w	l	Ross	ctr	mtl	Spicer	Dart S
cent	Pierce	motor	1200	15	Zenith	grv	d-d	Fuller	selec	Fuller	mtr	4	worm	Timkn	8.50	sprgs	sprgs	S-P	int-r-w	int-r-w	l	Ross	ctr	mtl	Spicer	Dart M
cent	Pierce	motor	1200	10	Zenith	grv	d-d	Fuller	selec	Fuller	amid	4	worm	Timkn	8.75	sprgs	sprgs	S-P	int-r-w	int-r-w	l	Ross	ctr	mtl	Spicer	Dart W
suct	Mnrch	motor	1300	....	Stmbg	grv	d-d	Fuller	selec	Fuller	mtr	3	int-g	Russl	8.20	sprgs	sprgs	Dtr	ext-r-w	int-r-w	....	Gem	....	...	Unvsl	Denby 12
suct	Mnrch	motor	1275	25	Stmbg	grv	d-p	Fuller	selec	Fuller	mtr	3	int-g	Clrk	6.50	sprgs	sprgs	Dtr	ext-d-s	int-r-w	l	Gem	....	...	Unvsl	Denby 33
suct	Mnrch	motor	1275	....	Stmbg	grv	d-d	Fuller	selec	Fuller	mtr	4	int-g	Russl	8.85	sprgs	sprgs	Dtr	ext-r-w	int-r-w	....	Gem	....	...	Unvsl	Denby 134
suct	Mnrch	motor	1275	....	Stmbg	grv	d-d	Fuller	selec	Fuller	mtr	4	int-g	Russl	9.45	sprgs	sprgs	Dtr	ext-r-w	int-r-w	....	Gem	....	...	Unvsl	Denby 25
cent	Dplx	Dplx	1050	....	Stmbg	grv	d-d	Fuller	selec	Fuller	amid	4	int-g	Clrk	10.00	sprgs	sprgs	Dtr	ext-d-s	int-r-w	....	Gem	....	...	Unvsl	Denby 27
cent	Dplx	Dplx	1050	....	Stmbg	grv	d-d	Fuller	selec	Warn	amid	4	int-g	Clrk	12.55	sprgsl	sprgs	Dtr	ext-d-s	int-r-w	....	Gem	....	...	Pet	Denby 210
......	......	......	......	....	Stmbg	.....	d-d	......	selec	......	amid	3	worm	......	......	......	......	......	......	......	....	......	....	...	Therm	Patriot Revere
......	......	......	......	....	Stmbg	.....	d-p	......	selec	......	amid	4	worm	......	......	......	......	......	......	......	....	......	....	...	Therm	Patriot Lincoln
......	......	......	......	....	Stmbg	.....	d-p	......	selec	......	amid	4	worm	......	......	......	......	......	......	......	....	......	....	...	Therm	Patriot Washington
none	none	none	2000	40	Stmbg	vac	d-d	M&E	selec	Dund	mtr	3	bevl	Shel	6.14	sprgs	sprgs	......	int-r-w	int-r-w	l	Ross	ctr	mtl	M&E	Schwartz A
suct	Mnrch	motor	1200	18	Stmbg	grv	d-d	M&E	selec	Dund	mtr	3	worm	Shel	6.50	sprgs	sprgs	Rowl	int-r-w	int-r-w	l	Ross	ctr	mtl	M&E	Schwartz BW
suct	Mnrch	motor	1100	16	Stmbg	grv	d-d	M&E	selec	Dund	mtr	3	worm	Shel	8.75	sprgs	sprgs	Rowl	int-r-w	int-r-w	l	Ross	ctr	mtl	M&E	Schwartz CWS
......	Simp	motor	1200	14	Stmbg	grv	d-d	Fuller	selec	Fuller	amid	4	worm	Shel	12.25	sprgs	sprgs	Rowl	int-r-w	int-r-w	l	Ross	ctr	mtl	M&E	Schwartz DW
none	......	......	1500	12	Schblr	grv	d-p	B-Beck	selec	G-Lees	mtr	3	int-g	Torbn	8.00	frame	frame	S-P	int-r-w	int-r-w	l	Ross	ctr	fab	Snead	Towmotor Tractor A
......	......	......	......	....	Zenith	.....	d-d	......	selec	......	......	4	worm	Shel	......	......	......	......	int-r-w	......	....	Ross	....	...	......	Traylor E
cent	Pierce	motor	......	....	Zenith	.....	d-d	......	selec	......	......	3	worm	Shel	......	......	......	......	int-r-w	......	l	Ross	....	...	......	Traylor B
cent	Pierce	motor	......	....	Zenith	.....	d-d	......	selec	......	......	3	worm	Shel	......	......	......	......	int-r-w	......	l	Ross	....	...	......	Traylor C
cent	Pierce	motor	......	....	Zenith	.....	d-d	......	selec	......	......	4	worm	Shel	......	......	......	......	int-r-w	......	l	Ross	....	...	......	Traylor D

Steam Trucks

SYSTEM			ENGINE						TRANSMISSION					CONTROL					
Feed Pump Type	Feed Control	Location	No. of Cylinders	Cylinders Cast	Valve Location	Valve Action	Valve Stroke	Reverses By	Final Drive	Gear-Ratio	Axle Type	Propulsion Taken By	Torque Taken By	Throttle	Hook-up	Reverse	Steering Wheel Location	Brake Lever Location	Name and Model
plunger	auto	rear axle	4	2	cyl-ends	Stokesbary	adjustable	lever	Spur-gear	3.00-1	floating	springs	....	lever	....	lever	right*	center	Steam-O-Truck

ABBREVIATIONS—Makers of Parts—(Con)—

Dplx—Duplex governor
Drt—Detroit Pressed Steel Co.
Dtr—Detroit Products
Dtrt—Detroit lubricator
Dun—Dunbar Mfg. Co.
Dund—Dundore Mfg. Co.
Dunk—Dunkirk Axle Corp.
Dur—Durston Gear Corp.
Elyr—Elyria Steel Products Co.
E&M—English & Mersick
E&O—Eberly & Orris
Eismn—Eisemann
Ens—Ensign carburetor
Eric—Ericsson Mfg. Co.
Eurk—Eureka
Fed—Fedders
GB&S—Golden, Belknap & Schwarts
G&D—Gray & Davis
G&O—G & O Mfg. Co.
GCS—Garden City springs
Gem—Gemmer
G-Lees—Grant-Lees
Godn—Gordan Radiator Co.
Har—Harrison
Hart—Hartford
Harv—Harvey
Hay—Hayes Wheel Co.
H&D—Hoopes Bros. & Darlington
H&K—Hale & Kilburn
Her—Hercules
Hghy—Highway Engine Co.
Hink—Hinkley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Int—Interstate
Iron—Iron City
Jacox—Jackson-Church-Wilcox
Jck—Jackson Auto Rad.
Jmst—Jamestown Car Parts
Jns—Phineas Jones & Co.
John—Johnson Co.
K&B—Kinsler & Bennet
Kel—Kelsey Wheel Co.
Kug—Kueng Radiator Co.
K.W.—K.W. Ignition Co.
Laur—Lauraine Magneto
Lavn—Lavine
LeR—Le Roi engine
Lght—Light Mfg. Co.
Liggt—Liggett Spring & Axle Co.
L-N—Leece-Neville Co.
Lng—Long
Lvgn—Livingston
Lyc—Lycoming
Marm—Maremont Mfg. Co.
McCn—McCanna
M&E—Merchant & Evans
McC—McCord
Mech—Mechanics Machine
Merl—Merrill Spring Co.
Mnrch—Monarch
Mod—Modine Mfg. Co.
Morg—Morgan Mfg. Co.
Math—Mather
Munc—Muncie
MWC—Motor Wheel Corp.
Natl—National Can Co.
Natn—National Axle Co.
N-E—North East
Own&Sp—Own & Spicer
P&B—Parish & Bingham
Pfx—Perfex radiator
Pgh—Pittsburgh Pressed Steel
Phro—Pharo Mfg. Co.
Pitt — Pittsburgh Model Engine Co.
Prsh—Parish Mfg. Co.
Prud—Prudden
Rayfld—Rayfield
Rowl—Wm. H. Rowland
Roy—Royer Wheel Co.
R-T—Rome-Turney
Russl—Russel Axle Co.
Sag—Saginaw
Sal—Salisbury
Savg—Savage Arms
Sch—Schwarz Wheel Co.
Schblr—Schebler
Shar—Sharon Pressed Steel Co.
Shel—Sheldon
Sim—Simms Magneto Co.
Simp—Simplex
S-K—Slick Knox Steel Co..
Smh—A. O. Smith
Sn & Ac—Snead & Acme
Sn&Sp—Snead & Spicer
S-P—Standard Parts Co.
Sp&Fl—Spicer & Flexite
Spltf—Splitdorf
Sp-P—Spring Perch Co.
Sp&Pet—Spicer & Peters
Stan—Standard radiator
Stand — Standard Steel Spring Co.
Sterl—Sterling bearings
Stmbg—Stromberg
Stn—Standard Wheel Co.
Sth—Smith steel wheel
S-W—Sparks-Withington
Th&Ba Thermoid & Baker
Th&Bl—Thermoid & Blood
Therm—Thermoid
Th—Sp—Thermoid & Spicer
Till—Tillotson
Timkn—Timken
Torbn—Torbensen
Trav—Traverse City Iron Works
T-S—Turner-Seymour
Tuth—Tuthill
Unv—Universal
Unvsl—Universal Mach.
U.P.—U. P. Products Co.
U.S.—U. S. Spring Co.
Wab — Wabash Radiator Co.
Warn—Warner
Wau—Waukesha
Way—Wayne Wheel Co.
Wed—Weldley
West—Westinghouse
We-W — Western Wheel Co.
Wis—Wisconsin Parts
Wol—Wohlrab
W-S—West Steel Castings Co.
Wsc—Wisconsin engine
Yng—Youngstown Pressed Steel Co.

variation over a well constructed pressed steel frame.

An increasing number of radiators are of the tubular core cast case type. Less than 20 per cent use cellular cores, and these are mostly applied to the light pneumatic tired jobs. About 80 per cent of all models use cast case radiators, while of the remaining 20 per cent about one-third use sheet metal two-thirds pressed steel.

The Hotchkiss drive is employed in about 57 per cent of models as against about 55 per cent in 1920. Nearly 60 per cent of models are fitted with centrifugal type governors—less than last year because fewer trucks are fitting any governor. Quite a number of truck models are fitted with fabric universals exclusively, and a larger number are a combination of fabric and metal universals, but about 80 per cent of all models use only metal joints, though the percentage of fabric joints is increasing.

British Car Practices

By M. W. Bourdon

(See page 322)

PERCENTAGES OF BRITISH CARS INCORPORATING VARIOUS DESIGN FEATURES

Number of Cylinders

4-cylinder ....76.5 per cent
6-cylinder ....16.0 per cent
2-cylinder .... 3.5 per cent
8-cylinder .... 2.5 per cent
3-cylinder .... 1.5 per cent

Cylinder Type

L head ....72.0 per cent
Valve in head......21.5 per cent
Sleeve valve .... 5.0 per cent
Overhead inlet ..... 1.5 per cent

Overhead Valve Drive

Overhead camshaft..57 per cent
Push rods ....43 per cent

Cylinder Casting

Fours in block.......96 per cent
Fours in pairs........ 4 per cent

Cylinder Heads

Integral ....51 per cent
*Detachable ....49 per cent

*Unit cylinder and crankcase 40 per cent.

Piston Material

Cast iron ....70 per cent
Aluminum ....26 per cent
Steel .... 3 per cent
Aluminum and cast iron .... 1 per cent

Connecting Rods

H section ....95 per cent
Tubular .... 5 per cent

Number of Piston Rings

Three ....60 per cent
Two ....30 per cent
More than three.....10 per cent

Wrist Pin

Fixed in piston......52 per cent
Floating ....28 per cent
Fixed in rod.........20 per cent

Lubrication Systems

Trough (circulating splash) ....51 per cent
Hollow shaft (pressure) ....49 per cent

Oil Pump Type

Gear (twin pinion)...70 per cent
Plunger ....21 per cent
Multi plunger .... 5 per cent
Eccentric .... 4 per cent

Fuel Feed

Gravity ....56 per cent
Vacuum ....30 per cent
Pressure ....14 per cent

Water Circulation

Thermosyphon ......48 per cent
Pump ....44 per cent
Assisted thermo-syphon .... 8 per cent

(Continued on next page)

Truck Exports for Eight

	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918	Calendar Year 1919	1920	Total
Europe;										
Austria	2 $3,595	3 $7,455						10 $18,500	3 $1,348	18 $30,898
Azores and Madeira Islands								3 $3,816	1 $3,650	4 $7,466
Belgium			100 $365,000					138 $307,778	195 $209,985	433 $517,763
Bulgaria	2 $1,528								4 $9,723	6 $11,251
Denmark	3 $2,120		44 $25,033	41 $36,413	58 $81,414	2 $3,800		643 $1,339,880	296 $615,448	1,087 $2,103,608
France	6 $10,709	2 $5,070	4,990 $13,523,843	5,681 $17,709,579	4,264 $13,854,903	2,754 $10,001,636	2,025 $8,011,335	3,521 $15,143,226	135 $434,943	23,378 $78,695,244
Finland								10 $12,783	104 $202,719	114 $215,502
Germany	4 $4,029	24 $18,462	4 $2,800						47 $41,958	79 $67,249
Gibraltar						27 $58,325			8 $5,763	35 $64,088
Greece	1 $1,176	1 $1,800	142 $426,570	45 $98,815	3 $2,000	14 $32,000		37 $80,891	70 $100,073	313 $743,325
Hungary									1 $3,164	1 $3,164
Iceland and Faroe Islands						1 $2,245		26 $21,661	38 $22,321	65 $46,227
Italy		1 $1,229	1 $8,000	5 $14,655	65 $159,775	52 $28,055	26 $87,577	7 $24,310	37 $67,775	214 $391,376
Malta, Gozo, and Cyprus Islands									9 $10,557	9 $10,557
Netherlands	2 $4,489	1 $1,452	9 $19,069	50 $93,797	36 $55,305			122 $294,772	528 $593,491	748 $1,062,368
Norway	2 $2,200	2 $3,852	3 $4,689	81 $121,480	162 $266,741	40 $133,227	83 $212,574	815 $1,787,473	829 $1,434,712	2,017 $3,966,948
Poland and Danzig									22 $35,473	22 $35,473
Portugal	1 $1,400	8 $12,075	5 $10,291	295 $1,117,681	21 $45,087	12 $36,914	10 $42,300	30 $76,728	166 $284,197	528 $1,626,673
Roumania	12 $12,000							114 $94,951	75 $89,370	201 $196,321
Russia in Europe	13 $34,163	2 $5,322	2,251 $7,666,883	3,909 $12,544,258	1,733 $5,428,979	406 $1,562,303		2 $2,503	104 $64,785	8,412 $29,809,693
Serbia, Montenegro & Albania			10 $6,300	20 $65,000				4 $5,700	3 $1,511	37 $80,022
Spain	1 $1,400		1 $1,800	30 $57,277	29 $55,808	46 $97,910	33 $87,100	209 $409,493	567 $1,004,833	916 $1,715,621
Sweden		1 $900	10 $17,600	19 $29,050	6 $10,879	7 $10,360		211 $444,695	821 $1,416,124	1,075 $1,929,608
Switzerland								33 $40,044	78 $49,767	111 $89,811
Turkey in Europe		1 $2,000	2 $8,009					82 $118,005	120 $165,400	205 $293,414
England	184 $119,468	203 $189,099	5,306 $14,042,325	8,268 $18,723,403	6,525 $17,061,105	4,805 $13,438,981	830 $2,456,993	890 $1,342,575	4,995 $7,148,880	32,006 $74,522,829
Scotland			4 $11,250	224 $271,745		447 $1,203,328		2 $1,779	162 $183,945	839 $1,672,047
Ireland			1 $7,033	8 $39,776			2 $4,276	15 $19,948	45 $40,555	71 $111,588
North America:										
British Honduras						2 $3,700	1 $834		21 $15,342	24 $19,876
Canada	489 $1,004,237	247 $474,724	306 $705,213	387 $724,817	636 $945,047	1,108 $1,381,542	895 $1,192,833	1,858 $2,896,325	2,149 $4,187,597	8,075 $13,212,335
Central Amer. States:										
Costa Rica	2 $3,643	8 $10,571	2 $4,165		1 $900	5 $10,245		1 $504	14 $22,553	33 $52,581
Guatemala				2 $4,916	4 $4,323	3 $5,512		10 $16,761	25 $34,105	44 $65,617
Honduras	1 $3,000		6 $12,500	6 $14,540	4 $4,094	6 $3,373		7 $9,589	19 $19,770	49 $66,866
Nicaragua				1 $2,500		1 $2,509	2 $5,742	11 $16,026	23 $32,253	38 $59,030
Panama		5 $7,243	6 $12,010	32 $55,171	75 $97,970	47 $47,859	16 $20,504	38 $39,148	68 $53,127	287 $333,038
Salvador				1 $1,300	1 $868	4 $14,811	1 $175	4 $8,897	42 $118,585	53 $144,636
Mexico	35 $83,363	12 $17,509	8 $14,492	51 $100,500	218 $198,151	365 $525,664	201 $260,968	938 $1,205,664	1,281 $1,973,994	3,109 $4,380,305
Miquelon, Langley & St. Pierre Islands								6 $6,000		6 $6,000
Newfoundland & Labrador	4 $8,845	1 $1,221	1 $750	1 $1,692	1 $2,675	2 $7,250	5 $2,997	10 $23,306	12 $54,907	37 $103,643
West Indies, British:										
Barbados					1 $1,506	2 $3,400	5 $11,792	15 $14,394	58 $62,150	81 $93,242
Jamaica	4 $9,234	3 $9,250	3 $7,292	9 $18,524	6 $8,285	10 $6,775	2 $800	36 $42,828	215 $313,578	288 $416,666
Trinidad & Tobago		1 $2,000		2 $1,974	2 $5,722	14 $18,361	7 $15,089	69 $86,479	202 $271,451	297 $331,076
Other British				6 $11,327	1 $500	28 $89,914	4 $3,304	25 $14,301	56 $38,168	120 $157,514
Cuba	14 $23,639	19 $33,500	21 $34,607	117 $176,647	397 $722,519	554 $1,130,982	279 $539,070	915 $1,955,509	1,944 $4,930,246	4,260 $9,546,719
Danish (Virgin Isl. of U. S.)	1 $4,250					2 $2,845		1 $3,350	168 $412,940	172 $423,385
Dominican Republic	1 $1,858	1 $1,800	2 $3,372	4 $5,173	22 $23,640	21 $13,323	8 $11,597	48 $75,953	213 $226,982	320 $363,698
Dutch		1 $595	1 $1,463		2 $2,095			3 $3,095	18 $8,542	25 $15,790
French			2 $3,975	1 $2,310	7 $13,305	26 $49,626	2 $3,650	58 $77,085	71 $55,607	167 $205,558
Haiti	3 $5,553				2 $1,324	11 $10,578	2 $1,200	8 $6,798	27 $51,358	53 $76,711

Years Show Progress

	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918	Calendar Year 1919	1920	Total
South America:										
Argentina	35 $78,000	48 $65,225	3 $2,910	45 $33,063	141 $146,255	51 $50,124	3 $4,094	145 $291,430	354 $825,333	785 $1,496,434
Bolivia					20 $48,590	14 $24,958	12 $38,716	8 $12,376	13 $21,895	67 $146,535
Brazil	36 $75,073	13 $20,449	3 $2,861	11 $19,635	14 $8,300	24 $31,133	21 $19,167	200 $199,738	1,540 $1,191,577	1,862 $1,567,933
Chile		2 $10,743		17 $46,566	69 $160,696	220 $282,638	85 $136,376	88 $131,055	299 $326,216	780 $1,094,290
Colombia	3 $6,112		1 $1,237	4 $1,236	2 $4,998	3 $7,100	2 $3,285	38 $39,341	275 $291,410	328 $354,719
Ecuador	1 $2,017			2 $3,378	1 $2,050	3 $6,876	4 $6,520	5 $6,865	46 $85,898	62 $113,601
Guiana, British			1 $900		1 $1,529	7 $5,100	1 $2,600	35 $24,119	123 $72,966	168 $104,614
Dutch				1 $1,037			1 $1,000	1 $506	6 $4,111	9 $6,655
French								4 $2,061	1 $3,061	5 $5,122
Peru		3 $5,301	2 $3,484	5 $5,830	25 $48,776	73 $155,834	52 $139,295	207 $215,175	900 $775,398	1,267 $1,299,094
Uruguay	7 $19,280	1 $865		2 $5,818	4 $10,437	16 $15,809	2 $2,000	68 $79,196	113 $113,479	213 $246,884
Venezuela	23 $34,291	12 $28,228	3 $7,164	6 $13,029	14 $28,502	16 $12,410	2 $2,200	41 $24,579	186 $144,308	117 $294,711
Asia:										
Aden								1 $922	2 $7,188	3 $8,110
China?		7 $12,700		39 $9,799	9 $14,287	23 $26,236	31 $46,595	273 $596,715	261 $464,845	643 $1,169,177
Kwantung (leased territory)*			1 $2,451					4 $6,335	82 $193,549	87 $202,335
Chosen (Korea)	1 $3,500			3 $5,027		2 $1,629				6 $10,156
East Indies:										
British India		7 $12,091	7 $8,680	135 $208,067	126 $205,023	11 $20,275	1 $2,118	260 $563,339	1,534 $3,069,542	2,081 $4,083,135
Straits Settlements	2 $5,588	7 $14,381		17 $25,169	57 $61,881	70 $113,554	44 $64,425	115 $229,624	447 $857,410	759 $1,371,982
Other British			1 $3,300	20 $27,841	26 $38,970	3 $7,138		16 $27,700	69 $152,849	135 $257,798
Dutch	2 $4,840	7 $14,232	11 $9,567	58 $82,586	108 $137,609	68 $162,749	139 $313,725	324 $689,225	1,182 $2,920,663	1,899 $4,335,196
French						2 $3,500	3 $7,299	16 $11,556	141 $117,984	162 $139,339
Hongkong			1 $4,780	3 $6,304		8 $5,371	8 $10,500	19 $25,547	26 $55,377	65 $107,879
Japan	21 $32,770	1 $900	1 $3,382	15 $14,528	70 $59,198	279 $317,787	381 $636,692	1,143 $1,736,439	1,233 $1,590,760	3,144 $4,392,456
Persia						4 $2,712			20 $10,601	24 $13,313
Russia in Asia			596 $1,903,221	1,170 $3,546,435	515 $1,662,144		15 $18,200	21 $41,482	9 $18,491	2,326 $7,189,973
Siam				9 $7,036	8 $6,700	6 $4,535	2 $4,867	8 $12,411	5 $8,965	38 $44,514
Turkey in Asia		1 $1,354	5 $26,282		2 $1,143			14 $27,695	93 $126,775	115 $183,249
Oceania, British:										
Australia	17 $23,027	32 $37,378	57 $84,142	201 $295,538	194 $237,159	109 $163,405	15 $26,274	418 $565,406	987 $1,441,366	2,030 $2,873,695
New Zealand	1 $1,201	39 $61,599	20 $31,575	93 $149,848	75 $119,833	74 $145,764	52 $59,690	225 $501,488	494 $1,115,886	1,077 $2,186,884
Other British				2 $2,612	1 $1,688	2 $2,404		9 $9,779	6 $6,250	20 $22,733
French	2 $3,400	4 $7,625		1 $860	2 $2,750	5 $6,480	1 $1,000	1 $600	4 $9,858	20 $26,093
German				1 $1,530	3 $2,377	4 $5,518	2 $2,213	8 $7,020	9 $4,706	27 $23,364
Philippine Islands	43 $91,809	38 $64,805	27 $62,132	58 $88,286	53 $57,457	163 $215,106	32 $56,815	516 $798,540	1,155 $1,818,221	2,085 $3,253,171
British Africa:										
West		1 $1,260		7 $13,173	115 $124,574	27 $20,136	13 $15,097	215 $254,836	780 $1,137,335	1,158 $1,566,411
South	11 $9,476	12 $11,539	15 $40,280	36 $54,519	34 $82,957	70 $107,085	23 $26,750	57 $102,992	237 $418,535	495 $854,133
East						1 $787		6 $5,010	8 $17,338	15 $23,135
Belgian Kongo								3 $3,196	13 $8,470	16 $11,666
Canary Islands		1 $1,203			1 $575			5 $4,312	11 $32,311	18 $38,401
Egypt					4 $9,624			15 $13,285	74 $69,492	93 $92,401
French Africa	1 $858					18 $12,963	11 $9,217	44 $47,157	337 $352,925	411 $423,120
German Africa								7 $3,544	11 $11,405	18 $14,949
Italian Africa									5 $11,500	5 $11,500
Kamerun									9 $7,308	9 $7,308
Liberia									2 $1,156	2 $1,156
Morocco				7 $9,675				13 $13,410	44 $24,376	64 $47,461
Portuguese Africa		1 $2,604		1 $2,803	1 $2,500		4 $7,725	4 $6,408	34 $49,409	45 $71,449
Spanish Africa									1 $2,118	1 $2,118
Total trucks Total value										115,241 $271,904,772

*Previous to 1918 listed as British, French and Japanese China.

British Car Practices

PERCENTAGES OF BRITISH CARS INCORPORATING VARIOUS DESIGN FEATURES

(Continued)

Radiator Core
Cellular ....68 per cent
Tubular ....32 per cent

Ignition
Magneto ....89 per cent
Battery .... 6 per cent
Magneto and battery 5 per cent

Distribution Gearing
Chain ....55 per cent
Skew pinion ....30 per cent
Straight pinion ....13 per cent
Worm .... 2 per cent

Chain Distribution
Non-adjustable ....51 per cent
Adjustable ....49 per cent

Clutches
Cone ....61 per cent
Single disc ....27 per cent
Multiplate .... 2 per cent

Gearset Mounting
Amidships ....68 per cent
On engine ....25 per cent
On axle .... 4 per cent
On torque tube.... 3 per cent

Number of Gears Change
Four speeds....50 per cent
Three speeds....50 per cent

Propeller Shafts
Open ....50 per cent
Enclosed ....45 per cent
Semi-enclosed .... 5 per cent

Propeller Shaft Joints
Disk ....34 per cent
Plain bearing star...31 per cent
Sliding block (pot)...27 per cent
Ball or roller star.... 8 per cent

Final Drives
Spiral bevel ....46 per cent
Bevel ....28 per cent
Worm ....26 per cent

Brake Location
Both on rear wheels.61 per cent
Transmission and wheels ....39 per cent
Transmission brakes:
External ....81 per cent
Internal ....19 per cent

Wheel Brakes
Internal ....90 per cent
External ....10 per cent

Rear Springs
Half elliptic ....48 per cent
Cantilever ....21 per cent
Quarter elliptic....16 per cent
Three-quarter elliptic.15 per cent

Front Springs
Half elliptic ....88 per cent
Quarter elliptic ....10 per cent
Cantilever .... 1 per cent
Transverse .... 1 per cent

Wheels
Pressed steel hollow spoked ....56 per cent
Wire ....20 per cent
Disk ....20 per cent
Wood .... 4 per cent

British Truck Chas

(Compiled for Automotive

Number	Name	Load Capacity Lb.	Wheelbase In.	Track In.	Type of Frame	Cylinders No-Bore-Stk	Normal R.P.M.	Cylinder Arrangement	Cylinder Type	Detachable Cylinder Head	Lubrication System	Water Circulation	Dynamo Lighting
1	A.E.C.	6270	170	70	Flitch	4-3.94x5.52	1050	Pairs	L	No	Trough	Pump	Yes
2	A.E.C.	8960	170	68	Pressed	4-4.78x5.90	1000	Pairs	L	No	Trough	Pump	Yes
3	Albion	2690	129	61	Pressed	4-3½x5	1250	Block	L	Yes	H. Shaft	Pump	Extra
4	Albion	3380	132	61	Rolled	4-3½x5½	1100	Pairs	L	No	H. Shaft	Pump	Extra
5	Albion	5600	157	70	Rolled	4-4½x5	1150	Block	L	No	H. Shaft	Pump	Extra
6	Albion	8960	173	70	Rolled	4-4½x5	1150	Block	L	No	H. Shaft	Pump	Extra
7	Austin	3380	126	60	Pressed	4-3¾x5	1200	Block	L	Yes	H. Shaft	Pump	Extra
8	Auto-Carrier	900	106	46	Pressed	4-2.73x3.94	....	Block	I	Yes	H. Shaft	Thermo	Yes
9	Beardmore	1700	100	54	Pressed	4-3.15x4.78	1200	Block	L	Yes	H. Shaft	Pump	Extra
10	Belsize	1350	99	56	Pressed	4-3.54x4.33	1000	Block	L	No	H. Shaft	Pump	Extra
11	Bristol	8960	170	70	Pressed	4-4½x5¾	1400	Pairs	L	No	Trough	Thermo	Yes
12	Caledon	8960	171	66	Pressed	4-4¼x5½	1200	Pairs		Yes	H. Shaft	Pump	Extra
13	Caledon	13500	171	66	Pressed	4-4¾x5½	1200	Pairs	L	No	H. Shaft	Pump	Extra
14	Churchill	7900	180	65	Rolled	4-5 x6	1000	Pairs	L	No	H. Shaft	Pump	Extra
15	Commer	2800	132	66	Pressed	4-3.74x4.78	1200	Pairs	L	No	Trough	Thermo	Extra
16	Commer	4480	144	66	Pressed	4-3.94x4.78	1200	Pairs	L	No	Trough	Thermo	Extra
17	Commer	7900	165	68	Rolled	4-3.94x5.52	1000	Pairs	L	No	Trough	Thermo	Extra
18	Commer	11000	162	72	Rolled	4-4.53x5.52	1000	Pairs	L	No	Trough	Thermo	Extra
19	Daimler	5600	138	63	Flitch	4-3.74x5.52	1000	Pairs		Yes	Trough	Pump	Extra
20	Daimler	5600	162	63	Flitch	4-3.74x5.52	1000	Pairs		Yes	Trough	Pump	Extra
21	Dennis	5600	144	62	Pressed	4-4.13x5.90	1000	Pairs	T	No	Trough	Pump	Extra
22	Dennis	9000	156	66	Pressed	4-4.53x5.90	1000	Pairs	T	No	Trough	Pump	Extra
23	Dennis	13500	170	66	Pressed	4-4.53x5.90	1000	Pairs	T	No	Trough	Pump	Extra
24	Enfield-Allday	4500	147	66	Pressed	4-3.94x5.12	1000	Pairs	T	No	H. Shaft	Thermo	Extra
25	Guy	5600	148	60	Pressed	4-4 x5½	1000	Block	L	Yes	H. Shaft	Pump	Extra
26	Halley	7900	160	62	Rolled	6-3½x6	1200	Threes	L	Yes	Trough	Pump	Extra
27	Hallford	4000	130	62	Pressed	4-3.94x5.52	1000	Pairs	L	No	Trough	Pump	Extra
28	Hallford	5600	148	64	Pressed	4-3.94x5.52	1000	Pairs	L	No	Trough	Pump	Extra
29	Hallford	6800	144	70	Pressed	4-4.33x5.52	1000	Pairs	L	No	Trough	Pump	Extra
30	Hallford	9000	162	72	Pressed	4-4.33x5.52	1000	Pairs	L	No	Trough	Pump	Extra
31	Hallford	11000	180	72	Pressed	4-4.78x5.52	1000	Pairs	L	No	Trough	Pump	Extra
32	Karrier	6800	168	66	Pressed	4-5 x6	1000	Pairs	L	No	Trough	Pump	Yes
33	Karrier	9000	168	66	Pressed	4-5 x6	1000	Pairs	L	No	Trough	Pump	Yes
34	Karrier	11000	168	66	Pressed	4-5 x6	1000	Pairs	L	No	Trough	Pump	Yes
35	Leyland	4500	141	65	Pressed	4-4½x5	1000	Pairs	L	No	H. Shaft	Pump	Extra
36	Leyland	6800	157	65	Pressed	4-4½x5	1000	Pairs	L	No	H. Shaft	Pump	Extra
37	Leyland	9000	168	65	Pressed	4-4⅝x6	1000	Pairs	L	No	H. Shaft	Pump	Extra
38	Leyland	11000	181	65	Pressed	4-5 x6	1000	Pairs	L	No	H. Shaft	Pump	Extra
39	Leyland	13500	190	65	Pressed	4-5 x6	1000	Pairs	L	No	H. Shaft	Pump	Extra
40	Maudslay	6800	162	66	Rolled	4-4½x5	1000	Pairs	I	No	H. Shaft	Pump	Extra
41	Maudslay	9000	162	66	Rolled	4-5 x5	1000	Pairs	I	No	H. Shaft	Pump	Extra
42	Maudslay	11000	174	66	Rolled	4-5 x5	1000	Pairs	I	No	H. Shaft	Pump	Extra
43	Maudslay	13500	186	66	Rolled	4-5 x5	1000	Pairs	I	No	H. Shaft	Pump	No
44	Pagefield	9000	164	69	Pressed	4-4¾x5½	1000	Pairs	L	No	H. Shaft	Pump	Extra
45	Palladium	10000	176	68	Pressed	4-4½x5½	1000	Pairs	L	No	Trough	Pump	Extra
46	Scammell*	18000	230	64	Pressed	4-5 x5½	1000	Pairs	I	Yes	H. Shaft	Pump	Extra
47	Scammell*	22000	254	64	Pressed	4-5 x5½	1000	Pairs	I	Yes	H. Shaft	Pump	Extra
48	Star	3400	138	57	Pressed	4-3.54x5.90	1500	Pairs	L	No	H. Shaft	Pump	Extra
49	Star	5600	150	60	Pressed	4-3.54x5.90	1500	Pairs	L	No	H. Shaft	Pump	Extra
50	Star	6800	150	60	Pressed	4-3.54x5.90	1500	Pairs	L	No	H. Shaft	Pump	Extra
51	Straker-Squire	11000	174	72	Pressed	4-4½x6½	1000	Block	I	Yes	H. Shaft	Pump	Extra
52	Tilling-Stevens	5600	144	57	Pressed	4-4.13x4.92	1000	Pairs	L	No	Trough	Pump	Extra
53	Tilling-Stevens†	9000	174	68	Pressed	4-4¾x5½	1000	Pairs	L	No	Trough	Pump	Extra
54	Thorneycroft	5600	144	62	Pressed	4-4 x5½	1000	Block	L	No	H. Shaft	Pump	Extra
55	Thorneycroft	7900	156	67	Pressed	4-4½x6	1000	Pairs	T	No	H. Shaft	Pump	Extra
56	Thorneycroft	9500	163	67	Pressed	4-4½x6	1000	Pairs	T	No	H. Shaft	Pump	Extra
57	Thorneycroft	13500	169	71	Pressed	4-4½x6	1000	Pairs	T	No	H. Shaft	Pump	Extra
58	Vulcan	3400	137	56	Pressed	4-3.54x5.12	1200	Block	L	No	Trough	Pump	Extra
59	W. & G.	4500	134	60	Pressed	4-3.74x5.52	850	Block	L	No	H. Shaft	As'td Thermo	Extra
60	W. & G.	5600	136	60	Pressed	4-3.74x5.52	850	Block	L	No	H. Shaft	As'td Thermo	Extra

†Gasoline electric. *Six Wheeler.

Magneto ignition on all trucks; fixed spark timing on 9, 10, 19, 20, 52, 53; honeycomb radiator, 10; plain tube, 25; others flanged tube; sheet metal radiator shell, 9, 10; other radiator shells cast. Vacuum fuel feed, 10, 25, 43, 51; others gravity feed; unit power plants, 7, 10; pneumatic tires, 8, 9, 10; optional tire equipment, 1, 3, 4, 12, 45, 58, 59, 60; other tire equipment solid. All hand brakes internal expanding.

Percentage of Various Design Features

Cylinder Number

All four-cylinders, except one make with one model.

Cylinder Type

L head ....71 per cent
T head ....12 per cent
Valve in head ....13 per cent
Sleeve valve .... 2 per cent
Overhead inlet .... 2 per cent

Cylinder Heads

Integral ....80 per cent
Detachable ....20 per cent

Lubricating Systems

Hollow shaft (pressure).....57 per cent
Trough (circulating splash).43 per cent

Fuel Feed

Gravity ....93 per cent
Vacuum .... 7 per cent

Water Circulation

Pump ....85 per cent
Thermo-syphon ....12 per cent
Assisted thermo-syphon ..... 3 per cent

Radiators

Vertical tubes ....84 per cent
Horizontal tubes ....16 per cent

Ignition

Magneto ....100 per cent
Variable timing .... 90 per cent
Impulse starter .... 10 per cent

sis Specifications

Industries by M. W. Bourdon)

Electric Starter	Governor	Clutch	No. of Gears	Gear Shift Lever	Final Drive	High Gear Ratio	Propeller Shaft	Universal Joints	BRAKES Foot Operated Position	Foot Operated Type	Hand Type	Road Wheels	Steering Pivots	Number
No	No	Cone	3	Right	Worm	8.5	Open	Star (Ball)	Wheels	Int	Int	Disk	Vert	1
No	No	Cone	4	Right	Worm	8.5	Open	Star (Ball)	Wheels	Int	Int	Disk	Vert	2
Extra	Yes	Plate	3	Right	Worm	4.5	Open	Star	Shaft	Ext	Int	Cast	Inclined	3
Extra	Yes	Plate	3	Right	Bevel	....	Open	Star & Block	Shaft	Ext	Int	Cast	Vert	4
Extra	Yes	Plate	3	Right	Chains	....			Shaft	Ext	Int	Cast	Vert	5
Extra	Yes	Plate	3	Right	Chains	....			Shaft	Ext	Int	Cast	Vert	6
Extra	No	Plate	4	Central	Worm	8	Open	Block	Shaft	Ext	Int	Wood	Vert	7
Extra	No	Plate	3	Right	Worm	4.5	Enclosed		Wheels	Int	Trans.	Disk	Vert	8
Extra	No	Cone	4	Right	Bevel	4.28	Open	Fab. Disk	Trans.	Ext	Int	Wood	Vert.	9
No	No	Cone	4	Right	Bevel	3.6	Open	Leather Disk	Wheels	Int	Int	Disk	Vert	10
No	Yes	Plate	4	Central	Worm	7	Open	Star	Shaft	Ext	Int	Cast	Inclined	11
Extra	Yes	Cone	4	Right	Worm	8½	Open	Star	Shaft	Ext	Int	Cast	Vert	12
Extra	Yes	Cone	4	Right	Chain	....			Shaft	Ext	Int	Cast	Vert	13
No	Opt	Cone	4	Right	Chain	....		Fab. Disk	Shaft	Ext	Int	Disk	Vert	14
No	No	Cone	3	Right	Worm	6.25	Open	Star & Block	Shaft	Ext	Int	Cast	Inclined	15
No	No	Cone	3	Right	Worm	7.33	Semi	Star	Shaft	Ext	Int	Cast	Inclined	16
No	No	Cone	3	Central	Chains	7.5			Shaft	Ext	Int	Cast	Inclined	17
No	No	Cone	3	Central	Chains	9.2			Shaft	Ext	Int	Cast	Inclined	18
No	No	Cone	4	Right	Worm	7.25	Open	Star (Ball)	Wheels	Int	Int	Cast	Vert	19
No	No	Cone	4	Right	Worm	7.25	Open	Star (Ball)	Wheels	Int	Int	Cast	Vert	20
No	No	Plate	4	Central	Worm	6.75	Open	Star (Ball)	Shaft	Ext	Int	Cast	Vert	21
No	No	Cone	4	Right	Worm	7.75	Semi	Star	Shaft	Ext	Int	Cast	Vert	22
No	No	Cone	4	Right	Worm	8.75	Semi	Star	Shaft	Ext	Int	Cast	Vert	23
Extra	Yes	Cone	3	Right	Chains	8		Fab. Disk	Shaft	Ext	Int	Disk	Vert	24
Extra	No	Cone	4	Right	Double Reduc.	6.83	Open	Star & Block	Trans.	Ext	Int	Cast	Vert	25
Extra	No	Plate	4	Right	Worm	7.66	Open	Fab. Disk	Trans.	Int	Int	Cast	Vert	26
Extra	Yes	Cone	3	Right	Chains	....			Shaft	Ext	Int	Cast	Vert	27
Extra	Yes	Cone	3	Right	Chains	....			Shaft	Ext	Int	Cast	Vert	28
Extra	Yes	Cone	4	Right	Chains	....			Shaft	Ext	Int	Cast	Vert	29
Extra	No	Cone	4	Right	Chains	....			Shaft	Ext	Int	Cast	Vert	30
Extra	No	Cone	4	Right	Chains	....			Shaft	Ext	Int	Cast	Vert	31
Extra	No	Cone	4	Right	Double Reduc.	6.65	Semi	Disk, Block	Shaft	Ext	Int	Cast	Vert	32
Extra	No	Cone	4	Right	Double Reduc.	8.23	Semi	Disk, Block	Shaft	Ext	Int	Cast	Vert	33
Extra	No	Cone	4	Right	Double Reduc.	9.52	Semi	Disk, Block	Shaft	Ext	Int	Cast	Vert	34
Extra	Yes	Cone	4	Right	Worm	7	Semi	Disk	Shaft	Ext	Int	Cast	Inclined	35
Extra	Yes	Cone	4	Right	Worm	7.5	Semi	Disk	Shaft	Ext	Int	Optl	Inclined	36
Extra	Yes	Cone	4	Right	Double Reduc.	7.6	Semi	Disk	Shaft	Ext	Int	Optl	Inclined	37
Extra	Yes	Cone	4	Right	Double Reduc.	8.9	Semi	Disk	Shaft	Ext	Int	Optl	Inclined	38
Extra	Yes	Cone	4	Right	Double Reduc.	8.9	Semi	Disk	Shaft	Ext	Int	Optl	Inclined	39
No	No	Cone	4	Right	Worm	6.75	Open	Star & Block	Shaft	Ext	Int	Cast	Vert	40
No	No	Cone	4	Right	Double Reduc.	8.25	Open	Star & Block	Shaft	Ext	Int	Cast	Vert	41
No	No	Cone	4	Right	Double Reduc.	8.25	Open	Star & Block	Shaft	Ext	Int	Cast	Vert	42
No	No	Cone	4	Central	Double Reduc.	8.25	Open	Star & Block	Shaft	Ext	Int	Disk	Vert	43
Extra	Yes	Cone	4	Right	Worm	8	Enclosed	Star & Block	Shaft	Ext	Int	Cast	Vert	44
Extra	No	Multi Plate	4	Right	Worm	7.8	Enclosed	Star	Shaft	Ext	Int	Disk	Vert	45
No	No	Cone	3	Right	Chains	....		Fab. Disk	Shaft	Ext	Int	Cast	Inclined	46
No	No	Cone	3	Right	Chains	....		Fab. Disk	Shaft	Ext	Int	Cast	Inclined	47
Extra	No	Cone	4	Right	Worm	....	Open	Star & Block	Shaft	Ext	Int	Disk	Inclined	48
Extra	No	Cone	4	Right	Double Reduc.	....	Open	Star & Block	Shaft	Ext	Int	Disk	Inclined	49
Extra	No	Cone	4	Right	Double Reduc.	....	Open	Star & Block	Shaft	Ext	Int	Cast	Inclined	50
Extra	Yes	Plate	4	Right	Worm	7 or 8	Open	Star	Wheels	Int	Int	Cast	Inclined	51
Extra	Extra	Cone	4	Right	Worm	6	Open	Star & Block	Wheels	Int	Int	Cast	Vert	52
No	No	None	..		Worm	10.3	Open	Star & Block	Wheels	Int	Int	Cast	Vert	53
No	Yes	Cone	3	Right	Worm	7.25	Open	Fab. Disk	Shaft	Ext	Int	Disk	Vert	54
No	Yes	Cone	4	Right	Worm	7.25	Open	Fab. Disk	Shaft	Ext	Int	Disk	Vert	55
No	Yes	Cone	4	Right	Worm	8.25	Open	Fab. Disk	Shaft	Ext	Int	Disk	Vert	56
No	Yes	Cone	4	Right	Worm	10.3	Open	Fab. Disk	Shaft	Ext	Int	Disk	Vert	57
Extra	No	Cone	4	Central	Worm	6.2	Open	Star & Block	Shaft	Int	Int	Cast	Vert	58
Extra	Yes	Cone	3	Right	Worm	6.5	Open	Fab. Disk	Wheels	Int	Int	Cast	Vert	59
Extra	Yes	Cone	4	Right	Worm	8	Open	Fab. Disk	Wheels	Int	Int	Cast	Vert	60

ABBREVIATIONS: Flitch—Flitch Plate; **H. Shaft**—Hollow Shaft; (pressure); **As'td Thermo**—Assisted Thermo-syphon; **Semi**—Semi-enclosed; **Fab. Disk**—Fabric Disk; **Int**—Internal; **Ext**—External; **Vert**—Vertical.

Governor

Not fitted ....57 per cent
Fitted as standard ....40 per cent
Optional .... 3 per cent

Clutches

Cone ....79 per cent
Single plate ....19 per cent
Multiple disk .... 2 per cent

Gearset Location

All amidships except one model of one maker.

Gear Shift Lever

Right hand ....88 per cent
Central ....12 per cent

Universal Joints

Star and sliding block (pot joint) ....33 per cent
Fabric disk ....32 per cent
Star with plain bushes ....18 per cent
Star with ball bearings ......11 per cent
Disk and sliding block .... 6 per cent

Propeller Shafts

Open* ....69 per cent
Semi-enclosed ....18 per cent
Enclosed ....13 per cent
*Including open shaft in chain drive.

Wheels

Hollow cast ....55 per cent
Disk ....21 per cent
Web cast ....15 per cent
Wood and miscellaneous...... 9 per cent

Brakes

Transmission and wheels.....77 per cent
Wheels only ....23 per cent
(No external wheel brakes.)

Final Drives

Worm ....52 per cent
Side chains ....23 per cent
Double reduction ....20 per cent
Bevel .... 5 per cent
(No internal drive on wheels.)

Frames

Pressed steel ....77 per cent
Rolled channel ....16 per cent
Flitch plate .... 7 per cent

Tendencies in British Truck Design in 1921

Only a few makers build trucks of less than 3000 lb. capacity. Steam trucks of 5-ton capacity hauling trailers and using either solid or liquid fuel compete with gasoline propelled trucks. Use of worm drive, pressed steel frame, and cast wheels increasing. Magneto ignition universal.

By M. W. Bourdon

THE manufacturers of British trucks are adopting a very conservative attitude on the subject of pneumatic tires for loads above 3500 lb. and not one of them is yet prepared to recommend either giant or twin pneumatics for bigger loads. Several are experimenting on their own transport vehicles, but are not yet inclined to advise buyers to discard solids. An exception must be made, however, of passenger-carrying vehicles—especially charabancs—with seating for from 18 to 32 passengers. In such cases pneumatics are advised, tentatively and with many reservations, it is true. But there is an inclination towards twin pneumatics for the rear wheels in place of giant singles, and the most favored make is the Michelin on the same firm's disk wheels. Goodyear is, nevertheless, pushing giants very hard and will no doubt make a gradual and an increasing impression on the potential market.

As might be gathered from what has been said, British truck makers are not yet making plans for a special chassis more suited to the use of pneumatics than the existing types. The great majority of firms spread themselves on trucks for 3 to 5 ton (say, 6700 lb. and 11,000 lb.) loads, comparatively few making smaller chassis and only isolated plants turning out vehicles for 30 cwt. and less.

Austin is the most prominent new-comer in the latter field with a chassis having the 20 h.p. engine and gearset unit designed originally for the post-war Austin passenger car. Of its size and type it is the cheapest British truck. There is no truck or light van made to compete with the Ford, for though a few firms have modified passenger car and taxicab chassis for light delivery service, their prices are far above that of the one-ton Ford.

The steam truck for loads of 5 tons on its own superstructure and 2 or 3 tons additional on a trailer is very popular among users for certain classes of work. It is not only, as it was at one time, confined to short journeys and dock and rail service, but several of the many transport companies which have sprung up all over the country since the war utilize this type of vehicle for runs up to 200 miles away from headquarters. It has a two-man control, for, clearly, stoking with solid fuel cannot be done by the driver. The majority are now fitted with solid rubber tires instead of the iron shod wheels which gave them a legal speed of only 5 m.p.h. and an economical speed of less than double that if the drivers cared to risk it. With rubber tires its legal speed is 8 m.p.h., but this is very frequently exceeded, speeds of 28 to 30 m.p.h. being maintained mile after mile on slightly falling gradients.

The internal combustion engined truck is, therefore, feeling the competition of the steamer more than previously, and the need for stops with the latter to replenish the water supply at least every 30 miles is, by many owners, considered compensated for by the lower cost of fuel consumed. Serious attempts are now being made to utilize liquid fuel for their burners, and although this shows approximately 20 per cent increase in cost at present as compared with coal, is offset by the greater convenience, time saved in filling up, and better average speed owing to the driver being able to maintain steam pressure more easily under varying conditions of running.

Reverting to gasoline trucks, with which the accompanying table deals exclusively, the most marked variations since the war are the wider use of pressed steel frame members in lieu of channel section rolled steel; the discarding of side chains for final drive in favor, as a rule, of the worm; the increasing use of the fabric disk type of universal joint; and the great popularity of the cast steel hollow spoke wheel. Disk wheels have not proved so durable as was originally anticipated; considerable trouble has been experienced with the loosening of rivets, and although Thornycroft, among the important makers, uses them exclusively, most of the other well-known firms are gradually dropping them. At present 55 per cent of British trucks have the cast hollow spoked type, 21 per cent disk (the latter including some of the light delivery vans), 15 per cent cast steel, solid spoked, and 9 per cent wood and miscellaneous.

The flitch plate frame still finds adherents in Daimler and A. E. C., though only in one model of the latter; 77 per cent of chassis have pressed steel side members and 16 per cent rolled steel channel. Of both pressed and rolled, 10 per cent have the channel facing outward, for with this arrangement, it is claimed, mounting of cross members, sub frames and main components is facilitated.

The T-head cylinder construction, which, before the war, was considerably favored, has been very largely discarded, and 71 per cent of engines now have L-heads. Nevertheless, one or two of the most prominent firms still arrange the valves on both sides, notably Dennis and Thornycroft, the latter in three models out of four. Seventy-seven per cent of cylinders are pair cast, but only 20 per cent have detachable heads. The 23 per cent of block cast cylinders all occur in chassis of a load capacity of 2 tons or under.

The following are average bores and strokes for British trucks of the load capacities given: 4500 lb., 3⅞ x 5½ in.; 6700 lb., 4¼ x 5½ in.; 9000 lb., 4⅝ x 5¾ in.; 11,000 lb., 4¾ x 6 in.

Frequently, however, makers whose range includes chassis with load capacity from 6700-11,000 lb., utilize the same size of engine for two or three models. For instance, Thornycroft uses a 4½ x 6 engine for three sizes,

(*Continued on page* 371)

Trend of Tractor Design as Revealed by Statistics for 1921 Models

Fewer manufacturers are making creeper type machines. Average piston displacement has decreased but is balanced by increase in piston speed. Fewer two-cylinder engines are used. Marked increase in the percentage of disk clutches. No material change in number of speeds.

By P. M. Heldt

IN order to get a concrete idea of trends in farm tractor design, we have analyzed the tractor specification tables for 1919, 1920 and 1921, and present the results herewith, in tabular form. Comparing the figures for 1921 with those for 1920, the first thing that stands out is a large decrease in the percentage of creeper type tractors. This, of course, is due to the fact that numbers of the creeper tractors listed last year were hardly beyond the experimental stage and never got onto a real production basis. Those firms in the creeper type tractor field which were really producing last year are still doing business. However, the enthusiasm with which the creeper type was taken up by newcomers in the industry last year has received something of a check.

In analyzing the specification sheets it was considered advisable in many cases to see how practice varied in the different capacity classes of tractors. In doing this a difficulty was introduced by the fact that quite a number of tractors now have a double rating, such as 2-3 plow or 3-4 plow. It was decided to use the lower rating for the purpose of this analysis and count the 2-3 plow tractors, for instance, with the 2-plow tractors.

There has been no material change in the distribution between the different classes of the tractors listed. The single plow class, which comprises the garden tractors, is slightly larger and the class of tractors for five or more plows slightly smaller; also the three-plow class does not predominate numerically to the same extent as last year, but on the whole the shifting from one capacity class to another has not been pronounced.

Average piston displacements in all classes have decreased, in the 2-plow class about 10 per cent, in the 3-plow class nearly the same, and in the 4-plow class about 8.5 per cent. No doubt this is largely balanced by an increase in piston speeds. The average piston speed of all four-cylinder engines without regard to plow capacity was found to have increased 2½ per cent.

The percentage of single-cylinder engines has increased, due to the fact that most of the garden tractors recently developed have that type of engine, but these engines are vertical and not exceptionally slow and heavy. The two-cylinder type shows a distinct loss, whereas each of the other three types used shows a gain. There is also a slight decline in the proportion of horizontal engines. On the whole the types of engine used remain very much the same.

There has been no change in the governor situation. A few makes have no governor. The hydraulic and electric types of governor are used on one make of tractor each, and all the rest of the tractors have centrifugal governors. The methods of cylinder casting remain substantially the same, though the block cast type shows a slight gain in popularity.

It was considered desirable to get a comparative figure for engine weight, and the average weights per cubic inch displacement and per belt horsepower. The average of all 1920 engines was found to be 2.69 lb. per cu. in. displacement. However, as the engines considered included some very small ones used on garden tractors, and also some very large ones used on the mammoth 30-60 and 40-80 hp. tractors, it was considered a more logical procedure to average the weights per cu. in. displacement for all engines between 250 and 500 cu. in. piston displacement, which includes practically all of the 2 and 3-plow and the majority of the modern 4-plow tractors. This average was found to be 2.64 lb. per cu. in. displacement, and therefore does not differ much from the general average. The average weight for all engines in respect to rated belt horsepower was found to be 39 lb., while that of engines between 250 and 500 cu. in. displacement was 37.1 lb.

Gravity fuel feed is very much in the lead in tractor practice. Pump feed is used in a number of tractors which have engines of a type similar to those used in stationary practice. The sponsors of vacuum feed have secured a foothold in the tractor industry but little more. The proportions are substantially the same as last year.

Practice in clutches has changed materially. Unfortunately, many concerns in filling out the specification blank do not give the type of clutch, and this leaves the percentage values obtained somewhat uncertain. Disk clutches, which constituted only 48 per cent of the whole in 1920, represented 60 per cent of the total in 1921. This is easily explained, as practically all stock clutches for tractors are of the disk or plate type. The chief competing type is the shoe clutch, which is used mainly by firms which entered the tractor business from the implement industry and manufacture their own clutches. This type of clutch is comparatively bulky and does not lend itself well to enclosure, so the clutches on the newer designs of completely enclosed tractors are practically all of the disk or plate type, the few exceptions being cone clutches.

There has been no great change in respect to the number of gear speeds provided. Slight gains are shown for the two and three-speed tractors and equivalent losses by the single and multi-speed machines. There appeared to be quite a strong tendency in the course of the year to go to three-speeds for three and four-plow tractors, but the figures now available do not bear out this impression. While the three-speed machine has gained somewhat, its gain is no greater than that of the two-speed.

Belt speeds average very close to the standard of 2600

Specifications of American

Name and Model	Price	Plow Capacity	H.P. Rating	Engine Make	No. of Cylinders Bore & Stroke	Engine Type	Cylinders Cast	R.P.M.	Make of Governor	Type of Governor	Engine Weight	Lubrication System	Mechanical Lubricator Make	Oil Pump Type	Ignition System	Impulse Starter	Carburetor Make	Water Injected with Fuel	Fuel Feed	Fuel Tanks and Capacities	Air Cleaner Make
Allis-Chalmers 6-12		1	6-12	Le Roi	4-3⅛x4½	L	Block	1000	Own	Cent	360	Sp-Pr		Plunger	Eisemann	No	Kingston	No	Grv	8½G	Toro
Allis-Chalmers 18-30		4	18-30	Own	4-4¾x6½	I	Block	830	Own	Cent	1600	Pressure		Gear	Eisemann	Yes	Kingston	Yes	Grv	7½G-22½K	Toro
Allwerk C		3	14-28	Own	4-5 x6	L	Singly	900	Own	Cent	1200	Circ-Sp		Plunger	Magneto	Yes	Kingston	No	Grv	5G-25K	Bennett
Allwerk G		3	14-28	Own	4-4¾x6	L	Singly	900	Own	Cent	1170	Circ-Sp		Plunger	Magneto		Kingston	No	Grv	5G-25K	Bennett
Andrews Kinkade D	$2,500	4	18-36	Climax	4-5 x6½	L	Pairs	900	Climax	Cent	1100	Pressure		Vane	Splitdorf	Yes	Stromberg	Yes	Grv	5G-20K	Spirex
Ano A			3-5	Own	1-4½x5	L	Singly	800	None			Splash			Magneto	Yes	Schebler	No	Grv	2G	
Appleton 12-20	1,650	3	12-30	Buda	4-4¼x5½	L	Block	1000	Pickering	Cent	750	Pressure		Gear	Bosch		Schebler	Yes	Grv	G-K	Bennett
Aultman-Taylor 30-60		8	30-60	Own	4-7 x9	I	Pairs	500	Own	Cent		Pressure	Detroit		Eisemann	No	Kingston	Yes	Grv	20G-60K	
Aultman-Taylor 22-45		6	22-45	Own	4-5½x8	I	Pairs	600	Own	Cent		Pressure	Detroit		Eisemann	No	Kingston	Yes	Grv	20G-35K	
Aultman-Taylor 15-30		4	15-30	Climax	4-5 x6½	L	Pairs	800	Climax	Cent		Circ		Vane	Eisemann	Yes	Kingston	No	Grv	6G-16K	Bennett
Automotive B-3	1,785	3	12-24	Hercules	4-4 x5⅛	L	Block	1000	Pierce	Cent	850	Pressure		Gear	Eisemann	Yes	Kingston	No	Yes	18G	Bennett
Avery Cultivator C				Own	6-3 x4	L	Block	1250	Own	Throt	470	Circ-Sp		Gear	K-W	Yes	Kingston	No	Grv	10G	Bennett
Avery...Single Row Colt			5-10	Own	4-3 x4	L	Block	1250	Own	Throt	300	Circ-Sp		Gear	K-W	Yes	Kingston	No	Grv	10G	Bennett
Avery B		2	5-10	Own	4-3 x4	L	Block	1250	Own	Throt	300	Circ-Sp		Gear	K-W	Yes	Kingston	No	Grv	11G	Bennett
Avery C				Own	6-3 x4	L	Block	1250	Own	Throt	470	Circ-Sp		Gear	K-W	Yes	Kingston	No	Grv	10G	Bennett
Avery 12-25		4	12-25	Own	2-6½x7	I	Singly	600	Own	Throt	1350	Circ-Sp		Gear	K-W	Yes	Kingston	Yes	Grv	6¾G-14K	Bennett
Avery 14-28		4	14-28	Own	4-4⅞x7	I	Block	700	Own	Throt	1620	Circ-Sp		Gear	K-W	Yes	Kingston	Yes	Grv	3¼G-20K	Bennett
Avery 18-36		5	18-36	Own	4-5½x6	I	Block	650	Own	Throt	2150	Circ-Sp		Gear	K-W	Yes	Kingston	Yes	Grv	6G-27K	Bennett
Avery 25-50		6	25-50	Own	4-6½x7	I	Block	600	Own	Throt	2200	Circ-Sp		Gear	K-W	Yes	Kingston	Yes	Grv	6G-27K	Bennett
Avery 45-65		10	45-65	Own	4-7¾x8	I	Block	600	Own	Throt	3300	Circ-Sp		Gear	K-W	Yes	Kingston	Yes	Grv	6¾G-44K	Bennett
Avery 8-16		2-3	8-16	Own	2-5½x6	I	Singly	600	Own	Throt	925	Circ-Sp		Gear	K-W	Yes	Kingston	Yes	Grv	2G-12K	Bennett
Bates D		3	15-25	Own	4-4¼x6	I	Block	900	Own	Cent	1000	Pressure		Gear	Splitdorf	Yes	Own	Yes	Grv	1G-15K	Own
Beeman G	340	½	2-4	Own	1-3½x4½	L	Single	800	None		600	Splash			Heinze	No	J & L	Yes	Grv	1¼G	Donaldson
Best Thirty	3,250	4	20-30	Own	4-4¾x6½	I	Singly	800	Own	Cent	1600	Circ-Sp		Gear	Berling	Yes	Ensign	Yes	Vac	40G	Pomona
Best Sixty	5,750	10	35-60	Own	4-6½x8	I	Singly	950	Own	Cent	3150	Circ-Sp		Gear	Bosch	Yes	Ensign	No	Vac	65G	Pomona
Case 10-18		2	10-18	Own	4-3⅞x5	I	Block	1050	Own			Circ-Sp		Plunger		Yes	Kingston	No	Grv	2G-10½K	Own
Case 15-27		3	15-27	Own	4-4½x6	I	Block	900	Own			Circ-Sp		Plunger		Yes	Kingston	No	Grv	2¾G-20K	Own
Case 22-40		5	22-40	Own	4-5½x6¾	I	Pairs		Own			Non-Circ	Detroit		Bosch	Yes	Kingston	Yes	Grv	3¾G-26½	Own
Caterpillar T-11		4	25-	Own	4-4¾x6	I	Pairs	1050	Own	Cent	1100	Pressure		Gear	Eisemann	Yes	Schebler	No	Vac	46G	Donaldson
Caterpillar T-16		6	40-	Own	4-6½x7	I	Singly	700	Own	Cent	2300	Pressure		Gear	K-W	Yes	Kingston	No	Vac	46G	Donaldson
Chase 12-25		2	12-25	Buda	4-4¼x5½	L	Block	1000	Pierce	Cent	800	Pressure		Gear	Splitdorf	Yes	Kingston	No	Grv	2G-15K	R. & W.
Cletrac W		3	12-20	Own	4-4 x5½	I	Block	1265	Own	Cent	650	Circ-Sp		Gear	Teagle	Yes	Kingston	No	Grv	¾G-13K	Own
Dakota 4	1,750	3	15-27	Doman	4-4¾x6	T	Pairs	800	Doman	Cent	900	Circ-Sp		Gear	K-W	Yes		No	Vac	18G	Johnson
DePue 20-30	2,500	4	20-30	Buda	4-4½x6			800		Cent	925	Pressure		Gear	Bosch	Yes	Stromberg	No	Grv	14G	Cyclone
Dill D	2,480	3	20	Cont	4-4½x5½	L	Pairs	1000	Pierce	Cent		Splash		Plunger	Bosch	No	Kingston	No	Grv	15G	Donaldson
Do-It-All	595	5-7	4-6	Own	1-4½x5	I	Singly	1000				Splash			Berling		Holly	No	Grv		Donaldson
Eagle F	1,390	3-4	12-22	Own	2-7 x8	I	Pairs	425	Own	Cent	2200	Pressure	M-K		Splitdorf	Yes	Schebler	Yes	Grv	4G-12K	Own
Eagle F	1,850	4-5	16-30	Own	2-8 x8	I	Pairs	425	Own	Cent	2750	Pressure	M-K		Splitdorf	Yes	Schebler	Yes	Grv	5G-18K	Own
Emerson-Brantingham 12-20		3	12-20	Own	4-4¾x5	L	Pairs	900	Own	Cent	1000	Splash		Plunger	K-W	Yes	Stromberg	Yes	Grv	4G-20K	Bennett
Fageol D	1,525	2	9-12	Lycom	4-3½x5	L	Block	1200	None		470	Circ-Sp		Plunger	Splitdorf	Yes	Tilloteon	No	Grv	12G	Own
Farm Horse "B"	1,885	3	18-30	Climax	4-5 x6½	L	Pairs	800							Splitdorf	Yes	Bennett	Yes	Grv	5G-18K	
Farquhar 15-25		3	15-25	Buda	4-4½x6	L	Block	900	Pierce	Cent	1100	Circ		Gear	K-W	Yes	Kingston	No	Grv	5G-25K	R. W.
Farquhar 25-50		6	25-50	Own	4-7 x8	I	Pairs	550	Own	Throt	2500	Circ-Sp	Detroit		K-W	Yes	Kingston	No	Grv	30G-30K	
Farquhar 18-35		4	18-35	Own	4-6 x8	I	Pairs	550	Own	Throt	2000	Circ-Sp	Detroit		K-W	Yes	Kingston	No	Grv	30G-30K	
Fitch		3	20-35	Climax	4-5 x6½	L	Pairs	800	Climax	Cent	1200	Pressure		Special	Climax	Yes	Ensign	No	Grv	2G-28K	Bennett
Fordson	790	2	-18	Own	4-4 x5	L	Block	1000			760	Circ		F. Wheel	Own	No	Holley	Yes	Grv	1G-21K	Own
Franklin G	3,650	3-4	18-30	Climax	4-5 x6½	L	Pairs	800	Climax	Cent	1250	Pressure		Vane	Eisemann	Yes	Zenith	No	Grv	17G-3K	Donaldson
Frick C		3	15-28	Beaver	4-4¾x6	I	Block	900	Taco	Cent	1000	Circ-Sp		Gear	Splitdorf	Yes	Bennett	No	Grv	3G-17K	Bennett
Frick A		2	12-20	Erd	4-4 x6	I	Block	900	Erd	Cent	775	Circ-Sp		Plunger	Kingston	Yes	Kingston	No	Grv	3G-20K	Bennett
G-O G	1,485	3	14-28	Waukesha	4-4½x5¾	L	Pairs	1000	Waukesha	Cent	750	Circ-Sp		Gear	Eisemann	Yes	Kingston	Yes	Grv	12G-24K	Bennett
Gray			18-36	Waukesha	4-4¾x6¾	L	Pairs	850	Waukesha	Cent	875	Circ-Sp		Gear	Bosch	Yes	Bennett	Yes	Grv	34G	Bennett
Ground Hog		3	19-31	Erd	4-4 x6	I		850							Splitdorf		Schebler				Amt. Co.
Hart Parr 30	1,595	4	15-30	Own	2-6½x7	I	Block	750	Own	Cent	1190	Pressure	M-K		K-W	Yes	Schebler	Yes	Grv	1G-23K	Own
Heider C		3	12-20	Waukesha	4-4½x6¾	L	Pairs	900	Waukesha	Cent	780	Circ-Sp		Gear	Splitdorf	Yes	Kingston	Yes	Grv	7G-14K	Bennett
Heider D		2	9-16	Waukesha	4-4¼x5¾	L	Pairs	1000	Waukesha	Cent	670	Circ-Sp		Gear	Splitdorf	Yes	Kingston	Yes	Grv	7G-14K	Bennett
Huber Super 4		3	15-30	Midwest	4-4½x6	I	Pairs	1100	Pierce	Cent		Pressure		Gear	Kingston	Yes	Kingston	No	Grv	23G	R-W.
Huber Light 4		3	12-25	Waukesha	4-4½x5¾	L	Pairs	1000	Waukesha	Cent	711	Circ-Sp		Gear	Kingston	Yes	Kingston	Yes	Grv	2G-20K	Bennett
Imperial E	5,000	10	40-70	Own	4-7½x9	I	Singly	400	Own	Cent		Pressure	Detroit		Splitdorf	Yes	Kingston	Yes	Pump	70G	Bennett
Indiana F		1	5-10	Le Roi	4-3⅛x4½	L	Block	1000	Le Roi	Cent	350	Splash		Plunger		No	Kingston	No	Grv	10G	Bennett
International 8-16	1,150	2	8-16	Own	4-4¼x5	I	Block	1000	Own	Cent	960	Sp-Pres		Plunger	Splitdorf	Yes	Ensign	No	Grv	1G-11½K	Own
International 15-30	2,300	4	15-30	Own	4-5¼x8	I	Pairs	575	Own	Cent	2265	Pressure	M-K		K-W	Yes	Own	Yes	Pump	24K	Own
J-T N			16-30		4-4¾x6	I	Block	900		Cent		Circ-Pr		Gear	K-W		Own	No	Grv	2½G-26½K	Bennett
La Crosse M	900	1	6-12	Own	2-4 x6	I	Block	1000	Own	Cent	600	Pressure	M-K		At-Kent	No	Kingston	No	Grv	2G-13K	Bennett
La Crosse H	1,250	3	12-24	Own	2-6 x7	I	Block	900	Own	Cent	900	Pressure	M-K		Splitdorf	Yes	Kingston	Yes	Grv	2G-13K	Bennett
Lauson 15-30		3	15-30	Beaver	4-4¾x6	I	Block	950	Taco	Cent	1200	Pressure		Gear	Splitdorf	Yes	Kingston	No	Grv	27G	Own
Leonard E		3	20-30	Buda	4-4½x6	L	Block	1000	Simplex	Cent	960	Pressure		Gear	Splitdorf	Yes	Zenith	No	Vac		Own
Liberty A	2,475	4	18-32	Climax	4-5 x6½	L	Pairs	850	Own	Cent	1150	Pressure		Vane	Splitdorf	Yes	Stromberg	Yes	Grv	5G-20K	Bennett
Lombard		16	140	Special	6-5½x6¾	T		1200	Special			Pressure		Gear		Yes				65G	
Macultivator	225		1½	Own	1-2¾x3½	L		1000				Splash			Berling	No	Schebler		Grv	1G	
Magnet 14-28	1,875	3	14-28	Waukesha	4-4½x6¼	L	Pairs	900	Waukesha	Cent	950	Sp-Pr		Gear	Berling	Yes	Stromberg		Grv	5G-20K	Bennett
Merry Garden	230		2	Evinrude	1-2⅝x2½		Singly	900				Circ			Bosch		Evinrude		Grv	1½G	Atma
Mohawk	785	2	9-16	Light	4-3¼x4½	L	Block	1000	Pierce	Cent	355	Splash		Plunger	Simms	No	Kingston			2G-6K	Bennett
Moline-Universal	1,325	2	9-18	Own	4-3½x5	T	Block	1400	Remy	Electric	730	Pressure		Gear			Holley	No	Grv	15G	Bennett
New Britain 1		1	3-6	Own	2-2¾x4	L	Block	1500	None			Splash			Splitdorf	No	Kingston	No	Grv	2G	Bennett
New Britain 2		1	3-6	Own	2-2¾x4	L	Block	1500				Splash			Splitdorf		Kingston	No	Grv	2G	Bennett
Nilsen, Senior H		4	20-40	Waukesha	4-5 x6¼	L	Pairs	900	Waukesha	Cent	900	Sp-Pr		Gear	Bosch	Yes	Stromberg	No	Grv	28K	Bennett
Oil-Pull 12-20		3	12-20	Own	2-6 x8	I	Pairs	560	Own	Cent		Splash	M-K		Bosch	Yes	Own	Yes	Pump	1G-23K	Donaldson
Oil-Pull 16-30		4	16-30	Own	2-7 x8½	I	Pairs	530	Own	Cent	2000	Splash	M-K		Bosch	Yes	Own	Yes	Pump	1G-31K	Donaldson
Oil-Pull 20-40		6	20-40	Own	2-8 x10	I	Singly	450	Own	Cent		Splash	M-K		Bosch	Yes	Own	Yes	Pump	1G-45K	Donaldson
Oil-Pull 30-60		8	30-60	Own	2-10 x12	I	Singly	375	Own	Cent	7500	Splash	M-K		Bosch	Yes	Own	Yes	Pump	3G-70K	
Oldsmar	395	½	3-5	Own	1-5⅛x5½	I	Singly	585	Own	Cent	350	Splash			Splitdorf	Yes	Schebler	Yes	Grv	2G	
Oliver A		3	15-30	Beaver	4-4½x6	I	Block	900		Cent	1000	Pressure		Gear	Splitdorf	Yes	Bennett	No	Grv	5G-15K	Bennett
Parrett K		3	15-30	Pitt	4-4½x6	I	Block	1000	Own	Cent	961	Pressure		Gear	Eisemann	Yes	Kingston	No	Grv	2¾G-18K	Own

ABBREVIATIONS—**Cent**—Centrifugal; **Circ**—Circulating; **Circ-Pr**—Circulating Pressure; **Circ-Sp**—Circulating Splash; **Cont**—Contracting; **Elec**—Electric; **Expand**—Expanding; **Fric**—Friction; **Grv**—Gravity; **H**—Horizontal; **Hyd**—Hydraulic; **Ind**—Individual; **L**—L-Head;

Farm Tractors for 1921

Radiator Make	Cooling System Capacity	Cooling Fluid	Fluid Circulation	Belt Pulley Diameter, Face and R.P.M.	Gearset Make	Clutch Make	Clutch Type	No. of Forward Speeds	Differential Lock	Final Drive	Plowing Speed	No. of Driving Wheels	Diameter and Face	No. of Tracks	Drive Wheel Axle Type	No. of Non-drive Wheels	Steering Arrangement	Frame Material	Wheelbase	Total Weight	Name and Model
Own	3½	Water	Ther.	10 x 5½-1000	Own	Borg & Beck	Plate		No	Rim		2	48 x6		Dead	2	Swinging	None	81	2500	Allis-Chalmers 6-12
Own	10	Water	Pump	15 x 7½- 830	Own	Own	Shoe	2	No	Spokes	2.3	2	50 x12		Revolving	2	Knuckle	None	95	6000	Allis-Chalmers 18-30
Perfex	12	Water	Pump	13½x 7 - 900	Own	Own	Disc	3	No	Rim	2¾	2	48 x12		Revolving	2	Knuckle	Struct	80	5200	Allwork C
Perfex	10	Water	Pump	11 x 6 - 900	Own	Own	Disc	3	Yes	Spokes	2½	2	42 x12		Revolving	2	Knuckle	Struct	74	4800	Allwork G
Spirex	12	Water	Pump	8 x14 - 900	Own	Own	Disc	2	No	Spokes	2.5	2	54 x14		Dead	2	Knuckle	Steel	96	4950	Andrews Kinkade D
	2	Water	Ther.	6 x 4½- 800	Own	Own	Shoe	1		Axle		2			Live	2					Ano A
Perfex	8	Water	Pump	12 x 7½- 800	Nuttall	Borg & Beck	Plate	2		Gear	2¼	2	54 x12		Live		Knuckle	Steel		4900	Appleton 12-20
Own	12	Water	Pump	24 x11 - 500	Own	Own		2	No	Rim	2⅕	2	90 x24		Live	2	Swinging	Struct	136	25000	Aultman-Taylor 30-60
Own	85	Water	Pump	20 x10 - 600	Own	Own		3	No	Rim	2 1/10	2	70 x20		Live	2	Swinging	Struct	102	12800	Aultman-Taylor 22-45
Hooven	5	Water	Pump	20 x 8 - 400	Own	Own	Shoe	3	No	Rim	2 1/10	2	70 x12		Live	2	Knuckle	Struct	98½	7800	Aultman-Taylor 15-30
McC.-T.	7½	Water	Pump	10 x 8 -1000	Own	Borg & Beck	Plate	2	Yes	Axle	2¼	2	40 x10		Live	2	Power	Steel	70	3950	Automotive B-3
Own	6¾	Water	Ther.	10 x 5¼- 800	Own	Own	Disc	3	No	Spokes	2½	2	42 x6		Dead	1	Caster	Channel	106	3450	Avery-Cultivator C
Own	4½	Water	Ther.	10 x 5¼- 800	Own	Own	Disc	3	No	Spokes	2½	2	42 x5		Dead	2	Swinging	Channel	81	2650	Avery Single Row Cult.
Own	4½	Water	Ther.	12 x 5¼- 800	Own	Own	Disc	3	No	Spokes	2½	2	38 x10		Dead	2	Knuckle	Channel	78	2600	Avery B
Own	4½	Water	Ther.	10 x 5¼- 800	Own	Own	Disc	3	No	Spokes	2¼	2	38 x10		Dead	2	Knuckle	Channel	90	3150	Avery C
Own	17½	Water	Ther.	19½x 7 - 700	Own	Own	Shoe	2	No	Spokes	2⅙	2	56 x20		Revolving	2	Swinging	Channel	95	7500	Avery 12-25
Own	30	Water	Ther.	16 x 7 - 700	Own	Own	Disc	2	No	Spokes	2⅓	2	60 x16		Revolving	2	Swinging	Channel	96	6800	Avery 14-28
Own	33	Water	Ther.	18 x 8 - 650	Own	Own	Disc	2	No	Spokes	2	2	65 x20		Revolving	2	Swinging	Channel	97	9250	Avery 18-36
Own	55	Water	Ther.	22 x 8½- 600	Own	Own	Disc	2	No	Spokes	2½	2	69 x20		Revolving	2	Swinging	Channel	114	12500	Avery 25-50
Own	90	Water	Ther.	26 x10 - 500	Own	Own	Disc	2	No	Spokes	1¾	2	87½x24		Revolving	2	Swinging	Channel	138	22000	Avery 45-65
Own	12½	Water	Ther.	18 x 7 - 600	Own	Own	Shoe	2	No	Spokes	1¾	2	50 x12		Revolving	2	Swinging	Channel	90	4900	Avery 8-16
Own	8	Water	Pump	10 x 7 - 850	Own	Own	Shoe	3	Yes	Rim	2½	2	50 x12		Dead	2	Knuckle	I-Beam	74	4000	Bates D
Shotwell	1½	Water	Ther.	4½x 3½		Own	Cone					2	25½x 3¼			2				600	Beeman G
Own	9	Water	Ther.	12 x 7	Own	Own	Disc	2		Gear	2			2			Power	None		2500	Best Thirty
Own	20	Water		16 x10	Own	Own	Disc	2		Gear	1⅞			2			Power	Struct		17500	Best Sixty
Own	9	Water	Pump	14¼x 5¼-1050	Own	Own	Shoe	2	Yes	Spokes	2¼	2	42 x9		Live	2	Knuckle	Cast	65	3400	Case 10-18
Own	11	Water	Pump	16 x 6½- 900	Own	Borg & Beck	Plate	2	Yes	Spokes	2¼	2	52 x14		Live	2	Knuckle	Cast	76½	6350	Case 15-27
Own	15½	Water	Pump	16½x 8½	Own	Own	Shoe	2	Yes	Spokes	2⅕	2	56 x16		Live	2	Knuckle	Struct	96	9200	Case 22-40
Modine	7½	Water	Pump	10½x 8½-1012	Own	Own	Disc	3		Gear	1 6/10			2			Clutches	Cast		9400	Caterpillar T-11
Own	12	Water	Pump	10½x10½- 850	Own	Own	Disc	3		Gear	1 6/10			2			Clutches	Cast		19000	Caterpillar T-16
Perfex	6	Water	Pump	10 x 8 -1000	Own	Bierman	Shoe	2		Rim	1¾	2	48 x12		Dead	1	Knuckle	Struct	94	5200	Chase 12-25
McCord	5	Water	Pump	8 x 6 -1265	Own	Borg & Beck	Plate	1	No	Gear	3½			2	Dead	8	Special	Struct		3455	Cletrac W
J-T	12	Water	Pump	14 x 7 - 800	Own		Shoe	2	No	Axle	3	1	42 x 6		Live	2	Knuckle	Struct	108	5700	Dakota 4
Perfex	8	Water	Pump	8 x10 - 385	Own	Borg & Beck	Plate	3	No		1½	4	40 x10		Live		Swinging	Struct	100	6500	Depue 20-30
Eureka	10	Water	Pump	x 1½		Borg & Beck	Plate	3	No	Chain	2½	2	42 x 3				Knuckle	Struct	144	4800	Dill D
Own	5	Water	Ther.	6 x 4																	Do-It-All
Perfex	12	Water	Pump	20 x10 - 425	Own	Own	Spur	2	No	Rim		2	48 x12		Dead	2	Knuckle	Struct	87	5850	Eagle F
Perfex	15	Water	Pump	20 x10 - 425	Own	Own	Spur	2	No	Rim		2	52 x12		Revolving	2	Knuckle	Struct	88	7100	Eagle F
Modine	7½	Water	Pump	12 x 6½- 900	Own	Own	Cone	2	No	Gear	2 7/10	2	54 x12		Revolving	2	Knuckle	Channel	87½	4355	Emerson-Brantingham 12-20
Modine		Water	Pump	6 x 6½-	Own	Own	Shoe	1		Axle	1¾	2	48 x 8		Live	2	Knuckle	Struct	77	3500	Fageol D
Shotwell	9	Water	Ther.	14 x 9 - 800	Own		Disc	2	No	Spokes	3½	2	52 x26		Dead	2	Knuckle	Channel	80	5200	Farm Horse
Modine	10	Water	Pump	14 x 7 - 800	Nuttall	Borg & Beck	Plate	2	No	Rim	2¼	2	54 x10		Dead	2	Knuckle	Channel	83	5800	Farquhar 15-25
Own		Water	Pump	32 x 9 - 275	Own	Own	Fric	1	Yes	Rim	2 3/10	2	84 x20		Dead	2	Swinging	Channel	132	19000	Farquhar 25-50
Own		Water	Pump	32 x 9 - 275	Own	Own	Fric	1	Yes	Rim	2 3/10	2	84 x20		Dead	2	Swinging	Channel	132	16000	Farquhar 18-35
Spirex	7	Water	Pump	14 x 8 - 700	Ganshaw	Cotta	Special	3	No	Axle	2¼	4	36 x12		Live		Swinging	Channel		5800	Fitch
Own	12	Water	Ther.	9½x 6½-1000	Own	Own	Disk	3	No	Axle	2 7/10	2	42 x12		Live	2	Knuckle		63	2325	Fordson
Modine	8	Water	Pump	12 x 8 - 132		Own		3		Chain	2¾		198 x12	2	Revolving		Clutch	Struct	60	9250	Franklin G
Perfex	9¾	Water	Pump	13 x 7 - 900	Nuttall	Own	Shoe	2	No	Rim	2 3/10	2	60 x12		Revolving	2	Knuckle	Struct	69¾	6450	Frick C
Perfex	7¾	Water	Pump	13 x 7 - 900		Own	Shoe	2	No	Rim	2 3/10	2	60 x10		Revolving	2	Knuckle	Struct	67¾	5700	Frick A
Perfex	6	Water	Pump	10 x 6 - 900	Own	Own	Fric	6	Yes	Rim	2⅖	2	46 x12		Revolving	2	Knuckle	Struct	85	4200	G-O G
Shotwell	9	Water	Pump	11⅜x 8⅛- 850	Own	Own	Cone			Rim	2½	1	54 x54		Revolving	2	Knuckle	Struct	104	6185	Gray
A.M.T.				14 x 7		Twin													90	3750	Ground-Hog
Perfex	10	Water	Pump	14 x 8 -2300	Own	Own	Shoe	2	No	Gear	3	2	52 x10		Revolving	2	Knuckle	Steel	132	5200	Hart-Parr 30
Perfex	9⅜	Water	Pump	14 x 7			Fric	4	No	Rim	2½	2	57 x10		Live	2	Knuckle	Steel	96	6000	Heider C
Perfex	8	Water	Pump	12 x 6 -1600			Fric	4	No	Rim	2½	2	54 x8		Live	2	Knuckle	Steel	90	4000	Heider D
Perfex	10	Water	Pump	13 x 8 -1100	Own	Own	Disc	2	No	Rim	2 9/10	2	60 x10		Revolving	2	Knuckle	Struct	90	6200	Huber-Super 4
Perfex	8	Water	Pump	13 x 7 -1000	Own	Own	Shoe	2	No	Rim	2 7/10	2	60 x10		Revolving	2	Knuckle	Struct	90	5200	Huber-Light 4
Own	45	Water	Pump	30 x12 - 400	Own	Own	Shoe	2	Yes	Rim	2½	2	96 x30		Dead	2	Swinging	Steel	137	20800	Imperial E
Chandler	4½	Water	Ther.	14 x 1¼	Own	Own	C. B.	4	No	Chain	2½	2	50 x12		Dead	2	Swinging	C. I.	64	2300	Indiana F
B. & L.	12	Water	Ther.	12¼x 8½- 625	Own	Own	Disc	2	No	Spokes	2¾	2	40 x10		Dead	2	Knuckle	Struct	85	3600	International 8-16
B. & L.	40	Water	P.&T.	18 x 9 - 575	Own	Own	Cont.	2	No	Spokes	2¾	2	66 x14		Live	2	Knuckle	Struct	94	8990	International 15-30
McCord	6½	Water	Pump	10 x 8 - 900	Covert	Covert	Disc	3	No	Rim	2½		242 x11	2				Struct	74		J-T N
Modine	14	Water	Pump	10 x 5½-1000	Own	Own	Fric	1	Yes	Rim	3	2	48 x7		Dead	2	Knuckle	Channel	72	2800	La Crosse M
Modine	8	Water	Pump	11 x 7½- 900	Own	Own	Cont.	1	Yes	Rim	3	2	56 x10		Revolving	2	Knuckle	Steel	90	3800	La Crosse H
Perfex	7½	Water	Pump	17½x 8 - 475	Own	Own	Shoe	2	No	Rim	2½	2	54 x12		Revolving	2	Knuckle	Struct	88	6550	Lauson 15-30
Modine	8	Water	Pump	16 x 8 - 575	Own	Hilliard		2	Yes	Gear	2¾	4	50 x12		Stationary		Swinging	Steel	98	5000	Leonard E
B. & J.	10	Water	Pump	12 x 8 - 950	Own	Own	Shoe	2	No	Axle	2¾	2	48 x12		Live	2	Knuckle	Channel	84	6000	Liberty A
Special						Special		3		Axle	2			2			Knuckle				Lombard
										Spokes		2	19½x3		Dead					210	Macultivator
S. & J.	10	Water	Pump	14 x 7 - 700	Own	Borg & Beck	Plate	3	No	Axle	2½	2	48 x12		Live	2	K. & Sw.	Channel	90	4400	Magnet 14-28
	2	Water	Ther.	6 x 2 - 200	Own	Own	Dog	1		Spokes		2	20 x3		Live			Iron		260	Merry Garden
Rex	6		Ther.	8 x 4 - 600	Own	Own		2	Yes	Axle	2¼	2	40 x8		Live	2		C. I.		2150	Mohawk
Modine	6	Water	Ther.	8¾x 6½-1200	Own	Own	Spur	1	Yes	Rim	2¾	2	51⅝x8		Dead		Knuckle	Channel		3380	Moline Universal
G. &O.	3	W.&O.	Ther.	5½x 4½-1500	Own	Own	Disc	1	Yes	Ax-Sp	2¼	2	3½x26½		Live	2	H. Bars	Iron	96	700	New Britain 1
G. & O.	3		Ther.	5½x 4¼-1500	Own			1	Yes	Ax-Sp	2¼	2	4 x32		Live	2	H. Bars	Iron	100	750	New Britain 2
Shotwell	12	Water	Pump	28 x 8 - 360		Twin	Disc	2		Chain	2½	3	52 x10		Live	2	Knuckle	Struct	100	6400	Nilson, Senior H
Own	10½	Oil	Pump	19 x 7 - 560	Own	Own	Shoe	2	No	Rim	2 1/10	2	51 x12		Live	2	Knuckle	Channel	80	6682	Oil-Pull 12-20
Own	15	Oil	Pump	23 x 8½- 530	Own	Own	Shoe	2	No	Rim	2 1/10	2	56 x18		Live	2	Knuckle	Channel	92½	9600	Oil-Pull 16-30
Own	17	Oil	Pump	26 x 4 - 450	Own	Own	Shoe	2	No	Rim	2	2	64 x20		Live	2	Knuckle	Channel	103	12820	Oil-Pull 20-40
Own	70	Oil	Pump	36 x11 - 375	Own	Own	Shoe	1	No	Rim	1 9/10	2	80 x30		Live	2	Swinging	I-Beam	141	26700	Oil-Pull 30-60
None		Air		4 x 4¼- 585	Own	Own	Shoe	1	Yes	Axle	2½	2	30 x8		Live	2	Power	Channel	72	1100	Oldsmar
Modine	10	Water	Pump	21½x 7 - 450	Own		Disc	2		Axle	2⅓			2	Live			Steel	60	8200	Oliver A
Perfex	10	Water	Pump	12 x 7½-1000	Own	Own	Disc	2	No	Rim	2½	2	60 x10		Revolving	2	Knuckle	Struct	91	5310	Parrett K

O—Opposed; **Splash-Gr**—Splash Gravity; **Sp-Pr**—Splash Pressure; **Struct**—Structural Steel; **T**—T-head; **Throt**—Throttle; **V**—Vertical; **Vac**—Vacuum. **EQUIPMENT—M-K**—Madison Kipp.

Specifications of American

Name and Model	Price	Plow Capacity	H.P. Rating	Engine Make	No. of Cylinders Bore & Stroke	Engine Type	Cylinders Cast	R.P.M.	Make of Governor	Type of Governor	Engine Weight	Lubrication System	Mechanical Lubricator Make	Oil Pump Type	Ignition System	Impulse Starter	Carbureter Make	Water Injected with Fuel	Fuel Feed	Fuel Tanks and Capacities	Air Cleaner Make
Peoria L	$1,785	3	12-25	Climax	4-5 x6½	L	Pairs	800	Climax	Cent.	1000	Pressure	.....	Plunger	Eisemann	Yes	Stromberg	No	Grv	5G-30K	Tako
Pioneer 18-36	.....	4	18-36	Own	4-5½x6	L	Pairs	750	Pierce	Cent.	1300	Pressure	Manzel	.....	Berling	Yes	Kingston	Yes	Grv	2G-23K	Bennett
Pioneer 30-60	.....	10	30-60	Own	4-7 x8	L	Pairs	625	Own	Cent.	4500	Pressure	Detroit	.....	K-W	Yes	Kingston	Yes	Grv	50G	Bennett
Plowman A	1,995	3	15-30	Buda	4-4½x6	L	Block	1000	Own	Cent.	1070	Pressure	.....	Gear	Splitdorf	Yes	Stromberg	....	Grv	2½G-17K	Leonard
Port Huron A	1,700	3	12-25	Chief	4-4¾x6	I	Block	900	Pickering	Throt.	1000	Pressure	.....	Gear	Eisemann	Yes	Kingston	No	Grv	5G-25K	Own
Post D	.....	2	12-20	Waukesha	4-4¼x5¾	L	Pairs	800	Waukesha	Cent.	725	Circ-Sp	.....	.....	Splitdorf	Yes	Kingston	No	Grv	2G-13K	Bennett
Ranger T-20	1,250	1	8-16	Le Roi	4-3⅛x4½	L	Block	1100	Le Roi	Cent.	345	Sp-Pr	.....	Plunger	Splitdorf	No	Holly	No	Grv	10G	Bennett
Reliable 10-20	985	2	10-20	Own	2-6 x7	I	Block	600	Own	Cent.	1120	Pressure	Detroit	.....	Splitdorf	Yes	Own	Yes	Pump	11K	.....
Rex 12-25	1,600	3	12-25	Waukesha	4-4¼x5¾	L	Pairs	900	Waukesha	Cent.	670	Splash	.....	Gear	K-W	Yes	Kingston	No	Grv	5G-20K	Bennett
																		No			
Samson M	1,060	2	.....	Northway	4-4 x5½	L	Block	1000	Own	Cent.	830	Circ	.....	Gear	Simms	Yes	Kingston	No	Grv	3G-20K	Own
Sandusky J	.....	2	10-20	Own	4-4¼x5¼	L	Block	1000	Own	Cent.	850	Splash	.....	Plunger	Splitdorf	Yes	Kingston		Grv	5G-15K	Bennett
Sandusky E	.....	4	15-35	Own	4-5 x6½	L	Singly	800	Own	Cent.	2060	Splash	.....	Plunger	Splitdorf	Yes	Kingston	No	Grv	5G-25K	Bennett
Shelby D	.....	3	15-30	Beaver	4-4¾x6	L	Block	900	Taco	Cent.	1100	Pressure	.....	Gear	Splitdorf	Yes	Kingston	No	Grv	4G-14K	Bennett
Shelby C	.....	2	10-20	Erd	4-4 x6	....	.....	1000	.....	.....	....	.....	.....	.....	Splitdorf	....	Kingston	No	Grv	5G-12K	Bennett
Square Turn A	2,075	3	18-35	Climax	4-5 x6½	I	Pairs	850	Climax	Cent.	1150	Pressure	.....	Vane	Splitdorf	Yes	Stromberg	No	Grv	15G-15K	Bennett
Stinson 4-E	.....	4	18-36	Beaver	4-4¾x6	I	Block	1000	Taco	Cent.	....	Pressure	.....	Gear	Splitdorf	Yes	Kingston	Yes	Grv	5½G-26½K	Own
Tioga T-3	2,625	3	15-27	Wisconsin	4-4½x6	L	Block	1000	Pharo	Oil	1000	Sp-Pr	.....	Gear	Splitdorf	Yes	Stromberg	No	Grv	28G	Bennett
Titan 10-20	1,200	3	10-20	Own	2-6½x8	I	Pairs	575	Own	Cent.	1691	Pressure	M-K	.....	K-W	Yes	Own	Yes	Pump	16K	Own
Topp-Stewart B	4,000	3	30-45	Waukesha	4-4¾x6¾	L	Pairs	950	Waukesha	Cent.	850	Sp-Pr	.....	Gear	Eisemann	Yes	Stromberg	No	Grv	25G	Bennett
Traylor T	815	1	6-12	Le Roi	4-3⅛x4½	L	Block	1200	Le Roi	C. D.	330	Pressure	.....	Plunger	Splitdorf	No	Kingston	No	Grv	10G	A. P. Co.
Turner 14-25	1,695	3	14-25	Buda	4-4¼x5½	L	Block	1000	Duplex	Cent.	700	Pres ure	.....	Gear	Splitdorf	Yes	Kingston	Yes	Pump	15G-5K	Bennett
Twin City 12-20	.....	3	12-20	Own	4-4¼x6	I	Block	1000	Own	Cent.	900	Circ-Pr	.....	Gear	Bosch	Yes	Holley	No	Grv	3G-23K	Bennett
Twin City 20-35	.....	5	20-35	Own	4-5½x6¾	I	Block	900	Own	Cent.	1800	Circ-Pr	.....	Gear	Bosch	Yes	Holley	No	Grv	1½G-40K	Bennett
Twin City 40-65	.....	8	40-65	Own	4-7¾x9	I	Singly	535	Own	Cent.	3500	Splash	Detroit	.....	K-W	Yes	Holley	No	Pump	10G-95K	.....
Uncle Sam C-20	1,385	2-3	12-20	Weidely	4-4 x5½	I	Block	1200	Own	Cent.	770	Sp-Pr	.....	Gear	Splitdorf	....	Kingston	No	Grv	19G or K	Bennett
Uncle Sam B-19	2,300	3-4	20-30	Beaver	4-4¾x6	I	Block	1000	Duplex	Cent.	1050	Sp-Pr	.....	Gear	Splitdorf	Yes	Bennett	No	Grv	5G-20K	Bennett
Utilitor 501	380	5-7	2-4	.....	1-3½x4½	L	Single	1000	Edco	Cent.	....	Splash	.....	.....	Eisemann	No	Holly	No	Grv	.....	Own
Victory 15-30	1,750	3	15-30	Waukesha	4-4¼x5¾	....	Pairs	1000	Waukesha	Cent.	750	Sp-Pr	.....	Plunger	Splitdorf	Yes	Miller	No	Grv	25G	Bennett
Victory 9-18	1,385	2	9-18	Gray	4-3½x5	I	Block	1000	Pierce	Cent.	500	Sp-Pr	.....	Plunger	Splitdorf	Yes	Carter	No	Grv	25G	Bennett
Vim 15-30	1,650	3	15-30	Waukesha	4-4⅜x5¾	L	Pairs	1000	Waukesha	Cent.	845	Press	.....	Gear	Simms	No	Bennett	No	Grv	3G-12K	R. W
Wallis K	.....	3	15-25	Own	4-4¼x5¾	I	Block	900	Own	Hyd	750	Splash	.....	Plunger	Berling	Yes	Bennett	No	Grv	20K	Bennett
Waterloo N	.....	3	12-25	Own	2-6½x7	I	Block	750	Own	Cent.	1200	Spray	.....	Plunger	Splitdorf	Yes	Schebler	Yes	Grv	1G-20K	.....
Wellington B	.....	2-3	12-22	Erd	4-4 x6	....	Block	900	Erd	.....	1000	Sp-Pr	.....	Plunger	Splitdorf	Yes	Stromberg	No	Grv	10G-20K	Ross
Wellington F	.....	3-4	16-30	Chief	4-4¾x6	I	Block	900	Chief	Cent.	1250	Sp-Pr	.....	Gear	Splitdorf	Yes	Stromberg	No	Grv	10G-20K	Ross
Wetmore 12-25	1,650	3	12-25	Waukesha	4-4 x5¾	L	Pairs	1000	Waukesha	Cent.	900	Pressure	.....	Gear	Splitdorf	Yes	Schebler	No	Grv	2½G-12K	.....
Whitney 9-18	1,175	2	9-18	Own	2-5½x6½	L	Singly	750	Own	Cent.	650	Pressure	M-K	.....	Splitdorf	Yes	Bennett	No	Grv	10G	Bennett
Wichita T	2,500	3	30-15	Beaver	4-4½x6	I	Block	950	Duplex	Cent.	1000	Sp-Pr	M-K	.....	Berling	Yes	Ensign	No	Grv	½G-25K	Bennett
Wisconsin	2,250	4	16-30	Climax	4-5 x6½	L	Pairs	800	Climax	Cent.	1350	Pressure	.....	Gear	Eisemann	Yes	Stromberg	No	Grv	6G-25K	Bennett
Zelle 12-25	.....	2	12-25	.....	4-4¼x5½	L	Block	1000	.....	Cent.	600	Sp-Pr	.....	Plunger	.....	Yes	Carter	Yes	Vac	5G-25K	Leonard

ABBREVIATIONS—Cent—Centrifugal; **Circ**—Circulating; **Circ-Pr**—Circulating Pressure; **Circ-Sp**—Circulating Splash; **Cont**—Contracting; **Elec**—Electric; **Expand**—Expanding; **Fric**—Friction; **Grv**—Gravity; **H**—Horizontal; **Hyd**—Hydraulic; **Ind**—Individual; **L**—L-Head;

ft. p.m. adopted by the S. A. E. some years ago, the average for different classes going up somewhat with the plow capacity. The average wheelbase of the two and three-plow tractors has decreased, whereas that of the four-plow tractors has increased.

The relation between knuckle steering and axle steering remains the same. Of the new tractors that have come out during the year 1920 a majority have been of the frameless type. The average diameter of the driving wheels remains substantially the same for two and three-plow tractors, but has come down by 2 in. in the case of four-plow tractors. An appreciable decrease in weight is shown for each capacity class of tractor.

ANALYSIS OF THREE YEARS' TRACTOR SPECIFICATIONS*

	1919	1920	1921
Form of traction			
Wheel tractors	86%	85.5%	94%*
Creeper tractors	14%	14.5%	6%
Plow Capacity (14-in. bottoms)			
Single-plow tractors	2%	6.6%	8%*
Two-plow tractors	13%	18.9%	17%
Three-plow tractors	49%	41.5%	36%
Four-plow tractors	22%	16%	16%
Five or more plow tractors	14%	17%	15%
Engine Cylinder Number			
Single-cylinder engines	1%	....	2%*
Two-cylinder engines	16%	19%	15%
Four-cylinder engines	82%	80%	81%
Six-cylinder engines	....	1%	2%
Eight-cylinder engines	1%	....	....
Type of Engine			
Horizontal	28%	25.5%	24%*
Vertical	72%	74.5%	76%
Cylinder Castings, Four-Cylinder			
Block-cast	55%	52%	54%*
Pair-cast	35%	41%	38%
Single-cast	10%	7%	8%
Average Piston Displacement			
Two-plow tractors	240 cu. in.	290 cu. in.	261 cu. in.
Three-plow tractors	370 cu. in.	422 cu. in.	386 cu. in.
Four-plow tractors	450 cu. in.	575 cu. in.	528 cu. in.
Average Engine Weight			
Per cu. in. displacement	2.4 lb.	2.69 lb.	....
Per belt horsepower	36 lb.	39 lb.	....
Fuel Feed			
Gravity	88%	83%	86%*
Pump	8%	10%	9%
Vacuum	4%	7%	5%
Cooling Water Circulation			
Pump	93%	83%	74%*
Thermo-siphon	7%	17%	26%
Engine Lubrication			
Gear type pump	34%	51%	47%*
Piston type pump	29%	21%	27%
Vane type pump	....	3%	4%
Mechanical lubricators	37%	25%	22%
Average Piston Speed			
Four-cylinder engines	....	860 ft.p.m.	883 ft.p.m.
Types of Clutch			
Friction drive (no clutch)	13%	4%	7%*
Cone	10%	11%	3%
Disk	34%	48%	60%
Block	43%	37%	30%

Farm Tractors for 1921—(Continued)

Radiator Make	Cooling System Capacity	Cooling Fluid	Fluid Circulation	Belt Pulley Diameter, Face and R.P.M.	Gearset Make	Clutch Make	Clutch Type	No. of Forward Speeds	Differential Lock	Final Drive	Plowing Speed	No. of Driving Wheels	Diameter and Face	No. of Tracks	Drive Wheel Axle Type	No. of Non-drive Wheels	Steering Arrangement	Frame Material	Wheelbase	Total Weight	Name and Model
Eureka	12	Water	Pump	16 x 7 - 650	Own	Own	Cone	3	No	Axle	3	2	50 x12	....	Live	2	Knuckle	Steel	80	4700	Peoria L
S. J.	13	Water	Pump	14 x 7 ...	Own	Own	Disc	3	No	Spokes	2¾	2	60 x18	....	Revolving	2	Knuckle	Steel	89	6500	Pioneer 18-36
S. J.	25	Water	Pump	18 x15 - 625	Own	Own	Disc	3	No	Spokes	2½	2	96 x24	....	Revolving	2	Knuckle	Channel	140	23000	Pioneer 30-60
Perfex	12	Water	Pump	14 x 8 - 590	Foote	Twin	Disc	2	No	Rim	3	2	60 x12	....	Dead	2	Knuckle	Channel	99	5400	Plowman A
Bremer	8¾	Water	Pump	14 x 8 - 650	Own	Rock	Fric	2	No	Rim	2	2	56 x10	....	Revolving	2	Knuckle	Channel	93	5960	Port Huron A
Perfex	9	Water	Pump	14 x 6 - 700	Fuller	Fuller	Disc	3	No	Axle	2¾	2	32 x4	....	Live	2	Power	Steel	108	4500	Post D
Bremer	2½	Water	Ther.	5 x 1 - 500	Own	Borg & Beck	Plate	1	Yes	Rim	1½	4	30 x6½	....	Dead	none	Own	Steel		830	Ranger A
Tank	50	Water	Pump	18 x 7 - 600	Own	....	....	2	No	Axle	2 1/1	2	48 x10	....	Live	2	Swinging	Struct	77	3785	Reliable 10-20
Perfex	9	Water	Pump	12 x 7 - 900	Own	Own	Shoes	2	No	Gears	2½	2	60 x1	....	Revolving	2	Knuckle	Channel	84	5500	Rex 12-25
Own	10	Water	Pump	18 x 6 - 375	Own	Own	Disc	2	No	Axle	2	2	45 x12	....	Live	2	Knuckle	....	64½	3233	Samson M
Perfex	8	Water	Pump	8 x 6 -1000	Own	Own	Cone	2	No	Rim	3	2	48 x10	....	Live	2	Knuckle	Channel	96	4920	Sandusky J
Perfex	30	Water	Pump	15 x10 - 800	Own	Own	Shoe	3	No	Rim	2	2	56 x16	....	Live	2	Swinging	Channel	100	9300	Sandusky E
Modine	6	Water	Pump	14 x 8 - 650	Foote	Twin	Disc	2	No	R.Spokes	3½	2	48 x12	....	Live	2	Knuckle	Channel	80	4800	Shelby D
Modine	....	....	....	10 x 7 - 850	....	Fuller	Disc	3	....	....	3	2	44 x12	....	....	2	....	Channel	72	3400	Shelby C
Modine	10	Water	Pump	12 x 8 - 850	Own	....	....	2	No	Rim	2½	2	60 x12	....	Dead	1	Swinging	Struct	130	7500	Square Turn A
Todd	10	Water	Pump	12 x 8 -1000	Own	Own	Spur	1	No	Axle	2 8/10	2	60 x12	....	Live	2	Knuckle	Steel	114	7100	Stinson 4-E
G. & O.	10	Water	Pump	12 x 7 - 700	Own	Twin	Disc	2	Yes	Hub	2 7/10	2	36 x16	....	Dead	2	Knuckle	Channel	80	4950	Tioga T-3
Own	40	Water	Ther.	18 x10½ - 575	Own	Own	Shoe	2	No	Spokes	2¾	2	54 x10	....	Live	2	Knuckle	Struct	91	5710	Titan 10-20
Bremer	12	Water	Pump	10 x 8 - 950	Own	Hilliard	Disc	3	No	Rim	2½	4	42 x12	....	Live	none	Swinging	Struct	100	7500	Topp-Stewart B
G. O.	3	Water	Ther.	8 x 6 -1200	Own	Borg & Beck	Plate	1	No	Rim	3	2	38 x10	....	Live	2	Knuckle	Steel	69	1750	Traylor T
Perfex	5	Water	Pump	.. x14 - 650	Foote	Twin Disc	Disc	2	Yes	Rim	2½	2	54 x12	....	Dead	2	Knuckle	Struct	80	4300	Turner 14-25
Modine	10	Water	Pump	16 x 6½ ...	Own	Twin	Disc	2	No	Axle	2 9/10	2	50 x12	....	Live	2	Knuckle	Channel	84	4300	Twin City 12-20
Modine	10	Water	Pump	21 x 8½ ...	Own	Twin	Disc	2	No	Axle	2.9	2	60 x20	....	Live	2	Knuckle	Channel	97	8350	Twin City 20-35
Own	130	Water	Pump	23 x10½ ...	Own	Own	Shoe	1	No	Rim	1.9	2	84 x24	....	Revolving	2	Knuckle	Steel	144	23700	Twin City 40-65
Perfex	12	Water	Pump	12 x 6 -1200	Own	Borg & Beck	Plate	2	No	Chain	3½	2	45 x10	....	Live	2	Knuckle	Struct	71	3500	Uncle Sam C-20
Perfex	12	Water	Pump	11 x 8½ - 900	Nuttall	Twin	Disc	2	No	Axle	2½	2	50 x12	....	Live	2	Knuckle	Struct	85	4500	Uncle Sam B-19
Fedders	....	Water	Ther.	4½x 3¾-1000	....	....	....	....	....	....	2½	2	25	....	....	2	Clutches	....	....	750	Utiliter 501
Own	5½	Water	Pump	10 x 6 -1000	Own	Borg & Beck	Plate	2	Yes	Axle	2¼	2	48 x12	....	Live	2	Knuckle	Steel	72	3500	Victory 15-30
Own	5	Water	Ther.	10 x 6 -1000	Own	Borg & Beck	Plate	2	Yes	Axle	2¼	2	48 x12	....	Live	2	Knuckle	Steel	72	3250	Victory 9-18
B. W.	1	Water	Pump	10 x 7 -1000	Own	Borg & Beck	Plate	2	No	Axle	3	2	48 x12	....	Live	2	Knuckle	Channel	72	4000	Vim 15-30
Modine	6	Water	Pump	18 x 6¾ - 430	Own	Twin	Disc	2	No	Axle	2½	2	48 x12	....	Live	2	Knuckle	Steel	84	3560	Wallis K
Modine	13	Water	Pump	14 x 8 - 750	Own	Own	Shoe	2	No	Rim	2½	2	52 x12	....	Revolving	2	Knuckle	Struct	88	5850	Waterloo N
Modine	8	Water	Pump	14 x 6½ - 740	Foote	Twin	Disc	....	....	Rim	....	2	48 x12	....	....	....	Knuckle	Struct	78	4200	Wellington B
Modine	10	Water	Pump	14 x 8½ - 740	Foote	Twin	Disc	....	No	Axle	....	2	48 x14	....	....	2	Knuckle	Struct	72	5000	Wellington F
Ideal	8	Water	Pump	12 x 7 - 900	Fuller	Fuller	Disc	3	No	Spokes	3½	2	46 x10	....	Dead	2	Knuckle	Steel	72	2900	Wetmore 12-25
Modine	7	Water	Pump	11 x 6¾ - 750	Own	Own	Shoe	3	No	Axle	2½	2	48 x10	....	Live	2	Knuckle	Channel	82	2850	Whitney 9-18
Perfex	9	Water	Pump	10½x 6 - 950	Nuttall	Twin	Disc	2	No	Axle	2 6/10	2	48 x12	....	Live	2	Knuckle	Struct	93	6000	Wichita T
Perfex	12	Water	Pump	16 x 8 - 600	Foote	Twin	Disc	2	No	Rim	3½	2	52 x12	....	Revolving	2	Knuckle	Channel	86	5440	Wisconsin
Harrison	12	Water	Pump	12 x 7 -1000	Own	Borg & Beck	Plate	4	No	Rim	2½	2	54 x12	....	Revolving	2	Knuckle	Steel	72	3800	Zelle 12-25

O—Opposed; **Splash-Gr**—Splash Gravity; **Sp-Pr**—Splash Pressure; **Struct**—Structural Steel; **T**—T-head; **Throt**—Throttle; **V**—Vertical; **Vac**—Vacuum. **EQUIPMENT—M-K**—Madison Kipp.

	1919	1920	1921
Number of Forward Speeds			
One	17.4%	19.7%	15%*
Two	63%	55%	58%
Three	15.3%	22%	24%
Four or more	4.3%	3.3%	3%
Average Wheelbase			
Two-plow tractors	83.5 in.	82.5 in.	79.5 in.
Three-plow tractors	96 in.	90 in.	85 in.
Four-plow tractors	97 in.	93.5 in.	100 in.
Method of Steering			
Knuckle	83%	74%	74%*
Swinging axle	17%	26%	26%
Average Diameter of Drive Wheels			
Two-plow tractors	50 in.	46.5 in.	46.3 in.
Three-plow tractors	52 in.	53 in.	53.4 in.
Four-plow tractors	....	59 in.	57 in.

	1919	1920	1921
Average Weights			
Two-plow tractors	3,670 lb.	4,000 lb.	3,721 lb.
Three-plow tractors	5,100 lb.	5,450 lb.	5,218 lb.
Four-plow tractors	6,050 lb.	7,800 lb.	7,461 lb.

*It should be noted that the figures given in this table are based upon specifications published in AUTOMOTIVE INDUSTRIES, this data being compiled from replies to questionnaires sent out for the purpose. In some cases the complete data requested is not furnished, hence the figures given are based upon returns actually made. For example, if 60 out of 100 tractors are reported to have vertical engines and 30 to have horizontal engines (10 makes failing to give data on this point), the table would show 66.7 per cent vertical engines and 33.3 per cent horizontal, the assumption being that of the 10 not reporting the percentage of vertical and horizontal will be the same as in the case of those reporting.

Forest Fire Patrol Activities from March Field

A CONSOLIDATED report of forest fire patrol activities carried on from March Field from May 19th to October 31, 1920, gives some interesting statistics.

Total number of flights	314
Total flying time	1,143 hrs. 38 min.
Total gallons gasoline consumed	19,990
Total gallons of oil consumed	1,222¼
Area of square miles covered	131,479,493
Total miles flown	108,920
Total number of fires discovered	131
Total number of planes flown (DH-4B's)	6
Total number of minor accidents	1
Total number of major accidents	None

This patrol was carried on under the direction of Captain Ernest Clark, officer in charge of flying at this field. Pilots were graduate cadets from this school. C. R. Benton, forester, was stationed at the field during the patrol season, relaying information about fires from the radio station to the various rangers in the mountain reserves.

Gas Tractor Engine Exports—Increase from 1914 to 1920

Large business with Canada continues during 1920, while nearly 20 per cent of engines exported go to South American countries.

AGAIN of 10 per cent in the number of gas tractor engines exported from the United States is recorded for 1920 over the 1919 figures. During the last year 22,481 engines were sent to foreign countries, 2045 more than were exported during the previous year.

Canada received the largest number of these exported engines during 1920, its total being 9606, while the Philippine Islands came next with a total of 1461. A few of the countries to receive the largest number of engines during the past year are:

Canada	9,606
France	2,071
Philippine Islands	1,461
England	977
Argentina	920
Peru	701
Australia	600
Spain	492

To South America as a whole went 4295 engines, comprising slightly over 19 per cent of the total gas tractor engine exports. The value of the engines sent to South America was $2,218,464 which is about 9.9 per cent of the total value of gas tractor engines exported during the year 1920.

This indicates that the South American countries were larger buyers of light gas tractor engines than the rest of the world as a whole, and that the market for small engines is better than for heavy ones in this section. This is further borne out by the fact that the average value of all engines exported in 1920 was $978, while the average value of those sent to South America alone was but $516.

Following is the average value of gas tractor engines exported each year:

1914	$1,965
1915	2,152
1916	2,040
1917	1,320
1918	1,018
1919	980
1920	978

This shows a steady decrease in the average price

Gas Tractor Engine

	1914	1915	1916	1917	1918	July 1 to Dec. 31 1918	Calendar Year 1919	1920	Total for all years
Europe:									
Austria-Hungary	20 / $58,977	....	....	....	....	....	....	....	20 / $58,977
Belgium	....	....	....	....	....	....	232 / $191,710	156 / $128,830	388 / $320,540
Bulgaria	8 / $9,433	....	....	....	....	....	....	26 / $27,061	34 / $36,494
Denmark	....	....	$23,905	7 / $9,130	1 / $2,370	2 / $6,800	890 / $770,715	192 / $170,374	1,108 / $983,294
Finland	....	....	....	....	....	....	5 / $6,800	29 / $67,823	34 / $74,623
France	2 / $4,986	25 / $100,500	28? / $744,240	1,20? / $1,259,232	2,157 / $2,428,335	555 / $1,036,879	4,620 / $5,066,823	2,071 / $1,691,594	10,918 / $12,332,549
Germany	47 / $121,652	....	....	....	....	....	35 / $22,820	4 / $2,812	86 / $147,284
Greece	....	....	....	....	9? / $95,500	3? / $16,800	126 / $85,723	36 / $40,051	295 / $238,074
Iceland and Faroe Islands	....	....	....	....	....	....	3 / $4,550	2 / $3,208	5 / $7,758
Italy	1 / $3,683	....	....	135 / $125,043	5,406 / $4,742,132	2,570 / $3,229,190	375 / $682,379	53 / $81,782	8,540 / $8,864,209
Netherlands	1 / $3,750	....	....	4 / $7,400	....	....	55 / $62,295	122 / $93,376	182 / $166,821
Norway	....	....	....	39 / $58,648	1 / $1,093	105 / $125,890	138 / $139,624	159 / $182,891	442 / $508,146
Poland and Danzig	....	....	....	....	....	....	....	261 / $217,737	261 / $217,737
Portugal	....	....	....	1 / $495	20 / $31,239	....	39 / $52,787	17 / $49,589	77 / $134,110
Roumania	23 / $55,320	....	....	....	....	....	106 / $127,178	77 / $114,610	206 / $297,108
Russia in Europe	67 / $196,617	26 / $69,370	11 / $84,550	136 / $353,666	366 / $959,424	....	7 / $9,000	10 / $10,200	656 / $1,682,827
Serbia, Montenegro, etc	....	....	20 / $27,000	....	....	....	1 / $584	....	21 / $27,584
Spain	2 / $7,405	....	1 / $1,050	53 / $55,169	12 / $11,728	8 / $11,030	182 / $212,985	492 / $553,055	750 / $852,422
Sweden	....	....	....	6 / $5,304	....	....	275 / $248,134	333 / $438,105	614 / $691,543
Switzerland	....	....	....	....	1 / $2,339	....	21 / $18,078	1 / $1,625	23 / $22,042
Turkey in Europe	....	....	....	....	....	....	20 / $28,564	3 / $5,021	23 / $33,585
United Kingdom:									
England	....	80 / $343,922	611 / $1,843,229	2,926 / $4,747,841	8,969 / $8,807,131	1,029 / $1,524,521	2,088 / $1,490,515	977 / $916,324	16,603 / $19,673,483
Scotland	....	1 / $1,562	....	....	64 / $105,882	9 / $52,466	1 / $600	31 / $24,967	106 / $185,477
Ireland	....	....	....	51 / $29,325	....	....	354 / $209,613	....	405 / $238,938
Jugoslavia, Albania, etc	....	....	....	....	....	....	....	7 / $8,622	7 / $8,622
North America:									
British Honduras	....	1 / $298	....	3 / $8,315	....	....	....	....	4 / $8,613
Canada	389 / $637,162	252 / $281,867	68? / $693,328	2,009 / $3,047,523	5,82? / $5,774,288	3,208 / $2,628,569	6,733 / $6,336,233	9,606 / $8,420,955	29,603 / $27,819,925
Central American States:									
Costa Rica	....	....	....	1 / $2,275	....	....	5 / $7,057	21 / $16,591	27 / $25,923
Guatemala	....	....	....	....	1 / $802	....	4 / $3,453	53 / $44,675	58 / $48,930
Honduras	2 / $3,682	....	5 / $8,928	5 / $7,302	....	....	8 / $13,835	8 / $21,972	28 / $55,719
Nicaragua	2 / $2,170	....	....	....	2 / $2,800	2 / $3,781	....	9 / $15,718	15 / $24,469
Panama	....	2 / $9,488	....	....	16 / $12,412	7 / $5,600	12 / $15,739	3 / $4,779	40 / $48,018
Salvador	....	....	....	1 / $2,800	....	1 / $1,400	3 / $5,800	5 / $6,088	10 / $16,088
Mexico	5 / $13,600	5 / $12,400	26 / $41,449	59 / $91,902	285 / $430,472	113 / $150,585	291 / $326,855	391 / $775,133	1,175 / $11,447,396
Newfoundland and Labrador	....	....	....	....	....	....	4 / $15,996	2 / $9,855	6 / $25,851
West Indies, British:									
Barbados	....	....	....	....	3 / $2,015	....	8 / $6,424	4 / $3,225	15 / $11,664
Jamaica	....	....	....	....	1 / $230	8 / $7,614	13 / $16,034	16 / $17,995	38 / $41,873
Trinidad and Tobago	....	....	....	....	1 / $1,632	5 / $8,349	11 / $15,076	11 / $23,981	28 / $49,038
Other British	....	....	....	....	2 / $1,708	1 / $1,496	3 / $2,550	6 / $5,966	12 / $11,720
Cuba	15 / $54,845	24 / $77,531	60 / $135,309	179 / $209,157	165 / $247,662	110 / $154,615	253 / $345,404	390 / $606,739	1,196 / $1,831,262
Dominican Republic	....	....	1 / $858	1 / $4,650	4 / $3,590	....	14 / $14,814	47 / $126,239	67 / $150,151
Danish West Indies (Virgin Is.)	....	....	....	....	....	3 / $3,525	2 / $2,177	12 / $18,940	17 / $24,642
Dutch	....	1 / $1,525	....	....	....	....	2 / $704	....	3 / $2,229
French	....	....	....	....	2 / $2,095	....	8 / $10,065	3 / $1,953	13 / $14,113

Exports 1914-1920

	1914	1915	1916	1917	1918	July 1 to Dec. 31 1918	Calendar Year 1919	1920	Total for all years
Haiti	....	....	....	....	1 $1,150	....	13 $16,146	9 $34,490	23 $51,786
South America:									
Argentina	73 $103,915	4 $1,828	18 $37,926	5 $7,848	7 $4,050	46 $66,778	528 $398,807	920 $721,527	1,601 $1,337,679
Bolivia	....	....	....	....	....	4 $6,300	7 $4,950	9 $3,519	20 $14,769
Brazil	6 $8,326	1 $2,724	5 $3,216	8 $7,499	4 $11,600	11 $12,600	96 $75,054	269 $308,236	400 $429,255
Chile	4 $10,540	1 $1,346	....	1 $3,175	16 $18,296	2 $2,922	167 $169,552	333 $304,242	524 $510,073
Colombia	1 $3,620	....	1 $2,100	....	12 $10,728	1 $4,377	....	14 $34,890	29 $55,715
Ecuador	....	....	....	....	....	....	5 $7,125	5 $6,000	10 $13,125
Guiana, British	....	....	....	1 $3,100	16 $13,727	17 $16,683	32 $47,820	76 $96,719	142 $178,049
Guiana, Dutch	....	....	....	....	....	....	2 $2,536	8 $19,739	10 $22,275
Guiana, French	....	....	....	....	....	....	....	1 $4,814	1 $4,814
Paraguay	1 $1,638	....	....	....	6 $7,111	....	....	2 $8,050	9 $16,799
Peru	2 $5,865	2 $3,971	....	10 $19,508	83 $101,594	154 $182,418	317 $314,018	701 $552,360	1,269 $1,179,734
Uruguay	....	....	....	....	....	7 $5,495	59 $46,773	112 $100,825	178 $153,093
Venezuela	3 $3,753	....	....	3 $8,237	....	....	22 $26,149	45 $57,543	73 $95,682
Asia:									
China	....	....	....	4 $3,396	....	....	7 $13,091	14 $29,814	25 $46,301
Kwantung, leased territory	....	....	....	3 $2,898	....	....	1 $2,670	2 $2,600	6 $8,168
Chosen	....	....	....	....	....	....	14 $22,271	....	14 $22,271
East Indies: British:									
British India	2 $4,619	....	....	3 $1,900	1 $2,842	2 $2,318	105 $86,437	316 $294,668	428 $392,794
Straits Settlements	....	1 $3,000	....	....	1 $2,063	....	32 $26,818	145 $207,281	179 $239,162
Other	....	....	....	....	....	....	13 $8,110	17 $11,160	30 $19,270
Dutch	....	5 $18,217	3 $12,421	5 $24,400	2 $10,241	7 $5,847	47 $68,248	184 $352,725	253 $492,099
French	....	....	....	....	1 $4,900	....	2 $1,552	73 $58,024	76 $64,476
Hong Kong	....	....	....	....	....	....	....	1 $3,303	1 $3,303
Japan	....	....	....	14 $20,332	5 $15,016	11 $13,302	50 $172,036	146 $119,000	226 $339,686
Russia in Asia	....	....	....	113 $305,192	....	....	2 $7,500	....	115 $312,692
Siam	....	....	....	....	....	....	3 $8,047	12 $19,588	15 $27,635
Turkey in Asia	1 $2,762	....	....	....	....	....	1 $440	25 $27,868	27 $31,070
Oceania: British:									
Australia	42 $71,428	18 $37,144	32 $37,441	22 $25,015	21 $19,505	21 $24,123	252 $279,371	600 $487,152	1,008 $981,179
New Zealand	....	....	16 $16,839	54 $57,863	40 $46,499	286 $181,588	170 $180,592	322 $360,734	888 $844,115
Other British	....	....	....	2 $2,964	....	....	....	3 $2,040	5 $5,004
German	....	....	....	....	....	....	1 $614	....	1 $614
French	....	....	....	1 $1,453	....	....	....	2 $1,929	3 $3,382
Philippine Islands	....	3 $12,992	2 $9,560	7 $9,137	13 $28,107	52 $102,408	687 $769,045	1,461 $1,763,878	2,225 $2,695,127
Africa:									
Belgian Kongo	....	....	....	....	....	....	1 $3,417	....	1 $3,417
British Africa:									
West	1 $4,760	....	....	....	....	....	....	6 $30,068	7 $34,828
South	4 $11,399	3 $3,613	2 $1,527	4 $3,240	36 $21,267	14 $9,900	325 $189,392	407 $413,015	795 $653,353
East	....	....	....	....	....	1 $300	15 $20,849	61 $71,478	77 $92,627
Egypt	3 $7,988	....	....	....	....	7 $2,185	29 $23,249	170 $188,680	209 $222,102
French Africa	1 $2,289	....	....	8 $8,305	1 $1,124	7 $5,250	363 $390,261	344 $278,181	724 $685,410
Morocco	....	....	....	....	1 $1,180	1 $575	110 $71,569	6 $8,447	118 $81,771
Portuguese Africa	....	....	1 $1,620	....	3 $7,144	....	2 $6,970	15 $30,911	21 $46,645
Totals	721 $1,416,294	455 $983,198	1,858 $3,726,496	7,988 $10,540,639	23,560 $23,995,023	8,426 $9,614,479	20,436 $20,026,172	22,481 $21,965,959	85,925 $92,268,260

since 1915, indicating that there has been an increased sale of lighter engines, and that it is to this class of gas tractor engine that much of the increased export trade in this field may be attributed.

The value of tractor engine exports increased in 1920 to $21,965,959, a gain of $1,937,-787 over 1919. This is an increase of 9.79 per cent. The enormous jump in the value of gas tractor engine exports during the last seven years can be readily perceived, when it is noted that a value gain of 1430 per cent has been made during that time.

It is interesting to note which countries have bought the most from U. S. gas tractor engine manufacturers during the seven years covered by the accompanying table. As might be expected, such an examination shows the largest business to have been done in general with the largest countries. The first five are in order as follows:

Canada	$27,819,925
England	19,673,483
France	12,332,549
Mexico	11,447,396
Italy	8,864,209

The large business with Canada may be attributed to its proximity and the freedom of intercourse between U. S. and Canada during the war period. The large Mexican total, it will be noted, is due rather to a steady business each year, rather than to extremely large sales in any one year. This steady business has remained on a high level since 1918 and has reached a new high mark in 1920.

Weight per Sq. Ft. of Sheet Steel

Gage	lb. per sq. ft.
0000000	20.00
000000	18.75
00000	17.50
0000	16.25
000	15.
00	13.75
0	12.50
1	11.25
2	10.625
3	10.
4	9.375
5	8.75
6	8.125
7	7.5
8	6.875
9	6.25
10	5.625
11	5.
12	4.375
13	3.75
14	3.125
15	2.8125
16	2.5
17	2.25
18	2.
19	1.75
20	1.50
21	1.375
22	1.25

British Agricultural Tractor Practice in 1921

No standard type yet developed. All engines are vertical but some are of low speed type and one uses fuel injection. Two speed gearset usually provided. Creeper types in favor with British farmers.

By M. W. Bourdon

THE accompanying list of agricultural tractors made in Great Britain indicates that the manufacture of these is a very extensive industry. The lead set by Ford has been followed by Austin, but this maker is practically alone among British manufacturers in adopting a comparatively high-speed lightweight motor in a compact and lightweight frameless machine with four wheels and two tracks.

There is actually no one type of tractor which can be said to represent general practice among British makers, but there is a tendency to favor a somewhat heavier machine than the Ford or Austin, with a larger engine than either of the latter. The new makes following these lines which have created a good impression are the Martin tractor, as distinct from the self-contained plow of that name, and the Peterborough, the latter having a Ricardo trunk piston engine. The British Wallis also exemplifies this type; it is made by a prominent engineering firm, Ruston, Proctor & Co., Lincoln, and has many modifications compared with the American Wallis, making it more compatible with British ideas. It is a four-wheeled machine with two tracks, and secured the highest award in its class in the British Tractor Trials last September.

There is no British tractor manufacturer using a horizontal engine, but the low speed of revolution which the horizontal type suggests occurs in the Sanderson. The Blackstone, which has a motor also with a normal speed of 750 r.p.m., is of a special type with three cylinders and low-tension magneto ignition. It also has a special vaporizing system in which the fuel is injected directly into the cylinders, the latter being previously charged with air under pressure. This engine is fitted with a compressed air starter, but generally speaking the Blackstone tractor has yet to prove its serviceability in practical use. The Glasgow three-wheel drive three-track machine, with a Continental engine, is making a good name for itself and is slowly getting into production, though it is the intention eventually to fit it with an Argyll-Burt single sleeve motor and to quadruple at least the present output of approximately 12 to 15 tractors per week.

There is a tendency to fit more efficient brakes to British tractors, the latter in several cases being provided with expanding shoes within wheel drums, these supplementing a block applying to the belt pulley.

Except in those machines designed for road haulage as well as work on the land, two forward speeds are most generally provided; but in regard to final drive there is no uniformity, practically every available system being utilized by one maker or another. The chain track machine is represented by only one example that counts, namely, the Martin self-contained plow. Both the Crawley and the Fowler, other self-contained implements, are of the wheeled type with the motor balanced against the plow, respectively front and back of the main axle. The chain track machine does not find much favor among British farmers, and it is anticipated that before long this type will not be produced by any British agricultural tractor manufacturer.

British Agricultural Tractor Specifications for 1921

No.	Make	Make of Engine	Cylinders Bore and Stroke	Normal R.P.M.	Lubrication System	Type of Oil Pump	Make of Carburetor	Fuel	Water Injection	Air Cleaner	Type Dry or Wet	Water Circulation	Type of Clutch	No. of Forwd. Speeds	Final Drive	Traction Wheel or Chain	No. of Tracks	No. of Driving Wheels	No. of Non-Driving Wheels	Wheelbase	Engine and Gearset as Unit	Weight	Ploughing Speed
1	Austin	Own.	4-3¾x5	1500	F.F.	G.	Zenith	K.	No.	Yes.		Ther.	Cone.	2	Spur.	Wh.	2	2	2	68	Yes.	2900	2½-3
2	Blackstone	Own.	3-5 x6½	750	F.F.	G.	Own	K.	Yes.	No.		Pmp.	Cone.	3	Spur.	Ch-T.	2				No.	5040	3
3	Crawley	Own.	4-4½x5½	1100	Pres	G.	Rayfield.	K.	No.	No.		Pmp.	Cone.	2	Gear.	Wh.	2	2	1	101	No.	4700	2¾-3½
4	Fowler	Wauk	4-3¾x5¼	1000	C-S.	P.	Zenith.	G.	No.	No.		Pmp.	Plate.	2	Spur.	Wh.	2	2			Yes.	3360	2-3
5	Martin*	Gall.	4-4¼x5½	1000	C-S.	P.	Holley.	K.	No.	Yes.	W.	Pmp.	Cone.	3	Bull.	Wh.	2	2	2	86	No.	5600	2
6	Pick	Own.	4-4½x5	800	Splash.	H.	Zenith.	G.	No.	No.		Pmp.	Cone.	3	Worm.	Wh.	2	2	2	90	Yes.	4480	2½
7	Glasgow	Cont.	4-4⅛x5¼	1200	C-S.	P.	Holley.	K.	No.	Yes.	D.	Pmp.	Cone.	2	Bevel.	Wh.	3	3	None	75	Yes.	4200	2
8	Martin†	Gall.	4-4¼x5½	1000	C-S.	P.	Holley.	K.	No.	Yes.	W.	Pmp.	Cone.	1	Spur.	Ch-T.	2				No.	4200	2¼
9	Peterboro	Ric.	4-4¾x5½	900	F.F.	P.	Zenith.	K.	No.	No.		Pmp.	Cone.	2	Spur.	Wh.	2	2	2	87	No.	4800	2½
10	Saunderson	Own.	2-5½x8	750	F.F.	G.	Own.	K.	No.	Yes.	D.	Ther.	Cone.	3	Spur.	Wh.	2	2	2	90	No.	5600	1½-2½
11	Saunderson Junx	Own.	2-5 x6½	950	F.F.	G.	Own.	K.	No.	Yes.	D.	Ther.	Cone.	2	Spur.	Wh.	2	2	2	78	No.	3360	2½
12	Wallis (British)	Rust.	4-4¼x5¾	850	F.F.	G.	Halliday.	K.	Yes.	Yes.	W.	Pmp.	Disc.	2	Bevel.	Wh.	2	2	2		Yes.	3360	2½
13	Weeks	Wauk	4-4¼x5¾	900	C-S.	P.	Zenith.	K.	No.	Yes.	D.	Pmp.	Disc.	3	Bull.	Wh.	2	2	2	66	Yes.	3700	2½
14	Berna	Berna.	4-4⅛x6½	1000	Pr-Sp.	G.	Own.	G.	No.	No.		Pmp.	Cone.	3		Wh.		2	2	118	No.	7800	2-3
15	Ownitractor	Own.	2-6½x9	750	F.F.	G.	N.&P.	K.	Yes.	Yes.		Pmp.	Cone.	2		Wh.	2	2	2	90	Yes.	7500	2½
16	Santler		2-5 x6	800		P.	Own.	K.						2	Bull.	Wh.	3	2				5370	
17	Boon	Own.	2-5¼x7	800				K.	No.	No.		Pmp.		2	Bull.	Wh.	3	2	1	84	No.	5800	2 ½

*—Tractor; †—Self Contained Plow; **F. F.**—Force Feed; **Pres**—Pressure; **C-S**—Circulating Splash; **Pr-Sp**—Pressure & Splash; **G**—Gear; **H**—Hand; **P**—Plunger; **G**—Gasoline; **K**—Kerosine; **O**—Opt; **D**—Dry **W**—Wet; **Rol-S**—Rolled Steel; **Prs-S**—Pressed Steel; **Wauk**—Waukesha; **Gall**—Galloway; **Cont**—Continental; **Ric**—Ricardo; **Rust**—Ruston.

Exports of Automotive Parts 1907-1920

Not Including Engines and Tires

	1907	1910	1912	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918	Calendar Year 1919	1920	Total, inc. 1908 1909, 1911
Europe:													
Austria-Hungary	$717	$2,511	$2,195	$4,572	$5,198	$1,045	......	......	......	......	$825	$363	$10,594
Azores and Madeira Islands	......	50	99	720	1,384	1,800	$1,532	$1,270	$198	$1,600	1,909	4,094	14,723
Belgium	5,187	9,991	13,614	4,897	20,978	446	......	......	906	......	141,974	246,585	448,903
Bulgaria	......	......	823	40	390	......	......	......	......	......	307	89,697	91,428
Denmark	2,029	2,339	2,996	6,646	8,664	13,710	31,886	53,917	1,048	5,296	472,376	3,061,296	3,668,393
Finland	......	......	1,104	1,799	2,931	1,178	5,627	55	......	......	12,137	24,787	50,104
France	23,477	54,035	85,537	165,950	179,351	480,764	2,216,823	3,700,812	3,999,904	3,158,628	1,966,719	3,980,079	20,110,871
Germany	14,252	10,023	80,036	113,602	213,351	13,770	......	......	......	......	......	3,972	502,683
Gibraltar	......	57	100	......	514	229	617	525	61	......	834	6,166	8,269
Greece	......	......	454	379	807	2,010	24,724	12,604	4,675	13,415	102,715	113,077	274,387
Iceland and Faroe Islands	......	......	......	17	180	880	456	2,608	2,757	3,385	13,661	11,903	31,847
Italy	5,502	4,421	6,304	14,156	50,580	65,521	115,260	180,977	99,947	26,195	100,078	360,856	1,061,192
Malta, Gozo & Cyprus Islands	......	......	......	......	......	......	......	54	......	......	136	6,822	7,048
Netherlands	1,049	3,532	6,440	14,135	7,634	3,055	41,525	96,200	3,625	......	286,540	454,966	926,091
Norway	400	2,684	934	1,636	1,893	15,607	59,769	100,542	18,855	65,253	385,508	483,741	1,148,185
Portugal	......	394	865	920	2,357	3,239	45,356	66,929	20,274	11,770	58,031	176,328	388,186
Roumania	......	......	2,734	1,003	887	......	391	......	......	......	85,087	44,061	53,623
Russia in Europe	4,004	7,004	1,743	9,566	14,079	123,667	2,498,879	1,624,431	328,633	177	510	13,733	4,637,498
Serbia, Montenegro and Albania	......	......	113	......	......	......	4,932	......	......	......	350	......	4,395
Spain	3,620	2,854	3,755	3,192	6,266	7,347	32,743	95,720	154,850	52,848	227,977	3,228,719	3,822,547
Sweden	9,748	3,818	3,789	4,276	6,140	4,211	37,917	26,891	4,032	......	64,535	472,007	736,283
Switzerland	178	1,894	......	457	1,069	400	1,150	565	54	......	28,177	119,792	155,927
Turkey in Europe	......	......	964	116	......	267	......	......	......	......	83,178	103,977	188,593
England		240,329	931,909	922,866	1,282,388	3,282,973	7,202,475	6,121,211	6,329,114	3,328,599	6,369,838	22,455,836	59,155,360
Scotland	*116,248	238	874	1,485	23,269	29,403	52,414	22,146	955	154,686	53,060	114,476	460,563
Ireland		54	523	451	250	208	7,181	1,264	......	......	16,481	61,382	88,150
North America:													
Bermuda	......	......	52	330	254	125	615	64	7	......	125	219	2,045
British Honduras	193	73	165	509	163	684	548	1,379	2,638	1,839	6,183	10,090	24,911
Canada	195,989	1,023,368	2,392,592	3,104,097	3,663,879	2,741,178	7,492,639	9,148,110	12,054,824	5,677,029	16,865,619	21,635,691	88,196,698
Central American States:													
Costa Rica	255	2,376	1,320	4,516	6,208	5,041	10,162	7,498	23,613	1,924	8,217	20,024	93,035
Guatemala	24	2,124	2,062	1,851	1,613	732	2,367	9,852	9,111	2,882	20,078	47,260	107,972
Honduras	1,465	48	151	308	1,053	6,870	15,649	12,639	11,952	4,297	19,884	48,566	123,290
Nicaragua	160	38	86	741	47	609	666	964	2,264	4,894	26,930	56,222	93,711
Panama	274	3,180	4,689	11,738	16,988	25,861	34,180	56,657	72,180	26,403	88,546	116,274	394,352
Salvador	......	526	2,790	2,242	2,481	2,371	3,717	11,314	10,179	4,206	43,915	45,593	131,372
Mexico	131,553	81,248	47,479	46,743	41,508	30,819	42,258	125,823	431,440	260,492	704,873	1,074,909	3,206,914
Miquelon, Langley & St. Pierre Is.	......	......	......	......	300	......	25	5	65	29	279	69	772
Newfoundland and Labrador	132	1,508	2,026	2,993	3,901	3,632	8,672	9,972	4,129	5,245	26,196	28,582	104,474
West Indies, British:													
Barbados			3,209	5,055	4,177	4,216	6,383	14,452	15,089	7,192	25,902	38,735	128,276
Jamaica	†2,310	†14,085	23,569	25,355	24,693	32,337	53,867	54,854	65,429	22,071	92,521	196,302	628,495
Trinidad and Tobago			4,847	9,119	13,003	12,865	21,826	44,060	55,794	24,355	104,251	175,810	467,727
Other British			1,426	1,157	2,538	3,707	9,303	12,863	21,446	7,706	38,299	40,649	139,521
Cuba	18,095	49,088	31,594	35,928	48,217	101,429	411,731	906,710	1,028,277	566,079	1,582,241	2,288,292	7,165,557
Danish (Virgin Island of U. S.)	......	......	558	1,640	1,206	865	975	1,876	2,844	2,283	12,077	27,642	52,005
Dominican Republic	......	253	3,381	1,331	3,439	3,633	12,389	35,301	39,816	44,189	88,744	241,873	475,509
Dutch	......	......	281	1,767	2,754	4,598	3,288	6,052	4,707	1,490	5,435	7,441	38,055
French	50	101	97	198	8,099	7,423	9,546	24,672	53,518	17,495	83,474	68,954	273,939
Haiti	......	......	331	2,212	1,095	185	3,285	3,962	24,385	7,949	49,922	68,920	162,361
South America:													
Argentina	10,137	22,150	70,446	74,138	92,663	49,990	222,637	1,458,111	3,088,534	706,571	3,753,370	7,263,624	16,850,190
Bolivia	190	......	25	172	1,209	2,880	3,453	11,864	14,533	4,891	18,519	19,076	77,102
Brazil	8,665	7,802	35,680	108,859	84,602	28,633	59,935	134,326	233,414	103,834	806,556	3,144,122	4,779,414
Chile	3,527	663	2,656	4,711	22,405	14,721	72,939	248,043	806,015	359,668	586,031	426,563	2,553,303
Colombia	17	2,286	7,681	18,676	19,970	9,695	18,967	27,777	40,717	8,549	77,159	216,772	455,444
Ecuador	......	613	3,461	9,115	6,324	4,458	8,014	12,648	12,964	4,251	21,949	49,376	134,061
Guiana:													
British	......	1,303	3,181	3,809	4,583	5,116	6,809	23,597	35,081	23,882	40,460	46,122	196,935
Dutch	......	7	12	39	911	1,702	2,052	3,212	3,282	1,872	5,511	15,153	34,353
French	......	......	6	125	......	165	328	11	2,337	17	307	191	3,487
Paraguay	......	......	32	......	......	1,030	848	228	698	21	1,978	8,694	13,619
Peru	1,666	1,884	1,604	2,550	5,982	4,727	5,458	27,332	88,098	61,925	173,348	434,784	813,035
Uruguay	......	1,390	12,599	32,978	21,401	14,359	27,086	125,913	183,005	47,408	372,223	608,269	1,466,360
Venezuela	......	9	4,648	20,123	36,286	28,750	40,783	87,768	57,873	28,842	110,496	212,835	630,037
Asia:													
Aden	......	......	......	502	1,676	361	998	4,541	263	6	7,578	12,344	28,269
China	690	845	2,254	3,134	5,825	5,265	21,661	54,753	60,134	39,714	175,579	302,258	678,075
Kwantung (leased territory)‡	......	......	......	......	......	......	46	1,747	672	855	63,831	11,337	78,191
Chosen	......	......	748	2,271	2,791	282	10,377	2,125	2,812	9,506	39,603	82,934	153,989
East Indies, British:													
British India	2,444	6,387	14,568	18,336	47,923	44,735	129,562	345,855	294,909	99,819	493,188	1,411,866	2,890,093
Straits Settlements	1,343	1,172	5,273	14,660	25,100	20,388	39,025	70,043	69,968	66,920	151,991	583,215	585,489
Other British	......	170	829	901	4,099	4,062	8,540	27,710	23,273	4,100	13,319	95,321	183,081
Dutch	1,758	4,577	3,452	11,453	15,368	15,232	34,638	193,225	192,430	338,429	488,705	1,041,283	2,353,480
French	......	......	......	......	......	274	......	......	1,998	2,367	9,356	42,210	56,205
Hongkong	123	290	2,711	92	626	1,088	2,180	2,885	7,702	9,764	27,277	44,338	99,743
Japan	5,021	3,375	39,681	51,619	35,637	26,028	30,446	116,130	319,038	235,317	719,460	624,805	2,212,638
Persia	......	......	......	......	......	174	......	......	1,090	3,080	270	8,415	13,029
Russia in Asia	......	67	......	......	......	107,351	226,255	146,083	25,512	......	194,613	18,265	718,887
Siam	2,134	921	970	1,925	4,905	2,451	34,412	9,734	7,639	3,708	9,479	13,909	94,644
Turkey in Asia	......	......	30	239	67	214	......	......	......	3,764	5,552	83,225	76,661
Oceania, British:													
Australia	3,826	21,533	102,427	166,176	202,363	199,154	389,690	753,309	1,052,986	963,753	1,462,330	1,855,174	7,258,036
New Zealand	25,625	5,150	26,095	37,438	53,644	48,111	176,618	285,654	309,658	243,468	529,000	1,205,309	2,965,220
Other British	......	......	971	479	1,060	665	1,991	4,751	4,674	2,713	8,330	10,461	36,406
French	......	......	495	3,032	7,560	5,730	5,640	4,383	6,272	2,435	9,906	7,424	54,077
German	......	......	......	220	396	......	66	936	7,138	2,107	7,961	9,037	27,919
Philippine Islands	4,168	17,154	62,631	53,434	69,933	40,228	63,756	116,670	178,036	198,489	600,646	859,396	2,336,762
Africa:													
Belgian Congo	......	......	......	......	......	......	34	......	......	......	7,893	1,896	9,823
British:													
West	......	......	56	465	5,743	6,537	20,311	64,938	49,077	29,807	141,902	348,473	576,309
South	3,000	14,655	29,123	62,304	157,246	100,240	286,401	422,200	811,323	195,714	878,723	1,625,438	4,606,743
East	......	2,473	851	1,444	3,203	3,929	11,371	9,599	23,290	4,570	35,158	52,461	149,330
Canary Islands	......	76	13	879	1,505	1,939	2,111	3,261	1,300	645	1,018	66,738	79,538
Egypt	110	277	99	295	130	1,494	4,751	2,623	716	......	27,886	104,582	143,522
French Africa	......	......	327	73	200	2,660	2,458	2,316	7,163	18,146	64,201	117,272	215,155
German Africa	......	......	......	......	999	522	21,098	......	......	......	1,820	7,609	32,048
Liberia	......	......	......	......	......	13	......	33	106	......	66	100	318
Madagascar	......	......	......	......	......	......	......	4	175	40	......	686	905
Morocco	......	......	......	......	166	3,386	9,928	2,431	7,347	1,350	48,455	39,104	112,167
Portuguese Africa	......	47	910	1,222	1,585	3,431	7,064	5,339	1,160	703	2,529	44,085	68,302
Spanish Africa	......	......	......	......	......	103	......	......	......	......	......	351	454
Other Countries	......	......	......	......	......	......	......	......	......	......	......	328,359	328,359
Grand Total													$257,288,041

*Included in totals of exports to England. †Included in totals of exports to Jamaica. ‡Previous to 1918 listed as British, French, German and Japanese China.

The Trend of Airplane Design

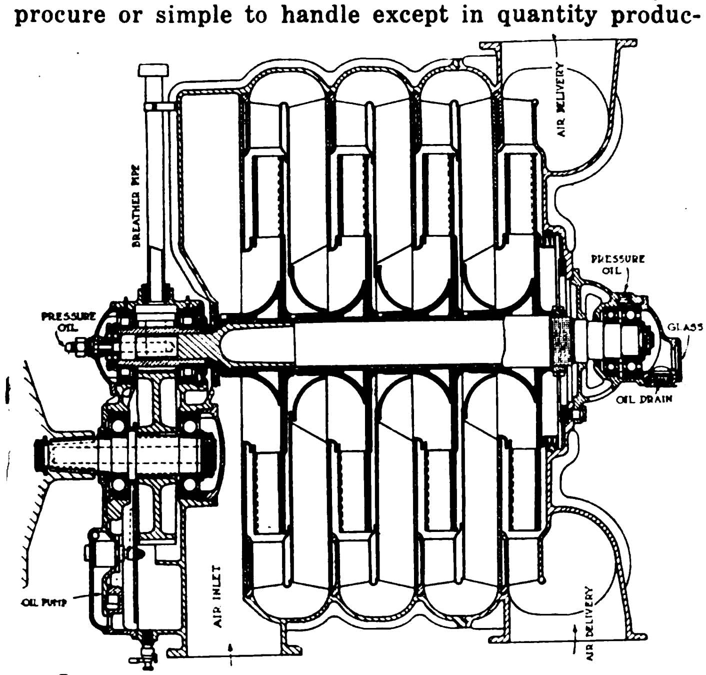
Those who recall the airplane trend article in the Statistical number of 1920 will be especially interested in the opinions on this page. The accuracy of last year's forecast makes no recommendation necessary this year.

THE year just past has been a period of re-adjustment for aircraft. The requirements of commercial aviation have been largely filled by surplus war material. General business conditions have made these requirements small. Designers have been studying the characteristics of planes developed during the war and the data accumulated is being incorporated in new designs. Those considering aviation a get-rick-quick game have left. Those remaining have chosen aviation as a life proposition, and have set out seriously to solve its problems. With the return of normal times the industry will be on a firm basis, ready to expand conservatively as conditions warrant.

Foreign Influences.—It is unfortunate, but true, that a tendency has existed to belittle American designs as compared with Continental designs. Since the war it has been possible to study these designs in direct comparison with our own. And all things considered—ease of manufacture, upkeep, air qualities, life—the coming conclusion is that American designs and American methods are best for Americans.

Early in the year the foreign all-metal monoplane led the field. From the apparent advantages, here was a machine that was fireproof, durable, efficient and well adapted to commercial use. Several of them, however, have been burned, and the problem of holding thin metal sections together under vibration has not been solved.

Startled by the evident advantages of all metal construction, American designers and constructors hastened to experiment with it in their own designs. It was found that the best metal—duralumin—was not easy to procure or simple to handle except in quantity production. Quantity production is at present lacking and the advantages of this construction are not sufficient for its extensive use at the present time.



Latest design of the Brown-Boveri blower for 1200-*hp. installation*

Metal Construction.—Metal construction, however, will increase, as American manufacturers become more familiar with its manufacture and airplane builders are organized to handle fabrication. There are serious construction problems to solve. In the meantime wood and metal construction will hold its own.

Monoplane, Biplane or Triplane.—Whether an airplane should have one, two or three supporting surfaces is still an open question. It can be no more arbitrarily settled than can the proper number of cylinders for a motor car engine. The present tendency, however, is toward internally braced monoplane design.

The internally braced monoplane is the cleanest and most efficient aerodynamic structure. Thick wing sections have been and are being developed that are extremely efficient. One interesting example of this type is the Stout bat-wing monoplane. A small commercial machine, having a veneer covered internally braced wing has been constructed and flown. A similar military machine of duralumin is in process. The feature of this type plane is that all longitudinal sections are lifting sections.

There is at present a slight trend toward the parasol type of monoplane—internally or externally braced. This construction provides maximum wing area for the span; permits continuous wing structure and provides good vision.

The majority of designers still favor the biplane type because of the combination of desirable features—moderate span, good air characteristics, adaptability to wooden construction and familiarity. This type will continue popular. At present all speed and distance records are held by biplanes, both here and abroad.

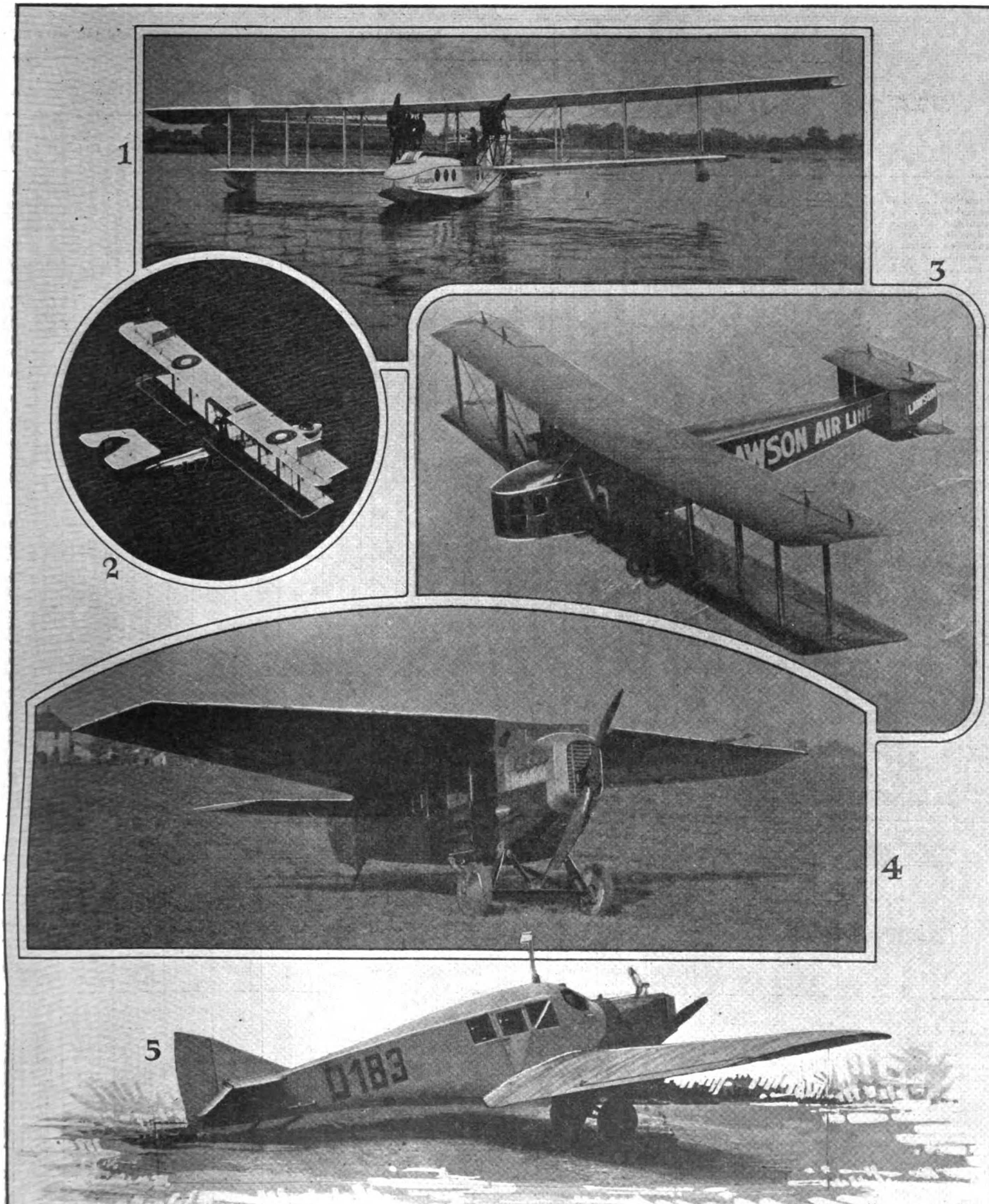
One of the fastest and cleanest of American planes—the Kirkham—is a triplane, and the large flying boat under construction by the Navy Department is reported to be a triplane.

Large Planes.—The trend toward large planes seems to be dying down somewhat. The development is retarded by lack of large power units and suitable landing fields. Possibly the largest under construction is the C.B. flying boat being made by the Navy Department. This will weigh around 70,000 pounds when complete, and be powered by groups of Liberty engines. The Army is also reported to have a large plane under construction. Under present conditions the reasonable upper limit of size appears to be approximately 100 ft. span and 5-7 tons total weight, depending on whether it is a land or seaplane.

Small Planes.—Small, that is, really small planes, have not proven as popular as was expected. Such planes are ordinarily without much purpose, and few experienced flyers fly simply for the sake of flying. There is, however, one comparatively small plane—the Sperry Mes-

(Continued on page 414)

Types of American and Foreign Built Aircraft



1—*The Aeromarine F5S Navy cruiser.** 2—*The Aeromarine HS2L commercial airplane.** 3—*The Lawson Airliner.** 4—*Stout batwing monoplane.* 5—*The Junker all-metal airplane*

*Photos supplied by Manufacturers' Aircraft Association.

Specifications of Ameri

(Compiled for Automotive Indus

Manufacturer and Model	GENERAL						POWERPLANT							WING AND TAIL DATA					
	Type	Use	Over-all Dimensions			Crew and Pass.	Engines			Propellers				Angle of Incidence		Chord		Span	
			Length, Ft.-In.	Height, Ft.-In.	Width, Ft.-In.		No.	Make	Total H.P.	No.	Blades	Diam., Ft.-In.	Pitch, Ft.-In.	Upper	Lower	Upper, Ft.-In.	Lower, Ft.-In.	Upper, Ft.-In.	Lower, Ft.-In.
Aeromarine 40-U	PB Boat.....	P......	28-11 5/16	12- 7	48-6	2	1	Aeromarine, U-6D.	130	1	2	8- 2	4-6	3°-5′	2°	6- 3	6- 3	48-6	37- 6
Aeromarine 44-U	PB Boat.....	P......	28-11 5/16	12- 7	48-6	3	1	Aeromarine, U-6D.	130	1	2	8- 2	4-6	3°-5′	2°	6- 3	6- 3	48-6	37- 6
Aeromarine 50-U	PB Boat.....	P......	28-11 5/16	12- 7	48-6	3	1	Aeromarine, U-8D.	180	1	2	8- 2	4-6	4°-20′	3°-5′	6- 3	6- 3	48-6	37- 6
Aeromarine 60-U	PB Boat.....	P......	31- 8⅝	12- 7	55-8 11/16	5	2	Aeromarine, U-6D.	260	2	2	8- 2	4-6	3°-5′	2°	6- 3	6- 3	55-8 11/16	....
Aeromarine 50-S-2	PB Boat.....	P......	28-11 5/16	12- 7	48-6	3	1	Wright-Hispano...	180	1	2	8- 2	5-0	4°-20′	3°	6- 3	6- 3	48-6	37- 6
Aeromarine 75	TB Boat.....	C......	49- 4	18- 9	103-6	12	2	Liberty, C........	700	2	......	....	......	4°	4°	8- 0	8- 0	103-9	74- 4
Boeing BBL-6	TB Land.....	P......	29- 3⅜	10-10	44-9¼	3	1	Hall-Scott, L-6....	200	1	2	8- 2	6-0	2°	2°	6- 6	6- 6	44-9¼	31-11¼
Curtiss........Eagle-1-Engine	TB Land.....	C......	37- 2 9/16	12-11	64-4⅛	10	1	Liberty, A........	400	1	2	10- 6	......	......	......	7- 9	7- 9	64-4⅛	64- 4⅛
Curtiss........Eagle-2-Engine	TB Land.....	C......	37- 2 9/16	12-11	64-4⅛	10	2	Curtiss, C-12......	800	2	2	....	......	......	......	......	......	......	......
Curtiss........Eagle-3-Engine	TB Land.....	C......	37- 2 9/16	12-11	64-4⅛	10	3	Curtiss, K-6.......	450	3	2	8- 2	......	......	......	7- 9	7- 9	64-4⅛	64- 4⅛
Curtiss........G.-B. Racer	TM Land.....	SP....	....	....	27-0	1	1	Curtiss, C-12.....	400	1	......	8- 0	......	......	None...	4- 0	None...	27-0	None....
Curtiss........MF-K-6	PB Boat.....	SP....	....	....	49-9⅜	3	1	Curtiss...........	160	1	......	8- 0	......	......	......	5- 0	5- 0	49-9⅜	38- 7 5/16
Curtiss........Oriole L-72-7	TB Land.....	SP....	....	....	40-9 15/16	3	1	Curtiss...........	150	1	2	8- 0	......	......	......	5- 4	5- 4	40-9 15/16	40- 9 15/16
Dayton-Wright ....K-T	TB Land.....	SP....	30- 1 9/16	11- 2½	43-7½	3	1	Liberty, A........	420	1	......	....	......	3°	3°	5- 6	5- 6	43-7½	43- 7½
Dayton-Wright ....O-W	TB Land.....	SP....	46- 0	9- 0	28-6	3	1	Wright, E-2.......	180	1	......	....	......	3°	3°	6- 6	6- 6	46-0	46- 0
Dayton-Wright ....R-B	TM Land.....	SP....	22- 8	8- 0	21-2	1	1	Hall-Scott........	250	1	2	....	......	1°	None...	6-6 to 4-0	None...	21-2	None....
Gallaudet C-3-2	TB Land.....	C......	29- 5	10- 2	45-0	5	1	Liberty, A........	420	1	2	9- 2	......	2°	2°	7- 0	7- 0	45-1½	45- 0
Gallaudet D-4	PB Seaplane..	F......	27- 5	36- 0	46-4⅝	2	1	Liberty, A........	420	1	3	9- 1½	8- 2	......	......	7- 0	7- 0	46-4⅝	45- 0
Gallaudet EL-2	TM Land.....	SP....	18- 7	5- 6	33-0	2	1	Lawrance........	60	1	3	5- 8	4- 6	2°	None...	4- 6	None...	33-0	None....
Huff, Daland HD-1	TB Land.....	C......	22- 0	8- 9	37-0	2	2	Le Rhone........	160	2	2	7- 0	......	2°	2°	6- 0	4- 0	37-0	36- 4
Huff, Daland HD-4	TB Land.....	T......	22- 0	8- 9	36-0	2	1	ABC, Wasp.......	150	1	2	9- 0	......	2°	2°	6- 0	4- 0	36-0	36- 0
Kinner ....Airster	TB Land.....	SP....	20- 0	7- 9	26-6	2	1	Kinner...........	60	1	2	7- 0	5-0	2°	2°	4- 0	4- 0	26-6	26- 6
Laird ....Swallow	TB Land.....	SP....	23- 4	8- 8	36-0	3	1	Curtiss, OX-5.....	90	1	2	....	......	......	......	4-10	4-10	36-0	36- 0
L-W-F ....H (Owl)	TB Land.....	B......	53- 9½	17- 6	105-0	3*	3	Liberty, A........	1200	3	2	9- 6	......	4½°	3½°	11- 0	11- 0	105-0	105- 0
L-W-F J-2	TB Land.....	M......	31- 2	11- 0	56-9¾	1†	2	Hall-Scott, L-6....	400	2	2	8- 6	6-6	3°	3°	5- 6	5- 6	56-9¾	56- 9¾
Glenn L. Martin MB-2	TB Land.....	B or C	43- 7 5/16	15- 6¾	74-2	4	2	Liberty, A........	800	2	2	10- 0	6-0	2°	2°	7-11	7-11	74-2	74- 2
Glenn L. Martin ....MB-T	TB Land.....	B or TP	46- 4	14- 0	71-5	4	2	Liberty..........	800	2	2	9-10	6-3½	2°	2°	7-11	7-11	71-5	71- 5
Glenn L. Martin ....MT	TB Land.....	TP....	45- 8	15- 6	71-5	4	2	Liberty..........	800	2	2	9-10	6-1	2°	2°	7-11	7-11	71-5	71- 5
Nebraska....L-S Cabin Cruiser	TB Land.....	SP....	26- 4	....	41-0	4	1	Hispano-Suiza.....	220	1	2	....	......	2½°	2½°	6- 0	6- 0	26-4	26- 4
Nebraska........L-S Speedster	TB Land.....	SP....	25- 8	10- 0	32-0	3	1	Hispano-Suiza.....	180	1	2	8- 3	6-6	3°	1½°	6- 0	6- 0	32-0	32- 0
Orenco ....D	TB Land.....	S......	21- 6	8- 3	30-0	1	1	Wright...........	300	1	2	8- 8	......	1¾° or 2°	1¾° or 1½°	5- 0	5- 0	30-0	28- 0
Orenco ....F (Tourister)	Biplane Land.	P......	24-10	9- 0	38-0	4	1	Wright...........	150	1	......	....	......	2°	2°	5- 0	5- 0	38-0	38- 0
Pacific ....Pacific Hawk	TB Land.....	C......	32- 0	10- 8	52-0	6	2	Curtiss, OX-5.....	360	2	2	8- 4	5-6	4°	4°	6- 6	6- 6	52-0	52- 0
Sperry........Amphib.-Triplane	PT Amph....	....	31- 6	15- 4	48-0	3	1	Liberty, C........	369	1	4	....	......	All 4°		All 5-0		All 48-0	
Sperry ....Messenger	TB Land.....	MS....	17- 9	7- 0	20-0	1	1	Lawrence.........	60	1	2	....	......	......	......	4- 0	4- 0	20-0	20- 0
Stout SM-20	TM Land.....	C......	24- 0	8- 8	36-0	3	1	Packard, 744......	200	1	2	8- 8	6-4¼	3°	None...	10-0 Mean	None...	36-0	None....
Stinson ....Greyhound	TB Land.....	SP....	22- 4	9- 0	34-2¼	......	1	Curtiss, OX-5.....	90	1	2	....	......	......	......	5- 0	5- 0	34-2¼	34- 2¼
Thomas-Morse. .2-Engine-Mail	TPB Land....	M......	25- 5	11- 0	45-6	2	2	Wright...........	600	2	2	9- 2	......	+⅓°	—⅓°	8-10	8-10	45-6	45- 6
U. S. Air Service........VCPR	TB Land.....	S......	24- 2	8- 8	28-2	1	1	Packard..........	638	1	2	9- 0	......	......	......	3-6 to 6-0	3-6 to 5-7	27-6	26- 2
Waterman 3-L-400	TB Land.....	C......	27- 6	11- 2	43-6	3	1	Liberty..........	400	1	2	9- 8	7-8	1°	1°	5- 6	5- 6	43-6	43- 6
West Virginia.Louis Bennett, Jr.	TB Land.....	SP....	27- 0	9- 9	44-5½	3	1	Hispano-Suiza.....	150	1	2	....	......	2°	2°	6- 0	6- 0	44-5½	34-10

*Also bomb load. †Also 650 lbs. mail.

For abbreviations see pages 368 and 369.

Specifications of

Manufacturer and Model	GENERAL						POWERPLANT			WING AND TAIL DATA					
	Type	Use	Over-all Dimensions			Crew and Pass.	Engines		Total H.P.	Angle of Incidence		Chord		Span	
			Length, Ft.-In.	Height, Ft.-In.	Width, Ft.-In.		No.	Make		Upper	Lower	Upper, Ft.-In.	Lower, Ft.-In.	Upper, Ft.-In.	Lower, Ft.-In.
Albatross—L-47	TB Land........	M.......	24- 6	10-10	38- 7	2	1	Mercedes..............	180	....	....	....	....	38- 7	....
Dornier—Commercial	1P 1TM Boat....	C.......	49- 6	....	92- 5	8 11	2	Maybach..............	520	....	....	....	....	92- 5	....
Dornier—R-I	PB Boat........	C.......	95- 9	23- 9	143- 6	..	3	Maybach..............	720	....	....	15- 2	11-10	143- 6	....
Dornier—R-II	TP1½ PL Boat...	C.......	70-10	25- 0	109- 6	..	4	Maybach..............	960	....	....	21- 4	11- 9	109- 6	....
Dornier—R-III	TPM Boat.......	C.......	75- 0	26- 9	122- 0	..	4	Maybach..............	1040	....	....	21- 4	....	122- 0	....
Dornier—R-IV	TPM Boat.......	C.......	73- 0	28- 0	121- 4	20	4	Maybach..............	1080	....	....	21- 4	....	121- 4	....
Fokker—D-VIII	TM Land........	F.......	19- 5	9- 4	27- 6	1	1	Oberursel..............	140	....	....	....	....	27- 6	....
Fokker—F-IV	TM Land........	C.......	....	12- 0	56- 3	12	1	B. M. W..............	185	....	....	....	....	56- 3	....
Fokker—V-36	TB Land........	F.......	21- 4	10- 1	29- 6	1	1	B. M. W..............	185	....	....	....	....	29- 6	....
Fokker—V-45	TM Land........	P.......	37- 0	....	42-10	6	1	B. M. W..............	185	....	....	10- 3	....	42-10	....
Gotha—G-VII	TB Land........	C.......	31- 7	11- 6	65- 1	..	2	Maybach..............	520	....	....	....	....	65- 1	....
Gotha—G-VIII	TB Land........	C.......	32- 2	11- 7	71- 4	..	2	Maybach..............	520	....	....	....	....	71- 4	....
H. A. W. A—F-VI	TB Land........	SP......	22-11	....	34- 5	2	1	B. M. W..............	185	....	....	5- 3	4- 5	34- 5	....
H. A. W. A—F-X	TT Land........	SP......	26-10	....	37-10	6	1	Benz..............	230	....	....	5-7 3-11	U. & L. Center	32-9 37-10	U. & C Lower
Junkers—D-I	TM Land........	F.......	22- 0	9- 5	29- 2	1	1	Mercedes..............	180	....	....	5-11½	....	29- 2	....
Junkers—J-I	TB Land........	TF......	29- 6	11- 9	55- 0	2	1	Benz..............	230	3°	3°	8-1 to 6-10	4-10	55- 0	35- 7
Junkers—JL-6	TM Land........	P.......	31- 6	10- 2	48- 6	8	1	B. M. W..............	185	....	....	....	....	48- 6	....
Pfalz—DR-I	TT Land........	S.......	18- 1	9- 1	28- 0	3	1	Siemens..............	160	4 to 0	3	3- 7	2- 4	28- 0	25- 7
Rumpler—5a	TB Land........	C.......	25- 8	10- 1	40- 0	3	1	Mercedes..............	160	5.7 to .5	5.7 to .5	5- 6	5- 6	40- 0	40- 0
Sablatnig—KE-1	TM Land........	SP......	17- 5	7- 3	27- 6	1	1	Rheinische..............	20	....	....	....	....	27- 6	....
Zeppelin—Lindau CL-I	TB Land........	F.......	....	9- 1	34- 5	2	1	Mercedes..............	160	3.7°	1.5° to 2°	4- 8	4- 8	34- 5	28-10
Zeppelin—Staaker	TM Land........	C.......	54- 7	13- 6	102- 0	22	4	Maybach..............	1040	....	....	....	....	102- 0	....

can Airplanes, 1920-1921.

tries by Arch. & Don R. Black.)

WING AND TAIL DATA											WEIGHT IN LBS.					PERFORMANCE								
Areas in Square Feet							Gap Ft.-In.	Stagger In.	Sweep-back	Dihedral	Empty	Gas and Oil	Useful Load	Total Gross	Useful % Gross	Lbs. H.P.	Lbs. Sq. Ft.	High Speed		Low Speed M.P.H.	Climb		Service or Approx. Ceiling (Feet)	Range at High Speed (Miles)
Wings Total	Ailerons	Stabilizer	Elevators	Vert. Fin	Rudder	Non-skid Planes												M.P.H.	Alt. Feet		Mins.	Feet		
504	58.0	39.0	25.6	15.0	17.5	None...	6- 6	8	None....	2°	2,161	278	638	2,799	22.8	21.5	5.55	76.0	0	44.0	10	2,400	....	200
504	58.0	39.0	25.6	15.0	17.5	None...	6- 6	8	None....	2°	2,245	282	821	3,067	26.8	23.6	6.1	73.5	0	50.0	10	2,500	....	200
504	58.0	39.0	25.6	15.0	17.5	None...	6- 6	12	None....	2°	2,240	391	931	3,275	28.4	18.2	6.5	87.8	0	52.2	10	3,500	3,000	200
584	58.0	39.0	27.0	15.0	17.5	None...	6- 6	8	None....	2°	2,750	600	1,500	4,250	35.3	11.8	7.3	76.0	0	49.0	10	3,000	....	200
504	58.0	39.0	25.6	15.0	17.5	None...	6- 6	12	None....	2°	2,240	391	931	3,275	28.4	18.2	6.5	87.8	0	52.2	10	3,500	....	300
1,397	119.0	120.9	55.3	34.7	33.5	31.1	8-10½	None...	None....	1½°	8,456	1,587	4,367	12,823	34.0	18.3	9.2	85.0	0	50.0	......	....	....	340
434	50.0	25.3	23.3	6.0	9.5	None...	6- 9	None...	None....	0° up 3° low	1,800	445	1,000	2,800	35.7	14.0	6.5	100.0	200	40.0	10	6,000	17,000	330
937	71.0	50.0	32.0	12.7	25.5	None...	7- 9	None...	None....	None....	4,245	1,580	3,180	7,425	42.8	18.5	7.9	100.0	......	....	10	2,600	10,000	....
......	......	......	......	......	......	None...	....	None...	None....	None....	5,310	1,780	3,380	8,890	38.4	11.1	......	124.5	0	56.2	......	....	....	....
937	71.0	50.0	32.0	12.7	25.5	None...	7- 9	None...	None....	None....	5,150	1,080	2,690	7,840	34.3	17.4	8.38	101.5	......	....	30½	10,000	12,300	....
190	......	......	......	......	......	None...	None...	None...	None....	None....	1,745	240	455	2,200	20.7	5.5	24.4	......	......	....	......	....	....	....
400	44.9	33.4	30.3	15.7	20.4	....	6- 4 1/16	None...	None....	0° up 2° low	1,911	289	815	2,726	29.9	17.0	6.82	76.5	0	....	10	3,000	7,900	....
403	48.9	19.9	21.8	5.5	11.9	None...	5- 6 11/16	9½	None....	0° up 1½° low	1,695	....	806	2,501	32.3	16.6	6.2	96.0	......	....	10	10,000	13,275	....
441	71.6	38.4	24.0	6.0	13.5	None...	5-10	11¾	None....	3°	2,686	869	1,442	4,128	35.0	9.8	9.3	120.0	0	55.0	10	10,000	....	720
534	62.0	40.0	22.8	......	15.6	None...	5- 6⅞	None...	None....	None....	1,450	474	1,042	2,492	41.9	13.8	4.66	100.0	......	35.0	10	6,000	....	540
103	23.0	14.6	9.6	3.0	7.1	None...	None...	None...	....	....	1,400	....	450	1,850	24.3	7.4	17.6	......	......	64.0	......	....	15,000	....
580	58.0	38.5	24.0	6.0	13.5	None...	6- 0	10⅝	None....	2°	2,770	900	2,000	4,770	42.0	11.3	8.22	125.0	0	45.0	15	10,000	17,600	500
620	46.0	37.6	30.2	......	17.2	....	7- 0	17.2	....	None....	3,800	650	1,600	5,400	29.6	12.8	8.7	124.5	0	46.0	2	2,100	15,000	....
128	13.0	15.0	11.0	2.3	4.3	None...	None...	None...	None....	1°	725	50	400	1,125	35.5	16.0	8.75	85.0	0	45.0	25	6,000	9,000	100
347	44.0	21.0	20.0	6.2	16.0	None...	4- 9	17.0	None....	0° up 2½° low	1,495	225	775	2,270	34.1	14.2	6.5	100.0	0	50.0	20	10,000	16,000	200
328	44.0	21.0	20.0	6.2	9.0	None...	4- 9	17.0	None....	0° up 2½° low	1,273	221	627	1,850	33.0	12.6	5.6	95.0	0	40.0	10	10,000	16,000	271
208	30.0	16.0	18.0	3.0	7.0	None...	4- 6	9	None....	2½°	600	64	400	1,000	40.0	16.6	4.7	75.0	0	35.0	10	4,000	12,000	130
324	......	......	......	......	......	None...	4-10	10	None....	1½°	1,075	195	675	1,750	38.6	19.4	5.4	86.0	0	38.0	10	4,000	....	....
2,200	200.0	174.4	83.2	28.0	78.9	None...	11- 0	None...	None....	0° up 2° low	12,400	3,720	7,600	20,000	38.0	16.6	9.1	110.0	0	55.0	9	6,000	17,500	1,100
604	70.6	38.4	24.0	6.8	20.0	None...	5- 8	None...	None....	3°	3,787	....	1,763	5,550	31.7	13.9	9.18	105.0	0	53.0	5	4,500	18,000	....
1,121	130.0	63.3	43.0	18.0	39.5	None...	8- 6	None...	None....	0° up 2° low	7,325	1,965	4,750	12,075	39.3	15.0	10.7	100.0	0	60.0	10	5,200	15,200	450
1,080	130.0	63.3	43.0	18.0	33.0	None...	8- 6	None...	None....	None....	6,449	1,085	3,683	10,123	36.5	12.6	9.38	118.0	0	56.0	10	6,000	16,400	300
1,080	130.0	63.3	43.0	18.0	33.0	None...	8- 6	None...	None....	0° up 2° low	7,130	1,800	4,948	12,078	41.0	15.1	11.2	102.0	0	58.0	10	5,800	14,960	410
456	......	......	......	......	......	None...	6- 2	5	4°	1½°	1,800	....	1,350	3,150	42.8	14.9	7.11	95.0	0	47.0	10	5,500	18,000	350
350	36.0	......	......	......	......	None...	5- 9	5½	3°	1½°	1,430	....	720	2,150	33.5	12.1	6.2	107.0	0	46.0	10	5,100	....	....
261	21.0	15.0	17.0	4.8	7.9	None...	4- 4	12	None....	None....	1,666	330	766	2,432	31.3	8.1	9.32	147.0	0	....	8.9	10,000	23,500	275
355	41.3	26.7	21.6	4.3	9.6	None...	5- 0	12	....	1½°	1,477	200	955	2,432	29.3	16.2	6.8	110.0	0	40.0	......	....	17,150	....
656	84.0	55.0	41.0	10.5	26.0	None...	7- 2½	None...	.None...	0° up 2½° low	2,630	....	1,320	3,950	33.4	11.0	6.0	82.0	0	47.0	10	4,100	....	492
678	78.0	36.4	42.0	15.8	21.8	None...	5- 0	12	None....	2° low	3,711	690	2,265	5,976	37.9	16.2	8.8	91.0	0	55.0	......	....	....	....
152	......	12.3	4.7	1.8	5.3	None...	3- 9	18	None....	Some....	581	75	239	820	29.2	13.7	5.4	95.0	0	35.0	10	10,000	....	....
346	33.0	44.0	32.0	9.0	14.6	None...	None...	Taper	ed Wings	2°	1,870	550	1,150	3,020	38.0	15.1	8.7	115.0	1,000	45.0	......	....	....	....
320	......	......	......	......	......	None...	5- 0	Some...	None....	....	947	....	545	1,492	36.5	16.6	4.66	96.0	0	35.0	1	1,150	....	312
645	44.0	16.0	34.0	4.0	22.0	None...	6- 3	None...	None....	2°	2,864	840	2,700	5,564	48.5	9.3	8.63	135.0	0	....	10	9,000	....	....
228	18.0	18.0	16.0	7.5	9.5	None...	4- 9	16 11/16	Tapered Wings	None....	2,485	544	740	3,225	22.9	5.1	14.1	....	......	....	......	....	....	....
475	60.0	18.0	25.0	5.0	13.0	None...	5- 1	26	None....	None....	2,800	900	1,400	4,200	33.4	10.5	8.85	126.0	0	45.0	8	10,000	22,000	500
435	35.0	28.1	22.0	4.0	12.0	None...	5- 1¼	12 5/16	None....	1°	1,700	173	700	2,400	29.2	16.0	5.51	80.0	......	40.0	10	4,000	7,000	....

German Airplanes.

WING AND TAIL DATA—*Continued*											WEIGHT IN LBS.					PERFORMANCE								
Areas in Square Feet							Gap, Ft.-In.	Stagger, In.	Sweep-back	Dihedral	Empty	Gas and Oil	Useful Load	Total Gross	Useful per Cent Gross	Lb. H.P.	Lb. Sq. Ft.	High Speed		Low Speed, M.P.H.	Climb		Service Approx. Ceiling (Feet)	Range at High Speed (Miles)
Wings Total	Ailerons	Stabilizer	Elevators	Vertical Fin	Rudder	Non-Skid Plane												M.P.H.	Altitude (Feet)		Minutes	Feet		
....	....	....	....	....	....	....	....	....	....	....	1,960	....	950	2,910	32.6	16.1	....	98.0	SL	....	31.0	16,400	....	300
....	....	....	....	....	....	....	....	....	....	....	6,600	....	2,000	8,600	23.2	16.5	....	110.0	SL	....	10.0	3,300	....	....
3,600	267.0	290.0	172.0	57.0	107.0	None	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
2,760	205.0	202.0	87.0	78.5	46.3	None	....	....	None	....	14,200	....	4,000	18,200	22.0	19.0	6.6	90.0	SL	....	....	....	....	....
2,430	226.0	254.0	107.0	15.0	47.3	None	....	....	None	....	14,400	....	7,000	21,400	32.7	20.6	8.8	....	....	....	....	....	....	....
2,430	226.0	226.0	94.7	30.1	48.4	None	....	....	....	....	14,000	....	7,000	21,000	33.0	19.4	8.6	110.0	....	....	....	....	....	....
115	....	....	....	....	....	....	....	....	....	....	890	....	440	1,330	33.1	9.5	11.6	124.0	SL	....	19.5	19,800	....	200
452	....	....	....	....	....	....	....	....	....	....	2,645	....	1,480	4,125	35.9	22.3	9.1	115.0	SL	....	45.0	13,000	....	500
189	....	....	....	....	....	....	....	....	....	....	1,400	....	515	1,915	26.9	9.9	10.1	124.0	SL	....	18.2	19,800	....	200
451	....	....	....	....	....	....	....	....	....	....	2,640	....	1,540	4,180	36.9	22.6	9.3	93.0	SL	....	45.0	13,200	....	744
686	....	....	....	....	....	....	....	....	....	....	5,320	....	1,580	6,900	22.8	13.3	10.1	112.0	....	....	38.0	19,500	....	....
850	....	....	....	....	....	....	....	....	....	....	5,880	....	2,140	8,020	26.7	15.4	9.4	100.0	....	....	56.0	19,500	....	....
307	....	....	....	....	....	....	4-11	15.5	None	....	1,160	240	....	....	....	....	....	115.0	....	....	12.6	9,800	29,500	450
484	....	....	....	....	....	....	4- 3	12	....	....	2,380	420	....	....	....	....	....	109.0	....	....	16.0	9,800	21,300	440
159	20.5	12.2	18.2	None	8.2	None	....	....	None	3°	....	....	....	....	....	....	....	....	....	....	....	....	....	....
533	64.8	49.0	33.6	12.0	17.0	None	6- 8	....	5°	0° up 3° low	3,724	....	845	4,569	18.5	19.9	8.6	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	2,245	550	1,650	3,895	42.3	21.1	....	112.0	5,000	50	35.0	12,000	23,000	1200
185	6.5	13.7	....	....	....	....	2- 6	....	....	....	860	85	690	1,550	44.5	9.7	8.4	....	SL	....	....	....	....	....
384	55.8	28.7	18.4	4.6	6.8	None	6- 1	....	2½°	1½°	1,760	....	1,210	2,970	40.7	18.5	7.7	100.0	SL	48	22.0	6,500	14,700	....
....	....	....	....	....	....	....	....	....	....	....	407	....	220	627	35.0	....	....	67.0	SL	....	....	....	....	150
278	20.8	(27.8	Tot.)	(10.3	Tot.)	None	....	....	None	....	1,560	240	790	2,350	33.6	14.7	8.5	103.0	....	....	10.0	6,500	....	310
1,900	....	....	....	....	....	None	....	....	....	....	12,000	....	6,700	18,700	35.8	18.0	9.8	118.0	SL	56	....	....	11,470	....

Specifications of For

(Compiled for Automotive Indu

Manufacturer and Model	GENERAL: Type	Use	Over-all Dimensions: Length, Ft.-In.	Height, Ft.-In.	Width, Ft.-In.	Crew and Pass.	POWER PLANT: Engines: No.	Make	Total H.P.	WING AND TAIL DATA: Angle of Incidence: Upper	Lower	Chord: Upper, Ft.-In.	Lower, Ft.-In.	Span: Upper, Ft.-In.	Lower, Ft.-In.
BRITISH															
Airco—DH-11	TB Land	B.	45- 0	13- 6	62- 0	4	2	A.B.C Dragonfly	640	....	....	....	....	62- 0	62-0
Airco—DH-14	TB Land	M	....	....	....	....	1	Rolls-Royce	600	....	....	....	....	....	....
Airco—DH-15	TB Land	B.	....	....	....	....	1	B.H.P.-Atlantic	500	....	....	....	....	....	....
Airco—DH-16	TB Land	P.	31- 9	11- 4	46- 6	5	1	Napier-Lion	450	....	....	5- 9	5- 9	46- 6	46- 6
Airco—DH-18	TB Land	P.	39- 0	13- 6	50- 5	9	1	Napier-Lion	450	3°	3°	6- 6	6- 6	50- 5	50- 5
Austin—Kestrel	TB Land	SP.	25- 6	10-2½	38- 6	2	1	Beardmore	200	....	....	6- 0	6- 0	38- 6	38- 6
Avro—Baby Sport	TB Land	SP.	18- 6	7- 6	23- 0	1	1	Green	40	4½°	4½°	4- 0	4- 0	23- 0	23- 0
Avro—547 Triplane	TT Land	P.	29-10	14- 5	37- 3	5	1	Beardmore	160	4°	4°	All-	4-9½	All-	37-3
Avro—547A Triplane	TT Land	P.	29-10	14- 6	37- 0	5	1	Siddeley-Puma	240	....	....	....	....	All-	37-0
Avro—548	TT Land	SP.	29- 5	10- 5	36- 0	3	1	Renault	80	....	....	....	....	All-	36-0
B. A. T.—Com'm'l. MK. I	TB Land	C.	34- 8	11- 3	46- 0	5	1	Rolls-Royce Eagle	360	....	....	....	....	46- 0	46- 0
B. A. T.—Crow	TM Land	SP.	14- 0	5- 0	19- 0	1	1	A. B. C. Gnat	40	....	....	....	....	19- 0	....
Beardmore—W. B. IX	TB Amph	P.	61- 0	20- 6	107- 0	12	4	Beardmore	800	....	....	....	....	107- 0	107- 0
Beardmore—W. B. X	TB Land	SP	26- 0	11- 0	46- 0	2	1	Beardmore	200	....	....	....	....	46- 0	46- 0
Bristol—Tourer	TB Seaplane	P.	25- 9	10- 1	39- 3	3	1	Rolls-Royce	275	....	....	5- 6	5- 6	39- 3	39- 3
Central—Centaur 2A	TB Land	P.	39- 3	12- 6	63- 6	9	2	Beardmore	320	....	....	7- 6	7- 6	63- 6	63- 6
Central—Centaur 4B	TB Seaplane	P.	27- 1	11- 4	39- 0	3	1	Anzani	100	....	....	....	....	39- 0	39- 0
Fairey—Amphibian	TB Amph	P.	34- 4	12- 0	46-1½	3	1	Napier Lion	450	4½°	4½°	5- 6	5- 6	46-1½	46-1½
Graham-White—AeroLimousine	TB Land	P.	40- 6	11- 0	60- 0	9	2	Rolls-Royce Eagle	640	....	....	6- 7	6- 7	60- 0	60- 0
Handley-Page—W-8	TB Land	P.	60- 0	17- 0	75- 0	..	2	Cosmos-Jupiter	900	....	....	....	....	75- 0	75- 0
Handley-Page—W-8A	TB Land	P.	60- 0	17- 0	75- 0	17	2	Napier Lion	900	....	....	....	....	75- 0	75- 0
Martinsyde—Semi-Quaver	TB Land	S.	19- 3	7- 3	20- 2	1	1	Hispano-Suiza	300	....	....	....	....	20- 2	20- 2
Martinsyde—A-Mark II	TB Land	P.	29-1½	10- 6	43- 4	5	1	Hispano-Suiza	300	....	....	....	....	43- 4	43- 4
Nieuport—Goshawk	TB Land	SP.	....	....	20- 6	..	1	A. B. C. Dragonfly	320	....	....	3-10	3-10	....	....
Short—Shrimp	TB Seaplane	C.	33- 0	12- 6	44- 0	4	1	Beardmore	160	....	....	....	....	44- 0	44- 0
Short—Silver Streak	TB Land	SP.	26- 5	10- 6	37- 6	1	1	Siddeley-Puma	260	....	....	5- 3	5- 3	37- 6	37- 6
Sopwith—Gnu (Le Rhone)	TB Land	SP.	25- 6	10- 0	38- 0	3	1	Le Rhone	110	....	....	5- 6	5- 6	38- 0	38- 0
Sopwith—Gnu (Bentley)	TB Land	SP.	25- 6	10- 0	38- 0	3	1	Bentley	200	....	....	5- 6	5- 6	38- 0	38- 0
Sopwith—Grasshopper	TB Land	T.	23- 1	8- 9	33- 1	2	1	Anzani	100	....	....	5-1½	5-1½	33- 1	33- 1
Sopwith—Antelope	TB Land	P.	30- 6	11- 0	46- 6	3	1	Hispano-Suiza	180	....	....	....	....	46- 6	46- 6
Sopwith—Dove	TB Land	SP.	19- 6	9- 6	25- 0	2	1	Le Rhone	80	....	....	....	....	25- 0	25- 0
Saunders—Kittiwaki	TB Amph	P.	43- 8	14- 9	68- 3	9	2	A. B. C. Wasp II	400	....	....	7- 0	7- 0	68- 3	68- 3
Supermarine—Amphibian	PB Amph	C.	33- 0	14- 0	50- 0	..	1	Rolls-Royce Eagle	360	4°	4°	6- 6	6- 6	50- 0	47- 0
Supermarine—Channel	PB Boat	C.	30- 0	13- 0	50- 3	4	1	Beardmore	160	....	....	....	....	50- 3	50- 3
Supermarine—Sea King	PB Boat	SP.	24- 0	10- 3	30- 5	2	1	Beardmore	160	....	....	....	....	30- 5	30- 5
Vickers—Viking III	PB Amph	SP.	32- 0	13- 0	46- 0	6	1	Napier Lion	450	....	....	6- 0	6- 0	46- 0	46- 0
Westland—6 Seater Limousine	TB Land	P.	33- 6	12- 6	54- 0	6	1	Napier Lion	450	2½°	2½°	7- 3	7- 3	54- 0	54- 0
Blackburn—Swift	TB Land	STP	35- 6	12- 0	48- 6	1	1	Napier Lion	450	....	....	....	....	....	....
Martinsyde—F-4A	TB Land		25- 6	8-10	32- 9	2	1	Hispano-Suiza	300	....	....	....	....	....	....
FRENCH															
A. Bernard—A-B3	TB Land	B.	37- 1	12- 0	62- 6	2	2	Hispano-Suiza	400	....	....	....	62- 6	62- 6	....
Bleriot—Mammouth	TB Land	P.	50- 6	21- 0	88- 6	28	4	Hispano-Suiza	1200	....	....	....	....	88- 6	....
Borel—1920	TB Land	SP.	23- 6	8- 7	37- 5	1 or 2	1	Hispano-Suiza	300	1½°	1½°	5- 3	5- 3	37- 5	....
Borel—Gordon-Bennett	TB Land	SP.	23- 3	....	23- 4	1	1	Hispano-Suiza	300	....	....	2-11	2-11	23- 4	....
Breguet—14T	TB Seaplane	P.	32- 9	....	47- 1	4	1	Renault	300	....	....	....	....	47- 1	40- 7
Breguet—17C-2	TB Land	F.	26- 6	....	46-10	2	1	Renault	300	....	....	....	....	46-10	41- 2
Breguet—18T Berline	TB Land	C.	36- 0	11- 7	57- 0	8	1	Renault	450	....	....	....	....	57- 0	57—0
Caudron—C-25	TB Land	C.	62- 4	18- 0	82- 0	18	3	Salmson	750	....	....	....	....	82- 0	82- 0
Caudron—C-33	TB Land	C.	31- 7	9-10	50-10	4	2	Le Rhone	160	....	....	....	....	50-10	46- 7
De Marcay—Passe-Partout	TB Land	SP.	10-5½	....	18-1½	1	1	A. B. C.	10	....	....	....	....	18-1½	18-1½
De Marcay	TB Land	SP.	13- 9	....	16- 5	1	1	Le Rhone	60	....	....	....	....	16- 5	16- 5
De Marcay—Tourer	TB Land	P.	16- 9	....	19- 6	2	1	Le Rhone	60	....	....	....	....	19- 6	19- 6
De Marcay—Pursuit	TB Land	S.	....	....	30- 4	1	1	Hispano-Suiza	300	....	....	....	....	30- 4	18- 9
Farman—David	TB Land	SP.	19-11	....	23- 3	2	1	Gnome-Rhone	60	....	....	4-11	4-11	23- 3	19- 4
Farman—Goliath	TB Land	P.	42- 8	16- 1	82- 0	14	3	Salmson	780	....	....	10- 1	10- 1	82- 0	82- 0
Gordou-Lesseure	TM Land	S.	21- 1	7-10	30-10	1	1	Hispano-Suiza	180	....	....	6- 7	....	30-10	....
Latham—Flying Boat	1P 2TB Boat		60- 0	19- 7	104- 0	..	3	Panhard-Levassor	1020	....	....	....	....	104- 0	78- 9
Levavasseur—Variable Wing	TB Land	EX.	36- 0	9- 6	44- 9	1	1	Salmson	250	3° to 5.5°	3°	5-3 to 10-9	3- 7	44- 9	42- 9
Liore—Et Olivier	TB Boat	C.	44- 4	13- 4	75-10	5	3	1-Salmson-250 2-Hispano-Suiza-150	550	....	....	9- 3	7-10	70- 1	75-10
Liore—Et Olivier	TB Land	TF.	27- 3	11- 0	47- 1	2	2	Le Rhone	350	....	....	....	....	47- 1	42- 2
Morane-Saulnier—AS	TM Land	SP.	18- 4	10- 4	28- 8	1	1	Le Rhone	80	....	....	....	....	28- 8	....
Morane-Saulnier—AR	TM Land	SP.	22- 2	11- 2	34- 6	2	1	Le Rhone	80	....	....	....	....	34- 6	....
Morane-Saulnier—AN	TB Land	S.	17- 5	9- 0	38- 6	2	1	Liberty	400	....	....	....	....	38- 6	38- 6
Morane-Saulnier—AI	TM Land	S.	19- 0	8- 1	29- 1	1	1	Le Rhone	150	....	....	....	....	29- 1	....
Nieuport—28	TB Land	SP.	20- 5	....	26- 3	1	1	Le Rhone	180	....	....	....	....	26- 3	26- 3
Nieuport—29C-1	TB Land	S.	21-10	8- 5	32- 2	1	1	Hispano-Suiza	300	....	....	4-11	4-11	32- 2	....
Nieuport—29 Vitesse	TB Land	SP.	20- 4	8- 3	19- 7	1	1	Hispano-Suiza	300	....	....	3-11	3-11	17-11	19- 7
Nieuport—30T	TB Land	C.	35- 1	....	47- 1	...	1	Renault	450	....	....	8- 6	8- 6	44- 3	47- 7
Pischoff—Avionette	TB Land	SP.	11- 7	4- 7	17- 0	1	1	Clerget	16	....	....	....	....	17- 0	....
Potez—IV C2	TB Land	F.	27- 6	....	39- 4	2	1	Lorraine-Dietrich	400	....	....	....	....	39- 4	39- 4
Potez—VII	TB Land	C.	30- 0	....	46- 0	2	1	Lorraine-Dietrich	400	....	....	....	....	46- 0	46- 0
Potez—VIII	TB Land	SP.	15- 5	6- 7	26- 3	2	1	Potez A-4	50	....	....	4- 7	4- 7	36- 3	22- 4
S. P. A. D.—Herbemont	TB Land	SP.	24- 0	....	21- 0	1	1	Hispano-Suiza	300	....	....	....	....	21- 0	....
S. P. A. D.—S-27	TB Land	SP.	24- 0	9- 3	31-10	3	1	Hispano-Suiza	300	....	....	....	....	31-10	31-10
Wibault	TB Land	F.	20- 8	7- 7	25- 7	1	1	Hispano-Suiza	220	....	....	....	....	25- 7	25- 7
ITALIAN															
Ansaldo—A-300C	TB Land	C.	32- 3	10- 8	43-10	6	1	F. I. A. T.	300	....	....	....	....	43-10	43-10
P. R. B.—1	1P 2TB Boat	C.	54- 2	21- 8	102- 8	..	4	Isotta-Frachini	1000	....	....	13-10	13-10	102- 8	98- 6
F. I. A. T.—12 Passenger	TB Land	P.	43-10	14- 9	68-10	12	3	F. I. A. T.	700	....	....	10- 6	10- 6	68-10	59- 9
F. I. A. T.—ARF.	TB Land	SP.	33- 3	12- 2	53- 2	2	1	F. I. A. T.	700	....	....	....	....	53- 2	53- 2
Ricci—RI	1P 2T Seaplane	C.	42-10	13-10	85- 9	13	3	Isotta-Frachini	660	....	....	....	....	85- 9	85- 9
Ricci—Triplane	TT Land	SP.	11- 0	6- 7	10- 4	1	1	Anzani	40	....	....	....	....	All	10-4
Savoia—S-16	PB Boat	C.	32-10	11-10	48-11	5	1	F. I. A. T.	300	....	....	6- 7	5-11	48-11	48-11

NOTE: Airplanes announced and never built omitted as far as possible. Airplanes for which complete data was not available omitted. **ABBREVIATIONS: B—**Bombing; **C—**Commercial (passenger and freight); **DB—**Day bombing; **Ex—**Experimental; **F—**Fighting; **M—**Mail carrier; **MS—**Messenger; **P—**Passenger; **PB—**Pusher biplane; **PM—**Pusher monoplane; **PT—**Pusher triplane; **S—**Scout or pursuit; **SP—**Sport including racing;

eign Airplanes 1920-1921

stries by Arch. & Don R. Black)

Wing and Tail Data—Continued: Areas in Square Feet: Wings Total	Ailerons	Stabilizer	Elevators	Vertical Fin	Rudder	Non-Skid Plane	Gap, Ft.-In.	Stagger, In.	Sweepback	Dihedral	Weight in Lbs.: Empty	Gas and Oil	Useful Load	Total Gross	Useful per Cent Gross	Performance: Lb. H.P.	Lb. Sq. Ft.	High Speed: M.P.H.	High Speed: Altitude (Feet)	Low Speed, M.P.H.	Climb: Minutes	Climb: Feet	Service Approx. Ceiling (Feet)	Range at High Speed (Miles)
719	102.0	55.0	30.5	7.4	20.0	....	5-10 to 7-2	None	None	4° up 2° low	3,795	1,300	3,205	7,000	45.8	10.3	9.7	117.0	....	....	13.5	10,000	......	350
....	....	....	....	....	....	....	....	....	None	....	4,000	1,400	3,000	7,000	42.9	11.6	....	129.0	6,500	....	....	....	19,000	....
....	....	....	....	....	....	....	....	....	....	....	3,312	950	1,461	4,773	31.6	9.5	....	136.0	6,500	....	82.0	10,000	20,000	....
490	74.4	38.0	24.0	5.4	13.7	None	5- 6	16	None	3°	3,155	....	1,595	4,750	33.6	9.5	9.7	136.0	SL	....	10.0	10,000	....	850
618	23.0	56.0	24.2	6.4	18.0	None	6-10	None	None	3°	4,180	800	2,550	6,730	37.9	13.5	10.9	121.0	SL	....	20.5	10,000	16,000	395
417	....	....	....	....	....	None	....	None	None	....	1,606	....	774	2,740	28.3	15.7	6.6	110.0	SL	45	12.0	10,000	....	325
176	21.0	14.5	7.8	None	7.0	None	4-3	18	None	3°	630	75	310	940	33.0	24.4	5.5	82.0	SL	40	35.0	10,000	12,000	225
498	69.0	26.5	18.5	7.3	9.0	None	4-9	None	None	2¼°	2,077	320	923	3,000	30.7	18.8	6.0	94.0	SL	45	38.0	10,000	....	444
498	....	....	....	....	....	None	....	None	None	....	2,080	....	1,206	3,286	36.5	13.7	6.6	98.0	SL	52	28.0	10,000	....	375
330	....	....	....	....	....	None	....	....	None	....	1,338	....	605	1,943	31.1	24.3	5.8	80.0	....	....	15.5	5,000	....	180
580	....	....	....	....	....	None	....	None	None	....	2,700	....	1,800	4,500	40.0	13.0	7.7	128.0	....	....	4.0	5,000	....	670
76	....	....	....	....	....	None	....	....	None	....	225	....	225	450	50.0	11.2	6.0	65.0	SL	....	....	....	....	130
2,202	....	....	....	....	....	None	....	None	None	....	9,720	2,120	4,280	14,000	30.5	19.4	6.4	93.0	SL	46	14	5,000	....	403
																					38.0	10,000		
540	....	....	....	....	....	None	....	....	None	....	1,852	....	997	2,849	35.0	....	....	91.0	SL	50	27.0	10,000	....	....
405	....	....	....	....	....	None	....	....	....	....	1,750	515	1,050	2,080	37.5	10.2	6.9	125.0	....	....	12.0	10,000	....	....
895	140.0	65.0	32.0	15.0	20.0	None	7-6	None	None	....	3,840	400	2,000	5,840	34.2	16.7	6.6	89.0	SL	38	....	....	....	350
380	....	....	....	....	....	None	....	None	None	....	1,230	....	670	1,900	35.2	19.0	4.9	75.0	SL	....	2.6	1,000	....	225
544	....	....	....	....	....	....	5-7	None	None	1°40′	3,771	....	....	....	....	10.4	9.6	118.5	SL	54	....	....	....	....
765	106.0	52.0	32.0	11.3	25.0	None	6- 6	....	....	4°	5,800	1,160	2,170	7,970	27.2	24.5	10.4	116.0	SL	50	9.9	10,000	17,000	....
1,500	....	....	....	....	....	None	....	None	None	....	....	....	....	12,000	....	....	....	112.0	SL	45	14.0	9,000	18,000	600
1,500	....	....	....	....	....	None	....	None	None	....	....	....	....	12,000	....	13.3	8.0	119.0	SL	55	....	....	....	750
302	....	....	....	....	....	....	....	....	....	....	2,025	....	....	....	....	13.8	6.7	160.0	SL	....	....	....	....	....
519	....	....	....	....	....	None	....	....	None	....	2,700	800	1,300	4,000	32.5	13.3	7.7	115.0	SL	....	....	....	....	550
....	....	....	....	....	....	....	....	None	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
500	....	....	....	....	....	None	....	None	None	....	2,095	285	1,005	3,100	33.9	15.5	6.2	83.0	SL	....	35.0	10,000	....	250
370	....	....	....	....	....	None	5- 0	None	None	....	1,865	425	1,005	2,870	36.6	11.0	7.9	120.0	SL	50	11.0	10,000	....	360
354	....	....	....	....	....	None	5- 0	11	None	2¼°	1,350	....	810	2,160	37.5	19.6	6.1	93.0	SL	....	7.8	5,000	....	230
354	....	....	....	....	....	None	5- 0	11	None	2¼°	1,580	....	820	2,400	34.1	12.0	6.8	110.0	SL	50	5.5	5,000	....	200
301	....	....	....	....	....	None	....	....	None	4°	1,020	....	650	1,670	38.9	16.7	5.5	90.0	....	....	....	....	....	180
550	....	....	....	....	....	None	....	None	None	....	2,100	....	900	3,000	30.0	16.6	5.4	110.0	SL	43	7.5	5,000	....	400
213	....	....	....	....	....	None	....	....	....	....	850	....	580	1,430	40.5	17.8	6.7	100.0	SL	....	7.5	5,000	....	200
864	60.0	67.0	45.0	40.5	28.0	None	7- 0	None	None	....	3,840	800	2,360	6,200	38.1	15.5	7.2	....	....	....	....	....	....	....
600	....	....	....	....	....	None	....	None	None	2° up 4° low	3,996	....	1,364	5,360	25.5	15.4	9.0	94.0	SL	55	....	....	....	....
453	....	....	....	....	....	....	....	None	None	....	....	....	....	3,400	....	21.2	7.5	85.0	SL	....	....	....	....	340
284	....	....	....	....	....	None	....	None	None	....	....	....	....	2,500	....	15.6	8.9	103.0	SL	....	20.0	10,000	....	....
520	....	....	....	....	....	None	7- 0	None	None	....	2,740	....	1,805	4,545	39.7	13.0	9.0	121.0	SL	52	11.0	6,000	....	440
726	108.0	40.0	30.0	9.8	15.9	None	7- 0	9	None	2¼°	....	730	....	5,550	....	12.3	7.6	120.0	SL	46	....	....	....	450
720	....	....	....	....	....	....	....	....	....	....	3,100	....	....	6,000	....	13.3	8.3	112.0	....	....	....	850	....	448
328	....	....	....	....	....	....	....	....	....	....	....	....	....	2,300	....	7.5	7.0	142.0	....	....	....	....	....	287
860	....	....	....	....	....	....	....	None	None	....	3,610	1,200	3,190	6,800	46.9	17.0	7.9	101.0	SL	....	49.2	13,000	16,000	500
1,600	....	....	....	....	....	....	....	None	None	....	8,360	3,300	4,950	13,310	....	....	....	94.0	SL	....	....	....	....	540
364	....	18.8	16.6	5.4	9.7	None	....	14½	None	2° up 0° low	1,800	....	1,100	2,900	37.9	9.7	8.0	151.0	SL	....	15.0	13,000	20,000	....
140	....	....	....	....	....	....	....	....	....	2°	....	....	....	1,870	....	6.2	13.4	....	....	....	....	....	....	....
534	....	....	....	....	....	None	....	....	None	....	2,820	550	1,360	4,180	32.5	13.9	7.8	103.0	SL	....	18.0	6,500	....	....
490	....	....	....	....	....	None	....	....	None	....	2,640	715	1,460	4,100	35.6	13.7	8.4	136.0	SL	....	5.5	6,500	....	....
791	....	....	....	....	....	None	....	....	None	....	3,540	970	2,400	5,940	40.4	13.2	7.5	106.0	SL	....	17.0	8,500	17,000	....
1,670	....	....	....	....	....	None	....	....	None	....	7,500	1,980	4,600	12,100	38.0	16.1	7.3	103.0	....	....	....	....	....	620
503	....	....	....	....	....	None	....	....	None	....	1,950	405	1,080	3,030	35.6	19.6	6.0	80.0	SL	....	....	....	....	480
....	None	....	....	....	....	None	....	....	None	None	....	....	....	385	....	38.5	....	68¼	....	....	....	....	....	137
....	....	....	....	....	....	None	....	....	None	None	....	....	....	573	....	....	....	118.0	....	28	....	....	....	....
....	....	....	....	....	....	None	....	....	None	None	....	....	....	650	....	....	....	93.0	....	35	....	....	....	186
....	....	....	....	....	....	....	....	None	None	None	....	....	....	2,368	....	7.9	....	156.0	SL	....	16.25	16,400	....	....
210	18.8	10.7	9.4	None	4.2	None	....	21½	None	None	460	....	440	900	49.0	15.0	4.3	80.0	SL	30	13.4	6,500	....	240
1,505	....	48.4	....	....	24.0	....	....	None	None	....	6,560	2,200	4,740	11,300	42.0	14.5	7.5	100.0	SL	....	8.0	6,500	....	....
202	23.7	13.8	14.0	3.4	6.7	None	....	....	....	....	1,254	220	594	1,848	32.3	10.3	9.2	155.0	SL	....	17.5	16,400	24,600	....
1,925	....	....	....	....	....	None	....	....	None	....	....	....	6,600	....	....	....	....	....	....	....	34.0	10,000	....	....
345 to 560	47.0	95.0	35.0	25.0	16.0	None	4- 7	12 to 36	None	3°	2,750	220	350	3,100	11.3	12.4	5.5 to 9.0	125.0	SL	35	....	....	25,000	....
1,150	....	....	....	....	....	....	8- 5	None	6°	None	6,250	1,010	3.210	9,460	34.0	17.2	8.2	87.0	SL	....	....	....	10,000	350
508	38.7	....	19.4	.,..	30.0	None	....	25	None	....	2,690	....	1,490	4,180	36.5	11.6	8.0	115.0	SL	....	39.0	16,400	18,000	460
140	....	....	....	....	....	None	....	....	....	....	840	....	330	1,170	28.2	14.6	8.4	103.0	SL	45	18.5	10,000	20,000	300
194	....	....	....	....	....	None	....	....	None	....	880	....	500	1,380	36.2	17.2	7.1	94.0	SL	35	19.2	10,000	20,000	300
447	....	....	....	....	....	....	....	....	....	....	2,640	....	1,245	3,885	32.0	9.7	8.7	125.0	SL	81	25.0	9,800	20,000	375
140	....	....	....	....	....	....	....	....	....	....	980	....	560	1,540	36.4	8.6	10.9	139.0	SL	75	7.5	9,800	23,000	417
172	....	....	....	....	....	....	....	....	....	....	880	240	660	1,540	42.8	8.6	8.9	129.0	SL	....	19.8	16,000	22,000	258
288	25.8	22.0	18.2	3.8	8.6	None	....	....	None	....	1,670	370	760	2,430	31.3	8.1	8.4	141.0	SL	....	6.8	9,800	25,000	350
132	13.2	13.0	8.1	4.7	4.8	None	4- 5	7.4	None	2° up 0° low	1,520	320	600	2,120	28.3	7.1	16.0	168.0	SL	....	....	....	....	....
700	56.6	64.6	36.6	....	15.0	None	....	....	....	....	3,300	550	1,980	5,280	37.5	11.7	7.5	....	....	....	....	....	....	....
81	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60.0	....	....	52.0	3,600	....	120
409	....	....	....	....	....	None	....	None	None	....	2,240	....	1,290	3,530	36.5	8.8	8.6	135.0	SL	....	21.8	16,400	24,600	435
474	....	....	....	....	....	None	....	None	None	....	2,425	....	1,212	3,637	33.3	9.1	7.7	124.0	SL	....	....	....	....	320
205	....	15.6	10.2	7.0	4.8	None	4-10	....	....	....	484	88	440	924	47.6	18.5	4.5	....	....	25	....	....	....	....
161	....	....	....	....	....	....	....	....	....	....	....	....	....	2,310	....	7.7	15.0	....	....	....	....	....	....	....
....	....	....	....	....	....	None	....	....	....	....	1,870	....	900	2,770	32.5	9.2	....	144.0	SL	65	....	....	....	432
235	....	....	....	....	....	....	....	....	....	....	1,410	242	450	1,860	24.2	8.5	7.9	148.0	....	....	....	....	21,000	370
473	....	....	....	....	....	None	....	None	None	....	2,535	....	1,653	4,188	39.5	13.8	8.8	112.0	....	....	....	....	....	500
2,215	....	172.0	....	....	48.4	....	13- 2	....	....	....	8,800	....	7,260	16,060	45.2	16.1	7.3	100.0	SL	....	30.6	13,200	....	1000
1,289	56.5	35.0	50.0	8.0	22.0	None	8- 6	None	None	....	7,040	1,650	3,960	11,000	36.0	15.6	8.6	125.0	SL	50	....	....	15,000	700
....	....	....	....	....	....	None	....	None	None	....	5,070	4,660	5,130	10,200	50.3	....	....	160.0	....	....	....	....	....	2730
1,300	....	....	....	....	....	None	....	None	None	....	6,160	....	4,760	10,920	43.6	16.5	8.4	105.0	SL	....	....	....	....	420
118	....	....	....	....	....	....	....	....	....	....	330	....	242	572	42.3	14.3	4.8	78.0	SL	24	....	....	....	150
570	....	....	....	....	....	None	....	None	None	....	2,860	....	1,760	4,620	38.1	15.4	8.1	105.0	....	....	....	....	....	420

STP—Scout torpedo plane; **T**—Training; **TB**—Tractor biplane; **TPB**—Tractor pusher biplane; **TPM**—Tractor pusher monoplane; **TP**—Tractor pusher; **TF**—Trench fighter; **TM**—Tractor monoplane; **TP**—Torpedo plane; **TT**—Tractor triplane.

British Motorcycle Practice

Lightweight 2½ horsepower machine gaining in popularity, because of economy and the higher tax on heavy machines. Many machines have stock engine and gearset. Single-cylinder engine predominates. Two-cylinder opposed also popular. 52 per cent of gearsets are three speed.

By M. W. Bourdon

THE outstanding feature of the British motorcycle industry at the moment is the large and increasing number of makers turning out lightweight machines with single-cylinder two-stroke engines of approximately 2½ hp. with belt, or chain and belt transmission. This feature is accounted for by two facts, (1) the demand for a machine economical in upkeep and fuel and (2) the new scale of taxation which came into force on Jan. 1. The latter imposes an annual tax of $7.50 on machines weighing not more than 200 lb. and double that amount on those over that weight, sidecars for either class being taxed $5 extra.

The two-stroke engine for these light machines is favored on account of its simplicity and low cost of production, though the four-stroke type is also widely used for low-powered mounts; in fact, if the class be extended to include as a maximum the 2¾ hp. machine, it will be found that 55 per cent have four-stroke engines. But that extra ¼ hp. usually means that the machine is carried into another class in performance, price and taxation rating.

Only 38 per cent of makers used stock engines, and of these J. A. Prestwich (J.A.P. engines) supplies 60 per cent; a similar percentage of the small two-stroke stock motors are of Villiers make and have a flywheel magneto for ignition.

The single-cylinder engine still predominates in point of numbers on British motorcycles generally; taking all sizes, it appears on 57 per cent, the 43 per cent of twins being made up of 25 per cent with horizontally opposed cylinders and 75 per cent Vee. The latter are almost completely out of favor in sizes under 5-6 hp., the at one time popular 3½-4½ hp. Vee twin having been superseded by the horizontally opposed type, which is constantly finding new adherents. Non-detachable cylinder heads are the rule, only 24 per cent being detachable, and most of these of the horizontal twin type.

The majority of crankshaft bearings are plain bushes, but ball and roller types are both increasing in favor, though not infrequently only one of the latter is used and that on the belt pulley or chain sprocket end of the shaft with a plain bearing at the other end. Roller or ball bearings are also being more widely used for the connecting rod big end. The table shows that some 36 per cent of engines have roller bearings at this point.

The difficulty of keeping the overall height of vertical and Vee engines within reasonable bounds doubtless accounts very largely for the paucity of overhead valve gear. Only 6 per cent of engines have both valves in the head, and these are mostly horizontal twins. Superimposed valves also account for 6 per cent. Thus the majority (68 per cent) have side valves, though among these are some engines with the exhaust and inlet valves arranged around the cylinder at 90 deg. from one another, the exhaust being arranged in front of the cylinder to submit it to the best cooling effect from air draught. With only one or two notable exceptions (for example, the two-cylinder water-cooled Scott and the 4½ hp. Dunelt) the valveless engines are the small two-stroke motors already referred to. But both the Scott and the Dunelt have earned excellent reputations despite (or possibly on account of) their two-stroke engines, and have shown that there is no good reason why the two-stroke type should be confined to the lightweights.

Almost all engines have cast iron pistons, only 2 per cent being provided with aluminum. But this uniformity does not extend to lubrication systems, where there is quite a remarkable diversity of practice. Splash lubrication pure and simple is held sufficiently effective in 73 per cent of engines, the feed from the oil compartment of the frame tank being usually maintained by a pump, the plunger of which is lifted by hand against a spring which returns it gradually to its normal position, driving out the oil through a sight drip feed. Some splash systems embody a modification consisting of a mechanically operated pump in the crankcase which has a big ratio of reduction in speed (30-40 to 1) in its drive from the crankshaft. This pump draws oil from the tank and discharges it in small quantities into the crank chamber, where splash is depended upon.

The "petroil" lubricating system (oil mixed with fuel) for two-stroke motors is disappearing. Triumph (one of the largest firms) retains it for the present, but in most other engines of this type a drip feed and splash or drips led to a hollow crankshaft are displacing it.

Ninety-five per cent of the clutches used are of the plate or disk type. Two-speed gearsets for machines up to 2½ hp. almost invariably have only a single driven plate, but the larger machines have the multi-plate type, generally with 3 or 4 driven units. Fabric facings running dry are found in 90 per cent single and multi-plate, only 10 per cent being metal to metal in an oil bath. Clutch control is by hand on 86 per cent of machines, and this is accounted for by the fact that even the largest and most highly powered are double-purpose machines; when used in solo form the pedal controlled clutch is disliked, owing to the impossibility of straddling with both feet on the ground until the machine moves off with the full engagement of the clutch.

The majority (55 per cent) of gearsets are stock jobs and 80 per cent of these are Sturmey-Archer, either two or three-speed with the clutch integral. Three-speeds form 54 per cent of the total, two-speeds 32 per cent, 7 per cent have a single ratio with belt drive and 7 per cent belt drive with variable pulley; two of the best known makes—Rudge-Whitworth and Zenith—have the latter system, even on 6-8 hp. models. Only 9 per cent of gearsets are arranged as a unit with the engine, this being partly due to the popularity of J.A.P. engines and Sturmey-Archer gearsets, neither of which is designed for or adaptable to unit construction.

The fact that, with few exceptions, the large number of

two-stroke lightweights have chain and belt drive accounts for the latter system being the most widely used (48 per cent). This system, consisting of a primary chain from crankshaft to gearset and a Vee belt from the latter to the rear wheel, is also used on all powers of machines up to the largest, but nevertheless the all-chain transmission is increasing in popularity through the range above 2½ hp. Rarely is the final chain protected by more than a top mud shield, but the primary chain is usually enclosed and not infrequently lubricated by only vapor discharged from an extension of the crankcase breather pipe.

Rear sprung frames are showing no rapid increase, not because there is any falling off in the demand for better protection against road shock, but on account of the additional cost and weight. As regards the first, crudity in design is largely the cause, for some of the arrangements are involved beyond measure. That a simple but effective rear spring can be provided without lack of lateral stability (the bugbear of designers) is evident from one or two exceptions to the general rule—the Beardmore-Precision, for example, wherein a cantilever spring located behind and loosely speaking, parallel with the saddle tube, is used. The drawback of undue additional weight has not, however, been overcome even in these exceptional cases, and in view of the inherent stability and low weight of the rigid tubular construction, it is not difficult to realize why the extra weight of a sprung frame is far more than that represented by the actual spring or springs; the lateral flexibility of the springs must be counteracted by means which considerably increase the weight of the tubular portions.

Much the same difficulty has been experienced by those designers who have attempted to employ pressed steel frames; they have found that to retain the lateral rigidity and torsional strength of the tubular construction has necessitated an increase of frame weight up to 80 per cent. While the pressed steel form is obviously desirable from several standpoints, the tubular frame unquestionably has the advantage in low weight combined with stability.

Readily detachable and interchangeable wheels have not increased to any marked extent during the past twelve months, and they appear almost entirely in large sidecar machines, and by no means invariably in these. Of the non-interchangeable wheels 15 per cent have knock-out rear spindles, enabling the back wheel to be quickly detached for tire removal, without disturbing the transmission details or brake gear.

In regard to brakes, the horseshoe tire rim type still predominates (76 per cent) on front wheels, and the V block applying to the belt rim on a brake rim on the rear wheels. But for both back and front the expanding shoe or contracting band applying to a 10 to 12 in. drum is gradually gaining ground; the former, for example, is now used on 25 per cent of machines.

British motorcycle design has not shown any pronounced improvement, except in detail and equipment, since the war. Makers during the past two years have devoted all their energies to securing output and have meanwhile, in the majority of cases, neglected to evolve new designs differing to any marked extent from pre-war standards. That they have thus restricted their market there can be no question, for they have as yet made little or no attempt to cater to the vast number of potential purchasers who desire a machine which they can use for business purposes without being compelled, for the sake of cleanliness and warmth, to wear special clothing. It has been computed that this market is as large as that which calls for the present type of machine, and yet, with the exception of scooters, nothing has been offered to the men who desire a means of getting to and from their home and city office or from one business house to another in normal attire. But there are indications suggesting that a few firms have realized possibilities in this direction, and it will be surprising if during the next twelve months there are not developments representing a new starting point for a section of the industry.

Tendencies in British Truck Design

(*Continued from page* 354)

although the chassis of the larger capacity trucks is stiffer and the gear ratios are varied. The 3 tonner (6700 lb.), for instance, has a back axle gear ratio of 7.25 to 1, while the 5 to 6 tonner has a ratio of 10.3 to 1.

The wheel tracks of these heavier types vary considerably, running from 65 in. in the case of Leyland to 72 in.

Worm final drive has increased in popularity very considerably of late, and 52 per cent of chassis now have this form of transmission as compared with 23 per cent chains and 20 per cent double reduction. Only 5 per cent have straight bevel gearing and no British trucks use an internal gear final drive. Open propeller shafts are favored in the proportion of 69 per cent as compared with 13 per cent enclosed and 18 per cent semi-enclosed. The fabric disk joint at both ends of an open shaft occurs in 32 per cent of trucks being equalled in popularity only by the arrangement having a star joint at one end and a sliding pot joint at the other, which occurs in 33 per cent. In star joints plain bushes are generally used, though 11 per cent of all universals have ball bearings. There are only 13 per cent of trucks with both brakes applying to the back wheels; none of these are external brakes, though among the 77 per cent of vehicles in which a transmission brake occurs the vast majority have external shoes.

In regard to engine lubrication, 43 per cent of engines listed have the trough system as compared with 57 per cent hollow shaft. The trough system usually includes direct leads to the main crankshaft bearings and sometimes to the camshaft as well. Magneto ignition is universal, with variable hand timing in 90 per cent. Impulse starters do not, however, show up prominently, only 6 chassis being equipped with them as standard. Pump water circulation occurs in 85 per cent of engines, thermo-syphon in 12 per cent and thermo-syphon assisted by a belt-driven water accelerator in 3 per cent. The thermo-syphon system is not, however, confined to the smaller trucks, for the whole range of Commer cars, including the largest type with a load capacity of 11,000 lb., has the water naturally circulated in an engine with a bore and stroke of 4½ x 5½ in. No cellular radiators are used except for the lightest delivery vans, 84 per cent of trucks proper having vertical tubes, the remainder having horizontal tubes. With one exception, the Guy with a 5500 to 6000 lb. load capacity, all have gilled tubes, the exception having a bank of ⅜ plain brass tubes vertically arranged. Fifty-seven per cent of British trucks have no governor as part of the standard equipment, while only 10 per cent have electric lighting included, though of the remainder, 50 per cent have provision for a lighting generator.

Cone clutches predominate (79 per cent as compared with 19 per cent disk and 2 per cent multiple-disk). All gearsets except the Austin are separately mounted. Ball bearings for gearsets are general, and in 90 per cent the gear shafts are side by side.

Detailed Technical Specifications

NAME OF MACHINE	Model	POWERPLANT: Cylinders: Number	Cylinders: Arrange-ment	Cylinders: Bore (In.)	Cylinders: Stroke (In.)	Piston Displacement (Cu. In.)	Cycle Type	Cooling Type	Lubrication Type	Carbureter Make	Engine Make	Ignition Make and Type	Maximum H. P. Development	TRANSMISSION: Number of Speeds	Gear Ratio to One	Change Speed Gear Type	Clutch Type	Final Drive Type
Cleveland	1921	1	Vert.	$2\frac{3}{4}$	$2\frac{3}{4}$	......	2	Air	Mix oil with gas.	Schebler	Own	Bosch or Berling Mag	$3\frac{1}{2}$	2	6.20 11.00	Spur Gear	O-Disk	Chain
Excelsior	520	2	Vee	$3\frac{21}{64}$	$3\frac{1}{2}$	61.0	4	Air	Splash	Schebler	......	Simms Mag	15	3	9.92 6.76 4.13	Prog Slid.	D-Disk	Chain
Harley-Davidson	21-F	2	Vee	$3\frac{5}{16}$	$3\frac{1}{2}$	6.03	4	Air	Splash	Schebler	Own	Bosch Mag.	16	3	9.77 6.51 4.34	Prog. Slid.	D-Disk	Chain
Harley-Davidson	21-J	2	Vee	$3\frac{5}{16}$	$3\frac{1}{2}$	60.3	4	Air	Splash	Schebler	Own	Own Gen.	16	3	9.77 6.51 4.34	Prog. Slid.	D-Disk	Chain
Harley-Davidson	21-W	2	Oppos.	$2\frac{3}{4}$	3	35.6	4	Air	Splash	Schebler	Own	Bosch Mag	8	3	13.88 8.33 5.00	Prog. Slid.	O-Disk	Chain
Harley-Davidson	21-WJ	2	Oppos.	$2\frac{3}{4}$	3	35.6	4	Air	Splash	Schebler	Own	Own Gen.	8	3	13.88 8.33 5.00	Prog. Slid.	O-Disk	Chain
Harley-Davidson	21-FD	2	Vee	$3\frac{7}{16}$	4	74.2	4	Air	Splash	Schebler	Own	Bosch Mag	19	3	9.77 66.51 4.34	Prog. Slid.	D-Disk	Chain
Harley-Davidson	21-JD	2	Vee	$3\frac{7}{16}$	4	74.2	4	Air	Splash	Schebler	Own	Own Gen.	19	3	9.77 6.51 4.34	Prog. Slid.	D-Disk	Chain
Indian "Scout"	G-21	2	Vee	$2\frac{3}{4}$	$3\frac{1}{16}$	36.3	4	Air	Splash and Force	Schebler	Own	Splitdorf Mag.	11	3	12.05 7.67 4.88	Prog. Slid.	O-Disk	Chain
Indian "Power Plus"	N-21	2	Vee	$3\frac{1}{8}$	$3\frac{31}{32}$	60.8	4	Air	Splash and Force	Schebler	Own	Splitdorf Mag.	15	3	10.47 6.65 4.24	Prog. Slid.	D-Disk	Chain
Henderson	K	4	Vert.	$2\frac{11}{16}$	$3\frac{1}{2}$	7.90	4	Air	Force	Zenith	......	Simms	16	1 Rev. 3 Ford	7.56 Ford 5.67 Ford 3.49 Ford 5.87 Rev.	Prog. Slid	O-Disk.	Chain
Iver-Johnson	16-7 T.S.	2	Vee	$3\frac{1}{4}$	$3\frac{3}{4}$	62.2	4	Air	Splash	Schebler	Own	Bosch Mag	8	2	6.50 3.75	2-Speed Hub	....	Chain
Iver-Johnson	16-7	2	Vee	$3\frac{1}{4}$	$3\frac{3}{4}$	62.2	4	Air	Splash	Schebler	Own	Bosch	8	1	4.25	2-Speed Hub	....	Chain
Iver-Johnson	16-4 T.C.S.	1	Vert.	$3\frac{1}{4}$	$3\frac{3}{4}$	31.1	4	Air	Splash	Schebler	Own	Bosch	5	2	6.50 3.75	2-Speed Hub	....	Chain
Iver-Johnson	16-4 C	1	Vert.	$3\frac{1}{4}$	$3\frac{3}{4}$	31.1	4	Air	Splash	Schebler	Own	Bosch	5	1	4.25	2-Speed Hub	....	Chain
Iver-Johnson	16-4 B	1	Vert.	$3\frac{1}{4}$	$3\frac{3}{4}$	31.1	4	Air	Splash	Schebler	Own	Bosch	5	1	....	....	Cone	Belt
Reading-Standard	21-T	2	Vee	$3\frac{3}{8}$	4	71.5	4	Air	Splash	Schebler	Own	Bosch & Opt	16	3	3.91 6.00 9.20	Prog. Slid	D-Disk	Chain
Reading-Standard	21-TE	2	Vee	$3\frac{3}{8}$	4	71.5	4	Air	Splash	Schebler	Own	Bosch & Opt.	16	3	3.91 6.00 9.20	Prog.	D-Disk	Chain

Motorcycle Records

The M. & A. T. A. (Motorcycle & Allied Trades Association) is the governing body for motorcycle competition in the United States. Its records on Jan. 1, 1921, are as follows:

COMPETITIVE RECORDS

These records are for the best time made in M. & A. T. A. competition for the distance, regardless of the nature of the course and whether or not a National Championship was involved:

SOLO, 61 CUBIC INCHES

One Mile—45 2-5 secs.—Made by Gene Walker, Indian, Cleveland, Ohio, Sept. 19, 1920. (Mile dirt track.)

Two Miles—1:14 3-5—Made by Otto Walker, Harley-Davidson, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile speedway.)

Five Miles—3:50 4-5—Made by Gene Walker, Indian, Readville, Mass., Oct. 23, 1920. (Mile dirt track.)

Ten Miles—6:19 2-5—Made by Gene Walker, Indian, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

Twenty-five Miles—18:40 3-5—Made by Gene Walker, Indian, Grand Island, Nev., July 4, 1919. (One and four-fifths mile dirt track.)

Fifty Miles—32:57 2-5—Made by Ray Weishaar, Harley-Davidson, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

One Hundred Miles—1:07:57—Made by Albert Burns, Harley-Davidson, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

Two Hundred Miles—2:26:46—Made by Maldwyn Jones, Harley-Davidson, Dodge City, Kan., July 5, 1920. (Two-mile dirt speedway.)

Three Hundred Miles—3:40:04 4-5—Made by Jim Davis, Harley-Davidson, Dodge City, Kan., July 5, 1920. (Two-mile dirt speedway.)

SIDECAR, 61 CUBIC INCHES

One Mile—1:13 3-5—Made by Lester Foote, Harley-Davidson, Greeley, Col., Sept. 17, 1920. (Half mile dirt track.)

Two Miles—1:49 1-5—Made by Jiggs Price, Harley-Davidson, Readville, Mass., Oct. 23, 1920. (Mile dirt track.)

Five Miles—4:35 3-5—Made by Jiggs Price, Harley-Davidson, Cleveland, Ohio, Sept. 19, 1920. (Mile dirt track.)

Ten Miles—8:15 3-5—Made by Sam Riddle, Indian, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

Twenty-five Miles—20:36 2-5—Made by Teddy Carroll, Indian, Sheepshead, Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

NON-COMPETITIVE RECORDS
STRAIGHTAWAY RECORDS

(Made under M. & A. T. A. Sanction)

Made at Daytona Beach, Fla., in 1920, not in competition. Both professional and amateur classifications. All electrically timed and checked and certified.

# of American Motorcycles for 1921.

FRAME AND WHEELS								MISCELLANEOUS											
Wheel-base (In.)	Frame Type	Front Forks Type	Tires Size (In.)	Type of Springs		Road Clearance Exclusive of Pedals (In.)	Height of Saddle Above Ground (In.)	Starting System	Lighting System	Brakes: Type and Number	Gas Tank Capacity, Gals.	Oil Tank Capacity Qts.	Weight		Speed			List Price Not Equipped	List Price, Equipped
				Front	Rear								Empty (Lb.)	Ready for Road (Lb.)	Record High (m.p.h.)	Normal High (m.p.h.)	Lowest (m.p.h.)		
56	Diamond....	Helical Spring	26x3	Helical....	....	4	28	Kick....	None.........	1 External.....	2¼	None...	180	200	....	....	....	$275	......
59	Loop........	Helical...... Spring	28x3	Helical....	....	......	30	Kick....	Split. Gem.....	2 Internal and External	......	....	361	387	100	65	6	$435	$485
60	Loop........	Helical Spring	28x3	Helical....	....	5	30½	Kick....	None.........	1 External 1 Inter-Opt.	3	4½	340	365	103	65	4	$450	......
60	Loop........	Helical Spring	28x3	Helical....	....	5	30½	Kick....	Own Gen. Exide Bat.	1 External 1 Inter-Opt.	3	4½	360	385	103	65	4	....	$485
53½	Diamond....	Helical Spring	28x3	Helical....	....	5½	28	Kick....	None.........	1 External 1 Inter-Opt..	3	2½	260	280	......	55	4	$415	......
53½	Diamond....	Helical Spring	28x3	Helical....	....	5½	28	Kick....	Own Gen. Exide Bat.	1 External 1 Inter-Opt.	3	2½	280	300	....	55	4	....	$445
60	Loop........	Helical Spring	28x3	Helical....	....	5	30½	Kick....	None.........	1 Internal 1 Exter-Opt.	3	4½	345	370	....	70	4	$485	......
60	Loop........	Helical Spring	28x3	Helical....	....	5	30½	Kick....	Own Gen. Exide Bat.	1 Internal 1 Exter-Opt.	3	4½	365	390	....	70	4	....	$520
54¼	Loop........	Leaf Spring..	26x3	Leaf......	....	4¾	28	Kick....	Split-Gen...... Witherbee Battery	1 Internal.....	3	3	......	275	....	55	7	$400	$440
59½	Loop & Cradle Springs	Leaf Spring..	28x3	Leaf......	....	6¼	32⅝	Kick....	Split-Gen. Witherbee Battery	1 Internal 1 External	3¼	3	......	351	115	65	9	$440	$480
60	Double Loop	Helical Spring	27x3½	Helical....	....	5¼	29	Kick....	Split-Gen......	1 Internal 1 External	3	3	392	421	75	65	4	$535	$600
58	Loop........	Leaf Spring..	28x3	Leaf......	....	5	29½	Kick....	None.........	1 External.....	2½	2	......	260	....	....	....	$320	......
58	Loop........	Leaf Spring..	28x3	Leaf......	....	5	29½	Kick....	None.........	1 External.....	2½	2	......	260	....	....	....	$290	......
58	Loop........	Leaf Spring..	28 3	Leaf......	....	5	29½	Kick....	None.........	1 External.....	2½	2	......	220	....	....	....	$250	......
58	Loop........	Leaf Spring..	28x3	Leaf......	....	5	29½	Kick....	None.........	1 External.....	2½	2	......	220	....	....	....	$225	......
58	Loop........	Leaf Spring..	28x2½	Leaf......	....	5	31½	Pedals..	None.........	Coaster Hub...	2	1½	......	215	....	....	....	$200	......
58	Diamond....	Helical Spring	28x3	Helical....	....	5½	31	Kick....	....	1 Internal..... 1 External	3¼	3	343	......	....	....	....	$435	......
58	Diamond....	Helical Spring	28x3	Helical....	....	5½	31	Kick....	Split-Gen......	1 Internal 1 External	3¼	3	366	......	....	....	....	....	$475

PROFESSIONAL, SOLO 61

(8-Valve Motors)—By Gene Walker, Indian, April 14-15, 1920. Kilometer—19:32 sec. One mile—31:53 sec. Two miles—1:04:45. Five miles—2:45:62.

Both Ways of Course—Kilometer—22:16 North; 21:04 South; 21:60 average. One mile—35:78 North; 33:62 South; 34:70 average.

PROFESSIONAL, SOLO 61

(Pocket Valve Motors)—By Gene Walker, Indian, April 14-15, 1920. Kilometer—21:15 sec. One mile—34:20 sec. Two miles—1:09:71. Five miles—3:04:70.

Both Ways of Course—Kilometer—23:83 North; 22:11 South; 22:96 average. One mile—38:00 North; 34:92 South; 22:96 average.

PROFESSIONAL, SOLO 30.50

(4-Valve Motors)—By Gene Walker, Indian, April 14-15, 1920. Kilometer—25:80 sec. One mile—40:98 sec. Two miles—1:23:03. Five miles—3:30:11.

Both Ways of Course—Kilometer—28:30 North; 26:12 South; 27:21 average. One mile—45:63 North; 42:08 South; 43:85 average.

PROFESSIONAL, SIDECAR 61

(8-Valve Motors)—By Leslie Parkhurst, Harley-Davidson, Feb. 17, 1920. Kilometer—26:54 sec. One mile—42:81 sec. Two miles—1:25:69. Five miles—3:34:52.

Both Ways of Course—Kilometer—26:54 North; 44:88 South; 43:85 average.

1920 NATIONAL CHAMPIONSHIPS

One Mile, 61—Won by Gene Walker, Indian, Cleveland, Ohio, Sept. 9. Time, 45 2-5 sec.

One Mile, 30:50—Won by Gene Walker, Indian, Akron, Ohio, Aug. 1. Time, 1:06.

One Mile, Sidecar—Won by Lester Foote, Harley-Davidson, Greeley, Colo., Sept. 17. Time 1:13 3-5.

Two Miles, 61—Won by Gene Walker, Indian, Akron, Ohio, Aug. 1. Time, 2:14 3-5.

Two Miles, Sidecar—Won by Jiggs Price, Harley-Davidson, Readville, Mass., Oct. 23. Time, 1:49 1-5.

Five Miles, 61—Won by Gene Walker, Indian, Readville, Mass., Oct. 23. Time, 3:50 4-5.

Five Miles, 30:50—Won by Albert Burns, Indian, Grand Junction, Colo., June 6. Time, 6:02.

Five Miles, Sidecar—Won by Floyd Clymer, Indian, Colorado, July 25. Time, 5:01.

Ten Miles, 61—Won by Ralph Hepburn, Harley-Davidson, Readville, Mass., Oct. 23. Time, 8:03 2-5.

Ten Miles, 30:50—Won by Gene Walker, Indian, Greeley, Colo., May 3. Time, 11:25.

Ten Miles, Sidecar—Won by S. J. Riddle, Indian, Pottstown, Pa., May 3. Time, 10:54.

Twenty-five Miles, 61—Won by Albert Burns, Indian, Ascot, Los Angeles, Cal., Jan. 11. Time, 18:32.

Twenty-five Miles, 30:50—Won by Don Marks, Indian, South Bend, Ind., July 1. Time, 27:00 4-5.

Twenty-five Miles, Sidecar—Won by F. R. Dreyer, Indian, Philadelphia, Pa., June 19. Time, 25:34.

Twenty-five Mile Road Race—Won by Leonard Buckner, Indian, Savannah, Ga., April 26. Time, 40:01.

Fifty Mile Road Race—Won by Gene Walker, Indian, Savannah, Ga., April 26. Time, 40:01.

Two Hundred Mile Road Race—Won by Ray Weishaar, Harley-Davidson, Marion, Ind., Sept. 6. Time 2:48:37:12.

Three Hundred Miles, 61—Won by Jim Davis, Harley-Davidson, Dodge City, Kan., July 5. Time, 3:40:04 4-5.

British Motorcycle

Compiled for Automotive

Number	Name	H.P.	ENGINE: Type 2-Stroke or 4-Stroke	ENGINE: Make	ENGINE: No. of Cylinders	ENGINE: Cylinder Arrangement	ENGINE: Bore and Stroke	ENGINE: Cylinder Head Detachable	ENGINE BEARINGS: Crank Shaft	ENGINE BEARINGS: Big-end	No. of Rings	Engine Lubrication System	Clutch Control	Make of Gearset	No. of Speeds
1	A. J. S.	7	4	Own	2	Ve	74x93	Yes	P	R	3	Sp	H	Own	3
2	Allon	2¾	2	Own	1	V	70x76	No	P	P	2	Sp	H	Own	2
3	Armis	2¾	4	J.A.P	1	V	70x76	No	P	P	2	Sp	H	Burman	2
4	Armis	3½	2	Precision	1	V	74x81	Yes	B	B	2	C-S	H	Burman	2
5	Armis	5	4	J.A.P	2	Ve	70x85	No	P	P	3	Sp	H	Burman	3
6	Bat	6	4	J.A.P	2	Ve	76x85	No	P	P	3	Sp	H	Stur. Arch.	3
7	Beardmore Precision	3½	2	Own	1	V	74x81	Yes	R	R	3	C-S	H	Own	2
8	Blackburne	4	4	Own	1	V	85x88	Yes	P	P	2	Sp	H	Stur. Arch	3
9	Blackburne	8	4	Own	2	Ve	85x88	Yes	B	R	2	Sp	H	Burman	3
10	Bradbury	2¾	4	Own	1	V	74.5x80	Yes	B	P	3	Sp	H	Own	2
11	Bradbury	4	4	Own	1	V	89x89	No	B	P	2	Sp	H	Own	3
12	Bradbury	6	4	Own	2	V	74.5x86	Yes	B	P	3	Sp	F	Own	3
13	Brough	3½	4	Own	2	H	70x64.5	No	R	R	2	Sp	H	Stur. Arch	3
14	Brough	5	4	Own	2	H	70x90	No	R	R	2	Sp	H	Stur. Arch	3
15	B. S. A.	4¼	4	Own	1	V	85x98	No	B	R	2	Sp	F	Own	3
16	B. S. A.	6	4	Own	2	Ve	76x85	No	B	R	2	Sp	H	Own	3
17	Clyno	8	4	Own	2	Ve	76x102	Yes	P	R	3	Sp	F	Own	3
18	Connaught	2½	2	Own	1	V	70x73	No	P	P	3	F		None	1
19	Connaught	2¾	2	Own	1	V	70x73	No	P	P	3	F	H	Stur. Arch	2
20	Coulson	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Stur. Arch	3
21	Coulson	4	4	Blackburne	1	V	85x88	Yes	P	P	2	Sp	H	Stur. Arch	3
22	Diamond	2½	2	Villiers	1	V	70x70	No	P	R	3	Sp	H	Stur. Arch	2
2	Diamond	2½	4	J.A.P	1	V	70x76	No	P	P	2	Sp	H	Stur. Arch	2
24	Dot	3½	4	J.A.P	2	Ve	70x64	No	P	P	2	Sp	H	Albion	2
25	Dot	8	4	J.A.P	2	Ve	85x85	No	P	P	2	Sp	H	Stur. Arch	3
26	Douglas	2¾	4	Own	2	H	61x60	No	B	P	2	Sp		Own	2
27	Douglas	2¾	4	Own	2	H	61x60	No	B	P	2	Sp	H	Own	2
28	Douglas	4	4	Own	2	H	74.5x68	No	B	P	2	Sp	F	Own	3
29	Douglas	2¾	4	Own	2	H	61x60	Yes	B	P	2	Sp	H	Own	3
30	Douglas	3½	4	Own	2	H	68x68	Yes	B	P	2	Sp	H	Own	3
31	Dunelt	4½	2	Own	1	Ve	85x88	No	B	P	3	Sp	H	Stur. Arch	3
32	Enfield	8	4	Vickers	2	Ve	85.5x85	No	R	R	3	Sp	H	Own	2
33	Excelsior	2½	2	Villiers	1	V	70x70	No	P	R	3	Sp		Stur. Arch	2
34	Excelsior	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Stur. Arch	2
35	Excelsior	4½	4	Own	1	V	86x112	No	P	P	3	Sp	H	Stur. Arch	3
36	Excelsior	6	4	J.A.P	2	Ve	70x85	No	P	P	2	Sp	H	Stur. Arch	3
37	Francis Barnett	2¾	4	J.A.P	1	V	70x76	No	P	P	3	Sp	H	Stur. Arch	2
38	Hazlewood	6	4	J.A.P	2	Ve	70x88	No	B.&P	P	3	Sp	F	Own	3
39	Hazlewood	8	4	J.A.P	2	Ve	85x85	No	B.&P	P	3	Sp	F	Own	3
40	Hobart	2½	2	Villiers	1	V	70x70	No	P	R	3	Sp	H	Stur. Arch	2
41	Hobart	2¾	4	J.A.P	1	V	70x76	No	P	P	3	Sp	F	Stur. Arch	2
42	Humber	4½	4	Own	2	H	75x68	No	B	B	2	C-S	H	Own	3
43	Hoskison	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Burman	2
44	Hoskison	4	4	Blackburne	1	V	85x88	Yes	P	P	2	Sp	H	Burman	3
45	Imperial	2¾	4	J.A.P	1	V	70x76	No	P	P	2	Sp	H	Own	2
46	Imperial	8	4	J.A.P	2	Ve	85x85	No	B.&P	P	2	Sp	H	Own	3
47	James	2¼	2	Own	1	V	66x70	No	P	R	3	Sp	H	None	2
48	James	3½	4	Own	2	Ve	64x77	No	B	R	2	Sp	H	Own	3
49	James	4¼	4	Own	1	V	86x103	No	B	P	2	Sp	F	Own	3
50	James	7	4	Own	2	Ve	73x90	No	B	R	2	Sp	F	Own	3
51	J. E. S.	2	2	Own	1	V	60x60	No	P	P	3	Sp		None	1
52	J. E. S.	1½	4	Own	1	V	55x60	Yes	P	P	2	Sp		None	1
53	Levis	2¼	2	Own	1	V	62x70	No	P	P	2	H-S		None	1
54	L. M. C.	6	4	Own	2	Ve	79x85	No				Sp shaft	H	Stur. Arch	3
55	L. M. C.	8	4	Own	2	Ve	79x98	No				Sp	H	Stur. Arch	3
56	Matchless	8	4	J.A.P	2	Ve	85x85	No	P	P	3	Sp	H	Own	3
57	Metro Tyler	2½	2	Own	1	V	70x70	No	B	R	2	Sp		Own	2
58	Norton	3½	4	Own	1	V	79x100	No	R	R	2	Sp		None	1
59	Norton	3½	4	Own	1	V	79x100	No	R	R	2	Sp	H	Stur. Arch	3
60	Norton	4	4	Own	1	V	82x120	No	R	R	2	Sp	H	Stur. Arch	3
61	Nut	3½	4	Own	2	V	64.5x76	No	B	R	2	C-S	H	Stur. Arch	3
62	Nut	3½	4	Own	2	Ve	64.5x76	Yes	P	R	2	C-S	H	Stur. Arch	3
63	Nut	5	4	Own	2	Ve	70x88	No	B	P	2	C-S	H	Stur. Arch	3
64	Olympic	2¾	2	Orbit	1	V	68x72	No	P	P	2	Sp	H	Jackes	2
65	P. & M.	3½	4	Own	1	I	84.5x88.9	No	B	P	2	Sp	H	Own	2
66	Quadrant	4½	4	Own	1	V	87x95	No	B	P	2	Sp	H	Stur. Arch	3
67	Quadrant	5	4	Own	1	V	87x110	No	B	P	2	Sp	H	Stur. Arch	3
68	Radico	2½	2	Own	1	V	67x70	No	P	P	2	Sp		Albion	2
69	Raleigh	6	4	Own	2	H	77x75	Yes	R	R	2	Sp	H	Stur. Arch	3
70	Rover	3½	4	Own	1	V	85x88	No	B	R	2	Sp			1
71	Rover	3½	4	Own	1	V	85x88	No	P	R	2	Sp	F	Own	3
72	Rover	6	4	J.A.P	2	Ve	70x85	No	P	P	2	Sp	F	Own	3
73	Ruby	2¾	4	Own	1	V	74.5x80	No	P	P	3	Sp	H	Own	2
74	Ruby	3	4	Own	1	V	74.5x86	No	P	P	2	Sp	H	Own	2
75	Ruby	8	4	J.A.P	2	Ve	85x85	No	P	P	3	Sp	H	Stur. Arch	3
76	Rudge	3½	4	Own	1	V	85x88	No	B	P	2	Sp	H		Var
77	Rudge	5	4	Own	1	V	85x132	No	B	P	2	Sp	H		Var
78	Rudge	7	4	Own	2	Ve	85x88	No	B	P	2	Sp	H		Var
79	Rudge	7	4	Own	2	Ve	85x88	No	B	P	2	Sp	H	Own	3
80	Scott	3¾	2*	Own	2	V	73x63.5	No	R	R	3	Sp	H	Own	2
81	Sun	2¾	2	Own	1	V	70x70	No	R	R	2	F-F	H	Stur. Arch	2
82	Sunbeam	3½	4	Own	1	V	85x88	No			1 & S	Sp	H	Own	3
83	Sunbeam	8	4	J.A.P	2	Ve	85x85	No			1 & S	Sp	H	Own	2
84	Superb Four	10	4	Own	4	V	63x78	Yes	P	P	2	C-S	F	Own	3
85	Triumph	2¼	2	Own	1	V	64x70	No	P	P	3	F		Own	2
86	Triumph	4	4	Own	1	V	85x97	No	B	R	3	Sp	H	Stur. Arch	3
87	Triumph	4	4	Own	1	V	85x97	No	B	R	3	Sp	H	Own	3
88	Velocette	2¼	2	Own	1	V	62x73	No	P	P	2	H-S		Own	2
89	Wilkin	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Stur. Arch	3
90	Wilkin	3½	4	Blackburne	1	V	85x88	Yes	P	P	2	Sp	H	Stur. Arch	3
91	Wolf	2½	2	Villiers	1	V	70x70	No	P	R	3	Sp	H	Stur. Arch	2
92	Wolf	2¾	4	J.A.P	1	V	70x76	No	P	P	3	Sp	H	Stur. Arch	2
93	Wolf	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Stur. Arch	2
94	Wolf	4	4	J.A.P	1	V		No	P	P	3	Sp	H	Stur. Arch	3
95	Wooler	2¾	4	Own	2	H	60.5x60	Yes	B	B	2	C-S	F	Own	3
96	Wooler	2¾	4	Own	2	H	60.5x60	Yes	B	B	2	C-S			Var
97	Zenith	2¾	4	Bradshaw	2	H	58x65	No	B	P	2	Sp		None	Var
98	Zenith	5	4	J.A.P	2	Ve	70x85	No	B.&P	P	3	Sp		None	Var
99	Zenith	6	4	J.A.P	2	Ve	76x85	No	B.&P	P	3	Sp		None	Var
100	Zenith	8	4	J.A.P	2	Ve	85x85	No	B.&P	P	3	Sp		None	Var

Aluminum pistons—Nos. 52, 62—All others cast iron. Overhead valves—13, 29, 30, 62, 84. Superimposed valves—52, 76, 77, 78, 79, 95, 96. Electric lighting—61. Floating piston pin—42, 61, 62, 63. Piston pin fixed in rod—7, 17, 52, 69, 70, 71, 73, 74, 90, 93. Expanding clutches—7, 32, 65, 80. Cone clutches—56, 64, 84, 100. Dog clutches—47. Unit power plants—7, 28, 57, 84, 85, 95. Frames spring at rear—6, 7, 17, 20, 21, 56, 69, 74, 75, 95, 96. Detachable and interchangeable wheels—1, 6, 9, 16, 17, 81, 86, 56, 69, 76, 79, 82, 83, 84. Selective gear shift—6. Crank and fenders part of frame—7. Two primary transmission chains—32. Two exhaust valves per cylinder—61.

Specifications for 1921

Industries by M. W. Bourdon

Gear Ratios: Top	Gear Ratios: 2nd	Gear Ratios: Low	Type of Transmission	Width of Belt	Mudguards: Width	Mudguards: Clearance	Ground Clearance	Brakes, Type: Front	Brakes, Type: Rear	Type and Wheel Size	Weight, Solo Machine	Tank Capacity: Fuel, Pints	Tank Capacity: Oil, Pints	Foot-boards or Footrests	Number	Name
5	9	16	Ch.	....	7	3	6	Exp.	Exp.	28x3	.....	18	3	B.	1	A. J. S.
5¼	.....	9	Ch. & B.	¾	4	1½	4¼	Exp.	Exp.	26x2¼	190	12	3	B.	2	Allon
5	.....	9.5	Ch. & B.	¾	4¼	1½	5½	Rim.	Belt rim.	26x2¼	170	12	3	B.	3	Armis
5	.....	9.5	Ch. & B.	¾	4¼	1½	5½	Rim.	Belt rim.	26x2¼	180	12	3	B.	4	Armis
.....	.....	.....	Ch. & B.	1	6	2½	5½	Rim.	Belt rim.	26x2½	220	12	3	B.	5	Armis
4.6	8	11	Ch.	....	4	1¾	6	.....	Exp. & Cont.	28x3	300	16	4	B.	6	Bat
5	.....	9	Ch.	....	4½	1¾	5½	Cont.	Cont.	26x2¼	230	16	2	B.	7	Beardmore Precision
.....	.....	.....	Ch.	....	6	2	5½	Rim.	Cont.	28x3	250	16	4	O.	8	Blackburne
.....	.....	.....	Ch.	....	6	2	6	Rim.	Exp.	28x3	330	16	4	B.	9	Blackburne
5.1	.....	10	Ch. & B.	....	3¼	1½	5	Rim.	Belt rim.	26x2¼	240	12	3	B.	10	Bradbury
5.1	8.4	14.8	Ch.	....	3¼	1½	5	Rim.	Exp.	26x2⅜	280	12	3	B.	11	Bradbury
5.1	8.4	14.8	Ch.	....	3¼	1½	6	Rim.	Exp.	26x2½	325	18	3	B.	12	Bradbury
4¼	5¼	8½	Ch.	....	4	1¼	6½	Exp.	V rim.	26x2⅜	196	14	3	R.	13	Brough
4½	7½	12	Ch.	....	5	1¼	6½	Exp.	V rim.	26x2½	255	18	3	O.	14	Brough
5	8	12.8	Ch.*	....	.....	.....	.....	V rim.	V rim.	26x2½	238	16	2½	B.	15	B. S. A.
5	8.2	13.2	Ch.	....	.....	.....	.....	V rim.	Exp.	28x3	336	17	3½	B.	16	B. S. A.
4.9	7.6	16	Ch.	....	8	3	6	Rim.	Exp.	28x3	.....	18	3	B.	17	Clyno
5	.....	.....	B.	¾	4	1¾	4½	Rim.	Belt rim.	24x2	170	8	2	R.	18	Connaught
5½	.....	10½	Ch. & B.	¾	4	1¾	4½	Rim.	Belt rim.	26x2¼	180	10	2	B.	19	Connaught
5	8	13	Ch. & B.	¾	5	1½	4½	.....	2 bands.	26x2½	191	12	3	B.	20	Coulson
5	8	13	Ch. & B.	1	5½	1½	4½	.....	2 bands.	26x2½	.....	12	3	B.	21	Coulson
6	.....	10.6	Ch. & B.	¾	5	1¾	5	Rim.	Belt rim.	26x2¼	167	16	2	R.	22	Diamond
6	.....	10.6	Ch. & B.	¾	5	1¾	5	Rim.	Belt rim.	26x2¼	168	16	2	O.	23	Diamond
4.5	.....	9	Ch. & B.	⅞	5	2¼	4½	Rim.	Belt rim.	26x2¼	196	12	2	B.	24	Dot
4¾	9	12½	Ch.	....	7	2½	6	Rim.	Exp.	28x3	280	20	3	B.	25	Dot
6.1	.....	8.5	Ch. & B.	¾	8	2½	7	Rim.	Belt rim.	26x2¼	175	10	3	R.	26	Douglas
6.1	8.5	13	Ch. & B.	¾	8	2½	7	Rim.	Belt rim.	26x2¼	200	10	3	R.	27	Douglas
5	8	12	Ch. & B.	⅞	8	2½	6	Rim.	Belt rim.	26x2⅜	250	16	3	B.	28	Douglas
.....	.....	.....	Ch.	....	5	2½	5	V drum.	Exp.	26x2½	240	12	3	R.	29	Douglas
.....	.....	.....	Ch.	....	5	2½	5	V drum.	Exp.	26x2½	260	12	3	R.	30	Douglas
4½	8	12½	Ch. & B.	1	6	2	6½	Rim.	Belt rim.	26x2½	260	18	3	B.	31	Danelt
5	.....	9	Ch.	....	6	2½	5	V rim.	V rim.	28x3	320	16	3	B.	32	Enfield
.....	.....	.....	Ch. & B.	¾	3	1½	5	Rim.	Belt rim.	26x2¼	.....	....	...	B.	33	Excelsior
.....	.....	.....	Ch. & B.	¾	5	2	5	Rim.	Belt rim.	26x2¼	.....	....	...	B.	34	Excelsior
.....	.....	.....	Ch. & B.	1	5	2	5	Rim.	Belt rim.	26x2½	.....	....	...	B.	35	Excelsior
.....	.....	.....	Ch.	....	5	2	5	Rim.	Exp.	28x3	.....	....	...	B.	36	Excelsior
6	.....	10	Ch. & B.	¾	3¼	1¼	4	Rim.	Belt rim.	26x2¼	188	16	3	B.	37	Francis Barnett
4	7	13	Ch. & B.	1	8	2½	5	Rim.	Belt rim.	28x2½	200	16	4	B.	38	Hazlewood
4¼	7	13	Ch. & B.	1	8	3	5½	Rim.	Belt rim.	26x3	230	20	6	B.	39	Hazlewood
5½	.....	11	Ch. & B.	¾	6	2	5	V rim.	Belt rim.	26x2¼	164	12	3	B.	40	Hobart
5½	.....	11	Ch. & B.	¾	6	2	5	V rim.	Belt rim.	26x2¼	175	12	3	B.	41	Hobart
5	8.5	14	Ch.	....	4¾	1½	5	Rim.	V rim.	26x2½	275	18	2	B.	42	Humber
5.4	.....	9.25	Ch. & B.	¾	7¼	1⅝	5¼	V rim.	Belt rim.	26x2¼	183	12	2	B.	43	Hoskison
5.1	8.3	12.2	Ch. & B.	1	7¼	1⅝	5¼	V rim.	Belt rim.	26x2½	248	20	2	B.	44	Hoskison
5¾	.....	11	Ch. & B.	¾	7	3	5	Rim.	Belt rim.	26x2¼	165	12	2	B.	45	Imperial
4½	8½	12½	Ch.	....	7	3	6	Rim.	Vee rim.	28x3	315	16	4	B.	46	Imperial
5½	.....	10	Ch. & B.	¾	5	2½	5	Rim.	V rim.	26x2¼	168	8	2	B.	47	James
5	8½	13	Ch.	....	5	2½	5	Rim.	V rim.	26x2½	232	16	2	B.	48	James
5	8½	13	Ch.	....	7	3	6	Rim.	Exp.	28x3	280	16	2	B.	49	James
5	8½	13	Ch.	....	7	3	6	Rim.	Exp.	28x3	296	16	2	B.	50	James
6	.....	.....	B.	⅝	3	1½	.....	Rim.	Belt rim.	26x1¾	80	8	2	B.	51	J. E. S.
8	.....	.....	B.	½	3	1½	.....	Rim.	Cont.	26x1¾	75	6	1	P.	52	J. E. S.
5¾	.....	.....	B.	¾	3	1¼	5	Rim.	Belt rim.	24x2	110	10	2	R.	53	Levis
4	7	12	Ch. & B.	1	5	2	4½	Rim.	Belt rim.	26x2½	.....	12	3	B.	54	L. M. C.
4	7	12	Ch.	....	5	2	4½	V rim.	Exp.	26x2½	.....	12	3	.....	55	L. M. C.
.....	.....	.....	Ch.	....	5	3	6	Rim.	Exp.	28x3	320	16	6	B.	56	Matchless
5.8	.....	11	Ch. & B.	⅞	6	2	4½	Rim.	Belt rim.	26x2¼	180	12	2	R.	57	Metro Tyler
3⅞	.....	6	B.	1	5	1½	3⅞	Rim.	Belt rim.	26x2¼	197	12	3	R.	58	Norton
4½	7¾	13¼	Ch.	....	5	2	3¾	Rim.	V rim.	26x2½	252	16	3	R.	59	Norton
4½	7¾	13¼	Ch.	....	7	3	6	Rim.	V rim.	26x2½	285	16	3	B.	60	Norton
4.5	7.3	12	Ch. & B.	1	5	2½	5	Rim.	Belt rim.	26x2½	265	16	4	R.	61	Nut
4.2	5.3	8	Ch. & B.	1	3½	2	4	Rim.	Belt rim.	26x2½	.....	16	8	R.	62	Nut
4.5	7.3	12	Ch. & B.	1	5	2½	5	Rim.	Belt rim.	26x2½	285	16	4	R.	63	Nut
5¾	.....	10	Ch. & B.	¾	7	2	6	Rim.	Belt rim.	26x2¼	180	16	4	B.	64	Olympic
5.4	.....	9.5	Ch.	....	5	2¾	5½	V rim.	Cont.	26x2½	265	12	3	R.	65	P. & M.
5	8	13	Ch. & B.	1	6¾	2¼	5	Rim.	Belt rim.	26x2½	260	18	4	B.	66	Quadrant
5	8	13	Ch. & B.	1	6¾	2¼	5	Rim.	Belt rim.	26x2½	270	18	4	B.	67	Quadrant
5	.....	9¼	Ch. & B.	¾	3	1½	4	Rim.	Belt rim.	24x2	128	11	3	B.	68	Radico
5	7.5	13.2	Ch.	....	5	1¾	6	V rim.	Exp.	26x2½	295	18	3	B.	69	Raleigh
3.7	.....	7	B.	⅞	4½	1½	4½	V rim.	Belt rim.	26x2½	220	16	2	R.	70	Rover
4.5	7.6	14.2	Ch.	....	6	2	4½	V rim.	Exp.	26x2½	270	16	2	B.	71	Rover
4.9	8.2	15.4	Ch.	....	6	2	6	V rim.	Exp.	28x3	280	16	2	B.	72	Rover
5¼	.....	10	Ch. & B.	¾	5	1¾	6	Rim.	Belt rim.	26x2¼	180	12	3	R.	73	Ruby
5¼	.....	10	Ch. & B.	¾	6½	1¾	6	Rim.	Belt rim.	26x2½	230	12	3	B.	74	Ruby
5	8	14	Ch.	....	8½	2	6	Rim.	Exp.	28x3	280	16	4	B.	75	Ruby
3½	.....	7	B.	1	5	1¾	5½	Rim.	Belt rim.	26x2½	240	18	3	R.	76	Rudge
3½	.....	7	B.	1	5	2	4	Rim.	Belt rim.	26x2½	246	18	3	R.	77	Rudge
3½	.....	7	B.	1	5	1¾	5½	Rim.	Belt rim.	26x2½	260	18	3	R.	78	Rudge
4	6.8	9.7	Ch.	....	5	1¾	5½	V rim.	V rim.	26x2½	290	18	3	B.	79	Rudge
4.26	.....	7.84	Ch.	....	5½	2	5	Rim.	Exp. drum.	26x2½	227	16	2	B.	80	Scott
5	.....	9.5	Ch. & B.	¾	7	2½	5	Rim.	Belt rim.	26x2¼	.....	10	2	B.	81	Sun
5	8	13	Ch.	....	.....	.....	.....	Rim.	Exp.	26x2½	.....	....	...	B.	82	Sunbeam
4.6	7.3	12.6	Ch.	....	.....	.....	.....	Rim.	Exp.	28x3	.....	....	...	B.	83	Sunbeam
.....	.....	.....	Ch.	....	6	3	6	.....	2 exp.	28x3	.....	....	...	B.	84	Superb Four
6	.....	10	B.	¾	.....	.....	4½	Rim.	Belt rim.	24x2¼	130	9	2	R.	85	Triumph
5	8¾	13½	Ch. & B.	1	.....	.....	4	Rim.	Belt rim.	26x2½	230	12	2	R.	86	Triumph
4¾	8	13½	Ch.	....	.....	.....	.....	Rim.	V rim.	26x2½	240	12	2	R.	87	Triumph
5.3	.....	9.3	Ch.	....	6	2	5	Rim.	Exp.	24x2¼	160	9	3	B.	88	Velocette
5¼	8	11	Ch.*	....	7	2½	5	Rim.	V rim.	26x2¼	220	16	3	R.	89	Wilkin
5	9	14	Ch.	....	7	2½	5½	Rim.	V rim.	26x3	228	16	3	O.	90	Wilkin
.....	.....	.....	Ch. & B.	¾	4	1¾	5½	Rim.	Belt rim.	26x2¼	160	8	3	O.	91	Wolf
.....	.....	.....	Ch. & B.	¾	4	1¾	5½	Rim.	Belt rim.	26x2¼	175	8	3	O.	92	Wolf
.....	.....	.....	Ch. & B.	¾	5	2	5½	Rim.	Belt rim.	26x2¼	195	8	3	O.	93	Wolf
.....	.....	.....	Ch. & B.	¾	5	2	5½	Rim.	Belt rim.	26x2½	.....	10	3	B.	94	Wolf
.....	.....	.....	Ch.	¾	5	2	6	Cont.	V rim.	26x2¼	165	16	3	O.	95	Wooler
.....	.....	.....	B.	⅞	5	2	6	Cont.	Belt rim.	26x2½	160	16	3	O.	96	Wooler
6	.....	13*	Ch. & B.	⅞	5	2	3¾	Rim.	Belt rim.	26x2¼	.....	12	3	R.	97	Zenith
3.3	.....	7.3*	B.	1	5	2	4½	Rim.	Belt rim.	26x2½	254	12	4	R.	98	Zenith
3.3	.....	7.3	B.	1	5	2	5¼	Rim.	Belt rim.	28x3	274	16	4	R.	99	Zenith
4	.....	11	Ch. & B.	1⅛	5	2	5	V rim.	Belt rim.	28x3	318	16	4	R.	100	Zenith

Water cooled engine—80. **Cylinder Arrangement:** V—Vertical; Ve—Vee; H—Horizontal; I—Inclined. **Engine Bearings:** P—Plain; B—Ball; R—Roller. **Engine Lubrication System:** Sp—Splash; C-S—Circulating Splash; F—Oil mixed with fuel; H-S—Hollow Shaft; F-F—Forced Feed. **Clutch Control:** H—Hand; F—Foot. **Type of Transmission:** Ch—Chain; B—Belt; *—Chain & Belt Optional. **Foot Boards or Footrest:** B—Foot Boards; R—Foot Rests; O—Optional; P—Pedals.

Summary of British Motorcycle Specifications

By M. W. Bourdon

See table on page 374

Number of Cylinders

Four ....1 only
Three ....1 only
Remainder:
1-cylinder .....57 per cent
*2-cylinder .....43 per cent

*25 per cent horizontally opposed.

Engine Type

Four-cycle ....80 per cent
Two-cycle ....20 per cent
Up to 2¾ hp.:
Four-cycle .....55 per cent
Two cycle ......45 per cent

Cylinder Heads

Integral ....76 per cent
Detachable ....24 per cent

Valve Location

Side ....68 per cent
Valveless ....20 per cent
Both overhead.... 6 per cent
Inlet overhead.... 6 per cent

Crankshaft Bearings

Plain ....45 per cent
Ball ....36 per cent
Roller ....13 per cent
Ball and plain.... 6 per cent

Big-End Bearings

Plain ....61 per cent
Roller ....36 per cent
Ball .... 3 per cent

Piston Material

Cast iron ....98 per cent
Aluminum .... 2 per cent

Number of Rings

Three ....65 per cent
Two ....35 per cent

Wrist Pin

Fixed in piston...81 per cent
Fixed in rod......15 per cent
Floating .... 4 per cent

Lubrication

Splash ....73 per cent
Circulating splash.20 per cent
With fuel......... 5 per cent
Forced .... 2 per cent

Clutches

Plate ....95 per cent
Miscellaneous .... 5 per cent

Clutch Control

Hand ....86 per cent
Foot ....14 per cent

Number of Gear Changes

1-speed .... 7 per cent
2-speeds ....32 per cent
3-speeds ....54 per cent
Variable belt pulley 7 per cent

Gearset Mounting

Separate ....91 per cent
Unit with engine.. 9 per cent

Transmission

Chain and belt ...48 per cent
Chain ....40 per cent
Belt only ....12 per cent

(Continued on page 377)

Motorcycle Exports

	1913	1914	1915	1916	1917	1918	July 1 Dec. 31 1918	Calendar Year 1919	1920	Total for All Years
Europe:										
Austria-Hungary		29 $5,875	7 $1,535					8 $1,620		44 $9,030
Azeros, and Madeira Islands				1 $228				2 $500	21 $6,797	24 $7,525
Belgium	25 $5,176	65 $11,803	1 $151					571 $143,231	1,033 $323,344	1,665 $483,705
Bulgaria									1 $108	1 $108
Denmark	38 $6,269	239 $43,325	149 $24,163	784 $128,186	757 $135,787	2 $650	11 $3,850	1,281 $348,265	741 $208,406	4,002 $898,901
Finland	21 $4,479	78 $13,798						149 $38,015	259 $80,516	507 $136,808
France	39 $8,043	132 $29,663	56 $11,573	216 $36,121	78 $14,562	90 $20,946		272 $84,421	672 $164,406	1,555 $369,735
Germany	96 $17,525	231 $48,201	2 $597						5 $1,227	334 $67,550
Gibraltar	2 $338				3 $495					5 $833
Greece		15 $2,230		4 $868	1 $293	1 $400		16 $5,064	18 $5,447	55 $14,302
Iceland, and Faroe Islands						8 $2,000	10 $2,755	22 $7,048		40 $11,803
Italy	115 $23,298	342 $70,054	121 $24,190	790 $147,223	1,666 $349,667	1,940 $464,661	562 $121,578	1,069 $296,584	2,281 $652,450	8,886 $2,149,705
Malta, Gozo and Cyprus Islds.									24 $6,210	24 $6,210
Netherlands	18 $4,570	89 $17,885	348 $67,962	998 $190,512	1,224 $237,008			2,656 $716,68	5,181 $1,433,854	10,514 $2,688,472
Norway	8 $805	40 $8,009	114 $20,656	227 $41,943	758 $162,126	86 $21,414	80 $19,870	1,787 $518,472	1,828 $517,432	4,928 $1,310,727
Poland and Danzig									25 $12,288	25 $12,288
Portugal	16 $3,424	89 $19,014	91 $18,609	197 $41,031	241 $57,981	222 $56,045	125 $27,821	341 $103,882	228 $74,350	1,550 $402,157
Reumania									4 $1,644	4 $1,644
Russia in Europe	85 $17,819	408 $75,505	649 $137,771	2,103 $494,338	14 $1,679					3,259 $727,112
Spain	40 $9,220	76 $16,443	132 $21,472	206 $36,040	703 $146,398	426 $90,162	226 $58,550	1,079 $293,332	1,416 $457,841	4,294 $1,129,458
Sweden	14 $3,162	179 $34,106	90 $18,556	457 $88,325	1,059 $245,062	73 $13,071		2,651 $776,120	5,888 $1,671,765	10,411 $2,850,167
Switzerland		5 $1,229	6 $1,327			2 $393		145 $41,590	591 $161,020	749 $205,559
Turkey in Europe	1 $262							30 $7,405	39 $12,036	70 $19,703
England	1,036 $203,734	1,604 $320,009	324 $578,836	3,797 $732,582	287 $61,710	28 $5,706		1,158 $326,307	2,783 $786,419	11,017 $3,015,303
Scotland	4 $828	16 $3,284	33 $8,393	109 $21,900				14 $3,747	117 $35,786	293 $73,938
Ireland				50 $10,738				3 $395	2 $624	55 $11,757
North America:										
Bermuda				1 $250						1 $250
British Honduras						1 $39		1 $75	1 $83	3 $197
Canada	1,335 $236,362	1,065 $193,987	832 $140,015	927 $148,409	1,064 $196,645	1,041 $198,739	299 $65,136	1,654 $380,325	1,313 $339,350	9,530 $1,898,968
Central American States:										
Costa Rica	6 $1,174			2 $1,418	3 $450				5 $1,542	16 $4,584
Guatemala	3 $671	5 $1,242	2 $442	4 $804	31 $8,125	28 $5,033		45 $13,051	41 $13,085	159 $42,453
Honduras			5 $1,159	4 $330	2 $400	2 $575		3 $961	5 $1,371	21 $4,796
Nicaragua				1 $200	2 $162	1 $290	4 $987	5 $1,860	24 $7,748	37 $10,547
Panama	27 $6,238	32 $7,725	59 $12,637	76 $15,387	61 $15,574	62 $16,710	5 $1,037	30 $8,373	27 $8,264	379 $91,945
Salvador	1 $200		3 $919		8 $1,638	20 $4,458	12 $3,212	18 $5,849	18 $5,815	80 $22,091
Mexico	48 $9,593	26 $5,481	8 $1,897	51 $9,877	102 $23,360	59 $14,622	14 $3,717	36 $10,465	61 $17,829	405 $96,841
Newfoundland and Labrador	3 $717	8 $1,998	7 $1,226	12 $2,505	5 $1,062	3 $750		4 $726	1 $470	43 $9,454
West Indies, British:										
Barbados		6 $1,455	11 $2,585	5 $757	11 $2,204	14 $2,763	2 $599	5 $1,274	8 $2,999	62 $14,636
Jamaica	2 $500	7 $1,685	8 $1,625	18 $3,080	32 $4,672	30 $5,327	9 $1,524	15 $3,441	58 $16,947	179 $38,801
Trinidad and Tobago		16 $4,086	14 $2,833	12 $2,506	26 $5,318	14 $2,452	4 $886	10 $2,647	18 $6,043	114 $26,771
Other British				2 $480	10 $1,949	31 $4,167		9 $1,884	17 $4,863	69 $13,343
Cuba	43 $8,285	80 $15,980	75 $13,880	66 $12,217	73 $15,076	165 $36,408	50 $12,899	175 $46,330	221 $60,018	948 $221,093
Danish (Virgin Is. of U. S.)	1 $146	4 $630					2 $405	2 $457	3 $966	12 $2,604
Dominican Republic	14 $2,945	2 $376		12 $1,733	10 $1,173	10 $1,029	4 $836	21 $5,412	29 $9,151	102 $22,655
Dutch	1 $166	1 $150	1 $196		2 $368	3 $904		1 $300	1 $387	10 $2,471
French			2 $484		5 $900	4 $636	2 $500	25 $6,421	1 $250	39 $9,191
Haiti	1 $62				4 $1,015	14 $4,026	2 $315	12 $3,651	9 $2,089	42 $11,158
South America:										
Argentina	163 $30,330	110 $23,470	69 $12,798	111 $20,299	173 $35,929	227 $48,655	81 $19,663	437 $125,929	597 $171,615	1,968 $488,688

Covering Eight Years

	1913	1914	1915	1916	1917	1918	July 1 Dec. 31, 1918	Calendar Year 1919	1920	Total for All Years
South America—Continued:										
Bolivia	......	1 $261	......	9 $1,606	7 $1,918	11 $2,151	......	4 $1,560	6 $1,694	38 $9,190
Brazil	57 $12,090	61 $10,935	43 $7,743	78 $9,966	88 $16,051	94 $23,387	18 $4,583	247 $82,835	268 $81,485	954 $249,075
Chile	39 $8,134	37 $7,967	2 $570	14 $2,406	34 $6,389	88 $18,041	6 $1,572	67 $17,518	130 $37,588	417 $100,185
Colombia	4 $900	9 $2,066	11 $2,359	12 $2,607	11 $2,128	13 $2,472	5 $740	8 $2,067	24 $8,082	97 $23,421
Ecuador	2 $436	6 $852	1 $135	7 $1,493	13 $3,111	11 $2,216	3 $798	10 $2,864	34 $9,483	86 $21,388
Guiana, British	2 $338	8 $1,523	7 $1,356	8 $1,383	30 $5,047	55 $8,828	......	......	......	110 $18,475
Dutch	......	......	......	......	......	......	......	......	4 $1,695	4 $1,695
French	......	......	......	......	......	......	......	1 $120	......	1 $120
Paraguay	......	......	......	1 $196	......	......	......	......	1 $312	2 $508
Peru	......	3 $632	3 $847	8 $1,576	25 $4,546	5 $1,103	6 $1,170	1 $370	18 $4,918	69 $15,162
Uruguay	15 $2,921	10 $2,409	......	21 $4,743	49 $9,207	26 $5,892	19 $4,935	90 $22,715	133 $40,767	363 $93,589
Venezuela	18 $3,466	23 $4,725	4 $912	4 $456	22 $4,746	2 $573	1 $347	8 $1,885	8 $2,384	90 $19,494
Asia:										
Aden	......	......	2 $246	14 $2,431	6 $787	......	......	6 $1,439	......	28 $4,903
China	18 $4,542	20 $4,786	25 $6,790	11 $2,562	92 $16,943	......	57 $10,811	239 $47,883	157 $49,874	619 $144,191
Kwantung (leased territory)	......	......	......	......	......	79 $14,172	1 $200	12 $2,520	7 $1,660	99 $18,552
Chosen (Korea)	6 $1,350	......	2 $413	7 $1,008	23 $4,852	10 $2,396	3 $685	7 $1,951	19 $5,283	77 $17,938
British India	4 $570	11 $2,404	4 $925	214 $40,388	558 $111,411	16 $3,796	......	682 $189,108	1,331 $381,815	2,820 $730,497
Straits Settlements	11 $3,349	11 $2,116	......	11 $1,789	82 $15,773	140 $30,899	10 $2,146	106 $23,630	344 $87,415	715 $167,117
Other British East Indies	2 $591	7 $1,811	3 $1,211	18 $3,050	140 $26,198	68 $16,192	......	34 $11,393	161 $48,326	433 $108,872
Dutch East Indies	3 $642	20 $4,916	54 $11,871	185 $34,753	1,079 $229,167	251 $50,126	268 $52,591	634 $142,007	1,283 $371,762	3,777 $897,835
French East Indies	......	......	......	......	......	......	1 $108	......	14 $3,175	15 $3,283
Hongkong	......	1 $325	2 $690	23 $4,353	37 $7,531	18 $3,070	14 $3,549	85 $24,515	167 $44,710	275 $88,743
Japan	137 $25,833	21 $4,548	14 $3,597	19 $3,191	122 $25,716	384 $78,324	270 $64,056	864 $208,066	751 $206,806	2,582 $620,137
Persia	......	......	......	......	......	2 $730	......	......	......	2 $730
Russia in Asia	......	1 $115	......	18 $3,738	21 $5,380	......	......	......	10 $2,687	50 $18,920
Siam	......	3 $648	6 $1,375	6 $1,189	21 $3,626	17 $3,311	5 $860	21 $4,493	19 $4,864	98 $20,366
Turkey in Asia	1 $206	1 $152	......	......	......	......	2 $591	4 $1,564	5 $1,235	13 $3,748
Oceania, British:										
Australia	24 $4,706	786 $132,998	709 $137,269	2,394 $475,157	2,998 $634,011	1,678 $380,786	1,004 $251,433	2,004 $570,967	2,910 $855,581	14,507 $3,442,908
New Zealand	136 $22,664	29 $6,029	333 $49,072	1,576 $282,049	1,108 $236,432	731 $157,432	310 $79,742	1,308 $378,020	2,007 $569,741	7,538 $1,781,181
Other British	......	......	11 $1,560	10 $2,120	5 $1,330	1 $267	3 $1,001	3 $1,023	7 $2,459	40 $9,760
French	6 $1,157	......	......	......	2 $628	4 $1,186	3 $513	11 $2,426	......	26 $5,910
German	......	......	......	......	1 $298	1 $96	......	......	1 $110	3 $504
Philippine Islands	257 $42,052	134 $25,690	135 $29,383	247 $51,276	142 $30,743	163 $35,725	20 $4,032	118 $32,092	200 $54,119	1,416 $305,112
Africa:										
Belgian Kongo	......	......	......	......	......	1 $289	......	......	2 $530	3 $819
British Africa, West	......	2 $418	2 $396	72 $15,689	29 $3,575	86 $12,336	21 $2,737	133 $31,570	107 $29,725	452 $96,446
South	40 $6,784	187 $33,659	555 $101,210	1,444 $204,302	1,364 $252,478	1,874 $449,846	129 $36,277	1,786 $480,814	1,536 $450,325	8,915 $2,015,695
East	......	1 $251	6 $834	69 $12,210	32 $5,033	155 $34,358	15 $4,500	135 $39,869	27 $7,202	440 $104,257
Canary Islands	......	2 $493	14 $2,732	9 $2,056	6 $984	......	......	6 $1,666	18 $5,835	54 $13,766
Egypt	......	4 $739	2 $438	20 $3,559	39 $7,251	......	......	44 $14,887	284 $81,968	393 $108,842
French Africa	......	......	......	......	1 $432	1 $237	......	17 $3,886	9 $2,091	28 $6,646
German Africa	......	1 $201	1 $473	......	......	......	......	1 $175	......	3 $849
Kamerun	......	......	......	......	......	......	......	......	4 $968	4 $968
Liberia	......	......	......	......	2 $300	......	......	......	1 $207	3 $507
Madagascar	......	......	......	3 $502	1 $217	......	......	......	......	4 $719
Italian Africa	......	......	......	......	......	......	......	......	1 $203	1 $203
Morocco	......	......	1 $283	......	1 $355	1 $360	......	6 $2,416	3 $1,050	12 $4,494
Portuguese Africa	......	11 $1,827	5 $999	23 $5,000	4 $1,034	3 $520	2 $565	17 $5,012	37 $11,591	102 $26,548
Spanish Africa	......	......	......	2 $575	......	3 $638	......	......	......	5 $1,213
Grand Total Number **Value**										126,313 $30,963,518

Summary of British Motorcycle Specifications

(*Continued from page 376*)

Frames

Rear rigid ....90 per cent
Rear sprung .....10 per cent

Wheels

*Non-interchangeable ....85 per cent
Interchangeable ..15 per cent
(*15 per cent have knock-out rear spindles.)

Front Brakes

Rim ....76 per cent
V rim ....18 per cent.
Expanding, drum. 4 per cent
Contracting, drum 2 per cent

Rear Brakes

Belt rim ....56 per cent
Expanding, drum..25 per cent
Special V rim.....14 per cent
Contracting, drum. 5 per cent

Motorcycle Wheel Materials

The present S.A.E. Recommended Practice for Motorcycle Spokes and Nipples, specifies a steel slightly different from that of S.A.E. Steel No. 1045.

	Present Specified Composition	S. A. E. Steel No. 1045
% Carbon	0.40 to 0.55	0.40 to 0.50
% Manganese, min.	0.50	0.50 to 0.80
% Phosphorus, max.	0.05	0.045
% Sulphur, max.	0.05	0.05

In order to have the specification conform to the standard steel the present recommended practice has been revised to specify S.A.E. Steel No. 1045.

(23) Motorcycle Wheels and Rims

The present S.A.E. Recommended Practice for Motorcycle Wheels and Rims, specifies a steel composition for rims which is very nearly the same as and no more satisfactory than S.A.E. Steel No. 1010, hence present practice is revised to specify No. 1010.

	Present Specified Composition	S.A.E. Steel No. 1010
% Carbon	0.10 to 0.15	0.05 to 0.15
% Manganese,	0.40 to 0.60	0.30 to 0.60
% Phosphorus, max.	0.05	0.045
% Sulphur, max.	0.05	0.05

Marine Engine Specifications for 1921

Acme 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
H.D.	8	6¼x 7½	1	360	1470	M.&B.
H.D.	10	7¼x 9	1	340	1850	M.&B.
H.D.	16	6¼x 7½	2	366	2250	M.&B.
H.D.	20	7¼x 9	2	340	2925	M.&B.
H.D.	27	8¼x10	2	320	3975	M.&B.
H.D.	25	6¼x 7½	3	375	2550	M.&B.
H.D.	35	7¼x 9	3	350	4075	M.&B.
H.D.	45	8¼x10	3	325	5050	M.&B.
H.D.	55	8¾x10½	3	300	6680	M.&B.
H.D.	40	6¼x 7½	4	450	3475	M.&B.
H.D.	50	7¼x 9	4	375	5160	M.&B.
H.D.	65	8¼x10	4	350	6675	M.&B.
H.D.	85	8¾x10½	4	325	8200	M.&B.
H.D.	65	6¼x 7½	6	500	5825	M.&B.
H.D.	80	7¼x 9	6	425	6950	M.&B.
H.D.	100	8¼x10	6	400	8900	M.&B.
S.H.S.D.	125	8¾x10½	6	375	10800	M.&B.
S.H.S.D.	22	6¼x 7½	2	500	2150	J.S.
S.H.S.D.	35	6¼x 7½	3	500	2450	J.S.
S.H.S.D.	50	6¼x 7½	4	500	3350	J.S.
S.H.S.D.	75	6¼x 7½	6	500	4800	J.S.

Aerothrust 2-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
1919	3	2½x 2¼	2	1000	85	J.S.
1919	5	3 x 3½	2	1000	115	J.S.

Amphion 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
Out-B.	3	2½x 2½	2	900	80	Mag.
In-B.	3	2½x 2½	2	900	80	Mag.

Andersen 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
4	4	4½x 5	1	550	400	Bat.
8	8	4½x 5	2	550	550	Bat.
12	12	5 x 6	2	500	1000	Mag.
24	24	5 x 6	4	500	1600	Mag.
50	50	7 x 8½	4	450	2900	Mag.

Arrow 2-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
K-1	2½-3	2¾x 3	1	700	36	B.or M.
K-2	5 -6	2¾x 3	2	750	60	B.or M.
A-4	4 -5	4 x 4	1	650	110	B.or M.
C-21	3	2¾x 3	1	1100	85	Mag.
C-21	3	2¾x 3	1	1100	80	Mag.

Automatic 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
Open	3	4½x 5	1	500	300	M.&B.
Closed	6	4½x 5	2	500	525	M.&B.
....	9	4½x 5	3	500	760	M.&B.
....	6	5½x 7	1	400	643	M.&B.
....	12	5½x 7	2	400	1115	M.&B.
....	18	5½x 3	3	400	1425	M.&B.
....	24	5½x 7	4	400	1800	M.&B.
....	25	7½x 9	2	350	2625	M.&B.
....	37	7½x 9	3	350	3465	M.&B.
....	50	7½x 9	4	350	4430	M.&B.
....	75	10 x14	3	275	8000	M.&B.
....	100	10 x14	4	275	11780	M.&B.
En-	30	5 x 7	4	550	1850	J.S.
closed	45	5 x 7	6	550	2700	J.S.
....	40	5½x 7	4	550	1950	J.S.
....	60	5½x 7	6	550	2900	J.S.
....	50	6½x 8	4	500	3000	J.S.
....	75	6½x 8	6	500	4800	J.S.
....	70	7½x 9	4	500	4000	J.S.
....	105	7½x 9	6	500	6000	J.S.
....	100	8½x10	4	500	6000	J.S.
....	150	8½x10	6	500	9000	J.S.

American 2-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
	2½	3¼x 3½	1	800	140	Bat.
....	4	3⅞x 3½	1	800	150	Bat.
....	6	4¾x 4½	1	800	200	Bat.
....	8	5¼x 5	1	600	335	Bat.
....	8	3⅞x 3½	2	1000	220	Bat.
....	8	3⅞x 3½	2	800	280	Bat.
....	14	4¾x 4½	2	700	350	Bat.
....	20	5¼x 5	2	600	495	Bat.
....	30	4¾x 4½	4	850	595	Mag.

Capital 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
H-A4	32-34	4¼x 5½	4	1000	625	Delco.
H-A4	60-65	4¼x 5½	4	1500	625	Delco.

Barber 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
....	2½	3¼x 3¼	1	750	75	J.S.
....	5	3¼x 3¼	2	750	140	J.S.
....	8	3¼x 3¼	3	750	190	J.S.
....	4	4 x 4	1	600	150	J.S.
....	8	4 x 4	2	600	270	J.S.
....	12	4 x 4	3	600	390	J.S.
....	6	4¾x 4¾	1	600	245	J.S.
....	12	4¾x 4¾	2	600	375	J.S.
....	18	4¾x 4¾	3	600	500	J.S.
....	9	5½x 5¼	1	500	270	J.S.
....	18	5½x 5¼	2	500	535	J.S.
....	27	5½x 5¼	3	500	675	J.S.
....	12	6½x 6¼	1	500	400	J.S.
....	24	6½x 6¼	2	500	695	J.S.
....	36	6½x 6¼	3	500	925	J.S.
....	40	8 x 8	2	350	1950	J.S.
....	60	8 x 8	3	350	2850	J.S.

ABBREVIATIONS: H-D—Heavy Duty; **†**—Semi-High Speed, Heavy Duty; **‡**—Outboard; **Mag**—Magneto; **J. S.**—Jump-Spark; **Be & Bo**—Berling or Bosch; **Eismn**—Eisemann; **B or M**—Battery or Magneto; **G**—Gasoline; **K**—Kerosene; **D**—Distillate; **S-D**—Semi-Diesel; **At-K**—Atwater-Kent.

In revolutions per minute column when there is more than one figure given—as for instance 7-900—it indicates that the R.P.M. range is 700 to 900. In each case the first number represents hundreds.

Barber 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
....	4	3½x 5	1	...	160	J.S.
V.	8	3½x 5	2	...	...	J.S.

B.O.E.C. 4-Cycle K.-Fuel Oil

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
A-12¾	50	12¾x18	Single	250	17000	....

Barker 2-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
A	1¼	3 5/16x 3½	1	500	110	Opt.
B	2½	4⅛x 4¼	1	500	170	Opt.
C	4	2 x 4 5/16	1	450	220	Opt.
D	6½	5½x 6½	1	400	350	Opt.
G	8	4 9/16x 5	2	450	380	M.&B.

Belinder 2-Cycle—Surface Ignition

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete tons	Ignition
....	500	20½x29½	4	160	55	....
....	320	16½x18⅞	4	225	28	....
....	240	14 11/16x18⅞	4	250	21	....
....	160	16½x18⅞	2	225	14	....
....	120	14 11/16x16⅛	2	250	11½	....
....	90	13 x13⅜	2	300	7	....
....	80	13 x13⅜	2	325	6½	....
....	65	11⅞x12¼	2	350	5½	....
....	50	10⅝x11	2	375	4½	....
....	40	9½x 9⅞	2	425	3	....
....	30	8½x 9	2	450	2½	....
....	40	13 x13⅜	1	325	5	....
....	32	11⅞x12¼	1	350	4	....
....	25	10⅝x11	1	375	3	....

Brennan 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
M	17-20	4 x 5	4	1000	650	B.&M.
B	25-35	4½x5	4	800	750	B.&M.
"B" spec	35-40	4½x 5	4	1200	700	B.&M.
6B	40-50	4½x 5	6	1200	850	B.&M.
6B Mex.	40	4½x 5	6	750	950	B.&M.
11	30-40	5 x 5	4	1000	850	B.&M.
12	35-50	5½x 6	4	800	1100	B.&M.
12	40-80	6 x 6	4	800	1250	B.&M.
6D	75-100	4½x 6½	6	1000	800	B.&M.

Bridgeport 2-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
40	4½	4½x 5	1	500	225	Opt.
50	6	5¼x 5¼	1	500	260	Opt.
80	9	5½x 5	2	500	375	Opt.
100	12	5¼x 5¼	2	500	470	Opt.
243	30	6½x 7	3	400	1800	Bosch
363	45	7½x 9	3	375	3200	Bosch
484	60	7½x 9	4	375	4000	Bosch
142	14	5½x 6½	2	500	850	Bat.

Buffalo 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
....	3-4	3 x 4	2	700	240	.....
....	5-6	3½x 5	2	600	400	.....
....	16-20	3¾x 5	4	800	710	.....
....	25-30	3¾x 5	4	800	800	.....
....	40-60	5½x 7	4	700	1730	.....
....	50-80	6¾x 9	4	700	2600	.....
....	10-12	5 x 6½	2	400	1170	.....
....	13-15	6 x 7½	2	350	1400	.....
....	20-22	7 x 9	2	350	2100	.....
....	20-24	5 x 6½	4	400	1960	.....
....	26-30	6 x 7½	4	350	2525	.....
....	40-45	7 x 9	4	350	3655	.....
....	60-70	7 x 9	6	350	4850	.....
....	88-100	10 x12	4	300	8200	.....
....	125-150	10 x12	6	300	12800	.....

H. L. B. 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
E.	2-3	3¼x 3	1	900	42	U.S.

N. L. B. 4-Cycle

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
G.	4	2½x 5	2	900	125	U.S.

Diesel 4-Cycle D.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
B.	120	10½x13	4	300	47000	.....
B.	165	11¾x15	4	276	61000	.....
B.	250	13¾x17½	4	257	92000	.....
B.	365	16½x21	4	225	135000	.....
B.	520	19 x24½	4	200	185000	.....

Diesel 2-Cycle

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
C.M.	650	17 x27	4	165	....	.....
C.M.	1100	22 x34	4	135	.....	.....
C.M.	1800	28 x44	4	105	.....	.....
C.M.T.	1100	17 x27	6	165	.....	.....
C.M.T.	1850	22 x34	6	135	.....	.....
C.M.T.	3000	28 x44	6	105	.....	.....

Cady 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	1½	3 x 2½	1	700	45	J.S.
....	3	3⅝x 3¾	1	700	90	J.S.
....	6	3⅝x 3¾	2	700	135	J.S.
....	4	4⅛x 4	1	700	140	J.S.
....	8	4⅛x 4	2	700	205	J.S.

Cady 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	12-16	3¾x 4	4	1000	300	J.S.

Perfection 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	2½	3¼x 3½	1	2-200	140	Bat.
....	3½-4	3⅞x 3½	1	2-800	150	Bat.
....	6	4¾x 4½	1	2-800	200	Bat.
....	8	5¼x 5	1	1-5	335	Bat.
....	7-8	3⅞x 3½	2	2-800	220	Bat.
....	14	4¾x 4½	2	2-700	350	Bat.
....	18-20	5¼x 5	2	1-600	495	Bat.
....	30	4¾x 4½	4	1-1000	600	Bat.
....	2	2⅝x 2½	1	700	65	Bat.
....	2	2⅝x 2½	1	800	50	Mag.

Perfection 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	14	3½x 4	4	1-950	650	Mag.
....	2	2⅝x 2½	1	700	75	Mag.

Knox 2-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
E.	3	4 x 4	1	600	205	M.or B.
E.	4½	4¼x 4½	1	550	250	Bat.
E.	5½	5 x 5¼	1	550	330	Bat.
E.	7½	5½x 6¼	1	500	500	Bat.
E.	6	4 x 4	2	600	340	Bat.
E.	9	4¼x 4½	2	550	380	Bat.
E.	11	5 x 5¼	2	550	480	Bat.
E.	15	5½x 6¼	2	500	760	J.S.

Knox 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
F.	25	7 x 8	2	500	1900	M.&B.
F.	50	7 x 8	4	500	3300	M.&B.
F.	75	7 x 8	6	500	4500	M.&B.
G.	6	5 x 5¼	1	600	575	M.&B.
G.	8	5½x 6¼	1	600	700	M.&B.
G.	12	5 x 5¼	2	600	950	M.&B.
G.	16	5½x 6¼	2	600	1100	M.&B.

Chesapeake 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
L.	7	5 x 6	1	475	350	Mag.
L.	14	5 x 6	2	475	575	Mag.
....	20	4 x 5	4	575	550	Mag.

Chesapeake 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
B.	5	5 x 5	1	500	270	Bat.
B.B.	10	5 x 5	2	500	475	Bat.

Honest-Clay 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	4	4½x 5	1	500	385	Bat.
....	8	4½x 5	2	500	575	Bat.
R.	6	5½x 7	1	375	675	Bat.
R.	8	6½x 7	1	375	825	Bat.
R.	10	7½x 7	1	375	950	Bat.
R.	12	5½x 7	2	375	1300	Bat.
R.	16	6½x 7	2	375	1525	Bat.
R.	20	7½x 7	2	375	1750	Bat.
R.	25	5½x 7	4	450	2300	Mag.
R.	35	6½x 7	4	450	2600	Mag.
R.	50	7½x 7	4	450	3000	Mag.
O.	25-28	7½x 9	2	375	2650	Bat.
O.	30-35	8½x 9	2	375	2800	Bat.
O.	38-42	8½x10¼	2	375	3000	Bat.
T.	40-50	8½x10	2	375	4000	Mag.
T.	80-100	8½x10	4	375	7000	Mag.

Clift 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	4	3¾x 4½	1	750	250	J.S.
....	8	3¾x 4½	2	750	350	J.S.
....	7	5 x 6	1	650	600	J.S.
....	15	5¾x 7	2	600	1200	M.&B.
....	20	4 x 5¾	2	600	1450	M.&B.
....	100	11 x13	4	600	20000	.....

Quale 4-Cycle HVID.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
4-M-28	30	4¾x 6½	4	650	2150	.....
4-S-30	30	4¾x 6½	4	600	1650	.....

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
Curtiss 4-Cycle G.						
O.X.-5	90	4 x 5	8	1400	390	.....
O.X.X.-6	100	4¼x 5	8	1400	412	.....
K-6	150	4½x 6	6	1700	417	.....
K-12	400	4½x 6	12	2500	680	.....
Speedway 4-Cycle G.						
K.	22-28	4 x 4½	4	1-1200	560	Be.&Bo.
Z.	35-44	4½x 5½	4	1-1200	950	Be.&Bo.
Z.	50-66	4½x 5½	6	1-1200	1200	Be.&Bo.
M.	130-150	5¾x 7	6	1-1200	1900	Be.&Bo.
M.	175-200	5¾x 7	8	1-1200	2350	Be.&Bo.
M.	48-75	5¾x 7	4	6-1000	1850	Be.&Bo.
M.	75-130	5¾x 7	6	6-1000	2400	Be.&Bo.
M.	100-175	5¾x 7	8	6-1000	2900	Be.&Bo.
L.	30-115	6¾x 8½	6	4-600	5000	Be.&Bo.
H.	200-250	11 x12	6	3-450	11400	Be.&Bo.
Dodge 4-Cycle HVID.						
....	12½	6¾x 9	1	425	3800	.....
....	25	6¾x 9	2	425	4800	.....
....	37½	6¾x 9	3	425	6200	.....
....	50	6¾x 9	4	425	7400	.....
....	75	6¾x 9	6	425	9700	.....
Doman 4-Cycle G.-K.						
K.	4	3¾x 4½	1	600-800	210	M.or B.
B.	5-7	4¾x 6	1	400-600	500	M.or B.
H.M.-2	12-15	4¾x 6	2	600-800	750	Mag.
H.M.-4	25-40	4¾x 6	4	600-900	1200	Mag.
T.-2	20-25	6 x 7	2	400-800	1200	Mag.
T.-4	40-50	6 x 7	4	400-800	1950	Mag.
Dow 4-Cycle Crude or Fuel Oil						
A.	320	12 x18	6	250	125000	.....
A.	425	12 x18	8	250	160000	.....
B.	500	15 x22¼	6	220	185000	.....
B.	666	15 x22¼	8	220	215000	.....
C.	500	16 x26	6	175	194000	.....
C.	666	16 x26	8	175	233000	.....
F.	900	21¼x28¾	6	140	325000	.....
H.	1500	24 11/16x37 15/16	6	125	534000	.....
Dupont 4-Cycle G.-K.						
D.T.	20	5 x 6½	2	750	1100	Eismn.
D.F.	40	5 x 6½	4	750	1600	Eismn.
D.S.	60	5 x 6½	6	750	2150	Eismn.
Erd 4-Cycle G.-K.						
T.	30	4 x 6	4	900	170	Mag.
A.	42	4¾x 6	4	900	1100	Mag.
Evansville 4-Cycle G.						
Reg.	3¾	4½x 5	1	500	300	Bat.
Reg.	7½	4½x 5	2	500	400	Bat.
Reg.	15	4½x 5	4	500	625	Mag.
Reg.	5	5 x 6	1	500	400	Bat.
Reg.	10	5 x 6	2	500	540	Bat.
Reg.	20	5 x 6	4	500	900	Mag.
Reg.	8	6 x 6¼	1	500	625	Bat.
Reg.	16	6 x 6¼	2	500	900	Bat.
Reg.	24	6 x 6¼	3	500	1200	Bat.
Reg.	32	6 x 6¼	4	500	1425	Mag.
Reg.	11	7 x 9	1	350	1150	Bat.
Reg.	22	7 x 9	2	350	1800	Bat.
Reg.	44	7 x 9	4	350	2900	Mag.
Evinrude 2-Cycle G.						
....	2	2⅝x 2½	1	800	73	Mag.
....	3½	2½x 3	1	650	116	.....
C.C.	2	2 x 2⅝	1	800	45	.....
Fay and Bowen 4-Cycle G.						
L-40	17	3¼x 4½	4	1400	450	Mag.
L-41	22	3½x 5	4	1200	525	Mag.
L-41	20	3½x 5	4	600	450	Mag.
LN-42	40	4¼x 5½	4	1400	900	Mag.
LN-42	25	4¼x 5½	4	600	700	Mag.
L-43	40	4¾x 5½	4	1000	950	Mag.
L-43	30	4¾x 5½	4	600	700	Mag.
L-44	45	5 x 6¼	4	1000	1095	Mag.
L-44	30	5 x 6¼	4	600	800	Mag.
L-63	50	4½x 5½	6	1000	1275	Mag.
L-63	47	4½x 5½	6	600	900	Mag.
L-64	45-75	5 x 6¼	6	6-1100	14800	Mag.
L-64	45-75	5 x 6¼	6	6-1100	1200	Mag.
C.O. 2-Cycle Semi-Diesel						
C.O.	30	....	2	400	5050	.....
C.O.	45	....	3	400	6870	.....
C.O.	60	....	4	400	8000	.....
C.O.	75	....	3	340	14800	.....
C.O.	100	....	4	340	17600	.....
C.O.	150	....	3	250	34000	.....
C.O.	200	....	4	250	41000	.....
C.O.	300	....	6	250	57400	.....
Franzer-Adams 2-Cycle G.						
....	2	3⅛x 3	1	2-1000	70	J.S.
....	4	3⅛x 3	2	2-1000	130	J.S.
....	5	3¾x 4¼	1	2-1000	140	J.S.
....	10	3¾x 4¼	2	2-1000	220	J.S.
Frisbie 4-Cycle G.-K.						
A.	5	4¾x 5	1	550	325	.....
C.	7	6 x 6	1	450	500	.....
B.	10	4¾x 5	2	550	430	.....
D.	16	6 x 6	2	475	700	.....
R.	18	4¾x 5	3	650	650	.....
N.	25	6 x 6	3	600	1050	.....
E.	30	6¾x 5	4	800	725	.....
F.	40	6 x 6	4	600	1200	.....
K.	50	6¾x 5	6	850	985	.....
L.	75	6 x 6	6	800	1600	.....
Gaeth 4-Cycle G.-K.						
....	14-18	5½x 8	2	4-600	1450	M.&B.
....	20-27	5½x 8	3	4-600	1800	M.&B.
....	28-36	5½x 8	4	4-600	2100	M.&B.
....	42-54	5½x 8	6	4-600	3000	M.&B.
....	36-50	5½x 8	4	4-600	2100	M.&B.
....	54-75	5½x 8	6	4-600	3000	M.&B.
Gaffga 2-Cycle G.						
A.	3	4 x 4	1	550	225	M.&B.
....	4	4⅜x 5	1	500	325	M.&B.
....	5	5 x 5½	1	475	350	M.&B.
....	6	5½x 6	1	450	425	M.&B.
....	8	6 x 6½	1	400	475	M.&B.
....	6	4 x 4	2	550	375	M.&B.
....	8	4⅜x 5	2	500	425	M.&B.
....	10	5 x 5½	2	475	525	M.&B.
....	12	5½x 6	2	450	700	M.&B.
....	16	6 x 6½	2	400	850	M.&B.
Gaffga 4-Cycle G.						
....	12	5 x 6	2	600	900	Bosch
Gierholtt 2-Cycle G.						
....	2	2¾x 2½	1	800	50	Bat.
....	2	2¾x 2½	1	800	56	Mag.
Monarch 4-Cycle G.-K.						
....	5-45	5 x 6	1-6	550	.....	J.S.
....	7-60	6 x 7	1-6	550	.....	or
....	72	8 x 9	4	400	.....	M.&B.
....	40-168	10 x10	2-6	400	.....	.....
Gray 2-Cycle G.-K.						
U.	3	3¼x 3½	1	3-1300	90	J.S.
U.	5½	4¼x 4½	1	7-1100	170	J.S.
U.	6	3¼x 3½	2	7-1100	138	J.S.
Gray 4-Cycle G.-K						
X-V.	20-25	3¼x 3½	4	5-1200	650	Mag.
E.	25-35	4 x 6	4	5-1000	800	Mag.
E.	35-45	4¾x 6	4	5-1000	1100	Mag.
Hartford 2-Cycle-G.						
X.	3-5	4 x 4½	1	5-700	330	M.&B.
X.	6-8	4½x 4½	1	5-700	335	M.&B.
X.	7-10	5 x 5¼	1	5-700	440	M.&B.
X.	14-20	5 x 5¼	2	5-700	620	M.&B.
Gray Prior 4-Cycle K. & G.						
D-4	3-6	4½x 8	4	6-750	1950	J.S.
Hall-Scott 4-Cycle G.						
LM-4	125	5 x 7	4	1700	1100	Delco.
LM-4	200	5 x 7	6	1700	1300	Delco.
Hess 4-Cycle Gasoline						
A-3	5	3¾x 4	1	925	225	Bosch
Hettinger 4-Cycle G.						
6	6	5½x 6	1	460	400	M.&B.
9	9	4½x 6	2	450	590	At-K.
12	12	5½x 6	2	450	650	M.&B.
18	18	6½x 8	2	400	1500	At-K.
25	25	7½x 9	2	350	2000	At-K.
36	36	6½x 8	4	400	3000	At-K.
50	50	7½x 9	4	350	4500	At-K.
Jacobson 2-Cycle Heavy Oil						
....	20	8½x10	1	410	2500	.....
....	25	9½x10	1	410	2700	.....
....	30	10½x11	1	375	3400	.....
....	35	11 x13	1	340	4500	.....
....	40	12 x13	1	340	[illegible]	.....
....	40	8½x10	2	410	4750	.....
....	50	9½x10	2	410	5100	.....
....	60	10½x11	2	375	5650	.....
....	70	11 x13	2	340	8200	.....
....	80	12 x13	2	340	8800	.....
....	60	8½x10	3	410	6300	.....
....	75	9½x10	3	410	6700	.....
....	90	10½x11	3	375	7500	.....
....	105	11 x13	3	340	9700	.....
....	120	12 x13	3	340	10300	.....
....	80	8½x10	4	410	7400	.....
....	100	9½x10	4	410	7800	.....
....	120	10½x11	4	375	9200	.....
....	140	11 x13	4	340	11500	.....
....	160	12 x13	4	340	12600	.....
Bud-E 2-Cycle G.						
Bud-E.	5	3 x 3	2	1200	126	Mag.
J. V. D. 4-Cycle G.-K.						
A-4	28-40	4¾x 6	4	600- 900	1450	Mag.
A4-R.	45-60	4¾x 6	4	1000-1450	1350	Mag.
A-4	28-40	4¾x 6	4	600- 900	1450	Mag.
A-4R.	45-60	4¾x 6	4	1000-1450	1350	Mag.
Kahlenberg 2-Cycle G.-K.						
1920	2-3	3½x 3½	1	600	125	M.&B.
1920	3-4	4 x 4	1	550	160	M.&B.
1920	4-6	5 x 5	1	400	400	M.&B.
1920	6-8	5½x 6	1	400	550	M.&B.
1920	9-12	6½x 7	1	350	750	M.&B.
1920	12-15	7 x 8	1	325	900	M.&B.
1920	6-8	4 x 4	2	550	350	M.&B.
1920	8-12	5 x 5	2	400	650	M.&B.
1920	12-16	5½x 6	2	380	950	M.&B.
1920	18-24	6½x 7	2	350	1300	M.&B.
1920	24-36	7 x 8	2	325	1800	M.&B.
1920	30-36	7¾x 8	2	325	2000	M.&B.
1920	50-55	9 x10	2	300	3400	M.&B.
1920	27-36	6½x 7	3	325	1700	M.&B.
1920	36-45	7 x 8	3	325	2600	M.&B.
1920	45-54	7¾x 8	3	325	2800	M.&B.
1920	75-85	9 x10	3	300	5000	M.&B.
1920	50-60	....	2	340	8500	.....
1920	75-90	....	3	340	10000	.....
1920	100-120	....	4	340	15000	.....
Airdrive 4-Cycle G.‡						
L-2	3	2 x 2½	2	2100	67	Mag.
M-2	10	4 x 3¾	2	1400	122	Mag.
O-4	24	3¾x 4½	4	1100	575	Mag.
O-4	15-35	....	..	.....	.....	.....
Kermath 4-Cycle G.-K.						
12	12	3½x 4	4	6-1200	470	Bosch
16	16	3¾x 4	4	6-1200	500	Bosch
20	20-25	4 x 4	4	6-1200	535	Bosch
40	24-40	4½x 6¼	4	5-1200	1350	Bosch
Knox 4-Cycle G.-K.						
350	40	5 x 5½	4	800	1100	M.&B.
940	20	3½x 5	4	1000	.....	.....
Koban 2-Cycle G.‡						
H.	3	2⅝x 2⅝	2	8-900	80	M.&B.
Fisherman 4-Cycle G.						
G-6	6	5 x 6	1	550	550	J.S.
G-12	12	5 x 6	2	550	850	J.S.
K-6	6	5 x 6	1	550	550	J.S.
K-12	12	5 x 6	2	550	850	J.S.
G-3½	3½	3¾x 5	1	650	250	J.S.
Fisherman 4-Cycle						
G-3½	3½	3¼x 3½	1	750	210	J.S.
Lockwood-Ash 2-Cycle G.						
‡	2	2⅝x 2	1	700	70	J.S.
24	2½	3¼x 3½	1	750	.....	J.S.
24	4	4 x 4	1	750	.....	J.S.
68	6	3¼x 3½	2	800	.....	J.S.
68	8	4 x 4	2	800	.....	J.S.
Lockwood-Ash 4-Cycle G						
44	14	3¾x 4½	4	800	600	Mag.
Lathrop 2-Cycle G.-K.						
1920	3	4 x 4	1	500	.....	M.&B.
1920	4	4½x 5	1	500	.....	M.&B.
1920	5	5⅛x 5	1	500	.....	M.&B.
1920	6 Lt.	5⅛x 5	1	500	.....	M.&B.
1920	6 St.	5¼x 6½	1	400	.....	M.&B.
1920	7	6 x 6½	1	375	..	M.&B.
1920	8	6½x 6½	1	375	.....	M.&B.
1920	10	7 x 7½	1	300	.....	M.&B.
1920	12	7½x 7½	1	275	.....	M.&B.
1920	8	4½x 5	2	550	.....	M.&B.
1920	10	5⅛x 5	2	500	.....	M.&B.
1920	12 Lt.	5⅛x 5	2	500	.....	M.&B.
1920	12 St.	5¼x 6½	2	400	.....	M.&B.
1920	14	6 x 6½	2	400	.....	M.&B.
1920	16	6½x 6½	2	400	.....	M.&B.
1920	20	7 x 7½	2	300	.....	M.&B.
1920	24	7½x 7½	2	275	.....	M.&B.
1920	36	7½x 7½	3	275	.....	J.S.
1920	12	5⅛x 5	2	500	.....	J.S.
1920	16	5¼x 6½	2	500	.....	J.S.
1920	21	5⅛x 6½	3	500	.....	J.S.

ABBREVIATIONS: **H-D**—Heavy Duty; **†**—Semi-High Speed, Heavy Duty; **‡**—Outboard; **Mag**—Magneto; **J-S**—Jump-Spark; **Be & Bo**—Berling or Bosch; **Eismn**—Eisemann; **B or M**—Battery or Magneto; **G**—Gasoline; **K**—Kerosene; **D**—Distillate; **S-D**—Semi-Diesel; **At-K**—Atwater-Kent.

In revolutions per minute column when there is more than one figure given—as for instance 7-900—it indicates that the R.P.M. range is 700 to 900. In each case the first number represents hundreds.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
1920	30	5½x 6½	3	700	.....	J.S.
1920	28	5 3/16x 6½	4	500	.....	J.S.
1920	40	5½x 6½	4	700	.....	J.S.

Mecco 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
A.	4	4½x 5	1	600	220	Mag.
B.	5	5 x 6	1	500	375	Mag.
AA.	9	4½x 5	2	600	375	Mag.
4-A	16	4½x 5	4	600	500	Mag.
C-2	12	5½x 6½	2	500	550	Mag.
C-3	18	5½x 6½	3	500	775	Mag.

M'Intosh & Seymour Corp. 4-Cycle Diesel

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
M6B25	390	....	6	265	.....	.....
M6B33	640	....	6	190	.....	.....
M6C44	1200	....	6	140	.....	.....
M6C50	1550	....	6	115	.....	.....
M6C56	2000	....	6	105	.....	.....
M8C56	2700	....	8	105	.....	.....

Mianus 2-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
A.	3	4 x 4	1	550	175	M.&B.
A.	5	4⅝x 5	1	500	280	M.&B.
M.	6	4⅝x 5	1	700	270	J.S.
A.	7½	5 3/16x 6	1	450	415	M.&B.
A.	10	6½x 7	1	375	675	M.&B.
A-2	6	4 x 4	2	550	300	M.&B.
A-2	10	4⅝x 5	2	500	500	M.&B.
M-2	12	4⅝x 5	2	700	500	J.S.
A-2	15	5 3/16x 6	2	450	750	M.&B.
A-2	20	6½x 7	2	375	1170	M.&B.
XI.	30	6½x 7	3	375	2000	J.S.
F-2	16	6 x 8	2	400	1600	M.&B.
F-3	24	6 x 8	3	400	2200	.....
F-4	32	6 x 8	4	400	2750	.....
A.	7½	5 5/16x 6⅝	1	500	1000	.....
B.	15	5 5/16x 6⅝	2	500	1700	.....
C.	15	7 1/16x 9⅞	1	360	3100	.....
D.	30	7 1/16x 9⅞	2	360	5100	.....
E.	45	7 1/16x 9⅞	3	360	6500	.....
F.	60	7 1/16x 9⅞	4	360	8200	.....

Mietz 2-Cycle Semi-Diesel

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	15	6 x 6½	2	500	1995	.....
....	22	6 x 6½	3	500	2520	.....
....	40	9 x10	2	400	6300	.....
....	50	10 x12	2	340	11000	.....
....	60	9 x10	3	400	7500	.....
....	75	10 x12	3	340	14000	.....
....	100	10 x12	4	340	18000	.....
....	150	14 x18½	3	240	35000	.....
....	200	14 x18½	4	240	42000	.....
....	350	16 x21	4	240	65000	.....

Miller 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
F-1	4	4½x 5	1	600	400	Mag.
1-1	6	5¼x 6	1	500	500	Mag.
F-2	10	4½x 6	2	600	600	.....
1-2	14	5¼x 6½	2	500	800	.....
E-4	12-20	3½x 5	4	6-900	650	Mag.
F-4	18-22	4½x 6	4	5-800	1200	.....
1-4	24-30	5¼x 6	4	5-700	1500	.....
R-4	28-35	5¼x 7½	4	4-550	1900	.....
S-4	40-50	6 x 9	4	350-450	2700	.....

Miller 2-Cycle

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
P-1	2½	2¾x 2½	1	850	70	.....

M. & T. 4-Cycle G.-1

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
E-2	18	6½x 8	2	425	1600	M.&B.
E-3	28	6½x 8	3	450	1900	M.&B.
E-4	40	6½x 8	4	450	2500	Opt.
E-6	60	6½x 8	6	500	3000	Opt.
E-4	60	7½x10	4	375	4000	Opt.
J-6	400	7¼x 9	6	1400	3350	Mag.
K-6	300	6¼x 7¾	6	1600	2100	Mag.

Missouri 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	8	4⅜x 5	2	500	....	J.
....	12	5 x 6	2	500	....	J.
....	18	4⅜x 5	4	500	....	J.
....	24	5 x 6	4	500	....	J.

Missouri 2-Cycle Semi-Diesel

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	7	5 x 6	1	500	....	.....
....	14	5 x 6	2	500	....	.....
....	22	5 x 6	3	500	....	.....
....	30	5 x 6	4	500	....	.....

N. & S. 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	4	3¾x 5	1	800	350	M.&B.
....	20	7 x 9	2	350	3200	M.&B.
....	20	7 x 9	2	350	2800	M.&B.

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In revolutions per minute column when there is more than one figure given—as for instance 7-900—it indicates that the R.P.M. range is 700 to 900. In each case the first number represents hundreds.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	30	8 x10	2	325	3500	M.&B.
....	40	8 x 9	3	325	4600	M.&B.
....	80	10½x12	3	320	8000	M.&B.

Ford Marine 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	10-15	3¾x 4	4	800-1200	450	At-K.

Niseco-Diesel

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	120	9 x12½	4	350	17400	.....
....	180	9 x12½	6	350	22820	.....
....	240	9 x12½	8	350	28375	.....
....	240	13 x18	4	240	34400	.....
....	360	13 x18	6	240	56940	.....
....	480	13 x18	8	240	76000	.....
....	600	16½x24	6	225	120000	.....

20th Century 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
1919	15-20	6½x 8½	2	400	2000	Mag.
1919	40-50	6½x 8½	4	400	3400	Mag.
1919	65-75	6½x 8½	6	400	4500	Mag.

Niagara 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
E-2	12	4¾x 5½	2	900	625	M.&B.
E-4	30	4¾x 5½	4	1000	925	M.&B.
D-4	50	6¼x 7	4	1000	1650	M.&B.
D-6	60	6¼x 7	6	1000	2350	M.&B.
D-8	80	6¼x 7	8	1000	3250	M.&B.

Ontario 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	2	2⅝x 3	1	1650	70	Mag.
....	3	3½x 3½	1	900	125	Mag.
....	6	3½x 3½	2	900	190	Mag.
....	9	3½x 3½	3	900	270	Bat.
....	12	3½x 3½	4	900	350	Bat.
....	7	5 x 5	1	450	300	Bat.
....	14	5 x 5	2	600	500	Bat.
....	21	5 x 5	3	600	700	Bat.
....	28	5 x 5	4	600	900	Bat.

Palmer 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
NL-1	3½	4½x 4½	1	4-600	350	J.S.
NL-2	7	4½x 4½	2	4-600	350	J.S.
RW-1	6	5⅜x 6	1	4-600	425	J.S.
RA-1	4½	4½x 6	1	4-600	375	J.S.
RA-2	10	4½x 6	2	4-600	650	At-K.
RA-3	14	4½x 6	3	4-600	900	At-K.
RA-4	19	4½x 6	4	4-600	1150	At-K.
NR-1	5	5 x 6	1	4-600	400	J.S.
NR-2	11	5 x 6	2	4-600	750	At-K.
NR-3	16	5 x 6	3	4-600	1000	At-K.
NR-4	22	5 x 6	4	4-600	1250	At-K.
F-2	17	6⅜x 8	2	350-400	1600	At-K.
F-3	25	6⅜x 8	3	350-400	2000	At-K.
F-4	32	6⅜x 8	4	350-400	2400	At-K.
F-6	50	6⅜x 8	6	350-400	3800	At-K.
NK-2	20	7½x10	2	3-400	3000	At-K.
NK-3	30	7½x10	3	3-400	3500	At-K.
NK-4	45	7½x10	4	3-400	4200	At-K.
NK-6	75	7½x10	6	3-400	5600	At-K.

Palmer 2-Cycle

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
C.	4	4½x 4½	1	450	240	M.&B.
D.	6	5 x 6	1	450	350	M.&B.
E.	7½	6 x 6	1	450	375	M.&B.
U-1	2	3¾x 3½	1	500	135	M.&B.
Q-1	2½	3¾x 3½	1	700	125	J.S.
Q-2	5	3¾x 3½	2	700	180	J.S.
P-1	4	4½x 4½	1	650	210	J.S.
P-2	8	4½x 4½	2	650	325	J.S.

Peerless 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	5	5 x 6	1	650	450	Mag.
....	10	5 x 6	2	650	600	Mag.
....	16	4 x 6	4	750	750	Bat.
....	25	5 x 6	4	750	850	Bat.
....	20	5¾x 7	2	600	1200	Bat.
....	40	5¾x 7	4	600	1700	Bat.

Pierce-Budd 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	4	4 x 4	1	1000	125	At-K.
....	12	4 x 4	2	12-1600	170	At-K.
....	18	4 x 4	3	3-1800	240	At-K.
....	30	4 x 4	4	2-1800	300	Bosch
....	40	4 x 4	6	3-2000	395	Bosch

Remington 2-Cycle 4 H. P. Heavy Oil. 6 H. P. Semi-Diesel

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	4-75	6 x 6	1-4	4-500	600-6000	....
....	6-75	5¾x 6	1-4	4-500	600-6000	....

Red Wing Thorobred G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	10	2¾x 4	4	1000	300	Bosch
A.	14	3½x 4½	4	800	670	Bosch
AA.	18	3¾x 4¾	4	800	680	Bosch
F.	28	4 1/16x 5	4	1000	610	Bosch
B.	32	4½x 5	4	1000	650	Bosch

Regal 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
Y.	2	3¾x 3½	1	800	125	J.S.
FA.	4	4 x 4½	1	800	290	J.S.
UA.	5	4½x 5½	1	700	380	J.S.
EA.	7	5¼x 6½	1	600	760	J.S.
JA.	9	6½x 7½	1	500	1230	J.S.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
FB.	8	4 x 4½	2	800	520	J.S.
UB.	10	4½x 5½	2	700	725	J.S.
EB.	14	5¼x 6½	2	600	985	J.S.
JB.	18	6½x 7½	2	500	1625	J.S.
UC.	20	4½x 5½	4	700	985	J.S.
EC.	30	5¼x 6½	4	600	1550	J.S.
JC.	36	6½x 7½	4	500	2700	J.S.
SC.	50	7½x 9	4	400	4600	J.S.
CB.	32	4½x 5½	4	1000	800	J.S.

Roberts 2-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
T.	4	3½x 4	1	1000	98	Mag.
2-T	8	3½x 4	2	1000	140	Mag.
4-T	16	3½x 4	4	1000	210	Mag.

Roberts 4-Cycle G. or K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
H.	8	3½x 4	2	1000	160	Mag.

Smith Marine Twin-Six 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	400	5 x 7	12	1700	1075	Delco.

Mohawk 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
B-20	3½	3¼x 3¼	1	900	145	Bosch
B-21	7	4½x 4½	1	900	225	Bosch
B-22	7	3¼x 3¼	2	900	215	Bosch
B-23	14-16	4½x 4½	2	900	395	Bosch
S-24	5-6	4½x 3¼	1	1200	155	Bosch
S-25	10-12	4½x 3¼	2	1200	220	Bosch
S-26	15-21	4½x 3¼	3	1200	290	Bosch
S-27	21-30	4½x 4½	3	1200	495	Bosch
M-28	6	4½x 4½	1	700	275	Bosch
M-29	12	4½x 4½	2	700	400	Bosch
M-30	18	4½x 4½	3	700	510	Bosch
H-31	5	4½x 4½	1	500	310	Bosch
H-32	10	4½x 4½	2	500	510	Bosch
K-33	6	4½x 4½	1	700	280	Bosch
K-34	12	4½x 4½	2	700	410	Bosch
K-35	25	4½x 4½	4	700	775	Bosch

Scripps 4-Cycle G.-K.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
D-2	12-18	4½x 6	2	6-900	650	Bosch
D-4	25-35	4½x 6	4	6-900	1000	Bosch
D-4	40-50	4½x 6	4	1000	825	Bosch
D-6	35-45	4½x 6	6	6-900	1425	Bosch
D-6	60-75	4½x 6	6	1000	1100	Bosch

Motor-Go 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	2½	3¼x 3¼	1	750	97	Bat.
....	4	4 x 4	1	750	135	Bat.
....	6	3½x 3½	2	750	154	Bat.
....	8	4 x 4	2	750	222	Bat.
‡	1¼	2½x 2½	1	850	70	Bat.

Werkspoor 2-Cycle Semi-Diesel

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	9	*162x*164	1	500	1325	.....
....	16	210x240	1	400	2800	.....
....	24	236x280	1	375	3740	.....
....	38	224x256	2	375	5450	.....
....	55	260x290	2	375	7800	.....
....	70	280x260	2	325	9250	.....
....	120	360x400	2	300	17500	.....
....	140	280x360	4	325	16000	.....
....	185	420x480	2	250	25500	.....
....	240	360x400	4	300	32000	.....
....	360	420x480	4	250	46000	.....
....	500	420x480	6	225	70000	.....
....	550	420x750	6	165	160000	.....
....	850	520x900	6	135	240000	.....

*Bore and Stroke in Millimeters

Frisco Standard 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
C.	5	5¾x 6½	1	400	1555	M.&B.
A.	8	4¾x 6	2	440	1800	M.&B.
B.	10	5½x 6	2	400	2190	.....
E.	12	6 x 7	2	380	2750	.....
F.	16	6¼x 7½	2	360	2930	.....
M.	20	7¼x 9	2	320	4635	.....
H.	25	6¼x 7	3	450	3710	.....
K.	30	6½x 8	3	360	5045	.....
O.	40	8 x10	3	320	6820	.....
P.	50	8¾x10½	3	300	9215	.....
O.	65	8 x10	4	360	7120	.....
R.	80	9¾x12	3	280	12710	.....
P.	85	8¾x10½	4	350	13150	.....
S.	110	11¾x15	3	250	20285	.....
R.	120	9¾x12	4	320	19500	.....
S.	175	11¾x15	4	275	28500	.....
S.	275	11¾x15	6	300	32700	.....

Smalley 2-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
MB.	4-6	4½x 4½	1	....	.....	.....
MBB.	12-15	4½x 4½	2	....	.....	.....

Standard 4-Cycle G.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	10-12	5 x 6½	2	400	850	Own
....	16-18	6 x 8	2	350	1200	Own
....	20-24	5 x 6½	4	400	1600	Own
....	24-27	6 x 8	3	350	1800	Own
....	32-37	6 x 8	4	350	2800	Own
....	50-54	6 x 8	6	350	3200	Own
....	50-60	6½x 8	4	550	3250	Mag.
....	65-75	8 x10	4	350	5300	Own
....	70-90	6½x 8	6	550	4200	Mag.
....	90-100	8 x10	6	350	8000	Own

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	125-150	8½x11	6	350	5800	Own
....	220	10 x11	6	460	6300	Own
....	300	12 x14	6	350	9500	Own
....	500	12½x13	6	350	18000	Own
2-K.W.	4	4½x 4½	1	750	900	.....
4-K.W.	8	4½x 5½	2	700	1300	.....
Sterling 4-Cycle G.						
D.	12-15	5½x 7	2	4-500	1150	Mag.
E.	17-25	3¾x 5½	4	6-1000	600	Mag.
E.	17-25	3¾x 5½	4	6-1000	600	Mag.
E.	17-25	3¾x 5½	4	6-1000	600	Mag.
R.	225-250	5½x 6¾	8	15-1700	1495	Mag.
FH.	25-55	5½x 6¾	4	4-800	2050	Mag.
FH.	35-85	5½x 6¾	6	4-800	2450	Mag.
FH.	50-115	5½x 6¾	8	4-800	2750	Mag.
FM.	60-85	5½x 6¾	4	8-1200	1700	Mag.
FM.	85-125	5½x 6¾	6	8-1200	2250	Mag.
EM.	120-170	5½x 6¾	8	8-1200	2600	Mag.
FM.	240-300	6¾x 9	8	8-1200	5000-5600	Mag.
FS.	90-1000	5½x 6¾	4	12-1400	1400	Mag.
FS.	130-145	5½x 6¾	6	12-1400	1750	Mag.
FS.	180-200	5½x 6¾	8	12-1400	2400	Mag.
GR.	150	5¾x 6¾	4	15-1600	1525	Mag.
GR.	225	5¾x 6¾	6	1500	2000	Mag.
GR.	300	5¾x 6¾	8	1500	2800	Mag.
GM.	98	5¾x 6¾	4	6-1200	1875	Mag.
GH.	63	5¾x 6¾	4	4-800	2000	Mag.
GM.	145	5¾x 6¾	6	6-1200	2400	Mag.
GH.	94	5¾x 6¾	6	4-800	2500	Mag.
GM.	195	5¾x 6¾	8	6-1200	2900	Mag.
GH.	126	5¾x 6¾	8	4-800	3000	Mag.
Stork 2-Cycle G.						
....	3	3½x 3½	1	700	120	J.-S.
....	4	4 x 4	1	700	180	J.-S.
....	6	4½x 4½	1	700	225	J.-S.
....	8	5 x 5	1	700	370	J.-S.
....	6	3½x 3½	2	700	200	J.-S.
....	8	4 x 4	2	700	400	J.-S.
....	12	4½x 4½	2	700	450	J.-S.
....	16	5 x 5	2	700	555	J.-S.
....	12	4 x 4	3	700	550	J.-S.
....	18	4½x 4½	3	700	600	J.-S.
Stork 4-Cycle						
....	8	4½x 5½	2	600	700	.....
....	10	5 x 6	2	500	900	.....
....	12	5½x 6½	2	500	900	.....
....	16	6 x 7	2	400	1500	.....
....	20	6¾x 8	2	400	2000	At-K.
....	25	7½x 9	2	400	2500	At-K.
....	16	4½x 5½	4	700	1200	At-K.
....	20	5 x 6	4	500	1500	Bosch
....	24	5½x 6½	4	500	1500	Bosch
....	32	6 x 7	4	400	5000	Bosch
....	40	6¾x 8	4	400	3500	Bosch
....	50	7½x 9	4	400	4500	Bosch
....	30	4½x 5½	6	700	1400	Bosch
....	50	5½x 6½	6	700	1800	Bosch
....	75	7½x 9	6	400	6000	Bosch
Sturtevant 4-Cycle G.						
F-4	75	4½x 6	4	1600	700	Mag.

ABBREVIATIONS: H-D—Heavy Duty; †—Semi-High Speed, Heavy Duty; ‡—Outboard; **Mag**—Magneto; **J. S.**—Jump-Spark; **Be & Bo**—Berling or Bosch; **Eismn**—Eisemann; **B or M**—Battery or Magneto; **G**—Gasoline; **K**—Kerosene; **D**—Distillate; **S-D**—Semi-Diesel; **At-K**—Atwater-Kent.

In revolutions per minute column when there is more than one figure given—as for instance 7-900—it indicates that the R.P.M. range is 700 to 900. In each case the first number represents hundreds.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
Summer 2-Cycle Heavy Oil						
F.	350	16½x22	4	200	40000	.....
S.	600	16½x22	6	200	40000	.....
Universal 4-Cycle G.-K.						
C.	9-12	2⅝x 4	4	1200	325	Mag.
Union 4-Cycle D.-G. or K.						
....	5	5¾x 6½	1	400	640	M.&B.
....	8	5¼x 6	2	500	1150	M.&B.
....	12	6 x 7	2	400	1290	M.&B.
....	16	6½x 8	2	400	1750	M.&B.
....	20	7½x 9	2	360	2900	M.&B.
....	35	7½x 9	3	360	4825	M.&B.
....	45	8¼x10½	3	360	6450	M.&B.
....	60	9 x11	3	320	7400	M.&B.
....	80	10 x12	3	310	10700	M.&B.
....	85	9 x11	4	330	10140	M.&B.
....	110	12 x15	3	280	17600	M.&B.
....	110	10 x12	4	330	12350	M.&B.
....	150	12 x15	4	290	22750	M.&B.
....	225	14½x18	4	225	36400	M.&B.
....	250	15¼x20	4	200	49785	M.&B.
....	300	16 x21	4	210	55700	M.&B.
....	125	9 x11	6	320	14400	M.&B.
....	225	12 x15	6	300	30600	M.&B.
....	325	14½x18	6	225	50400	M.&B.
....	375	15¼x20	6	200	68100	M.&B.
Van Blerck 4-Cycle G.						
M-4	75	5¾x 6	4	1000-1500	1798	Mag.
M-6	120	5¾x 6	6	1000-1500	2100	Mag.
M-8	150	5¾x 6	8	1000-1500	2667	Mag.
MM-4	40	5¾x 6	4	600-1000	1798	Mag.
MM-6	55	5¾x 6	6	600-1000	2100	Mag.
MM-8	75	5¾x 6	8	600-1000	2667	Mag.
Vulcan 4-Cycle G.						
....	4	4⅝x 6	1	550	300	J.-S.
....	5	5¼x 7	1	550	400	J.-S.
....	7½	6½x 7¼	1	450	600	J.-S.
....	11	7½x 8½	1	400	900	J.-S.
....	8	4⅝x 6	2	550	650	J.-S.
....	10	5¼x 7	2	500	900	J.-S.
....	15	6½x 7¼	2	475	1300	J.-S.
....	22	7½x 8½	2	425	2200	J.-S.
....	25	6½x 7¼	3	475	1700	J.-S.
....	35	7½x 8½	3	425	2800	J.-S.
....	56	8¾x10½	3	400	4200	J.-S.
....	16	4⅝x 6	4	550	900	J.-S.
....	20	5¼x 7	4	500	1200	J.-S.
....	30	6½x 7¼	4	475	2050	J.-S.
....	45	7½x 8½	4	425	3400	J.-S.
....	75	8¾x10½	4	375	5500	J.-S.
....	40	5¼x 7	6	550	1750	J.-S.
....	75	7½x 8½	6	425	4500	J.-S.
Venn-Severin 2-Cycle Semi-Diesel						
EM.	10	6 x 8	1	420	950	.....
FM.	15	8 x10	1	325	1875	.....
DM.	20	9½x11	1	325	2150	.....
IM.	40	12¼x13½	1	275	4950	.....
FMX.	30	8 x10	2	325	3380	.....
DMX.	40	9½x11	2	325	3950	.....
DMY	60	9½x11	3	325	4800	.....
IMX.	80	12¼x13½	2	275	9700	.....
IMY.	125	12¼x13½	3	275	14500	.....
IMZ.	170	12¼x13½	4	275	18700	.....
Goshen 2-Cycle G,						
A.	4	4 x 5	1	500	135	Bat.
C.	12	6 x 7	1	500	425	Bat.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
E.	9	4 x 5	2	500	280	Bat.
G.	25	26 x 7	2	500	650	Bat.
Western 4-Cycle Diesel						
....	75	9¼x14	3	325	21000	.....
....	100	9¼x14	4	325	36000	.....
....	150	9¼x14	6	325	35000	.....
Winton 4-Cycle G.						
W-6	80	6½x 9	6	450	5400	Bosch
W-5	125	8 x11	6	400	10000	Bosch
W-11	200	9½x14	6	450	18000	Bosch
W-28	150	6½x 9	6	900	4000	Bosch
W-29	200	6½x 9	8	900	5000	Bosch
W-24	300	12$\frac{11}{16}$x18	6	210	68000	Diesel
W-35	200	11 x14	6	250	44000	Diesel
W-40	400	12$\frac{11}{16}$x18	8	210	84000	Diesel
52	50	7½x11	3	425	11500	Diesel
53	75	7½x11	4	425	15000	Diesel
54	125	7½x11	6	425	24000	Diesel
58	150	11 x14	4	260	30000	Diesel
Wisconsin 2-Cycle G.						
A.	5	4 x 4	1	700	160	Bat.
B.	7	4½x 4½	1	700	190	Bat.
C.	10	4 x 4	2	750	240	Bat.
D.	15	4½x 4½	2	750	300	Bat.
E.	20	4 x 4	3	850	340	Bat.
F.	27	4½x 4½	3	900	400	Bat.
J-L‡	2	2⅝x 2½	1	750	55	Bat.
K-M‡	2	2⅝x 2½	1	750	55	Mag.
N‡	3½	3¼x 3¼	1	750	100	Mag.
Winona 2-Cycle G.						
....	5	4½x 4½	1	700	....	J.S.
....	10	4½x 4½	2	700	....	J.S.
....	15	4½x 4½	3	700	....	J.S.
....	20	4½x 4½	4	700	....	J.S.
Wisconsin (Consistent) 4-Cycle G.						
CM.	22	3¾x 5	4	1000	565	Mag.
EM.	24	4 x 5	4	1000	625	Mag.
AM.	40	4¾x 5½	4	1000	800	Mag.
JM.	48	5.1x5.5	4	1000	710	Mag.
MM.	62	5¾x 7	4	800	1290	Mag.
GM.	60	4¾x 5½	6	1000	1360	Mag.
PM.	90	5¾x 7	6	800	1565	Mag.
JRM.	110	5.1x5.5	4	2200	875	Mag.
LRM.	158	5.1x5.5	6	2200	1225	Mag.
Wolverine 4-Cycle K.-G.						
....	5	5½x 6	1	500	600	Simms
....	14	6½x 7	2	400	1545	Bosch
....	22	6½x 7	3	400	2285	Bosch
....	32	7½x 9	3	350	3914	Bosch
....	42	8½x 9	3	350	4130	Bosch
....	60	9½x12	3	360	7000	Bosch
....	80	11 x12	3	300	7516	Bosch
....	110	12½x14	3	300	12400	Bosch
....	160	11 x12	6	330	13600	Bosch
....	200	11 x15	6	330	17110	Bosch
....	35-40	5½x 7	4	700	1800	Bosch
Wright-Reliable 4-Cycle G.-K.						
S.	10	6 x 7½	1	450	1280	Bosch
S.	20	6 x 7½	2	450	1810	Bosch
S.	30	6 x 7½	3	450	2416	Bosch
S.	40	6 x 7½	4	450	3142	Bosch
S.	60	6 x 7½	6	450	4630	Bosch
P.	15	7½x 9	1	350	1780	Bosch
P.	30	7½x 9	2	350	3018	Bosch
P.	45	7½x 9	3	350	4068	Bosch
P.	60	7½x 9	4	350	5065	Bosch
P.	90	7½x 9	6	350	7000	Bosch

Motor Boat Records

All World's Records for Respective Classes

Class	Distance	Average Speed M.P.H.	Best Lap	1 Mile Trials: Average of 6 Runs	1 Mile Trials: Best Mile	Boat	Owner	Length	Powerplant
Hydroplane	30 Miles	70.00	71.4	76.65	77.69	Miss America	G. A. Wood	26	Two 440 H.P. Smithy-Liberty
Displacement Runabout (Marine Motors)	150 Miles	36.7	37.2	38.91	.....	Rainbow	H. B. Greening	32	One 220 H.P. Sterling
Displacement Runabout (Aviation Motors)	....	....	....	49.25	.....	Miss Nassau	C. B. Johnston	28	One 450 H.P. Liberty
Express Cruiser (Marine Motor)	20 Miles	31.4	....	34.32	.....	Hoosier V	H. R. Duckwall	42	Two 200 H.P. Sterlings
Express Cruiser (Aviation type Motor)	20 Miles	34.45	....	36.6	.....	Gar Jr.	G. A. Wood	40	One 450 H.P. Liberty

British Marine Engine Practice

By M. W. Bourdon

THERE is a tendency on the part of British manufacturers of marine motors to specialize on a more limited range of models with differing bores and strokes than was the case before the war. Nevertheless, there are still several firms who do not specialize on any particular type or types but are prepared, it would appear, to vary the leading dimensions and details, to suit even purchasers of single engines.

The fact is, the output of the average British marine motor plant is so small that very little is done or attempted in the way of standardization. All makers, of course, have stock models, but most of them require but very little persuasion to induce them to vary these in accordance with purchasers' ideas or requirements.

It will be inferred from the foregoing that the British marine engine is often a "hand-made" proposition, and, as might be surmised, no endeavor is made to turn out a low-priced product. Most of the engines can be looked upon as fairly high-class jobs, which, while making no great pretense in the way of volumetric efficiency, are built and finished with reliability and durability foremost in consideration.

There are very few attempts to follow closely along lines adopted by car engine builders, and speeds above 1000 r.p.m. are the exception. No determined effort is apparent, except in isolated cases, to take advantage of the possibilities offered by adopting a higher rate of crankshaft revolution coupled with reducing gear between engine and propeller.

Thorneycroft has a model running normally at 1400 r.p.m. and intended to be used with a propeller turning at 350 r.p.m., and it is claimed for this that the increased propeller efficiency more than compensates for the transmission loss in the reduction gear.

Until a few years back the majority of British marine engines had T head cylinders, but these are now few and far between, the great majority having L heads. There are a few examples of overhead inlets with side exhausts, but both valves overhead appear only in the designs of two makers.

Only three firms supply two stroke engines, one of these being the makers of the original engine of the type, namely Day. This make has the largest two-stroke marine motor burning gasoline or kerosene on the British market, a two cylinder 4¾ x 5 in.

The majority of engines are designed for kerosene, but very little advance has occurred of late years in the method of vaporizing this fuel, the usual plan being to adopt a large heating chamber built up or cast with a portion of the exhaust manifold. Except in the smaller sizes it is becoming less frequent to find provision for starting on gasoline and switching over to kerosene, a more usual

Marine Engine Ex

	1914	1915	1916	1917	1918	July 1 to to Dec. 31, 1918	Calendar Year 1919	Totals for all years inc. 1912, 1913
EUROPE:								
Austria	137 $15,967	25 $3,097	....	....	....	....	....	410 $47,375
Azores and Madeira Islands	14 $1,284	10 $1,291	7 $1,286	2 $1,240	2 $896	....	7 $681	49 $8,317
Belgium	182 $21,206	10 $1,472	....	....	....	....	30 $4,188	501 $66,327
Bulgaria	14 $2,270	....	....	....	....	....	....	34 $5,783
Denmark	313 $31,273	71 $8,710	153 $15,686	270 $40,837	90 $12,768	....	103 $28,393	1,949 $219,182
Finland	411 $41,473	10 $3,824	20 $1,641	32 $21,299	....	....	94 $31,925	1,242 $187,403
France	292 $22,332	81 $8,664	69 $6,620	800 $147,384	155 $170,560	61 $189,990	138 $120,699	1,925 $694,189
Germany	618 $70,964	16 $2,557	....	....	....	....	....	1,823 $197,120
Gibraltar	2 $253	2 $215	5 $817	7 $2,122	....	....	7 $1,531	25 $5,501
Greece	12 $1,533	19 $3,477	12 $5,220	5 $784	....	1 $5,200	107 $117,530	177 $136,564
Iceland	....	....	....	8 $593	10 $1,026	12 $839	3 $550	33 $3,008
Italy	165 $23,749	74 $9,072	85 $83,978	266 $89,007	358 $464,498	132 $301,612	174 $369,841	1,455 $1,376,866
Malta, Gozo, etc	2 $504	1 $52	....	....	....	....	6 $765	15 $2,089
Netherlands	463 $45,556	231 $16,387	377 $34,288	333 $57,457	....	....	298 $70,316	2,306 $286,752
Norway	490 $57,368	180 $29,608	395 $55,859	1,069 $190,914	317 $58,128	184 $52,829	1008 $180,021	4,515 $739,201
Portugal	21 $1,791	7 $1,041	33 $4,466	8 $817	25 $15,032	6 $970	30 $29,712	146 $55,971
Roumania	20 $3,324	2 $284	24 $1,822	....	....	....	....	68 $9,084
Russia in Europe	363 $48,593	109 $19,876	409 $92,299	292 $108,434	12 $13,245	....	....	2,076 $4,027,702
Serbia, Montenegro, etc	1 $54	....	....	....	....	....	....	1 $54
Spain	77 $8,646	57 $7,100	88 $7,997	122 $27,916	94 $43,707	7 $17,847	231 $236,400	757 $358,494
Sweden	687 $64,526	66 $8,964	177 $40,573	190 $63,275	49 $10,715	....	323 $86,162	3,325 $403,937
Switzerland	22 $3,478	25 $4,438	1 $260	....	....	....	51 $11,738	122 $23,368
Turkey in Europe	18 $3,337	5 $2,680	....	....	....	....	6 $1,001	46 $10,932
United Kingdom: England	958 $72,952	622 $57,639	1,241 $223,539	783 $93,173	341 $174,988	6 $1,247	1,326 $217,658	6,543 $948,511
Scotland	134 $16,343	49 $6,306	24 $3,256	27 $3,471	....	....	11 $3,213	470 $51,266
Ireland	44 $2,801	4 $244	22 $848	8 $943	....	....	151 $18,083	311 $28,001
NORTH AMERICA:								
Bermuda	20 $1,527	15 $1,667	21 $1,998	27 $5,609	8 $685	2 $467	6 $3,008	110 $16,405
British Honduras	22 $4,833	25 $9,581	11 $1,980	35 $6,052	14 $2,272	12 $2,994	16 $4,888	143 $34,422
Canada	1,747 $302,391	1,042 $147,730	1,761 $1,780,873	2,026 $757,735	2,553 $809,973	629 $272,391	1,306 $500,367	14,617 $5,262,436
CENTRAL AMERICA:								
Costa Rica	14 $4,811	13 $3,801	5 $978	7 $1,979	1 $231	....	4 $432	78 $22,357
Guatemala	5 $408	9 $4,656	8 $648	16 $3,069	6 $449	....	14 $4,925	59 $14,293
Honduras	10 $1,339	20 $3,095	10 $986	8 $2,177	2 $1,206	3 $1,232	15 $4,953	77 $19,163
Nicaragua	21 $3,963	13 $3,300	10 $3,007	9 $3,718	16 $9,237	9 $4,627	9 $8,198	97 $38,395
Panama	27 $6,092	46 $12,080	22 $4,804	24 $5,257	18 $13,058	2 $250	22 $8,555	215 $62,294
Salvador	4 $816	9 $1,248	2 $397	6 $536	....	....	2 $185	29 $3,855
Mexico	155 $38,902	45 $13,193	64 $30,255	94 $35,458	79 $40,109	60 $49,450	193 $230,981	1,067 $554,603
Miquelon, Langley, etc	142 $13,208	9 $814	30 $2,276	33 $2,922	70 $7,305	36 $5,033	123 $15,678	524 $56,162
Newfoundland and Labrador	799 $103,895	953 $65,127	769 $81,911	577 $61,062	735 $80,811	461 $109,719	1,414 $193,327	6,240 $754,937
West Indies, British: Barbados	1 $42	1 $97	13 $1,947	4 $1,753	3 $637	1 $886	2 $379	27 $6,191
Jamaica	5 $850	5 $600	2 $171	9 $1,449	5 $2,747	....	7 $2,604	51 $11,098
Trinidad and Tobago	12 $1,385	8 $1,012	11 $1,367	11 $1,028	20 $2,400	3 $899	11 $13,888	90 $25,156
Other British	23 $5,506	20 $3,720	12 $2,058	8 $3,320	7 $1,227	2 $234	25 $14,279	106 $32,796
Cuba	217 $30,393	228 $29,027	189 $26,344	254 $45,776	421 $75,143	86 $25,312	310 $102,656	2,083 $404,903
Dutch	4 $295	1 $128	4 $227	2 $243	3 $395	....	1 $78	24 $2,031
Dominican Republic	8 $1,908	13 $2,400	30 $4,830	10 $1,663	11 $4,008	1 $98	14 $5,766	87 $20,673
Danish (Virgin Is. of U. S.)	6 $434	3 $273	1 $67	1 $75	3 $1,511	2 $1,162	4 $1,438	26 $6,088
French	1 $124	1 $51	5 $1,028	6 $809	15 $1,528	2 $200	10 $3,938	60 $10,453
Haiti	5 $740	....	2 $140	14 $1,116	11 $1,008	1 $120	5 $1,728	40 $5,336
SOUTH AMERICA:								
Argentina	375 $70,058	90 $11,327	105 $14,101	250 $30,788	196 $30,004	51 $32,294	130 $106,194	1,888 $458,481
Bolivia	1 $34	....	5 $573	3 $257	....	....	11 $8,708	24 $11,500
Brazil	301 $62,882	102 $17,428	228 $25,862	210 $26,492	105 $19,259	48 $11,305	113 $69,749	1,689 $365,287
Chile	58 $5,942	33 $3,821	52 $3,912	61 $13,288	83 $28,091	37 $33,308	82 $275,939	441 $371,514

ports, 1912 to 1919

	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918	Calendar Year 1919	Totals for all years inc. 1912, 1913
Colombia	25 $3,647	38 $4,218	24 $4,826	53 $4,818	5 $759	5 $2,444	21 $3,721	201 $36,523
Ecuador	49 $10,636	56 $11,185	14 $2,178	38 $7,430	11 $15,026	3 $1,852	11 $5,889	267 $72,142
Guiana, British	9 $965	16 $1,875	10 $1,271	16 $2,138	30 $7,635	2 $1,219	27 $5,328	122 $22,482
Dutch	5 $698	3 $297	3 $229	10 $1,395	1 $572	2 $214	3 $1,446	30 $6,754
French	1 $96	1 $94	....	....	....	....	2 $277	5 $563
Paraguay	8 $3,042	....	1 $69	....	....	....	....	26 $6,236
Peru	61 $14,835	17 $5,052	23 $8,537	73 $38,316	60 $45,003	29 $63,569	50 $76,646	355 $263,005
Uruguay	27 $3,749	1[illegible] $2,205	24 $3,808	14 $1,574	8 $1,128	15 $2,207	25 $7,146	156 $24,848
Venezuela	52 $4,184	55 $4,808	28 $2,976	46 $9,599	21 $3,989	26 $2,804	9 $3,810	267 $35,492
ASIA: Aden	2 $604	....	1 $64	....	1 $148	....	....	4 $816
China	38 $19,330	29 $8,280	23 $7,618	48 $16,660	44 $36,107	57 $56,851	117 $79,597	397 $243,473
Kwantung: (Leased Territory)	1 $44	....	....	15 $1,389	2 $180	....	....	20 $1,800
Chosen	....	....	....	....	....	1 $1,285	....	1 $1,285
East Indies: British India	86 $12,532	179 $18,208	165 $15,679	165 $26,166	259 $130,745	46 $26,291	102 $107,675	1,097 $348,542
Straits Settlements	88 $9,361	52 $3,552	52 $6,209	112 $14,914	118 $22,220	95 $19,523	34 $16,175	596 $107,223
Other British	3 $708	11 $715	....	10 $918	....	....	8 $5,657	33 $8,298
Dutch	22 $3,051	6 $647	12 $1,262	56 $11,862	106 $24,819	22 $11,505	192 $91,621	443 $149,126
French	....	....	....	....	....	....	15 $2,588	13 $2,588
Hongkong	19 $3,115	4 $853	15 $2,715	2 $171	11 $25,691	10 $12,177	73 $54,466	141 $106,146
Japan	52 $16,466	1[illegible] $3,548	29 $8,386	54 $10,962	154 $33,243	129 $43,202	455 $108,796	946 $242,605
Persia	1 $100	....	....	....	....	2 $2,987	....	3 $3,087
Russia in Asia	25 $3,006	4 $274	14 $347,582	2 $352	....	....	15 $90,392	66 $442,988
Siam	11 $1,293	25 $2,296	42 $4,269	32 $5,132	45 $10,655	35 $12,541	82 $71,365	277 $108,516
Turkey in Asia	13 $1,493	....	4 $748	....	....	....	9 $1,868	35 $5,535
OCEANIA, BRITISH: Australia	1,001 $150,214	603 $85,517	735 $96,498	706 $87,120	318 $55,674	309 $40,617	456 $84,289	5,870 $862,328
New Zealand	124 $21,583	144 $20,338	99 $20,648	94 $23,963	30 $15,777	6 $6,861	125 $19,427	1,080 $247,020
Other British	19 $7,450	25 $6,001	4 $1,338	17 $11,886	29 $5,437	16 $5,759	27 $11,612	185 $69,826
French	22 $27,151	2 $2,490	4 $6,130	8 $11,609	24 $9,875	13 $12,663	15 $14,370	112 $103,715
German	7 $2,928	1 $550	....	1 $1,000	11 $14,788	3 $6,500	6 $3,060	44 $33,493
Philippine Islands	164 $22,915	91 $20,137	17 $4,319	188 $32,522	73 $40,075	108 $32,543	447 $316,169	1,185 $494,482
AFRICA: Belgian Kongo	....	....	....	....	....	....	1 $200	1 $200
British Africa: West	13 $1,241	1 $70	4 $300	8 $869	4 $583	7 $1,264	16 $6,887	54 $11,306
South	97 $15,394	108 $12,134	130 $31,897	82 $12,334	13 $2,079	14 $5,807	100 $21,197	706 $125,238
East	....	4 $696	1 $69	17 $2,854	....	1 $385	3 $1,511	26 $5,515
Canary Islands	5 $309	3 $732	5 $1,257	2 $150	....	....	8 $17,495	29 $22,132
Egypt	15 $990	....	4 $325	8 $795	....	....	14 $3,376	49 $7,551
French Africa	8 $2,578	8 $930	4 $1,490	2 $200	4 $435	....	40 $4,328	67 $10,022
German Africa	21 $1,676	....	....	....	....	....	....	22 $3,032
Italian Africa	2 $190	....	....	....	....	....	....	2 190
Liberia	5 $499	....	1 $90	....	1 $190	....	12 $1,041	19 $1,820
Madagascar	....	....	1 $239	....	....	1 $100	1 $462	3 $801
Morocco	1 $95	....	6 $796	....	....	....	5 $6,202	13 $7,277
Portuguese Africa	56 $6,516	5 $2,593	11 $938	9 $1,624	2 $706	3 $458	9 $3,914	108 $19,306
Spanish Africa	5 $585	....	....	....	....	....	....	6 $747
Number Grand Total Value	....	....	....	....	....	....	....	75,297 $22,729,900
EUROPE	5,460 $561,577	1,676 $196,995	3,142 $580,455	4,222 $849,666	1,460 $966,271	409 $570,534	4,104 $3,060,814	30,331 $7,799,079
NORTH AMERICA	3,248 $523,602	2,479 $303,600	2,982 $1,948,292	3,181 $942,886	4,001 $1,005,940	1,312 $477,075	3,513 $1,122,261	25,933 $7,319,955
SOUTH AMERICA	972 $180,768	428 $62,310	497 $68,342	774 $136,095	520 $151,466	218 $151,216	484 $564,855	5,471 $1,683,829
ASIA	361 $71,103	329 $38,373	357 $394,532	496 $88,526	740 $283,808	394 $185,077	1,099 $630,585	4,073 $1,764,129
OCEANIA	1,337 $232,241	866 $135,043	857 $128,933	1,014 $168,109	480 $141,626	455 $104,943	1,076 $448,927	8,476 $1,810,883
AFRICA	228 $30,073	129 $17,155	167 $19,401	128 $18,832	24 $3,993	26 $8,014	209 $66,613	1,105 $197,137

plan being to provide an opening in the heating chamber, normally covered with a flange plate, and through which the flame from a blow lamp can be made to provide the initial heating for starting from cold on kerosene.

Magneto ignition is universal, the battery type only occurring in a few cases as a supplementary ignition system.

In regard to lubrication, it is almost impossible to classify the various systems adopted. The hollow shaft system is increasing in favor, but despite this there are many firms still depending entirely upon drip feed and splash. The circulating splash system frequently includes direct leads to the main crankshaft journals, while in one type the flywheel is made use of to lift the oil from the sump to gutters carrying it to troughs under the big-ends and to others over the journals.

The conditions under which marine motors are operated, and the advisability of designing them so that they can be almost completely dismantled without disturbing the base, has induced British manufacturers to arrange subsidiary details and drives, for example, oil and water pumps, exterior to and separate from the crankcase. There is no doubt that in this connection careful consideration has been given to convenience in upkeep rather than to neatness in appearance; the majority of engines have large flange-covered hand-holes in the crankcase through which the big-ends can be reached and the pistons and connecting rods withdrawn.

It will be surmised from the foregoing that the submerged type of oil pump is quite exceptional, this unit being generally arranged well above the crankshaft axis and driven either by chain from the crankshaft or from an extension of the camshaft. Oil filtration is usually thorough, and the system provides means of readily removing filters for cleaning purposes without draining off the main supply of oil.

In circulating oil systems, the lubricant is usually cooled by carrying a water pipe through the crankcase sump in the run from the water inlet to the pump. Some makers go so far as to give this pipe several coils in its passage through the oil, so as to expose a large cooling area to the lubricant.

In one of the Brooke series, the oil in course of circulation is passed through a jacket of the induction manifold, thus serving a double purpose—cooling the oil and assisting vaporisation.

In regard to crankcase and cylinder construction, the detachable head is very rarely seen, the cylinders usually being cast separately or in pairs, and being integral units of cast iron bolted to the top of the cast iron crankcase. In most designs the latter is divided transversely in the longitudinal center line of the crankshaft, but in one or two cases the crankchamber is cast as a unit, the crankshaft being assembled through a large hole at the rear end and supported at that point by a detachable endplate which forms the bearing housing.

Non-Ferrous Metal Specifications

(*Continued from page 329*)

Specification No. 67, Semi-Plastic Bronze

Composition in percentage:

Copper	75.50 to 78.50
Tin	7.25 to 8.75
Lead	13.50 to 16.50
Zinc, max.	0.50
Phosphorus, max.	0.25
Iron, max.	0.25
Antimony, max.	0.50
Aluminum	None
Impurities, max.	0.75

General Information

Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	20,000
Elongation in 2 in. or proportionate length, per cent	10

This metal is intended for use where a soft bronze with good anti-friction qualities is desired.

Storage Battery Specifications

(Excerpts from the Report of the S.A.E. Standards Committee)

Ratings—Batteries for combined starting and lighting service shall have two ratings. The first rating shall indicate the lighting ability and shall be the capacity in ampere-hours when the battery is discharged continuously at the 5-hr. rate to a final voltage of not less than 1.7 per cell, the temperature of the battery beginning such discharge being 80 deg. fahr. The second rating shall indicate the starting ability and shall be the capacity in ampere-hours when the battery is discharged continuously at the 20-min. rate to a final voltage of not less than 1.5 per cell, the temperature of the battery beginning such discharge being 80 deg. fahr.

Terminal Posts.—When taper posts are used for terminals of lead-acid storage batteries, the dimensions in inches shall be

Small diameter of the negative post	5/8
Small diameter of the positive post	11/16
Taper per foot	1-1/3
Minimum length of taper	11/16

When straight terminal posts are used, the diameter of both the positive and negative posts shall be 13/16 in. and the minimum clear length of the post shall be 13/16 in.

These dimensions refer to batteries for lighting service as well as for combined starting and lighting service.

Compartments.—Compartments for starting and lighting batteries shall be of metal not less than 18 United States plate gage (0.050 in.) in thickness, supported entirely by the chassis.

Battery compartments shall be 8 in. wide and 10½ in. high in order to give a ¼-in. clearance all around the battery. End-to-end assembly of jars is not recommended on account of the inherent weakness of this type of construction.

The battery shall rest on two wooden strips each 2 in. wide by ¼-in. thick, running lengthwise of the compartment. **These shall be positively spaced with the edges** flush with the sides of the battery. Spacers **shall be provided to give a ¼-in. space at** each side of the battery and a 1½-in. space at each end outside of the hold-down devices.

The compartment shall be drained and ventilated.

The hold-down devices should be attached at the level of the top of the battery, not to the top of the handles.

Recommended Practice in Testing Spark Plugs

(Excerpts from the report of the S. A. E. Standards Committee)

A sufficient number of sample spark-plugs drawn at random from stock are to be fur-

(*Continued on page 385*)

Motor Boat Exports,

	1914	1915	1916	1917	1918	July 1 to Dec. 30 1918	1919	1920	Total
EUROPE:									
Austria-Hungary	5 $5,022								5 $5,022
Azores and Madeira Islands	1 $1,162								1 $1,162
Belgium								1 $900	1 $900
Denmark				2 $1,554			1 $2,500		3 $4,054
France				2 $932	2 $2,400				4 $3,332
Germany	17 $3,429	1 $110							18 $3,539
Gibraltar	1 $316								1 $316
Greece							1 $2,500	2 $2,230	3 $4,730
Italy	2 $1,280			7 $246,000	72 $2,080,800	50 $2,000,000	1 $2,000		132 $4,330,080
Iceland and Faroe Islands						1 $400			1 $400
Netherlands		1 $284	3 $2,685	1 $925				2 $6,200	7 $10,094
Norway	3 $4,400		3 $4,815	4 $7,950	1 $3,000	2 $3,349			13 $23,514
Portugal		1 $221					4 $2,351	4 $42,815	9 $45,387
Russia in Europe	11 $6,158		18 $387,325	16 $376,000	10 $117,500				55 $886,983
Spain	4 $11,748	1 $270	1 $189	4 $5,417	1 $999		3 $3,794	32 $62,735	46 $85,152
Sweden	1 $750	1 $200					1 $390		3 $1,340
Turkey in Europe	1 $2,625	1 $1,350						4 $12,560	6 $17,535
United Kingdom:									
England	8 $20,804	4 $21,166	10 $78,807	1 $8,160	1 $1,200			3 $75,000	27 $205,137
Scotland	1 $283								1 $283
NORTH AMERICA:									
Bermuda	4 $2,340	1 $600	1 $85	2 $2,875			2 $1,300	2 $7,500	12 $23,115
British Honduras	4 $3,350		1 $1,000	1 $300					6 $4,650
Canada	91 $39,045	45 $23,387	24 $10,569	54 $42,775	22 $27,296	20 $33,924	23 $10,458	18 $12,552	297 $200,006
Central America:									
Costa Rica	5 $9,067	2 $757		2 $3,118					9 $12,942
Guatemala	4 $2,684	1 $1,730	2 $4,829					1 $3,500	8 $12,743
Honduras	3 $5,550	4 $2,360				1 $1,450	4 $4,760	2 $2,094	14 $16,214
Nicaragua	8 $5,875	3 $1,465	3 $2,438	3 $4,230	3 $3,750	1 $9,000	3 $1,460	2 $4,114	26 $32,332
Panama	17 $52,553	6 $14,184	91 $26,243	18 $50,855	6 $5,538		10 $29,355	7 $50,160	155 $228,888
Salvador	3 $3,497	2 $2,003	1 $200	1 $360	1 $4,750			1 $1,100	9 $11,910
Mexico	56 $123,545	23 $115,516	11 $16,595	29 $32,513	36 $111,630	8 $21,498	17 $48,782	44 $171,206	224 $641,285
Newfoundland, Labrador, etc.		1 $3,000	1 $74				1 $75	1 $1,200	4 $4,349
West Indies: British:									
Barbados	2 $113				1 $1,500				3 $1,613
Jamaica	4 $1,289	1 $170	1 $475				1 $2,400	2 $2,050	9 $6,384
Trinidad				1 $600			1 $153		2 $750
Other British	6 $4,028	1 $240	7 $12,515	2 $5,200	2 $1,650		1 $1,100	2 $7,000	21 $31,733
Cuba	16 $18,539	11 $6,724	23 $20,556	16 $37,048	7 $5,301	4 $13,800	5 $7,882	36 $118,031	122 $227,881
Dominican Republic	9 $12,016	2 $738	6 $2,200	1 $700	3 $2,210		2 $845	7 $7,111	30 $25,820
Dutch			1 $3,500				5 $2,800		6 $6,300
French	2 $2,085	2 $3,960	2 $9,100	3 $6,350	1 $462		1 $941	1 $1,237	12 $24,135
Haiti	1 $500	1 $182	2 $4,538	4 $2,833		1 $1 700	2 $1,100	1 $1,200	12 $12,053
Virgin Islands							1 $350		1 $350
SOUTH AMERICA:									
Argentina	12 $8,662	1 $2,708			2 $2,496			6 $8,856	21 $22,722
Bolivia						1 $2,500			1 $2,500
Brazil	14 $13,518	7 $2,209	9 $7,136	6 $12,827	4 $4,575		6 $41,275	8 $13,170	54 $94,710
Chile	8 $8,035		3 $5,142	5 $8,911	8 $18,788	2 $6,600	2 $2,935	2 $4,046	30 $54,457
Colombia	9 $96,417	9 $26,810	6 $5,482	3 $7,305	3 $19,933	1 $2,500	7 $21,806	19 $59,041	57 $239,294
Ecuador	6 $4,497	5 $1,303	2 $1,052	3 $1,434	1 $335	1 $697		1 $3,850	19 $13,168

1914 to 1920

	1914	1915	1916	1917	1918	July 1 to Dec. 30 1918	1919	1920	Total
Guiana:									
British	1 $40		2 $1,512	1 $550	1 $6,000		1 $1,200		6 $9,302
Dutch	1 $608		1 $6,000	3 $8,363	2 $3,000	2 $21,000	1 $300	2 $10,425	12 $49,696
French								1 $3,000	1 $3,000
Paraguay	3 $1,800								3 $1,800
Peru	5 $12,844	4 $14,901	3 $6,914	3 $8,543	6 $11,531	2 $5,500	11 $5,362	14 $76,072	49 $141,667
Uruguay	7 $3,652				1 $585				8 $4,237
Venezuela	5 $4,155	1 $5,123		5 $12,870	4 $4,060		1 $6,000	4 $5,000	20 $37,208
ASIA:									
Aden	1 $750							1 $1,750	2 $2,500
China		2 $590	1 $3,500	2 $536	2 $1,089			3 $5,003	10 $10,718
French China	1 $350								1 $350
East Indies: British:									
British India	6 $1,247	5 $2,073		12 $7,127	3 $2,025		1 $635	10 $8,991	37 $22,098
Straits Settlement	5 $2,222						2 $1,156	6 $3,923	13 $7,301
Other British							1 $857		1 $857
Dutch	1 $639	1 $2,500	3 $641	1 $365	3 $804				9 $4,949
French							1 $2,150		1 $2,150
Hongkong				1 $300					1 $300
Japan	4 $5,422		1 $150		1 $287	6 $1,864	2 $7,000	2 $1,700	16 $16,423
Russia in Asia	2 $775		12 $159,833					2 $50,500	14 $211,108
Siam			1 $145			1 $900			4 $1,045
Turkey in Asia	1 $260								1 $260
OCEANIA: British:									
Australia	5 $1,134		2 $303					2 $2,021	9 $3,458
New Zealand	1 $200			2 $332					3 $434
Other British		1 $1,282	1 $260		3 $6,407				5 $7,949
French				1 $265	1 $1,000		1 $150		3 $1,415
Philippine Islands	1 $2,650	4 $5,500	2 $12,500				2 $5,050		9 $25,700
AFRICA:									
Belgian Congo	1 $414	1 $1,700					1 $115,000	2 $16,392	5 $133,506
British Africa:									
West	2 $1,294	2 $3,600		1 $8,500			1 $5,000	9 $14,792	15 $33,189
South	2 $375		3 $925	3 $431			7 $7,679	17 $14,186	32 $23,596
East	1 $802	1 $1,500			2 $827				4 $3,129
Canary Islands	1 $369								1 $369
Egypt	2 $1,750			1 $457				1 $758	4 $2,965
French Africa				3 $1,432			1 $4,500		4 $5,932
Liberia	1 $178	1 $1,100							2 $1,278
Madagascar								3 $5,140	3 $5,140
German Africa							1 $3,500		1 $3,500
Portuguese Africa	2 $472				2 $6,855			7 $8,761	11 $16,088
TOTALS	400 $519,584	164 $273,516	264 $800,231	230 $917,438	218 $2,460,583	104 $2,126,682	140 $358,851	298 $1,008,872	1,821 $8,465,757

RECAPITULATION

	1914	1915	1916	1917	1918	July 1 to Dec. 30 1918	1919	1920	Total
EUROPE	55 $57,977	10 $23,601	35 $473,821	37 $646,938	87 $2,205,899	53 $2,003,749	11 $13,535	49 $202,440	337 $5,627,960
NORTH AMERICA	235 $286,076	108 $177,016	177 $114,915	137 $189,757	82 $164,087	35 $81,372	79 $113,761	127 $190,055	980 $1,615,039
SOUTH AMERICA	71 $154,228	28 $53,054	26 $33,238	29 $61,003	32 $71,303	9 $38,797	29 $78,878	57 $183,460	281 $673,961
ASIA	21 $11,665	8 $5,163	18 $164,269	16 $8,323	9 $4,205	7 $2,764	7 $11,798	24 $71,867	110 $280,054
OCEANIA	7 $3,984	5 $6,782	5 $13,063	3 $597	4 $7,407		3 $5,200	2 $2,021	29 $39,054
AFRICA	11 $5,654	5 $7,900	3 $925	8 $10,820	4 $7,682		11 $135,679	39 $60,029	81 $228,689

Recommended Practice in Testing Spark Plugs

(*Continued from page* 384)

nished to equip at least two of the engines under consideration.

The spark-plugs submitted for test must conform in all important dimensions to the engine builder's drawings.

Preignition and leakage tests are to be made in the following manner: An engine of the type for which the plugs are intended shall be equipped with a set of the spark-plugs to be tested. The spark-plug gaps shall be carefully adjusted with a suitable thickness gage to the desired dimension and these gaps shall not be disturbed throughout the tests. The engine shall then be coupled to a suitable dynamometer and the circulating water maintained at a temperature of not less than 40 deg. fahr. or more than 60 deg fahr. The engine shall then be started up and as rapidly as possible brought to the speed corresponding to the maximum torque, the throttle and the spark adjusted for this condition, and the circulating water temperature brought up to a temperature of not less than 190 deg. fahr. nor more than 210 deg. fahr. as rapidly as possible and this temperature maintained for the remainder of the run. Torque and speed readings shall then be taken at 30-sec. intervals for a period of 15 min. Appreciable loss of torque or speed, missing or backfiring which can be attributed to the spark-plugs, will be considered grounds for rejecting the spark-plugs under test, provided the engine is of proved design and has previously demonstrated its ability to run steadily under these conditions. During this run tests for gas leakage shall be made by covering all joints of the spark-plugs with oil and inspecting for leaks.

Following this 15-min. run at the speed corresponding to maximum torque, the engine shall be brought up to the speed corresponding to maximum horsepower and be held at this speed for not less than 5 min. Observations similar to those mentioned above are to be made during this run.

Spark-plugs shall also be subjected to road tests to determine how well they will function under normal service conditions.

Spark-plugs which have successfully passed the above tests will be considered satisfactory for use in so far as the following points are concerned:

(1) Breakage owing to sudden temperature changes.
(2) Liability to cause preignition.
(3) Leakage.
(4) Power performance.
(5) Permanence of gap.

The following procedure for determining the relative susceptibility of the spark-plugs under test to fouling is intended to serve merely as a guide in making such tests, since general engine influences and more particularly lubrication and carburetion conditions varying as they do in different makes of engine, prohibit the setting of one strictly standard method applicable to all engines.

The engine equipped with the spark-plugs under test shall be run on the dynamometer with the circulating water at not less than 40 deg. fahr. nor more than 60 deg. fahr. The inlet manifold shall be kept at as low a temperature as practicable, all heating means being disconnected so far as possible. The engine shall be run with no load and a wide-open throttle, the speed being held down to between 1000 and 1500 r.p.m. by causing the carbureter to feed an abnormally rich mixture. The engine shall be run in this manner for 3 min., following which the carbureter adjustment shall be restored to standard condition and the load applied to hold the engine at a speed of about 1200 r.p.m. It is assumed that the torque which is to be expected of the engine under test at this speed, has been previously determined. At the end of 2 min. running after applying the load as above explained, the percentage of standard torque which the engine is capable of developing will be considered as a figure of merit for the spark-plugs under test. For instance, if at the end of 2 min. operation under load following the "choked" run, the engine is capable of pulling its standard torque, the spark-plugs shall be considered 100 per cent satisfactory in this regard. If, however, the engine pulls but one-half its regular torque, the figure of merit will be 50. These tests should be repeated a sufficient number of times to insure a consistent average result.

Specifications of British Marine Engines

(Compiled for Automotive Industries by M. W. Bourdon.)

Make	No. of Cylinders	Bore and Stroke, Inches	Fuel	Normal R.P.M.	Impulse Starter	Lubrication System	Valve Arrgt.	Starting By	Governor	Type of Water Pump	Type of Oil Pump	Weight Engine Only Lb.
Ailsa Craig	2	5 x5½	Ker	900	Yes	Press	L	Hc	Yes	Pist	Gears	720
Ailsa Craig	4	5 x5½	Ker	900	Yes	Press	L	Hc	Yes	Pist	Gears	1000
Ailsa Craig	6	5 x5½	Ker	900	Yes	Press	L	Hc	Yes	Pist	Gears	1400
Ailsa Craig	1	4⅝x6	Ker	900	Yes	Press	L	Hc	Yes	Pist	Plun	560
Ailsa Craig	3	4⅝x6	Ker	900	Yes	Press	L	Hc	Yes	Gear	Gear	1100
Aster	4	2 3/16x3 15/16	Gas. or ker	1100	No	Circ. spl	L	Hc. or elec	Yes	Gear	Gear	500
Aster	2	3½x4¾	Gas. or ker	900	No	Press	L	Hc. or elec	Yes	Gear	Gear	600
Aster	4	3½x4¾	Gas. or ker	900	No	Press	L	Hc. or elec	Yes	Gear	Gear	900
Aster	2	4⅜x5½	Gas. or ker	900	No	Press	L	Hc. or elec	Yes	Gear	Gear	750
Aster	4	4⅜x5½	Gas. or ker	900	No	Press	L	Hc. or elec	Yes	Gear	Gear	1300
Aster	4	5⅛x6	Gas. or ker	900	No	Press	L	Hc. or elec	Yes	Gear	Gear	1650
Aster	8	5¼x6	Gas. or ker	900	No	Press	L	Hc. or elec	Yes	Gear	Gear	2800
Atlantic	2	½x7	Ker	550	Yes	Drip & Spl	L	Hc	Yes	Pist	None	970
Atlantic	4	5½x7	Ker	550	Yes	Drip & Spl	L	Hc	Yes	Pist	None	1340
Atlantic	4	4 x5	Ker	1000	Yes	Drip & Spl	L	Hc	Yes	Pist	None	845
Atlantic	4	6 x8	Ker	550	Yes	Drip & Spl	L	Hc	Yes	Pist	None	1950
Atlantic	6	6 x8	Ker	550	Yes	Drip & Spl	L	Hc	Yes	Pist	None	2100
Brooke*	1	3⅜x3¼	Gas	850	No	Spl		Hc	No	Plun	None	140
Brooke	1	3⅝x4¼	Gas. or ker	950	Opt	Spl	T	Hc	Yes	Eccen	None	200
Brooke	2	3⅝x4¾	Gas. or ker	950	Opt	Circ. spl	T	Hc	Yes	Eccen	Gear	400
Brooke	3	3⅝x4¾	Gas. or ker	950	Opt	Circ. spl	L	Hc	Yes	Eccen	Gear	600
Brooke	4	3⅝x4¾	Gas. or ker	950	Opt	Circ. spl	T	Hc	Yes	Eccen	Gear	920
Brooke	6	3⅝x4¾	Gas. or ker	1200	Opt	Circ. spl	L	Hc	Yes	Eccen	Gear	1100
Brooke	2	5½x6	Gas. or ker	1000	Opt.†	Circ. spl	T	Hc	Yes	Eccen	Gear	1100
Brooke	4	5½x6	Gas. or ker	1000	Opt.†	Circ. spl	T	Hc	Yes	Eccen	Gear	1750
Brooke	6	5½x6	Gas. or ker	1000	Opt.†	Circ. spl	T	Hc	Yes	Eccen	Gear	2050
Day*	1	3¼x3¼	Gas	900	No	Drip		Hc	No	Gear	None	75
Day*	1	4⅛x4½	Gas	850	No	Drip		Hc	No	Gear	None	175
Day*	2	4⅛x4½	Gas	850	No	Drip		Hc	No	Gear	None	300
Day*	2	4¾x5	Gas	800	No	Drip		Hc	No	Gear	None	450
Dixon	1	3½x3½	Gas. or ker	950	Yes	Press	F	Hc	Yes	Gear	Gear	180
Dixon	2	3½x3½	Gas. or ker	950	Yes	Press	F	Hc	Yes	Gear	Gear	392
Dixon	4	3½x3½	Gas. or ker	950	Yes	Press	F	Hc	Yes	Gear	Gear	700
Dixon	1	4¾x6½	Ker	900	Yes	Press	T	Hc	Yes	Gear	Gear	630
Dixon	2	4¾x6½	Ker	900	Yes	Press	T	Hc	Yes	Gear	Gear	830
Dixon	3	4¾x6½	Ker	900	Yes	Press	T	Hc	Yes	Gear	Gear	1200
Dixon	4	4¾x6½	Ker	900	Yes	Press	T	Hc	Yes	Gear	Gear	1450
Dixon	6	4¾x6½	Ker	900	Yes	Press	T	Hc	Yes	Gear	Gear	1900
Dixon	4	6 x6½	Ker	950	Yes	Press	F	Hc	Yes	Gear	Gear	2070
Dixon	6	6 x6½	Ker	950	Yes	Press	F	Hc	Yes	Gear	Gear	2800
Djinn	1	4 x5	Ker	1100	No	Spl	L	Hc	No	Gear	None	220
Djinn	2	4½x6	Ker	800	No	Circ. spl	L	Hc	No	Pist	Pist	900
Djinn	2	6½x8¾	Ker	500	No†	Circ. spl	L	Hc	Yes	Pist	Pist	3920
Djinn	4	5½x7½	Ker	650	No†	Press	L	Hc	No	Pist	Pist	3900
Djinn	6	6½x8¾	Ker	600	No†	Press	L	Hc	No	Pist	Pist	7800
Fyfe Wilson	4	2⅝x4⅜	Gas. or ker	1000	No	Press	L	Hc	No	Eccen	Gear	280
Fyfe Wilson	4	3½x5	Gas. or ker	1000	No	Press	L	Hc	Yes	Gear	Plun	450
Gardner	4*	4½x4½	Ker	1000	No	Circ. spl	F	Hc	Yes	Gear	Gear	650
Gardner	3*	8 x8½	Ker	500	No	Press	T	Hc	Yes	Gear	Gear	5800
Gleniffer	2	4¼x5	Ker	800	Yes	Circ. spl	L	Hc	Yes	Pist	Disk	400
Gleniffer	4	5¾x7	Ker	650	Yes	Circ. spl	L	Hc	Yes	Pist	Flywh	1900
Gleniffer	1	6 x8	Ker	650	No	Circ. spl	L	Hc	Yes	Pist	Flywh	
Gleniffer	2	6 x8	Ker	650	No	Circ. spl	L	Hc	Yes	Pist	Flywh	
Gleniffer	4	6 x8	Ker	650	No	Circ. spl	L	Hc	Yes	Pist	Flywh	
Gleniffer	6	6 x8	Ker	650	No	Circ. spl	L	Hc	Yes	Pist	Flywh	
Green	4	4 3/16x4¾	Gas	1200	No	Press	I	Elec	No	Gear	Gear	250
Green	6	5½x6	Gas	1250	No	Press	I	Elec	No	Gear	Gear	590
Green	6	5½x7	Gas	1200	No†	Press	I	Elec	No	Gear	Gear	900
Green	12	5½x7	Gas	1200	No†	Press	I	Comp. air	No	Gear	Gear	1250
Green	18	5½x7	Gas	1200	No†	Press	I	Comp. air	No	Gear	Gear	1850
Parsons	1	4½x6	Ker	850	No	Press	L	Elec. opt	Opt	Eccen	Gear	420
Parsons	2	4½x6	Ker	850	No	Press	L	Elec. opt	Opt	Eccen	Gear	690
Parsons	3	4½x6	Ker	850	No	Press	L	Elec. opt	Opt	Eccen	Gear	800
Parsons	4	4½x6	Ker	850	No	Press	L	Elec. opt	Opt	Eccen	Gear	1100
Parsons	6	4½x6	Ker	850	No	Press	L	Elec. opt	Opt	Eccen	Gear	1400
Parsons	2	6½x8	Ker	650	No†	Press	L	Elec. opt	Yes	Eccen	Pist	2000
Parsons	3	6½x8	Ker	650	No†	Press	L	Elec. opt	Yes	Eccen	Pist	2400
Parsons	4	6½x8	Ker	650	No†	Press	L	Elec. opt	Yes	Eccen	Pist	3200
Parsons	6	6½x8	Ker	650	No†	Press	L	Elec. opt	Yes	Eccen	Pist	4400
McLaren	2	4 x5	Ker	850	No	Circ. spl	L	Hc	No	Gear	Gear	500
McLaren	4	4 x5	Ker	850	No	Circ. spl	L	Hc	No	Gear	Gear	890
McLaren	6	4 x5	Ker	850	No	Circ. spl	L	Hc	No	Gear	Gear	1300
Spherota	1	4¼x5½	Ker	1000	Yes	Spl	T	Hc	No	Cent	None	340
Spherota	2	4¼x5½	Ker	1000	Yes	Spl	T	Hc	No	Cent	None	450
Spherota	4	4¼x5½	Ker	1000	Yes	Spl	T	Hc	No	Cent	None	680
Thorneycroft	2	4½x6	Ker	1000	No	Circ. spl	L	Hc	Yes	Gear	Gear	900
Thorneycroft	4	4½x6	Ker	1000	No	Circ. spl	L	Hc	Yes	Gear	Gear	1300
Thorneycroft	4	4 x5½	Ker	1000	No	Circ. spl	F	Hc	Yes	Gear	Gear	1350
Thorneycroft	6	4 x7	Gas	1400	No†	Circ. spl	F	Hc	No	Gear	Gear	1150
Thorneycroft	4	6 x8	Ker	750	No	Circ. spl	F	Hc	Yes	Gear	Gear	2800
Thorneycroft	6	6 x8	Ker	750	No	Circ. spl	F	Hc	Yes	Gear	Gear	3900
Wasp	1	4⅛x6	Ker	800	No	Circ. spl	I	Hc	No	Plun	Plun	330
Wasp	2	4⅛x6	Ker	800	No	Circ. spl	I	Hc	No	Plun	Plun	530
Webber	2	4 x6	Gas. or ker	950	No	Press	L	Hc	No	Plun	Plun	670
Wolseley	4	2 7/16x3½	Gas	1050	No	Circ. spl	F	Hc	No	Gear	Gear	220
Wolseley	4	3 9/16x4¾	Gas. or ker	1000	No	Circ. spl	L	Hc	No	Gear	Gear	670
Wolseley	6	3¾x5⅛	Gas. or ker	1000	No	Circ. spl	L	Hc	No	Gear	Gear	875
Wolseley	6	4¾x5¾	Gas. or ker	1000	No	Circ. spl	L	Hc	No	Gear	Gear	1300
Watermota*	1	2⅝x2⅝	Gas (outboard)	800	No	With fuel		Flywh	No	Gear	None	60††
Watermota*	1	2¾x3	Gas (outboard)	800	No	With fuel		Flywh	No	Gear	None	100††
Watermota*	1	2¾x3	Gas (inboard)	800	No	With fuel		Hc	No	Plun	None	50
Watermota*	2	2¾x3	Gas (inboard)	800	No	With fuel		Hc	No	Plun	None	90

*Two stroke.
†Battery in addition to magneto; all engines have magnetos.
††Typical of range of 30 engines with 1 to 6 cylinders of 5 H.P. to 220 H.P.

ABBREVIATIONS: **Circ**—Circulating; **Comp**—Compressed; **Eccen**—Eccentric; **Elec**—Electric; **F**—Exhaust Valve Over Inlet in Pocket; **Gas**—Gasoline; †Complete Installation; **Hc**—Hand-crank; **I**—In Head; **Ker**—Kerosene; **L**—Side by Side (in L head); **Opt**—Optional; **Pist**—Piston; **Plun**—Plunger; **Press**—Pressure; **Spl**—Splash; **T**—in pockets at Both Sides (T. head).

Tire Exports, 1911 to 1920

	1911	1913	1914	1915	1916	1917	1918	July 1 to Dec 31, 1918	Calendar Year 1919	1920†	Total for All Yrs. Inc. 1912
Austria-Hungary	$329	$299	$1,009	....	....	....	....	....	$43,121	$224,087	$271,218
Azores and Madeira Islands	....	....	138	$178	$373	....	$72	....	....	66,698	77,459
Belgium	821	401,900	15,730	....	....	....	....	$28,718	532,532	1,280,309	2,311,730
Bulgaria	....	500	170	150	....	....	....	....	....	3,570	4,390
Czechoslovakia	....	....	....	....	....	....	....	....	....	154	154
Denmark	98	16,611	11,414	12,288	16,089	$6,917	....	....	1,254,324	959,241	2,277,250
Finland	....	1,545	4,585	....	....	....	....	....	23,367	440,157	469,694
France	185,473	20,205	5,448	8,723	80,423	425,132	661,648	425,149	3,535,178	2,369,018	8,033,026
Germany	29,979	401,196	132,181	6,090	....	....	....	....	33,280	576,714	1,180,[illegible]00
Gibraltar	....	....	....	....	....	....	129	....	175	43,028	43,332
Greece	....	....	271	2,680	698	34,654	2,000	....	83,449	311,079	434,832
Iceland and Faroe Islands	....	....	....	....	....	61	....	....	23,961	2,855	26,877
Italy	537	1,150	915	11,740	333,437	101,362	55,913	585	226,245	992,648	1,726,919
Malta, Gozo and Cyprus Islands	....	....	....	....	....	....	....	....	424	72,669	73,093
Netherlands	....	424	2,286	1,907	36,548	26,326	215	....	1,043,981	1,813,149	2,915,241
Norway	1,295	456	5,649	7,394	10,001	11,937	525	6,668	845,690	1,430,389	2,320,083
Poland and Danzig	....	....	....	....	....	....	....	....	....	278,096	278,096
Portugal	693	282	157	1,434	25,990	9,0[illegible]5	15,488	4,388	176,303	367,321	501,382
Roumania	....	146	211	....	576	....	....	....	70,785	590,620	662,512
Russia in Europe	655	729	1,168	6,480	1,125,7[illegible]3	143,916	94,264	211	1,402	13,569	1,388,127
Serbia, Montenegro and Albania	....	....	....	....	....	....	....	....	300	....	300
Spain	3,547	567	1,595	2,408	32,[illegible]84	77,753	12,233	20,899	825,007	1,925,185	2,902,178
Sweden	8,335	5,301	77,537	26,707	35,859	6,347	....	18,825	1,373,847	2,619,103	4,179,497
Switzerland	....	....	....	....	....	....	....	....	220,052	628,659	848,711
Turkey in Europe	....	....	....	1,927	....	....	....	....	85,334	215,834	303,095
England	1,104,416	1,125,718	1,503,440	2,655,099	9,175,248	2,569,901		78,573	1,508,460	4,178,548	25,695,153
Scotland	....	....	336	245	116,858	66,753	618,071	....	263	144,294	328,749
Ireland	....	....	....	....	1,3[illegible]6	....		....	....	2,220	3,763
Jugoslavia	....	....	....	....	....	....	....	....	....	16,674	16,674
North America:											
Bermuda	....	401	267	139	1,440	14	409	....	268	593	3,531
British Honduras	15	163	727	64	36	590	3,469	2,503	6,663	6,744	21,586
Canada	405,778	1,324,459	961,937	772,574	1,176,836	1,485,939	1,766,518	350,345	1,021,014	2,704,230	12,666,065
Newfoundland and Labrador	955	693	1,668	4,034	5,108	8,243	11,317	8,952	24,319	31,871	88,304
Miquelon, Langley, etc.	....	....	....	....	....	....	....	....	....	20	20
Central American States:											
Costa Rica	951	2,793	6,877	2,381	6,068	11,918	4,018	4,505	12,301	15,568	69,243
Guatemala	1,343	2,224	5,547	3,406	6,299	24,545	7,089	15,642	64,981	61,776	194,980
Honduras	....	299	1,392	3,229	7,932	19,657	19,602	8,813	35,489	26,455	123,270
Nicaragua	....	429	180	419	157	294	1,042	2,743	32,075	26,480	63,949
Panama	5,379	19,466	18,362	24,549	73,854	74,047	137,609	51,959	416,037	482,641	1,308,576
Salvador	525	1,705	2,084	2,617	11,673	22,530	22,319	17,036	95,664	98,074	161,873
Mexico	144,893	203,883	111,948	106,083	236,811	257,413	777,984	566,442	805,614	1,438,777	4,798,327
West Indies, British:											
Barbados	1,227	4,588	4,351	4,136	6,019	15,666	19,391	20,385	31,026	31,813	140,221
Jamaica	11,614	30,004	55,361	36,887	40,354	109,048	109,097	76,099	156,822	271,381	915,952
Trinidad and Tobago	689	16,364	17,023	22,672	30,510	45,654	107,353	49,838	78,435	184,000	554,874
Other British	477	1,869	2,472	3,327	8,337	21,526	25,991	20,787	33,700	83,550	202,546
Cuba	27,072	12,322	55,236	192,355	547,410	1,019,915	1,336,233	929,796	2,013,071	3,409,986	9,565,110
Danish (Virgin Islands of U. S.)	....	540	1,739	577	1,099	2,753	6,939	6,089	8,679	21,658	50,263
Dominican Republic	321	2,306	2,902	3,062	18,223	37,441	61,684	54,755	121,891	274,442	579,961
Dutch	30	767	746	3,068	4,437	7,386	9,084	8,190	10,390	24,137	68,358
French	....	115	1,045	1,527	1,283	19,399	36,474	32,493	159,176	103,374	355,010
Haiti	....	765	2,336	526	988	2,287	13,0[illegible]1	16,323	60,102	83,815	180,243
South America:											
Argentina	3,541	8,153	21,920	34,096	488,329	1,301,344	1,649,840	959,259	1,788,147	3,126,889	9,291,714
Bolivia	....	106	1,526	3,413	4,954	9,187	20,513	22,558	24,191	31,974	118,422
Brazil	10,112	47,537	11,839	77,425	295,479	606,876	455,102	111,550	1,018,055	1,965,201	4,714,128
Chile	262	2,844	10,636	21,35[illegible]	58,800	264,608	725,876	481,919	795,440	525,635	2,897,731
Colombia	2,564	16,211	18,925	15,23[illegible]	28,617	39,298	54,648	20,276	124,238	183,859	509,143
Ecuador	392	8,459	3,313	8,620	9,225	13,[illegible]5	46,305	20,052	77,189	52,297	240,112
Falkland Islands	....	....	....	....	....	1,817	....	....	....	....	1,817
Guiana, British	624	2,726	3,420	3,884	5,512	10,171	29,437	39,488	49,637	108,717	255,421
Dutch	....	63	544	308	1,339	2,588	1,918	3,385	3,265	5,518	17,928
French	....	....	....	....	14	45	....	75	81	420	635
Paraguay	....	....	....	16	....	35	....	264	2,046	1,245	3,606
Peru	557	1,273	4,838	5,253	9,663	27,934	107,236	156,232	230,812	263,698	808,241
Uruguay	586	1,990	17,987	11,826	76,608	100,427	224,694	72,735	645,970	903,687	2,057,359
Venezuela	130	10,703	20,439	32,635	71,849	128,966	116,612	67,565	226,953	285,497	963,184
Asia:											
Aden	....	....	55	264	1,585	440	2,536	....	1,847	16,714	23,471
China	590	622	28,326	18,971	41,298	36,952	53,089	48,536	254,784	421,364	905,332
Kwantung (leased territory)*	....	152	....	....	999	....	547	....	1,425	3,710	7,014
Chosen (Korea)	....	240	2,578	2,189	4,330	3,909	927	1,388	11,538	16,966	44,065
British India	874	882	3,555	15,441	119,242	145,820	416,411	133,146	557,396	1,096,377	2,489,820
Straits Settlements	283	1,133	7,174	8,595	63,572	142,271	214,887	352,666	636,101	1,109,200	2,537,194
Other British East Indies	160	337	30	1,883	19,012	6,692	52,466	20,236	18,477	33,169	152,869
Dutch East Indies	916	860	2,677	7,688	201,287	415,742	347,912	416,036	686,873	1,712,524	3,798,685
French East Indies	916	860	2,677	7,688	201,287	415,742	347,912	1,514	7,518	6,594	998,888
Hongkong	997	677	1,057	879	4,189	3,252	6,412	15,289	79,334	41,268	213,928
Japan	15,319	29,975	18,629	12,741	20,045	34,243	83,235	57,441	422,432	491,246	1,198,937
Persia	....	....	....	....	....	....	....	....	1,092	8,091	9,183
Russia in Asia	....	....	....	....	100	12,432	....	8,806	266,674	17,923	305,935
Siam	207	1,334	92	742	2,236	8,547	16,179	12,444	12,239	18,843	72,853
Turkey in Asia	....	....	....	4,037	....	....	....	1,067	12,734	77,202	95,199
Oceania, British:											
Australia	3,292	58,068	94,321	245,240	1,551,154	783,209	819,755	496,882	751,584	1,498,312	5,077,432
New Zealand	7,078	26,270	35,695	201,379	944,008	689,705	946,804	354,715	1,023,807	2,255,999	6,497,307
Other British	....	37	432	164	574	5,008	16,124	617	7,118	14,074	44,448
Dutch	36	956	7,278	5,26[illegible]	8,990	8,102	10,801	....	....	....	42,090
French	....	....	396	....	41	518	5,211	6,073	13,516	13,719	39,579
German	....	....	....	....	....	....	....	2,854	8,862	5,676	17,392
Philippine Islands	90,759	100,476	141,205	250,832	391,634	345,702	863,727	423,568	1,372,544	2,423,198	6,477,408
Africa:											
Belgian Kongo	....	....	....	....	17	....	....	....	....	2,352	2,369
British Africa, West	....	89	....	1,149	27,301	10,967	33,470	25,210	122,940	709,696	930,870
South	8,310	17,057	27,090	32,822	291,318	391,211	693,065	372,606	479,934	1,778,167	4,098,529
East	....	536	642	4,833	9,732	20,162	21,849	165	32,402	119,281	207,654
Canary Islands	....	270	....	....	1,777	....	....	....	4,545	18,326	25,009
Egypt	....	....	208	63	532	1,316	....	....	25,881	143,772	171,772
French Africa	....	....	....	....	....	420	2,399	131	28,821	53,082	84,953
Italian Africa	....	....	....	....	....	174	....	....	....	....	174
Liberia	....	....	....	....	....	92	....	....	45	2,661	2,798
Madagascar	....	....	....	....	197	....	....	565	....	....	762
Kamerun	....	....	....	....	....	....	....	....	....	8,125	8,125
Morocco	....	....	....	....	....	....	....	....	225	14,830	15,055
Portuguese Africa	71	....	....	946	3,2601	....	....	2,698	150	29,732	37,306
										Grand Total	$149,900,637

*Previous to 1918 listed as British, French and Japanese China. †Includes Casings, Inner Tubes and Solid Tires.

1921 Specifications of Stock Engines for

MAKE AND MODEL	Designed for (Cars, Trucks, Tractors)	Number of Cylinders	Bore and Stroke	Piston Displacement (Cu. In.)	Cylinders Cast	Is Cylinder Head Detachable?	Valves Placed	Valve Port Diameter (In.)	Valve Lift (In.)	Type of Cam Follower	Volume of Compression Space (Cu. In.)	Piston Length (In.)	Number of Piston Rings	Is Scraper Ring Used?	Weight of Piston with Wrist Pin and Rings (Lb.)	Weight of Connecting-Rod (Lb.)	Length of Connecting-Rod (C. to C.)	Width of Wrist Pin Bearing (In.)	Diameter of Wrist Pin Bearing (In.)	Width of Connecting-Rod Lower End Bearing (In.)	Diameter of Connecting-Rod Lower End Bearing (In.)	Diameter of Crankshaft	Number of Crankshaft Bearings	LENGTH OF CRANKSHAFT BEARINGS Front	1st Int.	Rear
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Beaver CL	C.	6	3½x5¼	303.0	B.	Yes	H.	1¾	⅜	R.	......	4½	4	Yes	2.87	4.25	11	1½	1½	2	2¼	2⅜	3	2¾	2⅜	2¾
Beaver JB	T,Tr.	4	4¾x6	425.0	B.	Yes	H.	2⅜	⅜	R.	......	5⅝	4	Yes	6.50	9.06	12½	2⅛	1½	2¾	2¼	2⅝	3	3½	3½	4½
Beaver JA	T,Tr.	4	4½x6	381.6	B.	Yes	H.	2⅜	⅜	R.	......	5⅝	4	Yes	6.00	9.06	12½	2⅝	1½	2¾	2¼	2⅜	3	3½	3½	4½
Climax TU	T,Tr.	4	5½x7	665.2	P.	Yes	R.	2¼	9/16	M.	59	7	3	No	12.18	11.62	14	2⅝	1½	3½	2½	2½	3	3½	4½	4½
Climax KU	T,Tr.	4	5 x6½	510.4	P.	Yes	R.	2¼	9/16	M.	49	5¾	3	No	7.12	8.50	13	2 3/16	1 23/64	3	2¼	2¼	3	3¾	4	4½
Climax K	T,Tr.	4	5 x6½	510.4	P.	Yes	R.	2¼	9/16	M.	49	5¾	3	No	7.12	8.50	13	2 3/16	1 23/64	3	2¼	2¼	3	3¾	4	4½
Continental J4	T.	4	3¾x5	221.0	....	Yes	R.	.....	5/16	M.	17	4⅞	4	No	3.62	4.87	11	1¾	1⅛	2 5/16	2	2¼	3	2¼	2¼	2⅝
Continental N	T.	4	3¾x5	221.6	B.	No	R.	.....	9/32	M.	15.8	3¾	3	No	3.00	3.62	10½	1½	1 3/32	2 5/16	1⅞	2¼	3	3⅛	2½	3 9/32
Continental 7R	C.	6	3¼x4½	224.0	B.	Yes	R.	.....	5/16	M.	10.6	4½	3	No	2.50	3.00	10½	1⅜	⅞	1⅝	2¼	2¼	4	2⅝	1⅞	3⅛
Continental C4	T.	4	4⅛x5¼	281.0	B.	No	L.	.....	9/32	M.	25.6	5⅛	3	No	4.25	4.50	10½	1¾	1 3/32	2½	2⅝	2¼	3	2⅝		4⅛
Continental K4	T.	4	4⅛x5¼	281.0	B.	Yes	R.	.....	5/16	M.	22.7	5⅞	4	No	4.06	3.56	11½	1⅞	1¼	2⅝	2⅝	2¼	3	2⅝	2¾	2¾
Continental C2	T.	4	4⅛x5¼	281.0	B.	No	R.	.....	5/16	M.	19.1	5¼	3	No	4.25	4.50	11	1¾	1 3/32	2¼	2	2¼	3	2⅞	3	4 15/32
Continental 9N	C.	6	3½x5¼	303.0	B.	No	R.	.....	9/32	M.	15.3	4½	3	No	3.18	3.87	10¼	1½	1 5/32	1⅝	2⅜	2⅜	3	2¾	2¼	3 9/32
Continental L4	T.	4	4½x5½	350.0	P.	Yes	R.	.....	5/16	M.	35.4	5⅝	4	No	5.87	8.50	12	2	1⅜	2⅝	2¼	2¼	3	3	3¼	3½
Continental E4	T.	4	4½x5½	350.0	P.	No	L.	.....	5/16	M.	28.7	5⅝	3	No	5.18	6.81	11	2¼	1 7/16	3	2¼	2¼	3	3	3¾	4⅝
Continental E7	T.	4	4½x5½	350.0	P.	No	L.	.....	5/16	M.	28.7	5⅝	3	No	5.18	6.81	11	2¼	1 7/16	3	2¼	2¼	3	3	3¾	4⅝
Continental B2	T.	4	4¾x6	425.0	P.	Yes	R.	.....	11/32	R.	42.6	6⅛	3	No	7.12	8.50	13¼	2⅛	1⅜	3	2⅜	2½	3	3	4	4
Erd TF	Tr.	4	4 x6	301.6	B.	Yes	H.	1¾	5/16	M.	......	4½	3	No	4.93	5.12	11½	1¾	1¼	2⅜	2	2	3	3	2½	4
Erd TF	Tr.	4	4¼x6	340.4	B.	Yes	H.	1¾	5/16	M.	......	4½	3	No	5.12	7.87	11½	1¾	1¼	2⅜	2	2	3	3	2½	4
Erd A	Tr.	4	4½x6	381.6	B.	Yes	H.	2	5/16	R.	......	6	3	No	7.00	7.87	12½	2⅛	1½	3¼	2⅜	2½	3	3½	3½	4½
Erd A	Tr.	4	4¾x6	425.3	B.	Yes	H.	2	5/16	R.	......	6	3	No	7.50	7.87	12½	2⅛	1½	3¼	2⅜	2½	3	3½	3½	4½
Falls V11000	C.	4	3⅛x4¼	130.4	B.	Yes	H.	1¼	9/32	M.	9.19	3½	3	No	2.07	2.00	8⅛	1¾	.74	1⅝	2	.....	3	2 7/16	1⅞	3
Falls T800	C.	6	3⅛x4¼	195.6	B.	Yes	H.	1¼	9/32	M.	9.19	3½	3	No	2.07	2.00	8⅛	1¾	.74	1⅝	2	.....	3	2 7/16	.....	.....
G. B. & S. S	C-T.	4	3¾x4¼	187.9	B.	Yes	R.	1⅝	7/32	.....	11.7	3⅝	3	Yes	2.81	1.68	7	1½	⅞	2	1½	1⅝	3	3⅞	2¼	4
G. B. & S. AA	C,T,Tr.	4	3¾x5	220.0	B.	No	R.	1 9/16	23/64	M.	12.7	3¾	3	Yes	3.06	2.25	10¼	1½	1	2 5/16	1⅞	2¼	3	3	2½	3
Gray-Beall A	C,T,Tr.	4	3½x5	192.4	B.	Yes	H.	1⅝	5/16	M.	14.7	4	3	Yes	2.00	2.81	11	2⅞	1	1⅞	2	*	3	2½	2½	3¼
Hercules CU-2	T,Tr.	4	3¾x5¼	226.4	B.	Yes	R.	1 7/16	11/32	M.	19.2	4⅞	4	Yes	4.20	5.20	11	1 9/16	1⅛	2 5/16	2	2	5	2¼	1½	3⅝
Hercules CU-3	T,Tr.	4	4 x5⅛	257.6	B.	Yes	R.	1 9/16	11/32	M.	21.6	4⅞	4	Yes	4.93	5.20	11	1 9/16	1⅛	2 5/16	2	2	5	2¼	1½	3⅝
Hercules MU-2	T,Tr.	4	4¼x5½	312.0	B.	Yes	R.	1⅞	11/32	M.	25.9	5⅛	4	Yes	5.00	5.68	12	1⅞	1¼	2½	2	2	5	2 5/16	1¾	4⅜
Hercules MU-3	T,Tr.	4	4½x5½	349.9	B.	Yes	R.	1⅞	11/32	M.	28.9	5⅛	4	Yes	5.56	5.68	12	1⅞	1¼	2½	2	2	5	2 5/16	1¾	4⅜
Hercules T-2	T,Tr.	4	4¾x6	425.3	P.	Yes	R.	2⅛	11/32	R.	35.5	5 5/16	4	Yes	7.25	8.00	13¼	2⅛	1⅜	3	2⅜	2⅜	5	2¼	2¼	4
Hercules T-3	T,Tr.	4	5 x6	471.2	P.	Yes	R.	2⅛	11/32	R.	39.4	5 5/16	4	Yes	8.12	8.00	13¼	2⅛	1⅜	3	2⅜	2⅜	5	2¼	2¼	4
Herschell-Spillman 7000	C,T,Tr.	4	3½x5	192.4	B.	Yes	R.	1⅞	5/16	M.	14.3	3⅜	3	No	2.00	3.27	11	1 7/16	⅞	2	2	2	2	4	.....	4
Herschell-Spillman 11000	C.	6	3¼x5	249.0	B.	Yes	R.	1⅞	5/16	M.	12.4	3½	3	No	1.87	3.25	11	1⅜	⅞	2	2	2⅛	4	3	2⅝	4
Hinkley HAA300	T,Tr.	4	3¾x5¼	231.9	B.	Yes	R.	1¾	5/16	R.	19.8	4¾	3	No	4.20	7.12	11½	1¾	1⅛	2¼	2⅛	2¼	3	2¼	3	3
Hinkley HAA400	T,Tr.	4	4 x5¼	263.9	B.	Yes	R.	1¾	5/16	R.	22.5	4½	3	No	4.37	7.12	11½	1¾	1⅛	2¼	2⅛	2¼	3	2¼	3	3
Hinkley HA500	T,Tr.	4	4¼x5½	312.0	B.	Yes	R.	2	5/16	R.	26.6	5¼	3	No	4.50	8.12	12	1⅞	1¼	2½	2¼	2⅛	3	2½	3½	3½
Hinkley HA200	T,Tr.	4	4½x5½	349.9	B.	Yes	R.	2	5/16	R.	29.8	5½	3	No	6.50	8.12	12	1⅞	1¼	2½	2¼	2⅜	3	2½	3½	3½
Hinkley HA1600	T,Tr.	4	4½x5½	349.9	B.	Yes	I.	2	5/16	R.	28.1	5½	3	No	6.50	8.12	12	1⅞	1¼	2½	2¼	2⅜	3	2½	3½	3½
Kessler K	C.	4	3¾x3¾	165.0	B.	Yes	I.	1 7/16	5/16	......	16.0	3	3	Yes	1.37	1.25	6¾	2⅝	¾	2¼	1⅝	2	5	1½	1½	2½
LeRoi 20	C,T,Tr.	4	3⅛x4½	138.1	B.	Yes	R.	1½	5/16	M.	10.2	3½	3	No	1.75	2.25	8	1 7/16	¾	2	1¾	1¾	2	2¾	.....	2¾
Lycoming K	C,T.	4	3½x5	192.4	B.	Yes	R.	1½	19/64	M.	14.3	4	3	No	2.12	2.50	9½	1 9/16	⅞	2⅛	2	2⅛	2	3 5/16	.....	3 5/16
Minerva A20	T,Tr.	4	4½x6	381.6	P.	Yes	R.	2¼	⅜	M.	31.7	6	3	No	6.43	8.18	13¼	2¼	1¼	3	2⅜	2½	3	3	4	4
Pittsburg 93	T.	4	3⅛x4½	138.0	B.	Yes	R.	1⅛	5/16	R.	11.7	4½	3	No	2.12	2.68	11	1½	55/64	1 57/64	1 9/16	1 15/16	3	3	2	2 15/16
Pittsburg 92	C.	8	3¼x5	331.8	B.	No	.....	1 7/16	5/16	R.	11.7	3½	3	No	2.12	3.00	11	1½	⅞	1 17/32	1⅞	2	3	3	3	3¼
Red Wing A	T.	4	3½x4½	173.0	P.	No	L.	1 5/16	.300	M.	61.0	4⅛	3	No	3.18	2.62	8½	1	1.10	2⅛	1½	1½	3	3	2¾	3
Red Wing F	Tr.	4	4 1/16x5	259.0	B.	Yes	L.	1¾	.300	M.	88.0	4¾	4	Yes	4.75	4.12	10⅜	1¼	1.10	2¼	2	2	3	3½	2¼	3
Red Wing B	Tr.	4	4½x5	318.0	B.	Yes	L.	1 15/16	.300	M.	113.0	4¾	4	Yes	5.31	4.12	10⅜	1 15/32	1.10	2¼	2	2	3	3½	2¼	4⅜
Reliable OO	Tr.	2	6 x6	178.0	S.	Yes	H.	2⅛	⅜	R.	53	7	3	No	19.50	.....	12	.....	.....	2⅜	2⅜	2⅜	2	5½	.....	5½
Reliable UR	Tr.	2	6 x7	198.0	B.	Yes	H.	2⅛	7/16	R.	68	7	3	No	19.50	15.00	18	3½	1¾	3	3	3	2	5	.....	5
Rutenber 25	C.	6	3⅛x5	230.0	B.	Yes	L.	1 5/16	5/16	M.	......	3⅛	4	No	.....	.....	9½	1½	¾	1⅞	2	2	3	2¾	2¾	3⅛
Supreme S4	C,T.	4	3⅜x5	179.0	B.	Yes	R.	1⅝	5/16	M.	......	4	3	No	2.12	2.25	10	1⅝	⅞	2	2	2	3	2 7/16	1¾	3½
Supreme 5K	C.	6	3¼x5	249.0	B.	Yes	R.	1⅝	5/16	M.	......	4 1/32	3	No	2.12	2.25	10	1⅝	⅞	1 15/16	2	2⅛	3	2 15/32	2⅝	2 15/16
Stearns FU	T,Tr.	4	4 x6	......	B.	Yes	H.	2	⅜	R.	24.8	5¾	3	Yes	5.75	9.00	12½	2⅛	1½	3¼	2½	2½	3	3¼	4	4
Stearns GU	T,Tr.	4	4¼x6	340.0	B.	Yes	H.	2	⅜	R.	28.0	5¾	4	Yes	5.87	9.00	12½	.....	1½	3¼	2½	2½	3	3¼	4	4
Stearns HU	T,Tr.	4	4½x6	381.0	B.	Yes	H.	2	⅜	R.	31.4	5¾	4	Yes	6.50	9.00	12½	2⅛	1½	3¼	2½	2½	3	3¼	4	4
Stearns AU	T,Tr.	4	4¾x6½	462.0	B.	Yes	H.	2¼	⅜	R.	38.0	6	4	Yes	7.31	12.00	13¼	2¼	1⅝	3½	2¾	2¾	3	3½	4½	4½
Stearns BU	T,Tr.	4	5 x6½	510.0	B.	Yes	H.	2¼	⅜	R.	42.1	6	4	Yes	7.43	12.00	13¼	2¼	1⅝	3½	2¾	2¾	3	3½	4½	4½
Twin City TW	T,Tr.	4	4¼x6	340.5	B.	Yes	H.	1½	5/16	M.	31.8	5 3/32	4	Yes	5.00	7.00	12	2	1¼	2⅞	2⅜	*	3	3	2⅝	4
Twin City AE	Tr.	4	5½x6¾	641.5	B.	Yes	H.	1¾	7/16	M.	64.0	6¾	5	Yes	9.75	15.75	14	3⅛	1⅝	3⅝	3	*	3	3 29/32	4	5¾
Waukesha BUX	T,Tr.	4	3¾x5¼	232.0	B.	Yes	R.	1¾	5/16	M.	......	3⅞	4	Yes	2.87	5.62	10⅝	1 15/16	1	2¼	1⅞	2	3	2½	2½	2 15/16
Waukesha FU	T,Tr.	4	4 x5¾	289.0	P.	Yes	R.	2	11/32	R.	10.9	5 9/16	3	No	5.31	7.25	12½	2 5/16	1¼	2½	2⅜	2½	3	2½	3¼	3¼
Waukesha CU	T,Tr.	4	4⅜x5¾	346.0	P.	Yes	R.	2	11/32	R.	13.1	5 9/16	3	No	5.31	7.25	12¼	2⅝	1¼	2½	2⅜	2½	3	2½	3¼	3¼
Waukesha DU	T,Tr.	4	4½x6¼	398.0	P.	Yes	R.	2⅛	11/32	R.	14.6	5⅞	3	No	6.50	7.62	13¼	2⅝	1⅜	2¾	2⅜	2½	3	2¾	3½	3½
Waukesha EU	T,Tr.	4	5 x6¼	491.0	P.	Yes	R.	2⅛	11/32	R.	18.0	6½	3	No	7.00	8.75	13¼	3⅛	1⅜	3¼	2⅜	2½	3	3¼	4	4
Weidely MB	......	4	3⅝x5½	227.1	B.	Yes	H.	1⅞	5/16	M.	16.0	4 9/16	3	Yes	2.68	4.18	12½	1⅝	1	2¼	2	2⅛	3	2½	2½	4
Weidely MAU	......	4	3¾x5½	242.9	B.	Yes	H.	1⅞	.3053	M.	20.3	4½	4	Yes	3.34	4.31	11	1⅝	1	2¼	2	2⅛	3	2 15/32	2 17/32	4 1/32
Weidely MAT	......	4	3¾x5½	242.9	B.	Yes	H.	1⅞	.3053	M.	20.3	4½	4	Yes	3.34	4.31	11	1⅝	1	2¼	2	2⅛	3	2 15/32	2 17/32	4 1/32
Weidely MAT	......	4	4 x5½	276.5	B.	Yes	H.	1⅞	.3053	M.	21.8	4½	4	Yes	4.11	4.31	11	1⅝	1	2¼	2	2⅛	3	2 15/32	2 17/32	4 1/32
Weidely MAU	Tr.	4	4 x5½	276.5	B.	Yes	H.	1⅞	.3053	M.	21.8	4½	4	Yes	4.11	4.31	11	1⅝	1	2¼	2	2⅛	3	2 15/32	2 17/32	4 1/32
Weidely M	......	4	4 x5½	......	B.	Yes	H.	1⅞	.3053	M.	21.8	4½	4	Yes	4.11	4.31	11	1⅝	1	2¼	2	2⅛	3	2 5/16	2 17/32	4 1/32
Weidely C	C.	12	2⅞x5	389.5	B.	Yes	H.	1 5/16	.258	M.	8.9	3½	3	Yes	1.60	.....	10	1½	⅝	1 5/16	2	2⅛	3	2½	2¾	4
Wisconsin CAU	C,T,Tr.	4	3¾x5	221.0	B.	No	L.	1½	5/16	M.	17.4	5 5/32	3	No	4.18	4.31	10½	1¾	1 5/16	2¼	1¾	1¾	3	2¾	2¾	4
Wisconsin EAU	C,T,Tr.	4	4 x5	251.0	B.	No	L.	1½	5/16	M.	19.9	4 25/32	3	No	4.31	4.31	10½	1¾	1 5/16	2¼	1¾	1¾	3	2¾	2¾	4
Wisconsin TAU	C,T,Tr.	4	4 x6	301.0	B.	Yes	R.	2 1/32	5/16 in.-⅜ Ex.	M.	24.9	5⅜	3	No	4.18	5.75	12	2	1 5/16	3	2	2	4	2½	2½	3½
Wisconsin UAU	C,T,Tr.	4	4¼x6	340.0	B.	Yes	R.	2 1/32	5/16 in.-⅜ Ex.	M.	28.1	5⅛	3	No	4.87	5.75	12	2	1 5/16	3	2	2	4	2½	2½	3½
Wisconsin VAU	C,T,Tr.	4	4½x6	382.0	B.	Yes	R.	2 1/32	5/16 in.-⅜ Ex.	M.	34.5	4 15/16	3	No	4.93	5.75	12	2	1 5/16	3	2	2	4	2½	2½	3½
Wisconsin RAU	C,T,Tr.	4	4¾x6	425.0	P.	Yes	R.	2⅛	11/32 in.-⅜Ex.	R.	38.4	5 29/32	3	No	6.12	7.18	12½	2⅛	1⅜	3	2¼	2¼	3	3	3¾	4
Wisconsin RBU	T,Tr.	4	5 x6	471.0	P.	Yes	R.	2⅛	11/32 in.-⅜Ex.	R.	42.4	6⅛	3	No	6.50	7.25	12½	2⅛	1⅜	3	2¼	**	3	3	3¾	4
Wisconsin M	T,Tr.	4	5¾x7	730.0	P.	No	O.	2 13/32	⅜	R.	60.6	6½	4	No	10.12	9.37	14	3⅝	1 7/16	3½	2⅜	2⅜	4	3	4	6
Wisconsin P	T,Tr.	6	5¾x7	1095.0	P.	No	O.	2 13/32	⅜	R.	60.6	6½	4	No	10.12	9.37	14	3⅝	2⅜	3½	2⅜	2⅜	4	4	4	6

STOCK ENGINE ABBREVIATIONS—Explanation of abbreviations: Numbers in brackets indicate the column to which reference is made; (1) C—Car; T—Truck; Tr—Tractor. (5) B—Block; P—Pairs; S—Singly; T—Threes. (7) H—Head; R—Right; L—Left; Op—Opposite; Sl—Sleeve. (10) R—Roller; M—Mushroom; R-A—Rocker Arm. (29) I—Integral; S—Separate; Opt—Optional. (30) C-P—Centrifugal Pump; T-S—Thermo-Syphon; G-P—Gear Pump; Opt—Optional. (31) S-P—Splash-Pressure; C-S—Circulating-Splash; Pr—Pressure; C-P—Circulating Pressure. (32-35) A—Aluminum; I—Iron; S-S—Semi-Steel; P-S—Pressed Steel; B—Bronze. (46) G—Gear; C—Chain. (47) S—Silent. (48) A—Adjustable.

Passenger Cars, Trucks and Tractors

Is Cylinder Offset?	If Offset—How Much?	Intake Manifold (Separate or Integral)	Water Circulated By	Lubrication System	Material of Crankcase	Material of Lower Half of Crankcase	Material of Cylinders	Material of Pistons	R.P.M. at Which Maximum H.P. is Developed	R.P.M. at Which Maximum Torque is Developed	Is Governor Fitted?	If So—What Type?	Governed Speed	Maximum Brake H.P. of Average Product	Weight of Engine Without Ignition or Carburetor (Lb.)	Overall Width of Engine (In.)	Overall Height of Engine (In.)	Overall Length of Engine (In.)	Type of Front End Drive	If Chain—What Type?	Adjustable or Non-adjustable	Points of Engine Support	Adapted for Heavy Fuel	Is Bell Housing Provided?	If So—What Number and Type?	MAKE AND MODEL
27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	
No.		I.	C-P.	Pr.	A.	A.	I.	I.	2400	1000	No.			67	675	24 1/2	34 1/8	42 1/2	G.			3	No.	Yes.	3-S.A.E.	Beaver CL
Yes.	1/2	I.	C-P.	S-P.	I.	I.	I.	I.	1250	750	No.			47	1025	19 1/2	39 1/8	41 3/4	G.			Opt.	Yes.	Yes.	3-S.A.E.	Beaver JR
Yes.	1/2	I.	C-P.	S-P.	I.	I.	I.	I.	1200	700	No.			40	1000	19 1/2	39 1/8	41 3/4	G.			Opt.	Yes.	Yes.	2-S.A.E.	Beaver JA
No.		S.	C-P.	Pr.	I.	I.	S-S.	I.	800	500	Yes.	Cent.		44	1530	26	43 7/8	55 5/8	G.			3	Yes.	Yes.	1-S.A.E.	Climax TU
No.		S.	C-P.	Pr.	I.	I.	S-S.	I.	850	500	Yes.	Cent.		35	1100	24	39 3/4	44 5/8	G.			4	Yes.	Yes.	2-S.A.E.	Climax KU
No.		S.	C-P.	Pr.	I.	I.	S-S.	I.	850	500	Yes.	Cent.		35	1050	24	39 3/4	44 5/8	G.			4	Yes.	No.		Climax K
No.		I.	C-P.	Pr.	A.	A.	I.	I.	1500	900	No.			30	590	24 1/2	31 1/8	34 3/32	G.			3	No.	Yes.	3-S.A.E.	Continental J4
No.			Opt.	S-P.	A.	P-S.	I.	I.	2200	1200	No.			38	475	24 1/2	30 3/8	34 1/4	G.			3	No.			Continental N
No.		I.	C-P.	S-P.	A.	P-S.	I.	I.	2600	1400	No.			55	580	21 5/8	31 5/8	40 1/8	G.			3	No.	Yes.	3-S.A.E.	Continental 7R
No.		S.	C-P.	S-P.	A.	A.	I.	I.	1600	850	No.			33	560	26 3/4	32 7/8	37 3/32	G.			3	No.	Yes.	2-S.A.E.	Continental C4
No.		I.	C-P.	S-P.	A.	A.	I.	I.	1600	900	No.			38	680	24 1/2	36 15/32	37 15/32	G.			3	No.	Yes.	2-S.A.E.	Continental K4
No.		I.	C-P.	S-P.	A.	P-S.	I.	I.	1400	900	No.			35	580	26 3/4	32 7/8	37 23/32	G.			3	No.	Yes.	Own Spec.	Continental C2
No.		S.	C-P.	S-P.	A.	P-S.	I.	I.	2000	900	No.			55	600	24 1/2	29 23/32	41 21/32	G.			3	No.	Yes.	3-S.A.E.	Continental 9N
No.		I.	C-P.	S-P.	A.	A.	I.	I.	1400	900	No.			48	807	24 1/2	37 3/8	40 9/32	G.			3	No.	Yes.	2-S.A.E.	Continental L4
No.		S.	C-P.	S-P.	A.	A.	I.	I.	1400	900	No.			40	650	26 3/4	33 5/8	41 27/32	G.			3	No.	Yes.	2-S.A.E.	Continental E4
No.		S.	C-P.	S-P.	A.	A.	I.	I.	1400	900	No.			40	650	26 3/4	33 5/8	41 27/32	G.			3	No.	Yes.	2-S.A.E.	Continental E7
No.		S.	C-P.	S-P.	A.	A.	I.	I.	1300	900	Yes.		1000	55	1016	24 5/8	39 25/32	45 7/8	G.			3	No.	Yes.	1-S.A.E.	Continental B2
No.		I.	C-P.	Pr.	I.	I.	I.	I.	1200	900	Opt.	Opt.	1000	32.5	800	23 1/2	34 5/8	40 5/8	G.			Opt.	Yes.	Yes.	Opt.	Erd TF
No.		S.	C-P.	Pr.	I.	I.	I.	I.	1200	900	Opt.	Opt.	1000	38	850	23 1/2	34 5/8	40 5/8	G.			Opt.	Yes.	Yes.	Opt.	Erd TF
Yes.	1/2	I.	C-P.	Pr.	I.	I.	I.	I.	1400	800	Opt.	Opt.	1000	44	1100	24	43 1/8	46 5/8	G.			Opt.	Yes.	Yes.	Opt.	Erd A
Yes.	1/2	I.	C-P.	Pr.	I.	I.	I.	I.			Opt.	Opt.	1000	46	1150	24	43 1/8	46 5/8	G.			Opt.	Yes.	Yes.	Opt.	Erd A
No.		I.	T-S.	Pr.	I.	I.	I.	I.			No.				360	25 3/4	28 3/4	32 5/8	G.			3	No.	Yes.	4-S.A.E.	Falls V11000
No.		I.	T-S.	Pr.	I.	I.	I.	I.	2000	700	No.			37	475	25 3/4	28 3/4	38 5/8	G.			3	No.	Yes.	4-S.A.E.	Falls T800
Yes.	5/8	S.	T-S.	C-S.	I.	P-S.	S-S.	S-S.	1600	800	Yes.		1000	30	450	23 1/2	25	34	G.			4	No.	Yes.	5-S.A.E.	G. B. & S. S
No.		S.	C-P.	Pr.	A.	A.	S-S.	S-S.	1700	800	Yes.	Cent.	1400	35	425	25 3/4	31	34 1/8	G.			3	No.	Yes.	3-S.A.E.	G. B. & S. AA
No.		I.	T-S.	S-P.	I.	P-S.	I.	I.	2200	1200	Opt.			35	460	25 3/4	33 1/2	34 1/8	G.			3	Yes.	Yes.	3-S.A.E.	Gray-Beall A
No.		S.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	Opt.	Opt.	Opt.	35	750	25 3/4	35 5/8	38 5/8	G.			3	Yes.	Yes.	3-S.A.E.	Hercules CU-2
No.		S.	C-P.	Pr.	I.	I.	I.	I.	1800	1000	Opt.	Opt.	Opt.	39	750	25 3/4	35 5/8	38 5/8	G.			3	Yes.	Yes.	3-S.A.E.	Hercules CU-3
No.		S.	C-P.	Pr.	I.	I.	I.	I.	1700	800	Opt.	Opt.	Opt.	46	850	25 3/4	41	43 5/8	G.			3	Yes.	Yes.	2-S.A.E.	Hercules MU-2
No.		S.	C-P.	Pr.	I.	I.	I.	I.	1600	750	Opt.	Opt.	Opt.	50	850	25 3/4	41	43 5/8	G.			3	Yes.	Yes.	2-S.A.E.	Hercules MU-3
No.		S.	C-P.	Pr.	A.	A.	I.	I.	1500	700	Opt.	Opt.	Opt.		1000	28 3/4	41 3/8	44 5/8	G.			3	Yes.	Yes.	1-S.A.E.	Hercules T-2
No.		S.	C-P.	Pr.	A.	A.	I.	I.	1500	700	Opt.	Opt.	Opt.	70	1000	28 3/4	41 3/8	44 5/8	G.			3	Yes.	Yes.	1-S.A.E.	Hercules T-3
No.		S.	T-S.	S-P.	S-S.	P-S.	S-S.	I.	1800	900	No.			33	441	25 1/2	31	35 3/4	G.			3	Yes.	Yes.	3-5 S.A.E.	Herschell-Spillman 7000
No.		S.	C-P.	S-P.	S-S.	P-S.	S-S.	I.	2300	900	No.			45	560	25 1/2	30 7/8	44					No.	Yes.	3-5 S.A.E.	Herschell-Spillman 11000
No.		S.	C-P.	Pr.	S-S.	P-S.	I.	I.	1600	800	Yes.	Own.	Opt.	37	732	25 3/4	36	37 1/4	G.			3	No.	Yes.	3-S.A.E.	Hinkley HAA300
No.		S.	C-P.	Pr.	S-S.	P-S.	I.	I.	1650	800	Yes.	Own.	Opt.	42	750	25 3/4	36	37 1/4	G.			3	No.	Yes.	3-S.A.E.	Hinkley HAA400
No.		S.	C-P.	Pr.	S-S.	A.	I.	I.	1450	700	Yes.	Own.	Opt.	45	887	26 1/2	40	43 7/8	G.			3	No.	Yes.	2-S.A.E.	Hinkley HA500
No.		S.	C-P.	Pr.	S-S.	A.	I.	I.	1500	700	Yes.	Own.	Opt.	50	895	26 1/2	40	43 7/8	G.			3	No.	Yes.	2-S.A.E.	Hinkley HA200
No.		S.	C-P.	Pr.	S-S.	A.	I.	I.	1600	700	Yes.	Own.	Opt.	55	1040	26 1/2	45 1/2	43 7/8	G.			3	No.	Yes.	2-S.A.E.	Hinkley HA1600
No.		S.	T-S.	S-P.	I.	A.	I.	A.	3300	2400	No.			70	385				G.			4	No.	Yes.	3-S.A.E.	Kessler K
No.		S.	T-S.	C-S.	I.	I.	I.	S-S.	2200	1200	Opt.		Opt.	25	325	16	25	32	G.			3	No.	Opt.	3-4-S.A.E.	LeRoi 20
No.		I.	T-S.	C-S.	I.	P-S.	I.	I.	2100	950	No.			35	470	21 5/8	26 7/8	38 1/8	G.			3	No.	Yes.	3-S.A.E.	Lycoming K
No.		S.	C-P.	Pr.	S-S.	I.	S-S.	I.	1000	800	Yes.	Cent.	900	40	900	24 1/4	37	46 1/4	G.			3	Yes.	Yes.	Opt-SAE	Minerva A20
No.		S.	T-S.	S-P.	I.	P-S.	I.	I.	1800	1000	No.			20	395	21	28 5/8	45 5/8	G.			3		Yes.	Special	Pittsburg 93
No.		S.	C-P.	S-P.	A.	A.	I.	I.	2400	1100	No.			70	705	24 5/8	23 7/8	55 5/8	G.			3	No.	Yes.	3-S.A.E.	Pittsburg 92
Yes.	5/8	S.	C-P.	C-S.	I.	I.	I.	I.			Yes.	Cent.	1100	17	480	19	30 5/8	31 1/2	G.			4	No.	No.		Red Wing A
No.		I.	C-P.	C-S.	I.	I.	I.	I.			Yes.	Cent.	950	22	560	20 3/8	28 1/8	36 7/8	G.			4	No.	No.		Red Wing F
Yes.	1/2	I.	C-P.	C-S.	I.	I.	I.	I.			Yes.	Cent.	900	26	600	20 7/8	28 3/8	36 7/8	G.			4	No.	No.		Red Wing B
No.		I.	C-P.	Pr.			S-S.	S-S.			Yes.	F-B.	600	24	800	40 3/8	28	55	G.			4	Yes.	No.		Reliable OO
No.		I.	C-P.	Pr.	S-S.		S-S.	S-S.	650	600	Yes.	F-B.	600	24	1150	47 1/2	26	47	G.			4	Yes.	No.		Reliable UR
No.		I.	C-P.	S-P.	I.	P-S.	I.	I.	2400		No.			45	545	25 1/4	27	40 5/8	G.			3	No.	Yes.	3-S.A.E.	Rutenber 25
Yes.	5/8	I.	T-S.	Pr.	I.	P-S.	I.	I.	2150	1400	No.			40	430	24 1/2	30	32 11/32	G.			3	No.	Yes.	3-5-S.A.E.	Supreme S4
Yes.	5/8	S.	C-P.	Pr.	I.	P-S.	I.	I.	2500	1000	No.			58	560	24 1/2	30	37 5/32	G.			3	No.	Yes.	3-S.A.E.	Supreme 5K
Yes.	1/2	O.	C-P.	Pr.	I.	A.	I.	I.	1650	1070	Yes.	Cent.	950			23	38 5/8	41	G.			Opt.	Yes.	Yes.	2-3-S.A.E.	Stearns FU
Yes.	1/2	O.	C-P.	Pr.	A.	A.	I.	I.	1650	1070	Yes.	Cent.	950			23	38 5/8	41	G.			Opt.	Yes.	Yes.	1-2-3-SAE	Stearns GU
Yes.	1/2	O.	C-P.		A.	A.	I.	I.	1650	1070	Yes.	Cent.	950			23	38 5/8	41	G.			Opt.	Yes.	Yes.	1-2-3-SAE	Stearns HU
Yes.	1/2	O.	C-P.	Pr.	I.	A.	I.	I.	1425	800	Yes.	Cent.	850			23	42 3/4	44 3/4	G.			Opt.	Yes.	Yes.	1-2-S.A.E.	Stearns AU
Yes.	1/2	O.	C-P.	Pr.	I.	A.	I.	I.	1425	800	Yes.	Cent.	850			23	42 3/4	44 3/4	G.			Opt.	Yes.	Yes.	1-2-S.A.E.	Stearns BU
No.		S.	C-P.	Pr.	I.	P-S.	I.	I.			Yes.	Cent.	1000	40†	950	25 3/8	39 1/2	44 5/8	G.			Opt.	Yes.	Yes.	2-S.A.E.	Twin City TW
No.		S.	C-P.	Pr.	I.	A.	I.	I.			Yes.	Cent.	900	58†	1750	29	50	55 3/4	G.			4	Yes.	No.		Twin City AE
No.		S.	C-P.	C-S.	A.	I.	I.	I.	1800	900	Yes.	Own.	1000	26	615	20 7/8	29	36 3/4	G.			3	Yes.	Yes.	3-S.A.E.	Waukesha BUX
Yes.	1/4	S.	C-P.	Pr.	A.	I.	I.	I.	1500	1000	Yes.	Own.	1000	32	825	30 1/2	38 3/4	55 1/2	G.			3	Yes.	Yes.	2-S.A.E.	Waukesha FU
Yes.	1/4	S.	C-P.	Pr.	A.	I.	I.	I.	1500	630	Yes.	Own.	1000	32	840	30 1/2	38 3/4	55 1/2	G.			3	Yes.	Yes.	2-S.A.E.	Waukesha CU
Yes.	1/4	S.	C-P.	Pr.	A.	I.	I.	I.	1500	650	Yes.	Own.	1000	40	910	30 1/2	40 1/2	58	G.			3	Yes.	Yes.	1-2-S.A.E.	Waukesha DU
Yes.	1/2	S.	C-P.	Pr.	A.	I.	I.	I.	1400	650	Yes.	Own.	1000	50	980	30 1/2	40 1/2	62	G.			3	Yes.	Yes.	1-2-S.A.E.	Waukesha EU
No.		I.	C-P.	Pr.	A.	A.	I.	I.	2400	1200	No.			55	700	25 3/4	34 3/8	38	G.			4	No.	Yes.	3-S.A.E.	Weidely MB
No.		I.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	Opt.			40	700	25 3/4	32 5/8	40 5/16	G.			Opt.	No.	Yes.	3-S.A.E.	Weidely MAU
No.		I.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	No.			40	700	25 3/4	32 5/8	40 5/16	G.			Opt.		Yes.	3-S.A.E.	Weidely MAT
No.		I.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	No.			45	700	25 3/4	32 5/8	40 5/16	G.			Opt.		Yes.	3-S.A.E.	Weidely MAT
No.		I.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	Opt.			45	700	25 3/4	32 5/8	40 5/16	G.			Opt.		Yes.	3-S.A.E.	Weidely MAU
No.		I.	C-P.	Pr.	I.	I.	I.	I.			Yes.			45	700				G.			4		No.		Weidely M
No.		S.	C-P.	Pr.	A.	A.	I.	I.	2000		No.			75	750	24 1/2	33 5/16	60	G.			3		Yes.	3-S.A.E.	Weidely C
No.		S.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.		1000	26	450	21	31	35 15/16	G.			3	No.	Yes.	3-S.A.E.	Wisconsin CAU
No.		S.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.		1000	30	460	21	31	35 15/16	G.			3	No.	Yes.		Wisconsin EAU
No.		S.	C-P.	Pr.	A.	A.	I.	I.	1500	1000	Opt.		1000	45	650	21 7/16	30 1/16	44 3/8	G.			3	Yes.	Yes.	3-S.A.E.	Wisconsin TAU
No.		I.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.		1000	55	660	21 7/16	30 1/16	44 3/8	G.			3	Yes.	Yes.	3-S.A.E.	Wisconsin UAU
No.		I.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.		1000	55	680	21 7/16	30 1/16	44 3/8	G.			3	Yes.	Yes.	3-S.A.E.	Wisconsin VAU
No.		I.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.		1000	60	790	24	31 3/4	46	G.			3	Yes.	Yes.	3-S.A.E.	Wisconsin RAU
No.		I.	C-P.	Pr.	A.	A.	I.	I.	1600	950	Opt.		950	65	800	24	31 3/4	46	G.			3	Yes.	Yes.	3-S.A.E.	Wisconsin RBU
No.		S.	C-P.	Pr.	A.	A.	I.	I.	1350	950	Opt.		800	90	900	23 1/2	37 1/8	48 1/8	G.			4	No.	No.		Wisconsin M
No.		S.	C-P.	Pr.	B.	A.	I.	I.	1350	850	Opt.		800	125	1275	23 1/2	37 1/8	64 1/8	G.			4	No.	No.		Wisconsin P

N—Non-Adjustable. Twin city model TW crankshaft stepped; Front, 2 1/4; center, 2 11/16; rear, 2 3/8. Twin City model AE crankshaft stepped; front, 2 7/8; center, 3; rear, 3 1/8. Wisconsin model RBU crankshaft stepped; front, 2 1/4; center, 2 5/16; rear, 2 3/8. Gray-Beall crankshaft stepped; front, 2; center, 2 1/16; rear, 2 1/8. Twin City horsepower rating based on gasoline as fuel. Develops 35 on model TW and 50 on model AE when using kerosene.

1921 Road Expenditures

MORE than $600,000,000 is available for road and bridge expenditures in the United States during the year 1921. The exact figure as given out by the U. S. Department of Agriculture is $622,000,000, all of which is authorized to be spent during the coming year.

As noted in the registration article, about $98,000,000 were collected as automobile fees by the various states. Adding this to the above sum gives a total of $720,000,000 which will probably be spent upon roads in this country immediately, the money received from fees being used chiefly for maintenance and repair.

Texas will spend the greatest sum on its roads, the total figure for this state being $60,000,000. New York follows with $55,000,000, and Iowa is next with $37,000,000. The ten states that will spend the most are in order:

Texas	$60,000,000
New York	55,000,000
Iowa	37,000,000
Ohio	35,000,000
Pennsylvania	30,000,000
California	26,000,000
Illinois	20,000,000
Kansas	20,000,000
Michigan	20,000,000
Minnesota	20,000,000

The fact that Texas leads this list is of interest in considering that state as a market for motor vehicles. Since it is one of the largest states as to population a large road expenditure might be expected. Nevertheless it is interesting to note that it does not yet have as many cars per capita as do several other large population states. The number of persons per car, for instance, in some of the big states is as follows:

California	6.04
Michigan	8.91
Ohio	9.34
Texas	9.79

Each of these big states which have more cars per capita than Texas, are more restricted in area. Michigan and Ohio, particularly are big manufacturing centers. In other words, Texas would seem to have certain natural advantages as an automobile market in the way of area that are not possessed by some of the other states which now lead it in cars per capita. Consequently, the expenditure of this large sum on new roads, would indicate that within the next few years the active market for cars in that state should increase materially.

The table shows that every state has made some appropriation for roads, the smallest appropriation being by the smallest state in the union, Rhode Island. The group of agricultural states has available the largest total, chiefly because it includes two of the three leaders, Texas and Iowa. The agricultural group has appropriated $201,000,000.

The manufacturing group includes Massachusetts, New York, Ohio, Pennsylvania, Michigan, Indiana, Delaware, Connecticut, Rhode Island, New Jersey and Wisconsin. The agricultural group includes Arkansas, North Dakota, South Dakota, Kansas, Minnesota, Nebraska, Oregon, Oklahoma, Texas, Washington, Iowa. The mining group includes Wyoming, Nevada, Utah, New Mexico, Montana, Colorado, Arizona, and Idaho. The Southern group includes Florida, Georgia, Virginia, North Carolina, South Carolina, West Virginia, Kentucky, Tennessee,

Specifications

MAKE AND MODEL	Designed for: (Cars or Trucks)	Load Capacity (Lb.) (Truck Axles Only)	Type	Final Drive	GEAR RATIOS						Diameter of Axle Shafts	Range of Spring Centers		Provision for Torque Taken on
					Standard			Optional				Maximum	Minimum	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Eaton 602	T.	4700	S-F	W.				6.50	7.25	7.75	2 5/32	39½	34½	Sp.
Eaton 603	T.	7480	S-F.	W.				5.80	6.50	7.80	2⅜	39¼	34½	Sp.
Eaton 604	T.	9300	S-F.	W.				7.75	8.33	9.66	2¾	39¾	36	Sp.
Eaton 605	T.	11150	S-F.	W.				7.75	8.50	9.33	2 5/16	41	36	Sp.
Eaton 607	T.	12900	S-F.	W.				8.75	9.33	10.25	3⅝	44¼	39¼	Sp.
Eaton 612	T.	19100	S-F.	W.				9.50	11.66		3⅞	47¼	43¼	Sp.
Eaton 1000	T.	4200	S-F.	B.	6.14			5.12	5.62		2	40½	37½	Sp.
Eaton 40	C.		S-F.	B.	4.08			3.77	4.45	4.90	1⅝	41½	37	Sp.
Eaton 50	C.		S-F.	B.	4.08			3.77	4.45	4.90	1¾	40	37	Sp.
Eaton 2550	C.		S-F.	Sp-B.				3.75	4.25	4.50	1 5/16	42¾	37	Sp.
Eaton 2050	C.		S-F.	Sp-B.				3.75	4.12	4.25	1⅜	43½	36	Sp.
Eaton 3070	C.		S-F.	Sp-B.				3.50	3.75	3.87	1¾	42	36	Sp.
Clark AW	T.	3600	FF.	I-G.	6.75			6.10			1⅛	39½	38½	Sp.
Clark 1D	T.	4200	FF.	I-G.	7.60			6.00	7.00	7.25	1⅛	39½	38½	Sp.
Clark 2D	T.	6500	FF.	I-G.	9.00			7.00	8.00	10.20	1½	39	38½	Sp.
Clark 3D	T.	11000	FF.	I-G	10.00			11.00			1½	42½	40	Sp.
Clark 5D	T.	18000	FF.	I-G.	12.50			10.00	11.00		1¾	42½	40	Sp.
Columbia 10000	C.		¾-F.	Sp-B.	4.63			5.10	4.25		1¼	41	37	Sp&TA.
Columbia 30000	C.		¾-F.	Sp-B.	4.40			4.67	4.10	4.87	1 5/16	41	37	Sp&TA.
Columbia 50000	C.		¾-F.	Sp-B.	4.40			4.67	4.10	4.87	1 7/16	41	37	Sp&TA.
Columbia 51000	T.	3600	¾-F.	Sp-B.	6.80			6.50	5.80	5.50	1 7/16	41	37	Sp&TA.
Kenosha 30	T.	5600		I-G.	8.00			5.90	6.80		1¼	42	38	Sp.
Kenosha. 4-wheel dv.	T.	5600		I-G.	6.70						1¼	42	38	Sp.
Parker 21	T.	4000		I-G.	7.25			6.32	9.00			39	37	Sp.
Parker 30	T.	5000		I-G.	7.25			6.32	9.00			39	37	Sp.
Parker 40	T.	7500		I-G.	8.35			7.60	9.30			40	38	Sp.
Peru FF	C.		FF.	Sp-B.	4.50			4.25	4.75		1 9/32	40	35	Opt.
Peru 3600	C.		S-E.	Sp-B.	4.50			4.25	4.75		1½	40	35	Sp&TA.
Russel P1	T.	2000	FF.	I-G.	7.00			7.70			1	40	38	Sp.
Russel S1	T.	4000	FF.	I-G.	8.85			7.4			1¼	39¾	39¾	Sp.
Russel U1	T.	5000	FF.	I-G.	9.45			7.80			1¼	40¼	39¾	Sp.
Salisbury A	C.		¾-F.	Sp-B.	10.45			8.38			1⅜	41⅜	36½	Sp&TR.
Salisbury B	C & T.	2000	¾-F.	Sp-B.	9.41			8.41	7.40		1½	41¼	36½	Sp.
Sheldon W21	T.	8000	S-F.	W.	7.75	8.75		9.50	10.33	17.66	1⅞	39	32	Sp.
Sheldon W500	T.	2400	S-F.	W.	5.50			14.66			1⅜	40	34	Sp.
Sheldon W1001	T.	3600	S-F.	W.	5.50	6.00		7.75	14.66		1⅜	39	39	Sp.
Sheldon W1501	T.	4000	S-F.	W.	6.50	7.80		5.50	9.66	8.75	1½	39	35	Sp.
Sheldon W103	T.	7000	S-F.	W.	6.50	7.75	8.66	5.50	10.66	14.66	1 11/16	39	32½	Sp.
Sheldon W31	T.	12000	S-F.	W.	11.75	8.75	10.25				2¼	44	38	Sp.
Sheldon W51	T.	18000	S-F.	W.	8.75	10.25		13.00			2 7/16	46	43	Sp.
Spacke M	C.		¾-F.	Sp-P.	57.12	49.11	54.11				1¼	41	35	Sp&TA.
Timken-Detroit 5011	C.		S-F.	Sp-B.	5.10						1⅜	40¼	40¼	Sp.
Timken-Detroit 5152	C.		S-F.	Sp-B.	4.66			5.90	4.30	3.73	1½	40½	38½	Sp.
Timken-Detroit 5302	C.		S-F.	Sp-B.	4.45			4.9	4.08	3.77	1¾	41	37	Sp.
Timken-Detroit 5762	C.		FF.	Sp-B.	4.08			4.90	4.45	3.77	1 5/16	39½	39½	T-A.
Timken-Detroit 6250	T.	1500	S-F.	W.	5.60			5.00	6.25	7.00	2	39	39	Sp.
Timken-Detroit 6352	T.	2000	S-F.	W.	7.20			5.16	6.20	8.25	2⅛	39½	37	Sp.
Timken-Detroit 6460	T.	3000	S-F.	W.	7.00			7.75	8.75	9.25	2⅝	38½	39½	Sp.
Timken-Detroit 6560	T.	5000	FF.	W.	7.75			8.50	9.25		1⅝	39¾	37	Sp.
Timken-Detroit 6660	T.	7000	FF.	W.	10.33			8.75	12.00		2	45	42½	Sp.
Timken-Detroit 6760	T,	10000	FF.	W.	11.66			13.66			2 5/16	46¾	42⅞	Sp.
Torbenson OX2L	T.	2700		I-G.	6.65			8.00	5.30			40¼	37¼	Sp.
Torbenson 750	T.	2700		I-G.	6.30			5.30				40¼	37¼	Sp.
Torbenson A3	T.	4200		I-G.	7.16			8.23	6.30			39½	37½	Sp.
Torbenson C3	T.	7000		I-G.	8.50			9.50	6.80			39	38	Sp.
Torbenson E1	T.	13000		I-G.	10.20			11.60	9.00			44	39	Sp.
Wisconsin 800G	T.	4000	S-F.	W.	7.75			6.20	8.66		2 3/16	40	38	Sp.
Wisconsin 800H	T.	5500	S-F.	W.	8.25			7.25	9.33		2 5/16	40	38	Sp.
Wisconsin 800J	T.	7300	S-F.	W.	8.66			7.75	9.66		2 9/16	40	38	Sp.
Wisconsin 900C	T.	8800	S-F.	W.	8.66			9.66	10.66		3	41	38½	Sp.
Wisconsin 900D	T.	12000	S-F.	W.	10.00			9.00	11.75		3⅜	40	39	Sp.
Wisconsin 900E	T.	12000	S-F.	W.	10.00			9.00	11.75		3⅜	44½	42	Sp.
Wisconsin 1000B	T.	16000	S-F.	W.	11.75						3¾	46	40¾	Sp.

# of Stock Axles

Provision for Radius Rods	Type of Differential	SERVICE BRAKE				EMERGENCY BRAKE			TYPE OF BEARINGS		Wheel Tread (In.)	Weight of Axle (Complete Unit Without Wheels)	Housing Material	Axle Shaft Material
		Location of Drum	Diameter of Drum	Width of Drum	External or Internal	Diameter of Drum	Width of Drum	External or Internal	In Differential	In Wheels				
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Yes	B.	R-W	16	5	Int.	16	3	Int.	Roller	Roller	56½	480	P-S	S.A.E. 2335
Yes	B.	R-W	16	5	Int.	16	5	Int.	Roller	Roller	57½	550	P-S	S.A.E. 2335
Yes	B.	R-W	18	6¼	Int.	18	6¼	Int.	Roller	Roller	61	930	P-S	S.A.E. 2335
Yes	B.	R-W	18	6¼	Int.	18	6¼	Int.	Roller	Roller	61	960	P-S	S.A.E. 2335
Yes	B.	R-W	21	7½	Int.	21	7½	Int.	Roller	Roller	68½	1375	P-S	S.A.E. 2335
Yes	B.	R-W	24	7	Int.	24	7	Int.	Roller	Roller	75	1820	P-S	S.A.E. 2335
No	B.	R-W	16	5	Int.	16	5	Int.	Roller	Roller	56½	400	P-S	S.A.E. 3140
No	B.	R-W	14½	2⅝	Ext.	14	2⅝	Int.	Roller	Roller	56		P-S	S.A.E. 3140
No	B.	R-W	15½	3⅜	Ext.	15½	3⅜	Int.	Roller	Roller	56		P-S	S.A.E. 3140
No	B.	R-W	14	2¾	Ext.	13⅝	2¾	Int.	Roller	Roller	56	297	P-S	Nickel Steel
No	B.	R-W	12⅝	2¾	Ext.	12	2¾	Int.	Roller	Roller	56	250	P-S	S.A.E. 2335
No	B.	R-W	16	3¼	Int.	15⅝	3¼	Int.	Roller	Roller	56	379	P-S	Nickel Steel
No	B.	R-W	14	2	Ext.				Roller	Roller	56	375	M-I	Nickel Steel
No	S-L	R-W	16	2½	Ext.	15⅝	1½	Int.	Roller	Roller	56	480	Steel	Nickel Steel
No	B-S	R-W	16½	3	Ext.	16	2½	Int.	Roller	Roller	58	705	Steel	Nickel Steel
No	B.	R-W	20	3	Ext.	9⅝	2½	Int.	Roller	Roller	70	888	Steel	Nickel Steel
No														
No	B.	R-W	12	2½	Ext.	12	2½	Int.	Roller	Ball	56	232	Steel	S.A.E. 2335
No	B.	R-W	14	2½	Ext.	14	2½	Int.	Roller	Ball	56	265	Steel	S.A.E. 2335
No	B.	R-W	16	3	Ext.	16	3	Int.	Roller	Roller	56	320	Steel	S.A.E. 2335
No	B.	R-W	16	3	Ext.	16	3	Int.	Roller	Roller	56	320	Steel	S.A.E. 2335
Yes	B-SL	D-S				7	4	Int.	Ball	Ball	56½	425	Steel	Nickel Steel
Yes	S-L	D-S	7	4	Int.				Opt.	Opt.	56½	425	Steel	Nickel Steel
	B.								Ball	R.&B	56	400	C-S	
	B.								Ball	R.&B	56	425	C-S	
	B.								Ball	R.&B	60½	675	C-S	
No	B.	R-W	12	2	Ext.	12	2	Int.	Roller	Roller	56	181	M.I.	Ch.Va. Steel
No	B.	R-W	12	2	Ext.	12	2	Int.	Roller	Roller	56	190	M.I.	Ch.Va. Steel
No	B.	R-W	14	3⅛	Ext.	14	3 1/16	Int.	Roller	Roller	56	440	M.I.	Ch.Ni. Steel
No	B.	R-W	16½	4⅜	Ext.	16½	4⅜	Int.	Roller	Roller	60	620	M.I.	Ch.Ni. Steel
No	B.	R-W	18	4¼	Ext.	18	4¼	Int.	Roller	Roller	60¼	775	M.I.	Ch.Ni. Steel
No	B.	R-W	14⅜	2¾	Ext.	14	2¾	Int.	Roller	Ball	56	248	P-S	Ch.Ni. Steel
No	B.	R-W	16⅜	2¾	Int.	16	2¾	Int.	Roller	Ball	56	294	P-S	Chrm. Steel
No	B.	R-W	18	2¼	Int.	18	2¼	Int.	Ball	Opt.	Opt.		C-S	Nickel Steel
No	B.	R-W	12	1½	Int.	12	1½	Int.	Ball	Opt.	56		M-C	Nickel Steel
No	B.	R-W	14	1¾	Int.	14	1¾	Int.	Ball	Opt.	56		M	Nickel Steel
No	B.	R-W	16	2	Int.	16	2	Int.	Ball	Opt.	57		M	Nickel Steel
No	B.	R-W	16	2	Int.	16	2	Int.	Ball	Opt.	Opt.		M	Nickel Steel
No	B.	R-W	20	2½	Int.	20	2½	Int.	Ball	Opt.	69¾		Steel	Nickel Steel
No	B.	R-W	24	3	Int.	24	3	Int.	Ball	Opt.	73¼		C-S	Nickel Steel
No	B.	R-W	14	2¼					Roller	Ball	56	270	P-S	S.A.E. 3135
No	B.	R-W	12	2	Ext.				Roller	Roller	56	190	P-S	Alloy Steel
No	B.	R-W	14⅜	1¾	Ext.	14	1½	Int.	Roller	Roller	56	260	P-S	Chrm. Steel
No	B.	R-W	15½	2½	Ext.	15	2½	Int.	Roller	Roller	56	295	P-S	Chrm. Steel
No	B.	R-W	16	2½	Ext.	15½	2½	Int.	Roller	Roller	56	395	P-S	Ch.Ni. Steel
No	B.	R-W	15	2½	Ext.	15	2½	Int.	Roller	Roller	56	420	P-S	Alloy Steel
No	B.	R-W	15	3	Int.	15	3	Int.	Roller	Roller	56	475	P-S	Alloy Steel
No	B.	R-W	16	3¼	Int.	16	3¼	Int.	Roller	Roller	58	660	P-S	Alloy Steel
Yes	B.	R-W	18	3½	Int.	18	3½	Int.	Roller	Roller	58½	855	P-S	Alloy Steel
Yes	B.	R-W	21	3¾	Int.	21	3¾	Int.	Roller	Roller	65¾	1300	P-S	Alloy Steel
Yes	B.	R-W	24	4	Int.	24	4	Int.	Roller	Roller	69½	1775	P-S	Alloy Steel
No	B.	R-W	14	3	Ext.	13⅝	3	Int.	Roller	Roller	56	270		
	B.	R-W	14	3	Ext.	13⅝	3	Int.	Roller	Roller	56	275		
	B.	R-W	15	8	Ext.	14⅝	3	Int.	Roller	Roller	56	365		
	B.	R-W	18	3	Ext.	17 9/16	3	Int.	Roller	Roller	56	560		
	B.	R-W	19	3½	Int.	10	4½	Ext.	Roller	Roller	67½	1100		
No	B.	R-W	17	2½	Int.	12¼	2½	Int.	Ball	Ball	57½	550	M.I.	Ch.Ni. Steel
No	B.	R-W	17	2½	Int.	12¼	2½	Int.	Ball	Ball	57½	640	M.I.	Ch.Ni. Steel
No	B.	R-W	17	2½	Int.	12½	2½	Int.	Ball	Ball	57¾	700	M.I.	Ch.Ni. Steel
No	B.	R-W	20	2½	Int.	15½	2½	Int.	Ball	Ball	59½	875	M.I.	Ch.Ni. Steel
No	B.	R-W	20	2½	Int.	15½	2½	Int.	Ball	Ball	60	975	M.I.	Ch.Ni. Steel
No	B.	R-W	20	2½	Int.	15½	2½	Int.	Ball	Ball	64	1000	M.I.	Ch.Ni. Steel
No	B.	R-W	24	3½	Int.	18½	3½	Int.	Ball	Ball	70	1590	M.I.	Ch.Ni. Steel

Louisiana, Mississippi, Alabama. The amounts appropriated by these respective groups are as follows:

Agricultural	$201,000,000
Manufacturing	171,200,000
Southern	92,500,000
Mining	44,500,000

These figures show that road building activity is to be greatest in the agricultural states during the next year, even in proportion to population since the manufacturing states hold the majority of the people. This is a natural development since the manufacturing states were, of course, the first to develop good roads.

The presence of a good-sized appropriation for the South is an encouraging sign, since good roads are the chief factor still needed to make that section an excellent market for motor vehicles.

Funds Available for Road and Bridge Expenditures, 1921

Alabama	$9,000,000
Arizona	8,000,000
Arkansas	12,000,000
California	26,000,000
Colorado	7,000,000
Connecticut	8,000,000
Delaware	3,500,000
Florida	7,725,000
Georgia	10,000,000
Idaho	4,500,000
Illinois	20,000,000
Indiana	9,500,000
Iowa	37,000,000
Kansas	20,000,000
Kentucky	8,000,000
Louisiana	6,000,000
Maine	7,500,000
Maryland	4,800,000
Massachusetts	8,000,000
Michigan	20,000,000
Minnesota	20,000,000
Mississippi	11,000,000
Missouri	15,000,000
Montana	8,500,000
Nebraska	6,000,000
Nevada	3,500,000
New Hampshire	2,500,000
New Jersey	16,000,000
New Mexico	4,000,000
New York	55,000,000
North Carolina	6,500,000
North Dakota	7,000,000
Ohio	35,000,000
Oklahoma	8,000,000
Oregon	10,000,000
Pennsylvania	30,000,000
Rhode Island	1,700,000
South Carolina	6,000,000
South Dakota	7,000,000
Tennessee	10,275,000
Texas	60,000,000
Utah	6,000,000
Vermont	2,000,000
Virginia	10,000,000
Washington	14,000,000
West Virginia	8,000,000
Wisconsin	19,500,000
Wyoming	3,000,000
Total	$622,000,000

Texas also shows the largest road appropriation per capita of the large states; that is, of the states whose population is three million or more. Texas has appropriated $12.83 per capita for road expenditure during 1921 alone. California is second in this respect with an appropriation of $7.60 per capita. Following is the way the ten large population states line up as regards appropriation per capita:

Texas	$12.83
California	7.60
Ohio	6.08
Michigan	5.45
New York	5.32
New Jersey	5.10
Missouri	4.41
Pennsylvania	3.44
Illinois	3.09
Massachusetts	2.08

Specifications of Stock Gearsets

MAKE AND MODEL	Designed for	Type Clash or Individual Clutch	BEARINGS Main Shaft	BEARINGS Secondary Shaft	Number of Speeds	WIDTH OF GEAR FACES Const. Mesh Set	Low	1st Inter.	2nd Inter.	Reverse	Gear Teeth Pitch	GEAR RATIOS First	Second	Third	Fourth	Reverse	Gearset Location	Control Location	Housing Material	Shaft Material	Gear Material	Sold with Clutch?	Weight Lb. (With Controls but without Clutch)	MAKE AND MODEL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Adco	Tr.	Clash	B.	P.	1	7/8	...	...	...	7/8	6-8	...	...	...	1.00	1.42	A.	...	C.I.	S.A.E. 2320	S.A.E. 2320	No.	...	Adco
Adco 5A	T.	Clash	R.	R.	4	1	1 1/4	1 1/4	1 1/4	1 5/16	6-8	4.00	2.61	1.50	1.00	4.84	A.	...	Al.	S.A.E. 2320	S.A.E. 2320	No.	...	Adco 5A
Adco	C.	Clash	B.	P.	3	5/8	5/8	5/8	5/8	5/8	7-9	3.00	1.21	1.00	...	3.62	U.	...	C.I.	S.A.E. 2320	S.A.E. 2320	No.	...	Adco
Adco	T.	Clash	B.	B.	3	1	7/8	7/8	7/8	7/8	6-8	3.14	1.74	1.00	...	3.62	A.	...	Al.	S.A.E. 2320	S.A.E. 2320	No.	...	Adco
Ball Gear BG3-4	C,T,Tr.	Ind. Cl.	B.	B.	3	5/8	5/8	5/8	...	5/8	7-9	3.00	1.70	1.00	...	...	U.	C.	G.I. or Al.	Nickel Van.	Chrome Nic.	Opt.	...	Ball Gear BG3-4
Ball Gear BG1-2	C,T,Tr.	Ind. Cl.	B.	B.	3	9/16	9/16	9/16	...	9/16	7-9	2.98	1.89	1.00	...	3.64	U.	C.	G.I. or Al.	Nickel Van.	Chrome Nic.	Opt.	...	Ball Gear BG1-2
Brown Lipe 50-4	T.	Clash	R.	R.	4	7/8	1	1	1	1	6-8	4.84	2.84	1.76	1.00	5.81	A.	C.	G.I.	Chrome Stl.	Nickel Stl.	No.	137	Brown Lipe 50-4
Brown Lipe 30	C,T.	Clash	R.	B.	3	5/8	3/4	3/4	3/4	3/4	6-8	3.33	1.68	1.00	...	4.35	U.	C.	G.I. or Al.	Chrome Stl.	Nickel Stl.	Yes.	140-105	Brown Lipe 30
Brown Lipe 60-4	T.	Clash	R.	R.	4	1 1/4	1 1/2	1 1/2	1 1/2	1 3/8	5-7	4.84	2.84	1.50	1.00	5.81	A.	S.	G.I.	Chrome Stl.	Nickel Stl.	Yes.	285	Brown Lipe 60-4
Brown Lipe 35-3	T.	Clash	R.	R.	3	5/8	3/4	3/4	...	3/4	6-8	3.36	1.50	1.00	...	4.32	A.	...	G.I.	Chrome Stl.	Nickel Stl.	...	...	Brown Lipe 35-3
Brown Lipe 35-4	T.	Clash	R.	R.	4	5/8	1 1/16	3/4	3/4	3/4	6-8	5.35	2.84	1.76	1.00	6.25	A.	...	G.I.	Chrome Stl.	Nickel Stl.	...	122	Brown Lipe 35-4
Brown Lipe UPP35-4	T.	Clash	R.	R.	4	5/8	3/4	3/4	3/4	3/4	6-8	5.35	2.84	1.76	1.00	6.43	U.	C.	G.I. or Al.	Chrome Stl.	Nickel Stl.	Yes.	198 or 150	Brown Lipe UPP35-4
Brown Lipe	T.	Clash	R.	R.	4	7/8	1	1	1	3/4	6-8	5.35	2.84	1.76	1.00	6.43	U.	C.	G.I. or Al.	Chrome Stl.	Nickel Stl.	Yes.	211 or 147	Brown Lipe
Campbell C20	C.	Ind. Cl.	B. & R.	P.	3	3/4	3/4	3/4	3/4	3/4	6-8	3.52	1.73	1.00	...	...	U.	C.	M.I.	S.A.E. 2340	S.A.E. 2340	No.	125	Campbell C20
Campbell C20	C.	Ind. Cl.	B. & R.	P.	3	3/4	3/4	3/4	3/4	3/4	6-8	3.52	1.73	1.00	...	...	U.	C.	Al.	S.A.E. 2340	S.A.E. 2340	No.	85	Campbell C20
Campbell 50	T.	Ind. Cl.	B. & R.	...	4	7/8	7/8	7/8	7/8	7/8	6-8	4.00	2.62	1.50	1.00	4.81	A.	Opt.	G.I.	S.A.E. 2340	S.A.E. 2345	No.	175	Campbell 50
Cotta 5S	T.	Ind. Cl.	B.	B.	3	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	4 1/2-5 1/2	4.51	1.81	1.00	...	6.00	A.	C.	S.S.	S.A.E. 2345	S.A.E. 2320	No.	...	Cotta 5S
Cotta 12SR	T.	Ind. Cl.	B.	B.	3	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	4 1/2-5 1/2	4.51	1.81	1.00	...	6.00	A.	C.	S.S.	S.A.E. 2345	S.A.E. 2320	No.	...	Cotta 12SR
Covert MUC	C,T.	Ind. Cl.	B.	B.	3	11/16	13/16	13/16	...	13/16	6-8	3.62	1.91	1.00	...	4.46	U.	C.	C.I.	S.A.E. 2320	S.A.E. 2320	Opt.	115	Covert MUC
Covert SA4	T.	Clash	B. & R.	R.	4	1 1/8	1 7/16	1 1/4	1 1/8	1 5/16	5-7	5.07	3.04	1.63	1.00	6.76	A.	...	C.I.	S.A.E. 2320	S.A.E. 2320	...	...	Covert SA4
Covert JT	Tr.	Clash	B.	R.	3	1 1/8	1 3/4	1 1/8	...	1 1/8	5-7	1.83	1.00	.58	...	2.15	U.	C.	C.I.	S.A.E. 2320	S.A.E. 2320	Yes.	...	Covert JT
Covert L	C.	Clash	B. & R.	R.	3	5/8	11/16	11/16	11/16	11/16	7-9	3.61	1.82	1.00	...	4.50	U.	C.	C.I.	S.A.E. 2320	S.A.E. 2320	No.	85	Covert L
Covert RUC3	C,T.	Ind. Cl.	B.	B.	3	7/8	1.0	1.0	...	15/16	6-8	3.62	1.60	1.00	...	4.37	U.	C.	C.I.	S.A.E. 2320	S.A.E. 2320	Yes.	...	Covert RUC3
Covert RA3	T.	Ind. Cl.	B.	B.	3	7/8	1.0	1.0	...	15/16	6-8	3.62	1.60	1.00	...	4.37	A.	...	C.I.	S.A.E. 2320	S.A.E. 2320	...	...	Covert RA3
Covert RU4C	T.	Ind. Cl.	B.	B.	4	7/8	1 1/4	1.0	1.0	1.0	6-8	4.75	2.69	1.60	1.00	5.94	U.	C.	C.I.	S.A.E. 2320	S.A.E. 2320	Yes.	...	Covert RU4C
Covert R-A-P-4	T.	Ind. Cl.	B.	B.	4	7/8	1 1/4	1.0	1.0	1.0	6-8	5.20	2.70	1.60	1.00	7.30	...	...	C.I.	S.A.E. 2320	S.A.E. 2320	...	...	Covert R-A-P-4
Detroit CY	T.	Clash	B.	B.	3	3/4	...	7/8	3/4	1	6-8	3.88	1.87	1.00	...	4.84	U.	C.	C.I. or Al.	Nic. or C. Stl.	Nic. or C. Stl.	Opt.	130	Detroit CY
Detroit DY	C,T.	Clash	B.	R. or P.	3	5/8	3/4	3/4	...	3/4	7-9	3.2	1.77	1.00	...	3.88	U.	C or S	C.I. or Al.	Nic. or C. Stl.	Nic. or C. Stl.	Opt.	115	Detroit DY
Detroit H-HU	T.	Clash	B.	B.	4	7/8	1	1	1	1 1/16	6-8	4.85	3.08	1.76	1.00	6.38	U or A	C.	...	Nic. or C. Stl.	Nic. or C. Stl.	Opt.	165	Detroit H-HU
Dundore F50	T.	Clash	B.	B.	3	1	1	1	1	1	6-8	3.36	1.90	1.00	...	4.32	U.	C.	S.S.	S.A.E. 2345	S.A.E. 2320	No.	135	Dundore F50
Dundore M35	C.	Clash	B.	B.	3	3/4	13/16	13/16	13/16	13/16	6-8	3.07	1.76	1.00	...	4.01	U.	C.	S.S.	S.A.E. 2345	S.A.E. 2320	No.	115	Dundore M35
Dundore K	C.	Clash	B.	B.	4	3/4	3/4	3/4	3/4	3/4	6-8	2.69	1.56	1.00	.731	3.46	U-A	C.	Al.	S.A.E. 2345	S.A.E. 6145	No.	125	Dundore K
Durston	C,T.	Clash	B.	P.	3	5/8	1	5/8	5/8	5/8	6-8	3.09	1.85	1.00	...	3.87	A.	C.	...	Chr. Nickel	Chr. Nickel	No.	95	Durston
Fuller H	T.	Clash	B.	B.	4	1 1/4	1 1/2	1 1/4	1 3/8	1 3/16	6-8	6.0	3.2	1.76	1.00	6.3	A.	...	C.I.	Nickel Stl.	Nickel Stl.	No.	200	Fuller H
Fuller LTU	T.	Clash	B.	B.	3	13/16	7/8	7/8	...	13/16	6-8	4.0	1.7	1.00	...	3.5	U-A	C.	C.I.	Nickel Stl.	Nickel Stl.	Yes.	85	Fuller LTU
Fuller GU7-8	T.	Clash	B.	B.	4	15/16	1 1/16	7/8	7/8	7/8	6-8	4.8	3.0	1.60	1.00	6.5	U.	C.	C.I.	Nickel Stl.	Nickel Stl.	Yes.	130	Fuller GU7-8
Fuller G7-8	T.	Clash	B.	B.	4	13/16	1 1/16	7/8	7/8	7/8	6-8	4.8	3.0	1.60	1.00	6.5	A.	C.	C.I.	Nickel Stl.	Nickel Stl.	Yes.	130	Fuller G7-8
Muncie T23N	C,T.	Clash	B.	B.	3	3/4	13/16	...	25/32	13/16	6-8	3.0	1.82	1.00	...	3.9	U.	C.	G.I.	S.A.E. 2320	S.A.E. 3120	Yes.	...	Muncie T23N
Muncie T25	C,T.	Clash	B.	B. & P.	3	5/8	3/4	11/16	...	3/4	6-8	2.6	1.76	1.00	...	3.4	U.	C.	G.I.	S.A.E. 2320	S.A.E. 3120	No.	90	Muncie T25
Pittsburgh 34T	C,T.	Clash	B.	R.	3	7/8	7/8	7/8	7/8	7/8	6-8	2.84	1.61	1.00	...	3.65	U.	C.	C.I. or Al.	S.A.E. 3140	S.A.E. 3450	Yes.	...	Pittsburgh 34T
Warner Gr. T60	C.	Clash	B.	R.	3	11/16	3/4	3/4	...	3/4	6-8	3.24	1.63	1.00	...	4.05	U.	C.	C.I. or Al.	Steel	Steel	Opt.	105	Warner Gr. T60
Warner Gr. T53	T.	Clash	B.	B.	4	1	1 3/8	1 1/4	1 1/4	1 3/8	5-7	4.99	3.16	3.17	1.00	5.78	A.	C.	C.I.	Steel	Steel	Sep.	195	Warner Gr. T53
Warner Gr. T38	C.	Clash	B.	B.	3	3/4	3/4	25/32	...	3/4	...	3.04	1.81	1.00	...	3.7	U.	C.	C.I. or Al.	Steel	Steel	Yes.	...	Warner Gr. T38
Warner Gr. T38	T.	Clash	B.	R.	3	3/4	3/4	25/32	...	3/4	...	4.84	2.39	1.00	...	6.05	U.	C.	C.I. or Al.	Steel	Steel	Yes.	...	Warner Gr. T38
Warren A	C,T.	Clash	B.	B.	3	11/16	3/4	3/4	...	3/4	6-8	3.52	1.70	1.00	...	4.40	U.	C.	C.I.	S.A.E. 3120	S.A.E. 2320	No.	110	Warren A
Warren B	C,T.	Clash	B.	P.	3	9/16	5/8	5/8	...	5/8	7-9	2.98	1.73	1.00	...	3.62	U.	C.	C.I.	S.A.E. 3120	S.A.E. 2320	No.	90	Warren B
Warren C	C,T.	Clash	R.	R.	3	11/16	3/4	3/4	...	3/4	6-8	4.01	1.98	1.00	...	5.01	U.	C.	C.I.	S.A.E. 3120	S.A.E. 2320	No.	120	Warren C

ABBREVIATIONS—Column 1. **C**—Cars; **T**—Trucks; **Tr**—Tractors. Column 2. **Ind. Cl**—Individual Clutch. Columns 3 and 4. **B**—Ball; **P**—Plain; **R**—Roller. Column 17. **A**—Amidships; **U**—Unit with Engine. Column 18. **C**—Center; **S**—Side; **Opt**—Optional. Column 19. **C-I**—Cast Iron; **Al**—Aluminum; **M I**—Malleable Iron; **G I**—Grey Iron. Column 20. **Nickel Van**—Nickel Vanadium. Column 21. **Chrome Nic**—Chrome Nickel Steel.

An Analysis of the American Farm Lighting Plant Industry

1920 output approximately 100,000 plants valued at about $60,000,000. Seventy-five concerns manufacture about 140 models. Nearly 80 per cent are 32-volt systems. Twenty-five per cent still employ belt drive. Ninety per cent have single cylinder engines with an average of about 3 b.h.p.

By Gustave Wiedeman

THE isolated electric plant industry had in 1920 an output of about 100,000 plants valued in the neighborhood of $60,000,000. The last census shows that over two and one-half million farms still remain in this country without electrical service of any kind. At present, there are about 75 concerns manufacturing complete electric plants whose various models exceed 140.

The majority of plants are designed for general lighting and power work on small and medium sized farms. The average size of all models is 1.9 kw. Many of the units are purposely over-powered for auxiliary belt work.

Types.—The four classes or types of electric plants are: First, the 110-volt system, which employs no battery at all. It has practically disappeared. Second, the 110-volt system, using a small automobile type battery for starting purposes only. Three per cent of all models are of this class. Third, the 110-volt system (or 55 volts, optionally) having a full battery complement of 56 cells, constituting about 15 per cent of all models. Fourth, the 32-volt systems, having a full battery of 16 cells. About 80 per cent of all models fall in this class.

Thirty per cent of present electric plants are provided with auxiliary pulleys for a power take-off. These have surplus power so that belt work can be done while the plant is charging the battery. The ratio of engine power to generator output averages 3 to 1 where a power take-off is supplied and 2 to 1 where the engine drives only the generator.

Drive.—The belted plant was the pioneer in the electric plant field and to-day about 25 per cent of the models have belt drive. Six per cent of the plants have either gear or silent chain drive, which permit of efficient engine and generator speeds. This is usually an engine speed of about 1000 r.p.m. and generator speed of 2000 r.p.m. The remaining plants are all direct coupled.

Classification.—There are three kinds of electric plants, commonly referred to by the trade as (a) full automatic, (b) semi-automatic and (c) manually started. The full automatic plant starts and stops itself automatically during the line or battery charging period. In the case of 110-volt systems employing only a starting battery, a starting switch or the act of switching on the first light automatically starts up such a plant. The semi-automatic must be started by depressing a starting switch but is capable of shutting itself down when the battery is charged. The manual systems must be started and stopped and (usually) controlled by hand. This is the simplest plant of all and is most generally found in the smallest and the largest units, the intermediate sizes being of the other two kinds.

Regulation.—The life of the battery and the effectiveness of the plant depend largely upon the system of charge regulation. Charging regulation not only affects battery upkeep, conceded to be the most important item in electric plant maintenance, but also influences the operation of lamps whereby the satisfaction of a plant is measured.

The centrifugal governor is quite commonly used to hold the engine speed constant under all conditions or to restrict excessive speed by shutting off either fuel or air. A compound wound generator is best suited to this class of plants. The third system of regulation permits of varying engine speeds so as to produce a constant generator voltage. A solenoid, shunted across the generator terminals, actuates the throttle directly and produces a "tapered" charge, regardless of generator characteristics. Inherent speed regulation is occasionally used on the small units. Maximum engine speed is limited by manifold restriction or similar means. The principle of armature reaction is used in some cases to regulate plant charging.

Charge Control.—In the design of semi and full automatic plants, some principle must be selected which automatically determines the state of charge of the battery. Three such principles are in use, (a) the ampere-hour meter, (b) the voltage relay and (c) the specific gravity relay. The first of these is by far the most popular. Initially, the plant is started with the battery charged and the meter set at "full." Subsequently, every ampere-hour is added or subtracted, depending on whether it is a charge or discharge. A stopping relay commonly set at the "full" position of the meter serves to shut down the engine when that point is reached. These meters make an allowance for a battery efficiency of 80 per cent but their manufacturers recommend that they be "put in step" with the plant once a month by making a hydrometer check on their setting. The voltage relay system (b) is merely a set of relays, shunted across the battery, which act between pre-determined voltage limits and start or stop the plant charging accordingly. The specific gravity control (c) is usually worked out by employing a master cell hydrometer and using its rise and fall to actuate control relays.

Generator.—The four-pole generator appears most frequently, especially where the shunt winding is used for both generating and starting. Laminated fields are the rule. The shunt is the most popularly used field winding. The compound winding appears most fre-

Specifications of Isolated Electric

(Compiled for AUTOMOTIVE IN

Name and Model	PLANT					ENGINE							GENERATOR			BATTERY		Misc. (See Footnote)
	Voltage	Drive	Automatic Start?	Automatic Stop?	Unit or Separate Construction	No. Cyls. and Bore X Stroke	Fuel	Type of Speed Governor	Type Ignition	Type Lubrication	Normal r.p.m.	No. and Kind Engine Bearings	Rated K.W.	No. Poles and Kind Field Winding	No. and Kind Generator Bearings	Standard 72-hr. Rating	Open or Sealed	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Aerothrust	32	Dir.	No.	No.	Unit	2-2½x2¼	G or K.	Cent.	Mag.	C.	1800		½	4-Shunt.	2-Brnz.	60	Sealed	a, g, o.
Alamo	32	Dir.	No.	Yes.	Unit	1-2¼x3¼	G.	Sol.	Mag.	Pres.	2000		1				Sealed	e, o, u, v.
Allis-Chalmers	125	Dir.	No.	No.	Unit	4-3⅛x4½	G.	Cent.	Mag.	Pr.&Sp.	1150		5	4-Comp.	1-Brnz.	Opt.		
Allis-Chalmers	125	Dir.	No.	No.	Unit	4-4½x6	G.	Cent.	Mag.	Pr.&Sp.	1150		15	4-Comp.	2-Brnz.	Opt.		
American-Automatic	60	Dir.	Yes.	Yes.	Unit	1-4 H.P.	G.	Cent.	Mag.	Sp.	800		1½	4-Shunt.	2	80		m, p.
American-Automatic	60	Dir.	Yes.	Yes.	Unit	2-8 H.P.	G.	Cent.	Mag.	Sp.	800		3	4-Shunt.	2	80		m, p.
American-Automatic	110	Dir.	Yes.	Yes.	Unit	4-12 H.P.	G.	Cent.	Mag.	Sp.	800		6	4-Shunt.	2	160		m, p.
American-Automatic	110	Dir.	Yes.	Yes.	Unit	4-16 H.P.	G.	Cent.	Mag.	Sp.	800		10	4-Shunt.	2	200		m, p.
Chambers	32	Blt.	No.	No.	Sepr.	1-4 x4	G or K.		Bat.	O-Cup.	550		1			107	Sealed	a, i, k.
Cushman	32	Blt.	No.	Yes.	Unit	1-4 x4	G.		Bat.	Sp.	800	2-Bab.	1	4-Comp.	2-Bab.	130 175 260	Sealed	l.
Delco-light	32	Dir.	No.	Yes.	Unit	1-2½x5	G or K.		Bat.	Sp.		B&R.	¾			160	Sealed	g, o.
Delco-light	32	Dir.	No.	Yes.	Unit	1	G or K.		Bat.	Sp.		B&R.	1			160	Sealed	g, o.
Delco-light	32	Dir.	No.	Yes.	Unit	1	G or K.		Bat.	Sp.		B&R.	1¼			160	Sealed	g, o, i.
Delco-light	32	Dir.	No.	Yes.	Unit	1	G or K.		Bat.	Sp.		B&R.	1¼			160	Sealed	g, o.
Delco-light	110	Dir.	No.	Yes.	Unit	1	G or K.		Bat.	Sp.		B&R.	2½			160	Sealed	g, o.
Dynelectric																		w.
Dyneto	32	Chn.	No.	Yes.	Sepr.	1-4 H.P.	G.	H&M.	Mag.	Sp.	800		1¼			80		g, k.
Dyneto	32	Blt.	No.	Yes.	Sepr.	1-1½ H.P.	G.		Bat.	Sp.			¾			53		k.
Dyneto	32	Blt.	No.	Yes.	Sepr.	1-1½ H.P.	G.		Bat.	Sp.			¾			80		k.
Dyneto	32	Blt.	No.	Yes.	Sepr.	1-1½ H.P.	G.		Bat.	Sp.			¾			110		k.
Essandee																		s.
Everlite	32	Dir.	No.	Yes.	Unit	1-2¾x4	G or K.	None.	Bat.	Sp.	1250	2-Ball.	1¼	2-Comp.	1-Brnz.	94 141 189 236 277	Sealed	n, l.
Electrion	32	Dir.	No.	Yes.	Unit	1-2⅞x3	G or K.	Sol.	Mag.	Sp.	1600	2-Ball.	1	2-Comp.	1-Brnz.	115	Sealed	j, m, o, u, p.
Electrion	32	Dir.	Yes.	Yes.	Unit	1-2⅞x3	G.	Sol.	Mag.	Sp.	1600	2-Ball.	1	2-Comp.	1-Brnz.	115	Sealed	j, m, o, u, p.
Electrion	110	Dir.	Yes.	Yes.	Unit	1-2⅞x3	G.	Sol.	Mag.	Sp.	1600	2-Ball.	1	2-Comp.	1-Brnz.	72	Sealed	j, m, o, q, u, p
Fairbanks-Morse	32	Dir.	No.	No.	Sepr.	1-1½ H.P.	G or K.		Mag.	Pr.	500	Bab.	¾	2-Shunt.	2-Ball.	84	Sealed	e.
Fairbanks-Morse	32	Dir.	No.	No.	Sepr.	1-3 H.P.	G or K.		Mag.	Pr.	475	Bab.	1½	2-Shunt.	2-Ball.	224	Sealed	e.
Fairbanks Co.	32	Dir.	No.	No.	Unit	1-3¼x3¼	G or K.		Bat.	Sp.	1150	2-Bab.	1	2-Comp.	2-Ball.	120 160	Sealed	h, i, l.
Farm-Lite	32	Dir.	No.	No.	Unit	1-3½x3¾	G or K.	Cent.	Mag.	Sp.	1200		1¾	4-Shunt.		120	Sealed	k.
Farm-O-Lite	32	Blt.	Yes.	Yes.	Unit	1-3 H.P.	G or K.	Cent.	Bat.	Sp.	700		1			160		k.
Farm-O-Lite	32	Blt.	Yes.	Yes.	Unit	1-3 H.P.	G.	Cent.	Mag.	Sp.	800		1½			120		k.
Farm-O-Lite	32	Dir.	Yes.	Yes.	Unit	1-3½ H.P.	G.	Cent.	Mag.	Sp.	1100		1¼			200		k.
Fort Dearborn	32	Gear.	No.	Yes.	Unit	1-2¾x5	G or K.	Cent.	Mag.	Sp.	1000	2-Ball.	1	4-Shunt.	2-Brnz.	240	Sealed	g, o.
Frost	32	Blt.	No.	Yes.	Sepr.	1-1½ H.P.	G.						¾					
Frost	32	Blt.	No.	Yes.	Sepr.	1-2½ H.P.	G.						1					
Genco-Light	32	Dir.	No.	Yes.	Unit	1-3¼x3	G or K.		Bat.	Sp.	1200	2-Bab.	1	2	2-Ball.	110	Sealed	o.
Genco-Light	110	Dir.	No.	Yes.	Unit	2-3¼x4	G or K.		Bat.	Sp.	1200	2-Bab.	3	4	2-Ball.	167	Sealed	o.
Genco-Light	110	Dir.	No.	Yes.	Unit	4-3¼x4	G or K.		Bat.	Sp.	1200	2-Bab.	6	4	2-Ball.	250	Sealed	o.
Globe	32	Dir.	No.	No.	Sepr.	1-2¾x4	G.	Cent.	Bat.	Sp.	1200		.8	2-Shunt.	2-Ball.	120	Sealed	k.
Globe	32	Dir.	No.	Yes.	Sepr.	1-2¾x4	G or K.	Cent.	Bat.	Sp.	1200		1	2-Shunt.	2-Ball.	110 150 180	Sealed	n.
Gray-Davis	32	Dir.	No.	No.	Unit	1-2½x2½	G or K.	None.	Bat.	Sp.	1150	2-Ball.	⅓	4-Shunt.		56	Sealed	g, k.
Hebco	32	Dir.	Yes.	Yes.	Sepr.	1-3 x3	G.	Sol.	Bat.	Sp.	1600	2-Bab.	1½	4-Shunt.	Bab.	120	Sealed	m, y.
Holt	110	Dir.	Yes.	Yes.	Sepr.	1-2⅜x3	G.	Sol.	Bat.	Sp.	1400	2-Bab.	¾	4-Shunt.	Bronze.	80		m, r, p.
Independent	32	Gear.	No.	Yes.	Unit	1-3½x4	G or K.		Bat.	Sp.	750	2-Bab.	1½	4-Comp.	2-Brnz.	95 140 190 235 275	Sealed	k.
Ker-o-el	32	Dir.	No.	Yes.	Unit	1-2⅜x3¼	G or K.	Cent.	Bat.	Pr.	1550	2-Bab.	⅞	4-Comp.				h.
Kewanee	32	Dir.	No.	Yes.			G.		Bat.		1250							k.
Kewanee	32	Blt.	No.	Yes.			G.		Bat.		1250							k.
Kohler	110	Dir.	Yes.	Yes.	Unit	4-2 x3	G.	Cent.	Mag.	Sp.	1000	2-Brnz.	1½	4-Comp.	1-Ball.	26		pr,
Lally-Light	32	Dir.	No.	Yes.	Sepr.	1-2⅝x2	G.	Cent.	Bat.	C.	1800	3-Ball.	1¼	2-Comp.	2-Ball.	115		a, c, o.
Langstadt-Meyer	32	Dir.	No.	No.	Sepr.	1-3⅛x4½	G or K.		Bat.	Pr.	1250		1½			134		k.
Langstadt-Meyer	110	Dir.	No.	No.	Sepr.	4-3⅛x4½	G.	Cent.	Mag.	Pr.	1100	Bab.	6	4-Comp.		Opt.		k.
Langstadt-Meyer	110	Dir.	No.	No.	Sepr.	4-2⅞x4	G.	Cent.	Mag.	Pr.	950	Bab.	4	4-Comp.		Opt.		k.
Langstadt-Meyer	110	Dir.	No.	No.	Sepr.	4-2⅞x4	G.	Cent.	Mag.	Pr.	1100	Bab.	5	4-Comp.		Opt.		k.
Lebby	32	Dir.	No.	Yes.									⅓					
Litscher-Lite	32	Dir.	No.	No.	Unit	1-3 x4½	K.	Cent.	Bat.	Sp.	1150	2-Bab.	1	4-Shunt.	2-Ball.	140 420	Sealed	i, k.
Lucolite	32	Dir.	No.	Yes.	Unit	1-3¼x3¼	G or K.		Bat.	Sp.	1150	3-Bab.	1¼	2-Comp.	2-Ball.	144	Sealed	h, i, l, o.
Lucolite	110	Dir.	No.	Yes.	Unit	1-3¼x3¼	G or K.		Bat.	Sp.	1150	3-Bab.	1¼	2-Comp.	2-Ball.	288	Sealed	h, i, l, o.
Main	32	Blt.	No.	Yes.	Sepr.	1	G or K.	Cent.	Mag.	Sp.	500	2-Bab.	¾	2-Shunt.	2-Bab.	140	Sealed	k.
Main	32	Dir.	Yes.	Yes.	Unit	1-2⅝x2½	G or K.	Sol.	Mag.	Sp.	1500	2-Bab.	1	2-Comp.	2-Bab.	140	Sealed	a, k.
Main	32	Dir.	No.	Yes.	Sepr.	1	G or K.	Cent.	Mag.	Sp.	450	2-Bab.	1	2-Comp.	2-Bab.	140	Sealed	k.

ABBREVIATIONS:

Column 2. **Dir**—Direct.
Chn—Chain.
Blt—Belt.

Column 5. **Sepr**—Separate.
Column 8. **Sol**—Solenoid.
Cent—Centrifugal.
H & M—Hit and miss.
Column 10. **Sp**—Splash system.

Pr—Pressure system.
O-Cup—Oil cup or sight feed.
C—Oil mixed with fuel.
Column 12. and 15. **Bab**—Babbitt.
B & R—Ball and Roller.

Column 14. **Comp**—Compound.
Column 16. **Opt**—Optional.
Column 18. **a**—2 Cycle. { Otherwise
b—Semi-Diesel. { 4 cycle.
c—Oil mixed with fuel.

quently with its series winding used for starting only although there are many generators where the series winding is employed for bucking or compensating regulation. The duplex winding is confined to the 110-volt system that uses only a starting battery, where a shunt is normally used for generating and a 12- or 24-volt winding for cranking only.

Whenever possible, designers have used generator characteristics for charge regulation, sometimes alone and more frequently in combination with some engine characteristic.

Safety or protective devices are used on all plants. Fuses appear usually on the simplest plants. The magnetic circuit-breaker is increasing in popularity for

Lighting and Power Plants, 1921

DUSTRIES by Gustave Wiedeman)

Name and Model	PLANT					ENGINE							GENERATOR			BATTERY		Misc. (See Footnote)
	Voltage	Drive	Automatic Start?	Automatic Stop?	Unit or Separate Construction	No. Cyls. and Bore X Stroke	Fuel	Type of Speed Governor	Type Ignition	Type Lubrication	Normal r.p.m.	No. and Kind Engine Bearings	Rated K.W.	No. Poles and Kind Field Winding	No. and Kind Generator Bearings	Standard 72-hr. Rating	Open or Sealed	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Marco	32	Chn.	No.	No.	Sepr.	1-5 H.P.	G or K.	Cent.	Mag.	Sp.	800		1½					g, z.
Marco	32	Chn.	No.	No.	Sepr.	1-5 H.P.	G or K.	Cent.	Mag.	Sp.	800		1½					g, z.
Matthews	32	Dir.	Yes.	Yes.	Unit.	1-2 x3	G.	Sol.	Bat.	Sp.	1200		.3	4-Shunt.	2	80	Sealed.	m, o, p.
Matthews	32	Dir.	Yes.	Yes.	Unit.	1-3 x3	G.	Sol.	Bat.	Sp.	1000		1	4-Shunt.	2	80	Sealed.	m, o, p.
Matthews	110	Dir.	Yes.	Yes.	Unit.	4-3½x5	G.	Sol.	Bat.	Sp.	900		6	4-Shunt.	2	80	Sealed.	m, o, p.
Mayhew	32		No.	Yes.		1-2¾x4	G or K.		Bat.		1400	Bab.	1	4-Comp.		90		
Mayhew	32		No.	Yes.		1-2¾x4	G or K.		Bat.		1400	Bab.	1	4-Comp.		120		
Mayhew	32		No.	Yes.		1-2¾x4	G or K.		Bat.		1400	Bab.	1	4-Comp.		160		
Merrell	32	Blt.	No.	Yes.		1-3 H.P.	K.						¾					
Merritt	32	Dir.	No.	Yes.	Unit.	1-3 x4	G or K.	Cent.	Bat.	Pr.	1200	Bab.	1½	4-Comp.		120	Sealed.	h, o.
Mills	32	Blt.	No.	Yes.		1-1½ H.P.	G or K.						¾					
National	32	Chn.	No.	Yes.	Unit.	1-5 H.P.	G or K.	Cent.	Mag.	Sp.	800	Bab.	1	4-Shunt.	Ball.	280	Sealed.	g, i, o.
National	110	Chn.	No.	Yes.	Unit.	1-5 H.P.	G or K.	Cent.	Mag.	Sp.	800	Bab.	2	4-Shunt.	Ball.	280	Sealed.	g, i, o.
Owen	32	Dir.	Yes.	Yes.	Unit.	1-3 x4	G.	Cent.	Bat.	Pr.	1350	Roll.	1¼	4-Comp.		120	Sealed.	f, p.
Perfection	32 to	Dir.	No.	Yes.	Sepr.	1-3¾x4	G or K.		Bat.	Sp.	1150	2-Bab.	1½	2-Comp.	2-Ball.	56 to	Sealed.	n, t.
Perfection	110	Dir.	No.	Yes.	Unit.	1-3¼x3¼	G or K.		Bat.	Sp.	1150	2-Bab.	1⅕	2-Comp.	1 Bab. 1-Ball.	448		n, t.
Petroleum																		b, w.
Phelps	32	Dir.	No.	Yes.	Sepr.	1-3 x4	G or K.	Cent.	Bat.	Sp.&Pr.	1335	2-Ball.	1½	4-Comp.	2-Ball.	135 225	Sealed.	i, o.
Pioneer	32	Blt.	No.	No.	Sepr.	1-5 H.P.	G or K.	Cent.	Bat.	Sp.	600	2-Bab.	1	4-Comp.	Bronze.	115		a, k.
Pioneer	65	Blt.	No.	No.	Sepr.	1-5 H.P.	G or K.	Cent.	Bat.	Sp.	600	2-Bab.	to	4-Comp.	Bronze.	to		e, k.
Pioneer	110	Blt.	No.	No.	Sepr.	1-5 H.P.	G or K.	Cent.	Bat.	Sp.	600	2-Bab.	2½	4-Comp.	Bronze.	320		k.
Plix	32	Dir.	No.	Yes.	Unit.	1-3 x3	G.	Sol.	Mag.	Sp.	1200	2-Bab.	1¼	4-Shunt.	1-Bab.	112	Sealed.	j, s.
Powerlite	32	Dir.	No.	Yes.	Unit.	1-3¼x3¼	G or K.	Cent.	Bat.	Sp.	1400	2-Bab.	1	2-Series.	Ball.	80	Sealed.	m, o.
Powerlite	32	Dir.	No.	Yes.	Unit.	1-3¼x3¼	G or K.	Cent.	Bat.	Sp.	1400	2-Bab.	1	2-Series.	Ball.	160	Sealed.	m, o.
Radiant	32	Dir.	No.	No.	Unit.	1	G or K.	Sol.	Bat.	Sp.	2100		.3	2-Comp.	Bab.	36	Sealed.	m.
Radiant	32	Dir.	No.	No.	Unit.	1	G or K.	Sol.	Bat.	Sp.	2100		1½	2-Comp.	Bab.	72	Sealed.	m.
Radiant	110	Dir.	No.	No.	Unit.	4	G or K.	Sol.	Bat.	Sp.	1300		3	2-Comp.	Bab.	53	Sealed.	m.
Radiant	110	Dir.	No.	No.	Unit.	4	G or K.	Sol.	Bat.	Sp.	1300		5	2-Comp.	Bab.	80	Sealed.	m.
Radiant	110	Dir.	No.	No.	Unit.		G or K.	Sol.	Bat.	Sp.	1300		10	4-Comp.	Bab.	80	Sealed.	m.
Reeco	32	Dir.	No.	No.	Sepr.	1-3 H.P.	G or K.		Mag.	Sp.	475	Bronze.	1¼	4	Bab.		Sealed.	z.
Regalite	32	Dir.	No.	Yes.	Unit.	1-3¼x3½	G or K.	None.	Bat.	Sp.	700	Bronze.	¾			80	Open.	g.
Rohaco	32	Dir.	No.	No.	Unit.	1-3 x4	G or K.	Cent.	Bat.	Pr.	1200	Ball.	1½	4-Comp.	2-Ball.	170	Sealed.	l.
Silvey	110 to	Blt.	No.	No.		2 H.P.	G or K.						1 up					
Silvey	220	Blt.	No.	No.		up	G or K.											
Stearns	32	Dir.	No.	No.	Unit.	1-2⅝x3	G or K.	Sol.	Mag.	Sp.	1500	2-Ball.	¾	2-Comp.	1-Bab.	126	Open.	m, o, x.
Sturtevant	32	Dir.	No.	No.	Unit.	4-3¼x5	G or K.	Cent.	Mag.	Pr.	900	2-Bab.	5	6-Comp.	1-Bab.			
Sturtevant	to	Dir.	No.	No.	Unit.	4-4 x6	G or K.	Cent.	Mag.	Pr.	750	3-Bab.	10	6-Comp.	1-Bab.			
Sturtevant	250	Dir.	No.	No.	Unit.	6-4 x6	G or K.	Cent.	Mag.	Pr.	750	4-Bab.	15	6-Comp.	1-Bab.			
Sunbeam	32	Dir.	Yes.	Yes.	Unit.	1-2¼x3	G.	Sol.	Bat.	Sp.	1400	2-Ball.	.65	4-Shunt.		75	Sealed.	m, p.
Sunnyhome	110	Dir.	Yes.	Yes.		1-2½ H.P.	G.			Pr.	2000	Roller.	1¼			36		H, m, p.
Suburban	32 to	Blt.	No.	No.		1-1½ to	G.						3 to					
Suburban	110	Blt.	No.	No.		1-10 H.P.	G.						4½					
Swanlite	32	Dir.	No.	Yes.	Unit.	1-3 x4	G or K.	None.	Bat.	Sp.	1250	2-Bab.	1¼	4-Comp.	2-Bab.	277	Sealed.	m.
Swanlite	32	Dir.	No.	Yes.	Unit.	4-3⅛x5	G.	Cent.	Mag.	Sp.	1200	3-Bab.	5	4-Comp.	2-Brnz.	Opt.	Sealed.	k.
Swartz-Light	32	Dir.	No.	Yes.	Unit.	1-3 x3¼	G.	Sol.	Mag.	O-Cup.	850	2-Bab.	1	4-Comp.	1-Ball.	225	Sealed.	a, m.
Swartz-Light	32	Blt.	No.	Yes.	Sepr.	1-5 x6½	G.	Cent.	Mag.	O-Cup.	450	2-Bab.	1½	4-Comp.	2-Ball.	225	Sealed.	m.
Swartz-Light	110	Blt.	No.	Yes.	Sepr.	1-5 x6½	G.	Cent.	Mag.	O-Cup.	475	2-Bab.	2¾	4-Comp.	2-Ball.	225	Sealed.	m.
Syco-Light	32 to	Dir.	No.	Yes.		1-2½ to	G.			Sp.			⅘ to			160		k.
Syco-Light	250	Dir.	No.	Yes.		4-8 H.P.	G or K.			Sp.			12			160		l.
Unilectric	110	Dir.	Yes.	Yes.	Unit.	1-2¾x3½	G.	Sol.	Mag.	Pr.	1600	1-Bab. 1-Ball.	1	2-Shunt.		80		e, m, r, y, p
United	32	Blt.	No.	Yes.	Sepr.	1-4½x6	G or K.	Cent.	Bat.	O-Cup.	425	2-Bab.	1	4-Shunt.	2-Brnz.	110		k.
United	32	Dir.	No.	Yes.	Unit.	1-3¼x3¼	G or K.	Cent.	Bat.	Sp.	1150	3-Bab.	1	4-Comp.	1-Ball.	150 180	Sealed.	m.
Universal Motor	32	Dir.	No.	Yes.	Sepr.	4-2 x3	G.	Sol.	Mag.	Sp.	1250	2-Bab.	2	6-Shunt.	1-Ball.	250	Sealed.	m.
Universal Motor	110	Dir.	No.	No.	Sepr.	4-2⅝x4	G.	Cent.	Mag.	Sp.	1100	2-Bab.	4	8-Comp.	1-Brnz.	168	Sealed.	k.
Universal Products	32	Dir.	No.	Yes.	Unit.	1-2⅝x3½	G or K.	Cent.	Mag.	Sp.	1100	2-Brnz.	1	4-Comp.		168	Sealed.	o.
Warner	32	Dir.	No.	No.	Sepr.	1-1¾ to	G.						⅔ to					
Warner	32	Dir.	No.	Yes.	Sepr.	1-22 H.P.	G or K.						3⅔					
Warner	110	Dir.	No.	Yes.	Sepr.	1-3½ to	G or K.						1¼ to					
Warner	110	Blt.	No.	Yes.	Sepr.	1-22 H.P.	G or K.						4⅖					
Wesco	32	Dir.	No.	No.	Unit.	1-3¼x3¼	G or K.	None.	Bat.	Sp.	1150	Bab.	1	2-Shunt.	Ball.	Opt.		i, l
Western Electric	32	Dir.	No.	Yes.	Unit.	1-3½ H.P.	K.	Cent.	Bat.	Sp.	1000		1½			90		g.
Western Electric	32	Dir.	No.	Yes.	Unit.	1-3¼ H.P.	K.	Cent.	Bat.	Sp.	1000		1½			180		g.
Western Electric	110	Blt.	No.	No.	Sepr.	5 to 25 H.P.	K.	Cent.	Mag.	Sp.			to 12			270		l.
Willys-Light	32	Dir.	No.	Yes.	Unit.	1-2⅞x3½	G or K.		Bat.	Sp.	1250	2-Bab.	1¼	4-Shunt.		225	Sealed.	d, g, o.
Winton	110	Dir.	No.	No.	Unit.	4-3 x4	G.	Cent.	Bat.	Pr.	1200	2-Bab.	5	4-Comp.	1-Bab.			
Winton	250	Dir.	No.	No.	Unit.	6-3 x4	G.	Cent.	Bat.	Pr.	1200	2-Bab.	7½	4-Comp.	1-Bab.			
Wisconsin	32	Blt.	No.	No.	Sepr.	1-4 x5	G or K.		Bat.		425	Bab.	.60	Shunt.				k.
Wisconsin	32	Blt.	No.	No.	Sepr.	1-4½x5½	G or K.	Cent.	Bat.		400	Bab.	.84	Shunt.		180		k.
Wisconsin	32	Blt.	No.	No.	Sepr.	1-3½x4½	G or K.	Cent.	Bat.		450	Bab.	.60	Shunt.		130		k.
Wisconsin	32	Blt.	No.	No.	Sepr.	1-5½x6	G or K.	Cent.	Bat.		340	Bab.	1.08	Shunt.		210		k.

d—Knight sleeve valve.
e—Rotating sleeve valve.
f—Rotating disk valve.
(d, e, f: Otherwise poppet.)
g—Air cooled.
h—Air and water cooled.
H—Oil cooled.
(g, h, H: Otherwise water cooled.)
i—Power pulley.
j—Entirely enclosed.
k—Rheostat control.
l—Manual throttle control.
m—Auto. Solenoid control.
n—Auto. Voltage relay.
o—Ampere-hour meter.
p—Auto. start and stop relay.
r—Starting battery only.
s—Designed for export sales.
t—Some Ford parts used.
u—Low-water safety device.
v—Low-oil safety device.
w—Product being re-designed.
x—Plant may be used without battery.
y—Remote control.
z—Engine easily disconnected.

the semi-automatic plant. Reverse current relays are a necessity with semi and full automatic plants, to protect the generator and battery against damage in case the engine stops.

Control Panels.—The manually controlled plants have rather elaborate control boards, consisting of ammeter, voltmeter, rheostat, switches, etc. Semi-automatic plants have, as a rule, the simplest control boards, consisting of a ampere-hour meter and a pair of controlling switches. The full automatic plants are made "fool proof" by concealing their control panel or compartment,

(*Continued on page* 421)

Specifications of Continental Agricultural Tractors

Compiled for AUTOMOTIVE INDUSTRIES by W. F. Bradley

Name and Nationality	Traction	No. of Cyl.	BORE AND STROKE		Total Weight Lbs.	Lubrication System	Carbureter	Air Clnr.	Water Circ.	Type Clutch	No. of Speeds	Final Drive	Axle Type	NO. OF WHLS.		Frame Con-struc-tion	Eng. and Gears
			M.M.	Inches										Drive	Non-Drive		
FRENCH																	
Abeille	Cr.	4	80x115	3.15x4.53	3,080	Pump		Yes	Pump	Disk	3	Gear	Stat.	1	2	None	Unit
Amiot‡	Wh.	4	105x160	4.14x6.32	5,500	Pres.	Super	No.	Pump	Cone	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Auror*†	Wh.	4	80x140	3.15x5.52	3,500	Pres.	Claudel	No.	Pump	Cone	3	Int. G.	Stat.	4	0	Roll Ch.	Separ.
Austin	Wh.	4	95x127	3.75x5. 0	2,900	Pres.	Zenith	Yes	Ther.	Cone	2	Dbl. Red.	Live	2	2		Unit
Chapron	Wh.	4	75x130	2.95x5.13	2,525	Pres.	Zenith	No.	Pump	Cone	3	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Charmes	Wh.	4	120x150	4.73x5.92		Pres.	Solex	No.	Pump	Cone	3	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Citroen	Wh.	4	65x100	2.56x3.94	1,760	Pres.	Solex	No.	Ther.	Cone	2	Bevel	Live	2	2	None	Unit
De Dion	Ca.	4	125x150	4.93x5.92		Pump	Zenith	No.	Pump	Plate	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
De Dion	Ca.	4	100x140	3.94x5.52		Pump	Zenith	No.	Pump	Plate	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Delahaye	Wh.	4	100x160	3.94x6.32	8,800	Pres.	Claudel	No.	Pump	Cone	2	Int. G.	Stat.	3	0	Roll Ch.	Separ.
Delieuvin*	Wh.	4	85x130	3.35x5.13	3,300	Pres.	Zenith	No.	Pump	Plate	2	Dbl. Red.	Stat.	3	2	Roll Ch.	Separ.
Dubois	Wh.	4	80x140	3.15x5.52	2,000	Pres.	Claudel	No.	Ther.	Cone	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Filtz	Ca.	4	100x150	3.94x5.92	4,000	Pump	Solex	No.	Pump	Plate	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Latil	Wh.	4	105x140	4.14x5.52	5,300	Pres.	Solex	No.	Ther.	Cone	2	Chain	Stat.	2	2	Roll Ch.	Separ.
Mistral	Wh.	4	100x140	3.94x5.52	3,800	Pump	Solex	No.	Pump	Disk	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Normania	Wh.	4	100x140	3.94x5.52		Pres.	Zenith	No.	Pump	Cone	2	Chain	Stat.	2	0	Roll Ch.	Separ.
Peugeot	Cr.	4	100x150	3.94x5.92	6,200	Pres.	Zenith	No.	Pump	Cone	2	Gear	Stat.	2	0	None	Separ.
Renault	Cr.	4	95x160	3.75x6.32	7,200	Circ.	Own	No.	Ther.	Cone	3	Gear	Stat.	2	0	None	Separ.
Rip*	Wh.	4	114x143	4.5 x5.64	4,400	Circ.	Kingst.	Yes	Pump	Disk	7	Int. G.	Stat.	2	2	Roll Ch.	
Scemia	Wh.	2	105x150	4.14x5.92	3,500	Pres.	Own	Yes	Ther.	Cone	2	S. Gear	Live	2	2	Roll Ch.	Separ.
Scemia	Wh.	2	140x205	5.52x8.08	5,800	Pres.	Own	Yes	Ther.	Cone	2	S. Gear	Live	2	2	Roll Ch.	Separ.
Somua	Wh.	4	98x170	3.86x6.70	5,500	Pres.	Claudel	No.	Pump		4	Dbl. Red.		2	1	None	Unit
Valere-Chochod*	Wh.	4	90x150	3.55x5.92	5,300	Pres.	Zenith	No.	Pump	Cone	2	Chain	Stat.	4	0	Roll Ch.	Separ.
ITALIAN																	
Fiat‡	Wh.	4	105x180	4.14x7.10	5,900	Pres.	Own	Yes	Pump	Disk	3	Worm	Live	2	2	None	Unit
Pavesi†	Wh.	2	130x170	5.13x6.70	5,100	Pres.	Own	No.	Pump	Disk	2	Int. G.	Stat.	4	0	None	Separ.

ABBREVIATIONS: Ca—Cable; **Circ**—Circulating; **Cr**—Creeper; **Dbl. Red**—Double Reduction; **Int. G**—Internal Gear; **Pres**—Pressure; **Roll. Ch**—Rolled Channel; **S. Gear**—Spur Gear; **Stat**—Stationary; **Ther**—Thermo-syphon; **Wh**—Wheel. *All makers use their own engine except as follows: Auror and Valere-Chochod use Ballot; Delieuvin uses DeDion and Rip uses Waukesha. †Pavesi has horizontal engine; all others vertical. ‡Kerosene burning. All others burn gasoline. All makes use gear type oil pump, magneto ignition and gravity fuel feed.

Pneumatic Equipment and Heavy Trucks

PROBABLY no question in the truck field has caused more discussion during recent years than that of pneumatic tire equipment.

Partially complete returns from a recent survey made by AUTOMOTIVE INDUSTRIES indicate a rather general unanimity of opinion on this question among truck manufacturers. Most manufacturers feel, in a general way, that the 3½-ton truck is the largest that can economically be equipped with pneumatic tires, although some believe that pneumatic equipment is not efficient on trucks larger than 2½ tons. A still smaller number think that pneumatic equipment is effective on models larger than 3½ tons.

The point was brought out, however, in a number of replies that not only the weight of the trucks but the operating purposes and conditions need to be considered when discussing the advisability of pneumatic equipment in any particular case. One manufacturer, for instance, says, " . . . We do not advocate the use of pneumatics on 3½-ton jobs unless the nature of the service has been carefully analyzed and sufficient assurance obtained that the tires would not be badly overloaded and that operating conditions are such as to enable this type of equipment to justify its higher cost . . . . We do not yet feel that trucks of this class can be indiscriminately sold on pneumatic equipment."

While a majority of those replying stated their belief that 3½-ton trucks were the largest upon which pneumatics might satisfactorily be used, some of this group was rather doubtful as to the real advisability of so equipping trucks of this size. In other words, while they felt it could be done, they are not thoroughly sold on the advisability of doing it except in special cases. One opinion ran like this: " . . . It is our opinion that pneumatic equipment reaches its limits on trucks of 2½-ton capacity, because of the fact that to withstand the hard wear and weight of the 3½-ton truck, the tires would have to be built so large that they could not be conveniently used. And furthermore, the solid tires of the large truck usually have large enough traction area, so there is no excuse for pneumatic equipment on these grounds."

Another general belief brought out by the survey was the opinion of most manufacturers that there would be a tendency towards the increased use of middle-sized trucks and a falling off in the use of the very large sizes. One manufacturer stated that, "We are firm believers in the fact that the heavy capacity truck is doomed and will be replaced with a greater number of medium capacity trucks. This we find is the condition existing all over the country, except, perhaps, in twelve or fifteen of the larger cities."

One maker thinks that the size of future trucks will be limited to the practicability of pneumatic tire sizes; that trucks will be built as large as can economically be operated on pneumatics and no larger.

Judging from the general opinions expressed as regards the attitude of the public towards pneumatic equipment for trucks of capacity of three tons and up, there is little question but that the public is rather skeptical in this regard. The following typical statements express the general opinion:

"We believe the general public in buying 3-ton sizes or over consider hard tires an investment as against the pneumatics as a speculation."

"No demand from public for pneumatic equipment on sizes of 3 tons or more."

"Attitude of public in this regard is that such equipment is not satisfactory."

While dissenting opinions are to be noted from all of the general trends indicated, a majority of truck manufacturers seem to believe in a general way the points outlined above in regard to the use of pneumatic equipment on trucks.

Billion Dollar Mark Passed in Automotive Exports

A study of the figures compiled since 1907 indicates a steady growth. Many interesting changes shown in the trend of trade since the war. Last year's total, $382,676,437, covering practically all countries.

By George E. Quisenberry*

THE foreign trade of the United States in passenger cars, trucks, motorcycles, parts, gas tractor engines and tires reached the huge total of $382,676,437 in 1920, an increase of slightly more than $175,000,000 over the preceding year. By expanding its overseas business by so great a value, the industry pushed its total export sales for all years well above the billion dollar mark, the statistics showing that the world has bought from the makers of this country $1,319,548,810 in these lines in all years since 1907.

All of the component automotive lines combined in rolling up the increase in 1920. Passenger car exports jumped from $73,700,527 to $165,255,921; trucks gained an approximate $11,000,000 to a 1920 total of $46,765,781; parts value rose from $42,562,186 to $85,362,093; the tire exports were $52,570,103, as against $28,924,659; engines from $20,026,172 to $21,965,959, and motorcycles grew from $6,687,346 to $10,756,580.

The detailed statistics follow.

	1919	1920	All Years
	24,481	37,662	126,313
Motorcycles	$6,687,346	$10,756,580	$30,963,518
	67,144	142,508	526,592
Passenger cars	$73,700,527	$165,255,921	$517,614,256
	15,485	29,126	115,236
Commercial vehicles	$35,424,337	$46,765,781	$271,904,722
Parts	$42,562,186	$85,362,093	$257,288,041
Gas tractor engines	$20,026,172	$21,965,959	$95,268,260
Tires	$28,924,659	$52,570,103	$149,570,013
Total value	$207,325,227	$382,676,437	$1,319,548,810

This does not include the aeronautic exports, of which the official reports reveal shipments of 65 airplanes, valued at $598,274, and airplane parts valued at $544,375. The corresponding totals in 1919 were 44 planes, worth $215,300, and parts valued at $3,249,266.

Records Inadequate

Unfortunately, the showing of car exports does not reflect the true volume of American automobiles which were placed in the overseas markets during the past year. The customs records give these at 142,508, a figure which in itself is sufficiently large to reveal something of the world demand for the automotive products of the United States but which, nevertheless, does not adequately point the way for calculations on replacements, accessories, maintenance parts, future markets, etc.

The reason is that pioneer figure in our foreign trading, Henry Ford. For several years, the Ford company has been establishing assembly branches in various centers which put together Ford cars from parts shipped from the Detroit factory. These, naturally, are not listed as either complete cars or chassis, but as parts, which take a different customs rating, and so do not show properly in the returns. But they are assembled into cars which should be considered as American products. For servicing and maintenance, they require spark plugs, for instance, of American sizes and other accessories of a similar nature, and they are in reality the product of American factories.

These assembling branches are located at Saõ Paulo, Brazil; Buenos Aires, Argentina; Manchester, England; Cadiz, Spain; Bordeaux and Copenhagen. Another factor is the shipment of Ford cars from the Canadian factory to those British possessions which have preferential tariff arrangements with that country. Ford has not announced the total assemblies of the foreign branches or the shipments from Canada on this basis, but, without doubt, they would swell materially the volume of American cars put in the foreign markets last year.

The Saõ Paulo branch, which has attained a reported production of 700 cars a month, takes care of only Southern Brazil, while the Buenos Aires plant, which has run as high as 1500 cars monthly, confines its sales entirely to the Argentine. All other countries of Latin-America are supplied with Ford cars and trucks from this country and show as complete cars or chassis in all cases. No Ford cars show for the Argentine and but part of those for Brazil, a condition which also exists in regard to the countries in Europe served from the European branches.

The maximum production at Manchester has been above 8,000 cars monthly, according to a recent statement, although early last year it ranged from 3,000 a month to 1,000 weekly. The Cadiz plant probably runs about 700 a month, whereas Bordeaux and Copenhagen have averaged much less.

Where Exports Go

With these factors in mind, as modifying the relative standings, a review of the 1920 exports of passenger cars, according to value and based on the customs reports, shows that England, India, Canada and Australia were the chief purchasers of complete cars and chassis. Following them come New Zealand, South Africa, Cuba, Sweden, Brazil, Dutch East Indies, Argentina, Spain, Uruguay, Philippine Islands and Mexico. Denmark, which had ranked seventh, and Norway, which had been twelfth in 1919, both dropped so low in 1920 that they did not come among the first fifteen buyers.

The purchases, according to number of machines, were

*Managing editor, El Automovil Americano.

somewhat different, although England and India were again the leaders, but Australia was ahead of Canada. After these leaders the relative order was South Africa, New Zealand, Cuba, Sweden, Argentina, Dutch East Indies, Uruguay, Mexico, Spain, Philippine Islands and Brazil.

Through all years, the fifteen leading countries in the purchase of American made cars have been Canada, England, Australia, Argentina, New Zealand, South Africa, Cuba, India, Mexico, Dutch East Indies, Philippine Islands, France, Uruguay, Japan, the Netherlands and Chile. The details of these statements may be gathered from the tables which are published elsewhere in this issue.

The countries in 1920 which purchased fewer cars than in the year before were Denmark, the Azores, Finland, France, Iceland, Chile, Roumania, British Honduras, Canada, Newfoundland and Labrador. The cars purchased by Brazil were less by 22 in 1920 but the value rose surprisingly from $2,580,304 to $6,761,382.

Among the smaller countries, there were some unusual gains between the two years, this being an evidence that the American made motor car is pushing itself into all corners of the world.

Some of these are shown in the following table:

	1919	1920
Portuguese Africa	18	244
Korea	11	595
French East India	37	537
Persia	4	128
Turkey	119	1010

Turning to the truck field, Brazil pushed prominently into the forefront of buyers. Ranking seventeenth in 1919, this Latin-American country was in fourth place last year, being exceeded only by England, Canada and Cuba, and leading India, Australia, Mexico, Japan, the Philippines and Peru, in the order named. The Brazilian gain was more than 700 per cent, from 200 to 1540. British India, the Dutch East Indies and Peru were other countries which also made surprising gains, these being as follows:

British India	266 to	1534
Dutch East Indies	324 to	1182
Peru	207 to	900

Two bright spots among the small countries which are taking their place in the truck buying field are the Virgin Islands and the Dominican Republic. The Virgin Islands, which are now American territory, made a percentage gain far surpassing anything shown in any of the other purchasing territories. One truck was sent there in 1919; in 1920 the number was 168. The Dominican Republic also made a favorable showing, taking 213 trucks as against 48 in the preceding year.

The Truck Trade

Truck exports, the comparisons show, do not always follow the motor car, although that should logically be the pioneer wedge by which any territory is opened up for automotive equipment. But, once opened, the utilization of trucks and cars may follow different lines. Three countries, for instance, appear among the first fifteen buyers of motor trucks which are not shown in the same list for passenger cars. These are Japan, Peru and West Africa, each of which increased its takings in 1920, although the early advent of the business depression in Japan prevented that country from making the gains recorded by the other two territories. On the other side of the ledger was France, which, after leading in 1919, almost dropped out of the truck market in 1920.

On the buying of tires, a much different line-up of leading purchasers was shown, the list being led by England and followed by Cuba and the Argentine. The English takings were $4,178,548, Cuba $3,409,986 and Argentina $3,126,889. The latter country, perhaps, in this comparison shows up for the first time more nearly where it should be considered as a user of American automotive equipment. Because of the big Ford assembly plant at Buenos Aires, its absorption of passenger cars and trucks is imperfectly given in the customs reports. On tires, however, this does not follow and the breadth of the market is shown without the possibility of any modification being needed.

The Argentine, in third place, was well ahead of Canada, which was followed in turn by Sweden, Philippine Islands, France, New Zealand, Brazil, Spain, Netherlands, South Africa, Dutch East Indies, Australia and Mexico. India, which had been so high in the other comparisons, was no more than nineteenth as a tire buying country.

From a constructive standpoint, a study of these exports evidences that the entire world has become a field of sale for American automotive equipment. Even the smallest countries have been buying cars and trucks. A common statement is that, whereas North America has nine million automotive vehicles, the rest of the world has but a million, or one-ninth as many. The exactness of the estimate may be questioned, but there can be no doubts here of the magnitude of the markets now confronting the American maker and the development that may be expected in coming years.

Markets Cover Every Country

Motor car and truck use outside the continental borders of the United States has expanded to an extent that two or three years ago would scarcely have been credited as possible. The American makers have been forced into foreign trade either by intention or by chance. The main point is that they are there and must stay there. The equipment already sold must be serviced and replaced; new services are being opened, and, for all of this, the American manufacturer must keep himself in the export business.

The year 1920 has been a prolific one in the sense of experience gained and lessons learned. The makers, as a whole, are better equipped today than they were twelve months ago for upholding the obligations that foreign trade has forced upon them. But the fundamentals still remain and, although our last year's trade was far in excess of that of any previous period, there can be no slackening now. Advertising, salesmanship, promotion for good roads, careful packing, the use of foreign language literature for both sales and service, proper servicing and maintenance, all of these factors must be rigidly held in upbuilding a foreign policy that will hold the markets already gained.

ACCORDING to information furnished by the Governor-General of French Western Africa, the number of automobiles imported into Senegal in 1918 was 91 (of which 85 were American and 6 French) besides 25 American trucks. In 1919 (December excepted) there were imported 94 cars, of which 87 were American and 7 French, and in addition 31 American trucks. Practically all of the American cars were of Ford and Overland make.

As regards the preferences of the population, vehicles for the country should be light, strong and of an average of 20 hp. They should have a low center of gravity and yet have plenty of ground clearance, owing to the fact that roads have hardly been broken. For city use vehicles are preferred which are heavier, more comfortable and of an average of 12-15 hp.

Canada Has 403,111 Cars and Trucks in Use

1920 totals show 13.4 per cent increase over 1919, the actual gain being 47,678. This article analyzes the Canadian registration figures and also comprises a thorough and valuable review of the present status and future prospects of the automotive industry in Canada. Tariff wall will remain high on automotive products, except on small tractors.

By Garnett Clay Porter

CANADA'S official registration of automobiles for 1920 totals 403,111. This is an increase over the 1919 registration of 47,678 cars, or 13.4 per cent. The increase of 1919 registration over that of 1918 in the Dominion was 85,706 cars.

The 1920 increase was by no means as marked as in other years. Reasons assigned by the trade quite agree as to the cause. Increased price was not so much a factor as inability of agents to guarantee delivery on orders placed in the winter of 1919-20. In the winter of 1918-19 the demand had been enormously in excess of manufacturers' capacity. The armistice brought a flood of orders. Money was the cheapest thing in the Dominion. The agrarian interests were never so flourishing. Men from the farm were in the market for cars whose pre-war conception of luxuries was confined to a fairly serviceable single horse buggy. Others with cheap grades of cars were discarding them for the more expensive types. In other words, Canada, like the rest of the world, was reacting from the rigid economies enforced by war conditions.

Frenzy of Spending in 1919

Three dollar wheat was no longer a mere figment of an optimistic rural imagination. Thousands of orders were taken following the close of the war and deposits made, with no guaranty of delivery and with the price to be determined "at time of delivery." This was the condition in Canada generally ruling in the trade in the winter of 1918-19. Then came the abolition of the government wheat board which had handled the crop so profitably to Canadian farmers in 1918-19. This machinery was expected to operate during 1920, but Ottawa authority desired to see the old supply and demand law of commerce re-established as soon as possible. The beginning had to be made with the great basic industries. All the political influence of the vast agrarian bund of the Dominion, commonly known as the United Grain Growers, was insufficient to change the Ottawa decision.

GRAIN PRODUCTION 1920, IN BUSHELS

Saskatchewan	298,474,200
Alberta	177,475,400
Manitoba	127,895,400
Total	604,445,000

Indeed, the spending frenzy had reached such proportions that the Dominion Government imposed a luxury tax to slow down the wheels of the spending multitude. It was particularly trying, this tax, on the automobile industry. In this trade the tax was known as an excise impost and was 15 per cent on all cars under $3,000 and 20 per cent over that amount.

As an offset, the 7½ per cent war tax added to the customs duty was abolished. This helped the United States manufacturers in the Canadian market, but proved really an additional burden to the manufacturers of cars in Canada. It meant to the Canadian trade that the already high price of cars had to be increased to the buying trade at least 15 per cent. The uncertainty of the grain market slowed down the buying in rural districts. These were the conditions which handicapped the automotive industries in the Dominion in 1920. Late in the fall of last year the orders for cars to be delivered this spring were appreciably less.

But then came another reaction, due to the abolition of the luxury tax and the excise burden. Prices came down to that extent and the new year opened with business prospects good. Various representatives of the trade from coast to coast have informed the writer that during January their orders increased enormously. All predict a prosperous year for the trade in Canada, especially in the west.

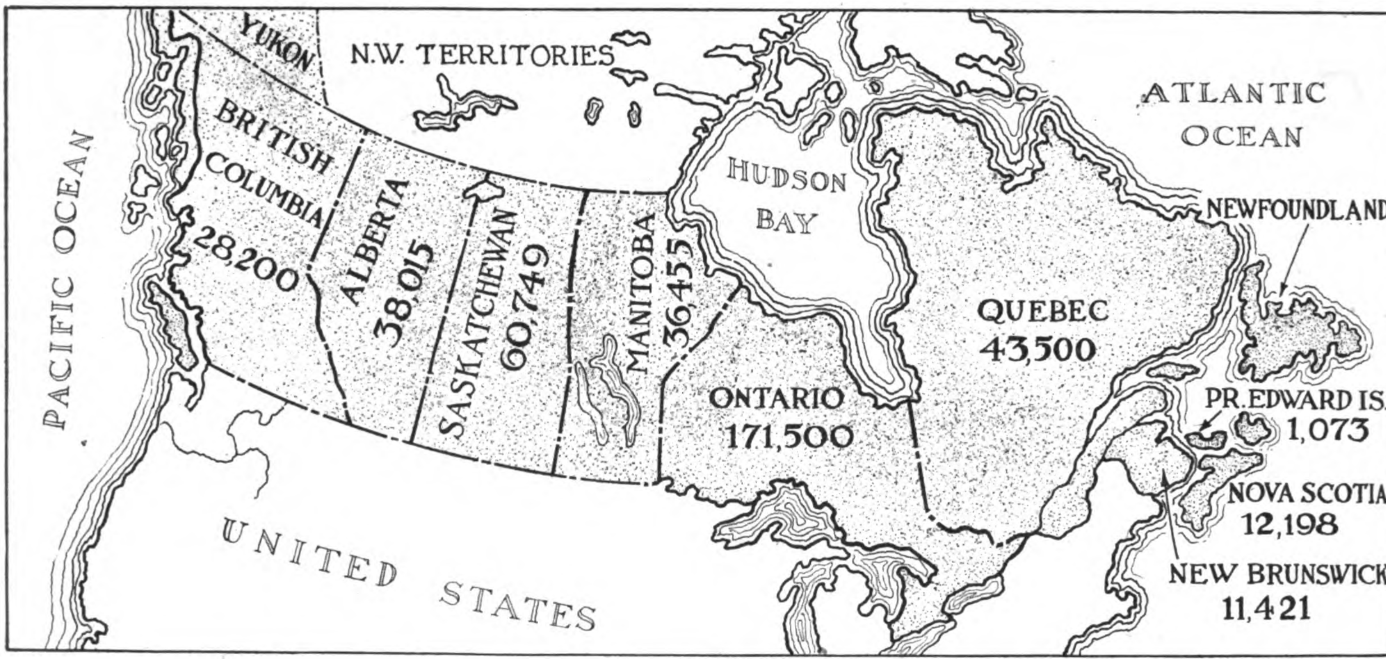
Tractor Demand Increases

In the three prairie provinces there were, during 1920, 31,998 farm tractors as against 26,832 in 1919. These are not official government registration figures, as the provinces do not require owners of farm tractors to register them. There were compiled from records of the grain growers, agricultural societies and customs offices.

OFFICIAL REGISTRATION OF AUTOMOBILES IN CANADA FOR TEN YEARS

TOTAL FOR 1920, 403,111, INCREASE OVER 1919, 13.4 PER CENT

Year	Ont.	Sask.	Que.	Alta.	Man.	B. C.	N. S.	N. B.	P. E. I.	Total
1911	11,339	1,304	1,878	1,631	2,599	2,220	228	483	...	21,682
1912	16,266	2,268	3,535	2,505	4,770	4,289	456	700	...	34,789
1913	23,700	4,659	5,452	3,773	5,406	6,138	511	824	26	50,489
1914	31,724	8,027	7,413	4,728	7,001	6,688	544	1,260	30	67,415
1915	42,346	10,225	10,112	5,832	8,812	7,440	971	1,900	35	87,673
1916	54,375	15,000	15,347	9,703	11,953	8,576	1,728	2,986	50	120,318
1917	83,790	32,500	21,702	20,800	17,333	11,386	5,678	5,249	301	198,739
1918	109,374	47,239	28,388	29,500	24,389	15,828	8,103	6,475	481	269,727
1919	151,623	54,754	40,557	34,362	33,896	19,050	10,981	9,420	790	355,433
1920	171,500	60,749	43,500	38,015	36,455	28,200	12,198	11,421	1,073	403,111



Motor vehicle registration in various Canadian provinces

Tractor Record on Prairies for Four Years

	1917	1918	1919	1920
Saskatchewan	8,610	10,937	14,207	16,907
Alberta	3,977	5,209	7,122	8,700
Manitoba	1,613	3,631	5,503	6,391
Total	14,200	19,777	26,832	31,998

The impression is very general that 1921 will show a huge increase in the demand for tractors. The Federal Government has placed some 30,000 ex-service men on farms in the west. Many of them produced good crops last year. This year they will be potential buyers of farm tractors and automobiles. To appreciate the possibilities of the western Canadian farm for automotive industries it must be recalled that in 1920 there were cultivated 29,279,000 acres, and the total grain production of the three prairie provinces was 604,445,000. An increase of fully 20 per cent. is indicated for 1921, due to virgin sod being broken and the exceptional season last year for the fall plowing, which, in these northern latitudes, is always the big problem.

No Duty on Small Tractors Likely

President W. H. Gibson of the Saskatchewan Livestock Association, at the annual meeting of that organization at Moosejaw, Sask., Jan. 25, declared that prairie farmers were beginning to prefer the horse again to the tractor, and the secretary's annual address asserted that "the tendency of our farmers is to swing back from high priced tractors to really good draft horses." But the automotive trade record does not bear out this forecast, for a new factory was opened at Saskatoon, Sask., in 1920 for the manufacture of the light prairie tractor, and a similar plant was opened at Medicine Hat, Alta. In fact the abolition of the customs duty on the $1,400 tractor type proved such a lure to the United States manufacturers of tractors that the manufacturers on this side have been doing everything they could since the close of the war to have the duty reimposed. The writer was over the country with Sir Henry Drayton, Minister of Finance, sitting with other members of the Federal cabinet as a tariff commission last fall. At both Saskatoon and Medicine Hat representations were made by tractor manufacturers to have the customs duty on the $1,400 tractor re-established.

In this connection the writer thinks it important to the manufacturer of both tractors and automobiles in the United States that he emphasize this: There is little probability, in fact only the remotest, of the Dominion Government's policy concerning the tariff regulations on tractors and automotive production of every description being changed. I took special note of the attitude of Sir Henry Drayton, chairman of the Tariff Commission, during the session at Medicine Hat last fall, when the manager of the new plant producing farm tractors there submitted his brief urging a resumption of the tariff on the small type of tractor, such as he was turning out. I recall distinctly that Sir Henry Drayton bore down on this point in interrogating the manager of the tractor manufacturing company: "But you knew when you established your plant for the manufacture of this class of tractors that your industry was not protected by the tariff?" Senator Robertson, the other member of the commission, nodded his head as if in agreement with the idea brought out by the chairman.

Municipal Distribution of Cars, 1920; Rural Excess, 119,145

	Cities	Village, Town, Townships
Ontario	63,478	108,022
Saskatchewan	18,213	42,436
Quebec	13,791	29,709
Alberta	11,341	26,674
Manitoba	14,322	22,133
British Columbia	12,377	15,823
Nova Scotia	4,121	8,077
New Brunswick	3,988	7,433
Prince Edward Island	352	721
Total	141,983	261,128

The commission, of course, has been investigating industrial conditions all over the Dominion with a view of submitting facts as the members find them. Their personal views will not prevail, but the policy of the Meighen Federal Government is strongly one of protective tariff generally, but with a tendency to treat the implements of production rather from the farmers' point of view. The Meighen government has a majority in Parliament at present of thirty. The next Federal election will occur in the late spring of 1922. It can be safely predicted that no resumption of the duty on $1,400 tractors will be made by this government, nor will there be any

reduction in that time of the duty on automobiles.

The duty on small tractors was removed as a war time measure to increase production. It has worked so well and proven so popular that in spite of the manufacturers of this type of tractors in Canada there is little probability of the duty ever being re-established.

The political complexion of the next government is in doubt. The country is rather evenly divided between the National Liberal and Conservative party now in power at Ottawa, the Farmers, and the Liberals. The Meighen government is openly pledged to a protective tariff policy. The Liberal strength is chiefly in Quebec, and that French province is largely a protective tariff section, though the Liberal platform calls for "such changes in the tariff as the needs of industry may require," while the farmers rather are inclined to free trade, in farm implements at least.

With the basis of political calculations vastly disturbed in Canada, it is still a pretty safe prediction that the elements opposed to any considerable change in present tariff relations will control the destinies of the Dominion for at least five years after the next election. The attitude of the Washington authorities in placing an embargo, or advocating such an embargo, on wheat and cattle, which Canada sends so heavily into the States, has strengthened the element on this side which is opposed in principle to reducing the customs wall. So automobile manufacturers in the States may make up their minds that they will continue to climb the tariff wall to get into Canada, and those manufacturing the small type of tractor may rest assured that there is unlikely to be a duty reimposed on their products coming over the line to the northward.

Canadian Oil Industry

In this connection, those interested in the oil and gasoline industry should study the situation now developing on this side of the line, for it is certain to loom large on the horizon of the trade before the close of the year. The Imperial Oil Co. of Canada, which is the Canadian name for the Standard, has definitely located a new oil field in the Mackenzie River basin at a point some 1000 to 1500 miles north of rail head in the Northwest Territories. Two wells have been drilled and one is unquestionably a gusher, flowing, on the best evidence that has come up from the Arctic, 1500 barrels daily. The importance of the discovery is suggested by the suspension of all regulations by the Dominion Government of oil and mineral land leases.

Energetic efforts are being made to get the Mackenzie River products onto the market. It is freely predicted that this petroleum will be a factor in the world market by this fall. A railroad is projected over the 16-mile portage which obstructs the all-water route via the Mackenzie River, Great Slave Lake, the Peace River and their tributaries to the rail head at Peace River Crossing, Alberta. There are indications that tank steamers will operate on both sides of this short portage, across which a pipe line will be constructed, to rail head. That public sentiment will permit these products to go out of the country in their raw state is quite remote. The probabilities are that all refining will be forced on the Canadian side of the line.

Large Potential Market for Automotive Products

But this means an era of cheaper gasoline and oil in Canada if not in the States. This is one of the imponderable factors in estimating the possible potentiality of the Canadian market for the automotive industry in the future. The trade estimates that each car will use annually 275 gallons of gasoline, at 40 cents, giving a total money value of the quantity at $44,342,210 for 1921, or 110,895,525 gallons. Each of these cars will use four tires in 1921, or 1,612,444 at estimated value of $40,321,-100. Each car will use for grease one-tenth of the value of gasoline consumed, estimated at $4,434,221, and it is estimated that 10 per cent of the value of a car is consumed each year in accessories, giving a possible expenditure for 1921 in Canada of $80,622,200, or a total expenditure for the cars as per registration this year in Canada of $169,719,731.

POTENTIAL BUSINESS FOR 1921 IN CANADIAN AUTOMOBILE INDUSTRY, BASED ON 1920 RECORDS

Each car will use four tires, 1,612,444; probable total value	$40,321,100
Each car consumes 275 gallons gasoline, 110,-895,525 gallons, value	44,342,210
Ten per cent value, all cars spent annually in accessories	80,622,200
Cars will use one-tenth value of gasoline in grease and oil	4,434,221
Total probable expenditures of cars in service 1921	$169,719,731

It is worth noting in considering these registration figures that some members of the trade deduct 5 per cent from all registrations for duplications. Undoubtedly this uncertain quantity accounts for some disputes in totals. When a car is sold to another user, he applies for a license. These duplications are weeded out at some of the capitals better than in others, but the feature is worth noting.

The registration shows 355,550 cars registered as passenger cars and 47,561 as commercial cars; but E. M. Trowern of Ottawa, who presented the brief before Sir Henry Drayton at Ottawa in December, when a plea was being made for the remission of the excise duty on cars on which the tax had been paid before it was abolished last fall, estimated that "about 85 per cent of all the cars sold in Canada are used for business purposes."

PASSENGER CARS, COMMERCIAL CARS AND MOTORCYCLES BY PROVINCES

December 31, 1920

	Passenger Car	Commercial Car	Motor-cycles
Ontario	155,500	16,000	5,500
Saskatchewan	51,514	9,235	3,125
Quebec	36,098	7,402	2,410
Alberta	33,094	4,921	2,040
Manitoba	31,827	4,628	3,209
British Columbia	25,056	3,144	1,611
Nova Scotia	11,098	1,100	980
New Brunswick	10,511	910	527
Prince Edward Island	852	221	....
Totals	355,550	47,561	19,535

It was from the Trowern brief that the following figures were secured. He recorded for the benefit of the Dominion of Finance Minister that: "The number of employees in the Canadian automobile factories is 20,000. There are 5,550 dealers actually merchandising cars in Canada. Allowing eight employees to each establishment gives a total of 44,000. If you allow five to a family of all these, a total is given of 320,000 direct dependents upon the automotive industries of Canada."

It is worth noting that the Government did not refund the tax on cars in stock of dealers at the time the tax was abolished, upon the theory that when the tax was imposed it did not apply to cars then in the hands of dealers. The leaders of the industry are still urging action in this direction, however. In actual operation, the failure to secure this rebate will mean that those dealers who have cars on sale on which they have paid the tax must lose same, as new cars delivered will be sold at a price proportionately less to the trade. This tax had to be paid at the time the car passed from factory to dealer.

CARS PER CAPITA ON PRAIRIES

	Population	Cars 1919	Per Cap.	Cars 1920	Per Cap.
Saskatchewan ...	647,835	54,754	11.8	60,749	10.7
Manitoba	553,860	33,806	16.8	36,455	15.6
Alberta	496,525	34,806	14.3	38,015	12.9
Total	1,698,220	122,922		135,219	

Increase over 1919 of 21,347 cars.

Prairies Form Chief Market

While Ontario and Quebec are big users of cars, the prairies continue to be the rich field for the business. For the three prairie provinces, with a population of 1,698,220, registered last year 135,219 cars as compared with 122,922 in 1919, an increase of 21,347. The four western provinces show 326 repairshops, 1117 garagemen and 1669 dealers. The estimated value of cars registered in the four western provinces for 1920 is $343,179,900 and $70,384,600 for tractors. The use of tractors and motor trucks for drawing grain to market is increasing all over the prairies. This is the testimony submitted at the annual meetings of the western grain growers, where it was said that even on bad roads 75 bushels could easily be handled by small tractors and motor trucks. In 1919 there were 89 distinct makes of cars registered in western Canada, and for 1920 the different makes had increased to 112. That these roads must improve for this traffic is indicated by increased revenue being devoted to road purposes all over Canada, $20,000,000 now being in sight for this purpose in Manitoba alone. The automobile leagues of Canada are responsible for this fine spirit, the Ontario Motor League alone increasing its membership in 1920 from 6607 to 11,115. Many agricultural societies are establishing tractor schools and the western universities are encouraging such departments.

REPAIRSHOPS, DEALERS AND GARAGEMEN IN WEST

	Shops 1919	Shops 1920	Garagemen 1919	Garagemen 1920	Retail Car Dealers 1919	Retail Car Dealers 1920
Saskatchewan	84	97	451	478	493	541
Alberta	55	63	198	214	380	394
Manitoba	95	105	284	321	415	510
British Columbia...	43	61	123	104	184	224
Total	277	326	1,056	1,117	1,472	1,669

INVESTED CAPITAL IN CARS THROUGH WEST AND POSSIBILITIES—AVERAGE PRICE IN WEST $2,100 PER CAR—AVERAGE TRACTOR $2,200 PER MACHINE

	Cars, 1920	Value	Tractors	1920 Value	Grain Acreage 1920
Sask.	60,749	$127,752,900	16,907	$37,184,400	16,270,000
Alta.	38,015	79,831,500	8,700	19,140,000	7,140,000
Man.	36,455	76,555,500	6,391	14,060,200	5,769,000
Brit. Col.	28,200	59,220,000	....	....	....
Total ..	163,419	$343,179,900	31,998	$70,384,600	29,279,000

These figures are authentic as far as they go, according to the Federal Government records at Ottawa. In many of the Canadian factories, so much of the car parts turned out complete are imported, chiefly from the States, that it is difficult to figure the extent of the purely Canadian industry and the number of cars each factory produces. The tendency, however, is for the United States factories to extend their assembly plants here and rely wholly on the factory product on this side to accommodate this growing Canadian market. There were ten automobile manufacturers registered in Canada in 1919 and eleven in 1920. One large factory is being established now at Winnipeg which is not included in this list, and there are several other old munition factories that will be equipped during 1921 for the manufacture of whole or parts of cars.

These factories turned out, in 1919, 89,900 cars, valued at $70,000,000, with 17,542 employees; while in 1920 they completed 94,421 cars, at a value of $78,000,000, and employed 20,000 persons. These values are those given for taxation purposes at the factories. In 1919 the cars and parts imported were valued at $29,768,000, and in 1920 these importations had fallen to $27,900,000. The manufacturing end of the cars for the Canadian territory is expected to increase considerably this year.

MANUFACTURERS IN CANADA AND IMPORTATIONS

	1919	Factory Value	1920	Factory Value
Total factories in Canada ..	10		11	
Number cars turned out..	89,900	$70,000,000	94,421	$78,000,000
Number employees in factories ..	17,542		20,000	
Number retail dealers in cars and parts	5,265		5,500	
Cars imported valued at ..	$29,768,000		$27,900,000	

Recent Motor Vehicle Lighting Laws in the Chief Canadian Provinces

(Latest Available Reports)

Province	Headlights	Regulations for Dimming	Spotlights and Searchlights
Alberta	Lights of moving or standing vehicles must be visible 200 ft. ahead and must display license number in figures 1 in. high.	The direct beam of light must not rise above 42 in. at a point 75 ft. ahead.	"No motor vehicle shall carry what is known to the trade as a searchlight."
British Columbia.	Efficient lights required. Lamp glass must display license number in black figures 1 in. high.	Lamp glass must be ground or painted.	No searchlights, intermittent lights or flashlights are allowed.
Manitoba	Lights must be visible 200 ft. ahead without glare.	Non-glare lens or other device is required and must be approved by the Municipal Commissioner or inspectors.	No searchlight is allowed on any motor vehicle.
New Brunswick..	Lights must be visible a reasonable distance.	Dimmers or non-glare lights are required.	No special law.
Nova Scotia	Lights visible a reasonable distance are required 1 hr. after sunset until 1 hr. before sunrise.	Lights must not dazzle.	
Ontario	Lights clearly visible 200 ft. are required.	No light over 4 cp. equipped with a reflector shall project a beam over 42 in. high at a point 75 ft. or more ahead.	Subject to laws governing headlights and dimming.
Quebec	Lights visible reasonable distance required.	Due precaution against glare must be taken.	No dazzling lights are allowed.
Saskatchewan ...	Lights must be visible 200 ft. under normal atmospheric conditions and reveal person 100 ft. ahead and 10 ft. to either side.	Lights must be permanently dimmed to prevent glare.	No special law.
Toronto	Lights must be clearly visible 200 ft.	No light of over 4 cp., equipped with a reflector, shall rise above 42 in. 75 ft. or more ahead.	No pivoted light allowed, or any light that can be projected in different directions.

The Trend of the Oil Industry in 1920

Year proves the most remarkable in history in nearly all respects. Commanding features are unusually large production, rapidly mounting imports, failure to locate quota of new pools, rapid rise of prices in first quarter and overproduction accompanied by declining prices near close.

By Joseph E. Pogue[1]

In practically all respects 1920 was the most remarkable year in the history of the petroleum industry. The commanding features of the twelve months just ended, so far as the automotive industry is concerned, were five in number: the unusually high volume attained by the domestic production of crude petroleum; the rapidly mounting imports of crude oil from Mexico; the failure of an active drilling campaign to bring in its due quota of new pools; a rapid rise of oil prices during the first quarter of the year; and the development of a period of overproduction accompanied by declining prices toward the close of the year.

Crude Petroleum.

The production of crude petroleum in the United States in 1920 attained the surprising total of 447 million barrels,[2] an advance of 18 per cent over the output of 378 million barrels characteristic of 1911. During the same period the domestic consumption of crude petroleum increased 28 per cent, from 419 million barrels in 1919 to 538 million barrels in 1920. This widening gap between production and consumption was made possible by a notable increase in imports from Mexico, which jumped from 53 million barrels in 1919 to 108 million barrels in 1920, thus slightly more than doubling. These relations are shown graphically in Fig. 1.

[1] Consulting engineer, New York.

[2] The 1920 totals given throughout this article are estimates based upon official figures for the first ten or eleven months of the year, to which are added graphically computed estimates for the remaining one or two months to complete the year. The totals given, therefore, will doubtless differ slightly from the official figures available in February or March, but the divergence will be of slight significance.

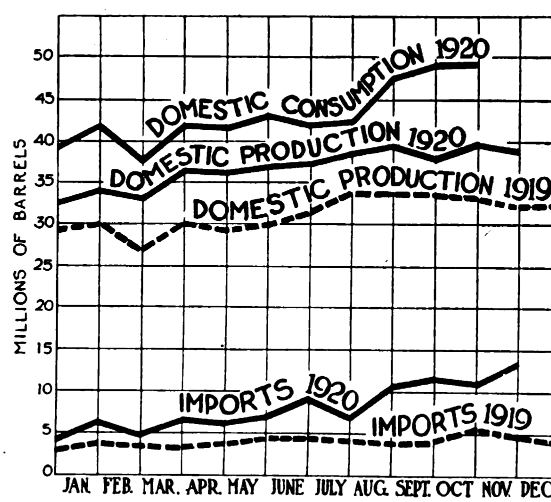


Fig. 2—Trend of the crude petroleum situation by months, 1919-1920

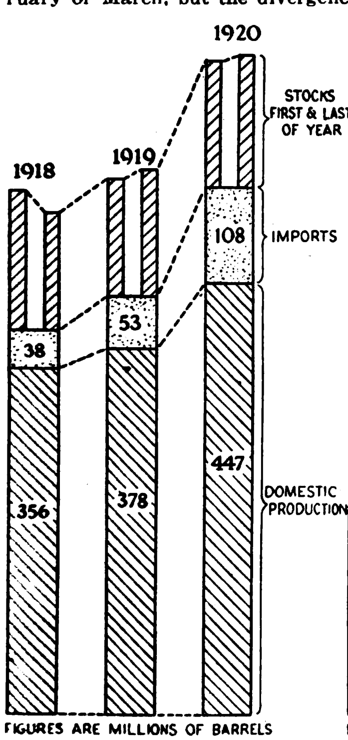


Fig. 1—Comparison of production, imports and stocks of crude petroleum in the United States, 1918, 1919, 1920

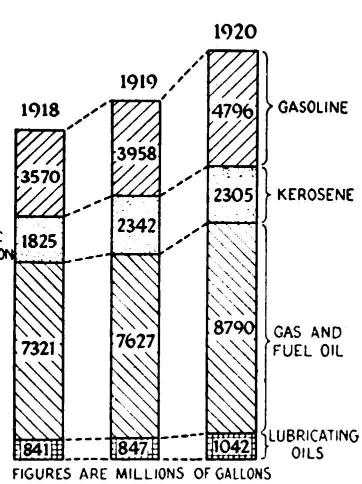


Fig. 3—Comparison of the production (of the major) petroleum products in the United States by years, 1918, 1919, 1920

Such were the year to year changes. During the course of 1920 production speeded up markedly during the first quarter of the year, maintained a good pace during the second and third quarters, and slowed up during the last quarter in reaction to conditions of overproduction that became evident toward the close of the year. Stocks of crude petroleum in the country reflected this condition by increasing from 128 million barrels on Jan. 1, 1920, to 137 million barrels on Dec. 31, 1920. During the year, imports of crude petroleum displayed an accelerating rate of increase. These relationships are presented graphically in Fig. 2.

During 1920, also, the number of oil wells brought to completion in the United States totaled 33,678, an increase of 16 per cent over the 29,069 wells completed in the year preceding. The figures just given reflect the intensity of the drilling campaign that characterized most of the year. It may be noted in this connection that on Oct. 31 there were 258,600 producing oil wells in the United States, averaging 4.98 barrels of oil each per day. The ratio of new wells to producing wells is a significant figure, pointing to the growing cost of oil production.

Between Jan. 1 and Oct. 15, 1920, the refinery capacity

of the United States, already in excess of the crude oil produced, increased approximately 27 per cent. Toward the close of the year the daily capacity of all the refineries in the country was 1946 thousand barrels, whereas the oils run daily to stills was only 1415 thousand barrels. Only about 73 per cent of the installed capacity was therefore being utilized in October, the month to which the figures just cited refer; and in November and December refinery activity notably fell off as a result of the seasonal decline superimposed upon the business depression. It is apparent, therefore, that the refineries of the United States are equipped in excess of market requirements, and many small refineries have in consequence ceased operations.

Petroleum Production

The principal petroleum products and those of interest to the automotive industry are, of course, gasoline, kerosene, fuel oil and lubricating oils. These four products, being made from the same raw material, have a joint relationship both as to quantity produced and market price. They should be looked upon in this light, therefore, if the true significance of their changes in status is to be grasped. A comparison of the production of these products in 1920 with their output in 1919 is given in Table I and graphically displayed in Fig. 3.

TABLE 1.—TREND OF PRODUCTION IN THE OIL INDUSTRY

		1918	1919	1920	Per cent change, 1918-1919	Per cent change, 1919-1920
Crude petroleum,	mill. bbl.	356	378	447	+ 6%	+18%
Gasoline,	mill. gal.	3570	3958	4796	+11%	+21%
Kerosene,	mill. gal.	1825	2342	2305	+29%	— 2%
Gas and Fuel Oil,	mill. gal.	7321	7627	8790	+ 4%	+15%
Lubricating Oils,	mill. gal.	841	847	1042	+ 1%	+23%

The last two columns of the table are particularly informing, since they unmistakably reflect the effect of the

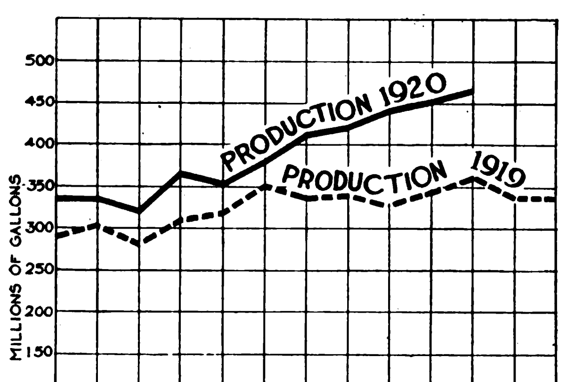


Fig. 4—Trend of the production and exports of gasoline by months, 1919-1920

automotive demand upon oil production. In 1919-1920 two products, gasoline and lubricating oil, entering into automotive transportation, increased more strongly than the domestic production of crude petroleum, whereas kerosene and fuel oil showed a smaller percentage increase than crude petroleum. With due qualification in mind, it is evident that a portion of the gasoline was made at the expense of kerosene and fuel oil, and a portion of the lubricating oils at the expense of fuel oil. This tendency, in spite of minor fluctuations and reversals, bids fair to continue with the expansion of automotive transportation.

Gasoline

The production of gasoline in the United States in 1920 attained the amazing total of 4796 million gallons, an increase of 838 million gallons over the 1919 output. The record production made in 1920 emphasizes the extent to which gasoline production was forced to meet the requirements of automotive transportation. Of the quantity produced in 1920, 618 million gallons, or 14.9 per cent, went abroad, leaving a domestic consumption of 4125 gallons, if the changes in stocks are taken into consideration. The trend of production and exports of gasoline during 1919 and 1920 is shown in Fig. 4.

The marked increase in output of gasoline, which ex-

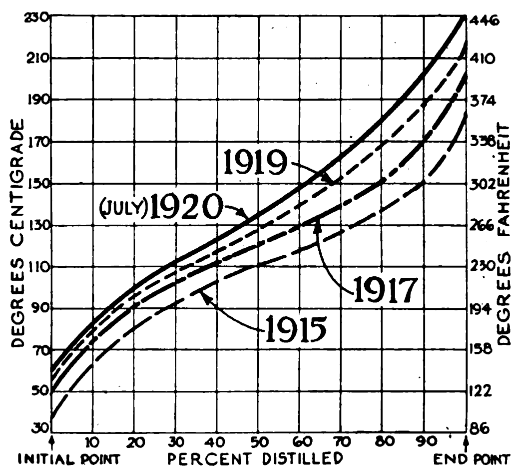


Fig. 5—Trend of the change in volatility of gasoline 1915-1920, *showing the rise in end-point. Data from U. S. Bureau of Mines*

ceeded the expectations of many of the most sanguine, was not attained without effort. A comparison with the increase in kerosene output (see Table I) suggests that an increased quantity of the light kerosene ends went into the gasoline supply to augment its volume. The degree to which the gasoline supply of the country was supplemented in this manner is shown by a country-wide motor gasoline survey conducted by the U. S. Bureau of Mines, the results of which are summarized in the following table:

TABLE 2.—TREND OF THE ENDPOINT OF MOTOR GASOLINE
Data from U. S. Bureau of Mines

	Endpoint, April, 1919	Endpoint, January, 1920	Endpoint, July, 1920
New York	411° F	418° F	432° F
Washington	426° F	439° F	449° F
Pittsburgh	425° F	425° F	454° F
Chicago	423° F	445° F	455° F
New Orleans	435° F	424° F	445° F
Salt Lake City....	441° F	440° F	456° F
San Francisco	374° F	406° F	428° F
Average	417° F	427° F	456° F

The change in the average endpoint of motor gasoline since 1915 is shown graphically in Fig. 5.

The rising endpoint of gasoline has attracted endless attention on the part of the automotive industry, although the true significance of this change has not been altogether fully understood in all quarters. The gasoline requirements of the country and of the export trade have grown so rapidly that the supply of gasoline has kept pace only by virtue of a change in volatility so as to include a greater proportion of the crude petroleum. In spite of additions to the normal gasoline supply in the form of volatile gasoline won from natural gas, and

gasoline produced from gas oil by means of cracking methods of distillation, a shortage would have intervened had a highly volatile standard been maintained. As to the future, it is probable that the endpoint of gasoline will show fluctuations and even recessions for a time, although it is the belief of many that the continued growth of automotive transportation in the years ahead will force still further changes toward a heavier and less volatile motor fuel.

Kerosene is assuming a growing interest to the automotive industry because of its use in the heavy service internal combustion engine, although the bulk of the kerosene is still used for purposes of producing light and heat. During 1920 as compared with 1919, kerosene showed a decline in both production and exports, in this respect standing in a marked contrast to the other principal petroleum products. The output of kerosene fell from 2342 million gallons in 1919 to 2305 million gallons in 1920, while the exports declined from 979 million gallons to 842 million gallons during the same period. These recessions in the quantity of kerosene coming on the market in the face of a greatly increased refinery consumption of crude petroleum merely represent a complementary circumstance to the high endpoint of gasoline.

Gas and Fuel Oil

Fuel oil, and its lighter, more highly refined variety gas oil, constituted 52 per cent of the total output of the four major petroleum products in 1920, as compared with gasoline which represented 28 per cent of the total. It is obvious, therefore, that fuel oil is a liquid fuel reserve of almost double the magnitude of gasoline, and too much emphasis cannot be laid upon the importance of this product as potential motor-fuel, whether the transition is made through cracking, changes in the automotive apparatus, or a combination of refinery and engine changes. The domestic output of gas and fuel oil increased from 7627 million gallons in 1919 to 8790 million gallons in 1920, an advance of 15 per cent. During the same period the exports of these products increased 35 per cent, or from 618 million gallons to 837 million gallons.

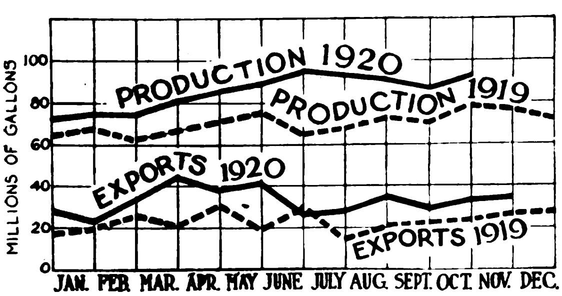


Fig. 6—Trend of the production and exports of lubricating oils by months, 1919-1920

Toward the middle of the year a serious shortage of gas oil developed, because of its growing utilization for the manufacture of cracked gasoline. Considerable attention was directed to the prospective supply by the gas companies of the country, since gas oil is widely used for enriching, or carbureting, manufactured city gas. The upshot of the wide publicity given the matter was an increased appreciation of the close interrelationship existing between the joint products of petroleum, and of the far-reaching influence upon the oil industry arising from the requirements of automotive transportation.

The production of lubricating oils in 1920 attained the surprising total of 1042 million gallons, an advance of 23 per cent over the 847 million gallons turned out in 1919. At the same time, exports increased from 275 million gallons to 401 million gallons. With the changes in stocks figured in, domestic consumption of lubricating oils increased from 574 million gallons in 1919 to 623 million gallons in 1920, the increase being largely due to the increased demand for motor oils.

The trend of the production and exports of lubricating oils during 1919 and 1920 is shown graphically in Fig. 6.

During the year considerable attention was devoted to the problem of dilution, and the relation between high endpoint gasoline and thinned out crankcase oil was clearly apprehended. This point was actively discussed at the meeting of the American Petroleum Institute in Washington in November, when the problem was looked at jointly by both automotive and oil engineers. The recognition of dilution as a part of the fuel problem registers an important step forward in the handling of this issue.

Exports

Exports of petroleum products play an important rôle influencing domestic prices, a vigorous export demand serving to take up the slack between supply and domestic demand. A comparative view of the exports of the major petroleum products in 1914, 1919 and 1920 is accordingly shown in the subjoined table, the year 1914 being introduced to indicate the pre-war export requirements.

TABLE 3.—EXPORTS OF THE PRINCIPAL PETROLEUM PRODUCTS IN 1914, 1919 AND 1920

	Exports, mill. gals.			Per cent of production exported		
	1914	1919	1920	1914	1919	1920
Gasoline	210	372	618	14	9	13
Kerosene	1010	979	842	52	42	36
Gas and Fuel Oil	703	618	837	19	8	10
Lubricating Oils	192	275	401	37	32	38

It will be observed that kerosene and lubricating oils group together in the fact that between one-third and one-half of the domestic output is normally sent abroad, whereas gasoline and fuel oil show an export factor of between one-tenth and one-fifth.

The stocks of petroleum products in storage in this country carry an important market meaning as a barometer indicating the tension between supply and demand. A detailed account of the course of stocks would be a long story, but a general view may be obtained from Table 4, in which the stocks of gasoline, kerosene, fuel oil and lubricating oils on hand on Oct. 31, 1919, and Oct. 31, 1920, are expressed in terms of the number of days' supply represented by these quantities.

TABLE 4.—NUMBER OF DAYS' SUPPLY REPRESENTED BY STOCKS ON HAND OCT. 31, 1919, AND OCT. 31, 1920[a]

	October 31, 1919	October 31, 1920
Gasoline	34 days	23 days
Kerosene	51 days	63 days
Gas and Fuel Oil	40 days	34 days
Lubricating Oils	66 days	49 days

[a]Calculated by dividing the stocks on hand by the average monthly consumption for the year.

In a period of falling prices in which accumulation of stocks of many commodities were in evidence, it is important to note the relative decline of petroleum products in storage, kerosene being the only major petroleum product showing an advance over 1919, and that but a moderate advance. Further significance of these figures appears from a comparison with the average stocks of all commodities which have been estimated by the Chase

National Bank to have been approximately 41 per cent of the annual production on Feb. 1, 1920, or roughly 150 days' supply. It is, therefore, apparent that the working reserve of petroleum products in this country is less than half as great as the working reserve of commodities in general. In spite of these conditions, the stocks of the major petroleum products have been increasing slightly during the latter portion of the year, particularly since autumn, as a result of a combination of the normal seasonal slackening in demand combined with the results of the business depression. Such changes, however, are to be looked upon as temporary fluctuations rather than fundamental alterations.

Prices

The price situation showed some interesting developments in the year just past. During the first quarter of the year the price of crude petroleum advanced sharply, rising some 40 per cent between Jan. 1 and March 31. This sharp advance was accompanied by an analogous rise in the price of fuel oil and lubricating oils, and by a less precipitate but still a notable increase in gasoline and kerosene. The second quarter of the year saw further rises in the price level, which became more or less stabilized for the rest of the year for crude petroleum, gasoline, and kerosene, but broke into sharp declines for fuel oil and lubricating oils, the two last named products tending to follow the price decline of commodities in general.

This remarkable course of prices in the petroleum industry, which in part ran counter to price developments in general, may be shown effectively by index numbers with 1913 as a base. Table 5 shows the results of expressing the price changes in this manner.

TABLE 5.—THE COURSE OF PRICES IN THE PETROLEUM INDUSTRY
(Average prices for 1913 = 100)

	1913	1919	1920 1st Q.	1920 2nd Q.	1920 3rd Q.	1920 4th Q.
Crude Petroleum	100	197	270	311	314	311
Gasoline	100	142	154	169	176	179
Kerosene	100	162	202	213	226	226
Fuel Oil	100	147	233	288	286	226
Lubricating Oils	100	209	293	344	336	302
All Commodities[a]	100	212	250	269	251	207

[a]U. S. Bureau of Labor Statistics.

The course of the average price of crude petroleum and its principal products is shown graphically by years in Fig. 7.

The price changes for a selected number of characteristic grades of petroleum products of interest to the automotive industry are shown in the table following:

TABLE 6.—CHANGES IN PRICE LEVEL OF SELECTED GRADES OF CRUDE PETROLEUM AND ITS PRODUCTS IN 1920

Grade	Quotation	Unit	Price, Jan. 1	Price, July 1	Price, Dec. 31
Penn. Crude..	At wells	Dols. p. bbl.	5.00	6.10	6.10
Kan.-Okla. Crude	" "	" " "	2.75	3.50	3.50
Gulf Crude (Humble) ..	" "	" " "	1.50	3.00	2.50
Gasoline, N. Y.	Tankwagon	Cents p. gal.	25.5	30.0	31.0
Gasoline, Chi..	"	" " "	21.0	26.0	26.5
Gasoline, K. C.	"	" " "	21.2	26.2	26.5
Kerosene, N. Y.	"	" " "	18.0	18.0	19.0
Kerosene, Chi..	"	" " "	15.5	18.5	18.5
Fuel Oil, Okla.	Refinery	Dols. p. bbl.	2.55	3.10	1.75
Lubs. Penn. Neutr. 200..	"	Cents p. gal.	27.0	35.0	22.5
Lubs. Okla. Neutr. 200..	"	" " "	17.6	27.3	21.8
Lubs. Penn. Cyl. Stk. 600.	"	" " "	33.5	48.5	26.0

The falling prices of fuel oil and lubricating oils during the latter portion of 1920, in the face of the maintenance of the price level for crude petroleum, seriously curtailed the margin of profit enjoyed by refineries in general and entirely wiped away this factor of safety in respect to many small refineries, especially the skimming plants in the south-central portion of the country. As a result of this circumstance and of complications growing out of the period of credit stringency through which the country has been passing, the mortality among refineries has been high in numbers. But, nevertheless, the refinery capacity of the United States is so over-expanded, and the country's petroleum products are so dominantly produced by refineries of 10,000 barrels daily capacity and above, that the rather wholesale closing of small refineries in certain sections of the country may not be expected to exert a far-reaching effect upon the productive capacity of the industry in the months ahead.

Summary

By way of summary, the outstanding features of the year were the following:

(1) The supply of crude petroleum, both from domestic and Mexican wells, increased surprisingly and led to conditions of moderate over-production toward the end of the year.

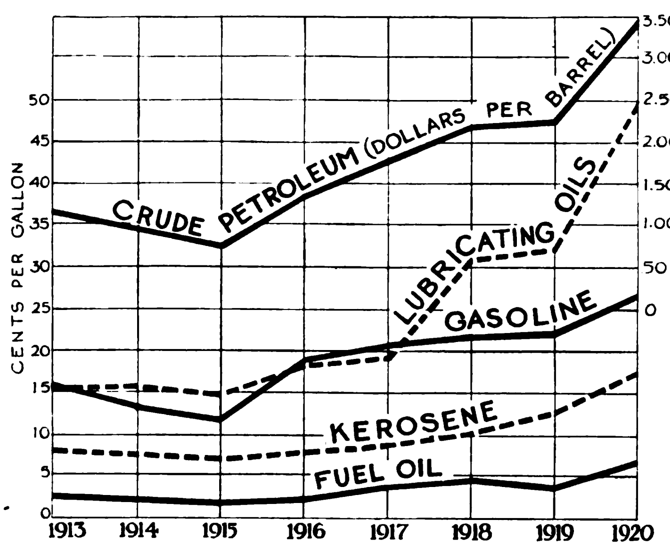


Fig. 7—Trend of the average price of crude petroleum and its principal products by years, 1913-1920

(2) The new production per well "brought in" in 1920 was less than in 1919, pointing to the necessity for intensive development if domestic production is to be maintained; toward the close of the year drilling operations were greatly curtailed.

(3) The supply of gasoline kept pace, but only with difficulty, with the greatly enlarged requirements of automotive transportation.

(4) The endpoint of gasoline notably increased during the year, this rise being accompanied by a lessened output of kerosene relative to the quantity of gasoline produced.

(5) A shortage of heavy-bodied lubricating oils developed during the early months of the year, which in turn led to greatly augmented production later on.

(6) Both crude petroleum and its principal products rose sharply in price to levels from which only fuel oil and lubricating oils partly receded.

(7) The oil industry was less affected by the period of industrial depression through which the country has been passing than most other activities, although a deferred effect has unmistakably been felt.

How the Automotive Industries Fared in 1920 Metal Market

Here you will find an explanation of the industrial statistics that have served only to confuse you during the last year. Also you will find statements of the use of metals in our industry and the prospects for 1921.

By William Crawford Hirsch*

A CURVE depicting the ups and downs of the iron, steel and non-ferrous metal markets in 1920 and one delineating the periods of prosperity and adversity in the automotive industries, would be as one egg is like another. The placing of this observation at the outset of this retrospect of metal market conditions in 1920, is prompted by the zeal with which statisticians, when the heyday of bloated values and fat premiums had vanished, sought to comfort the steel industry by stressing what they were pleased to call the minor importance of the automotive industries as a consuming outlet for iron and steel products. In the same breath in which they berated the automotive industries for having brought about the runaway steel market of the first half of 1920, they belittled the self same factor's importance as a buyer of steel by statistical legerdemain. The automotive industries consume only 2.6 per cent of the total steel ingot production. The automotive industries absorb only 3.5 per cent of the entire rolling mill output. These were some of the stones thrown into the steel industry's own garden. The deceptive character of these figures is all the more insidious because, standing by themselves, their inaccuracy is slight, while they are grossly misleading when employed to demonstrate the minor importance of the automotive industries in the steel market.

The measure of the automotive industries' support of the steel industry is **not one of tonnage but of dollars.** Conceding for the time being the correctness of the estimate that only 2.6 per cent of the steel ingot production went into automotive manufactures in 1920 (an estimate the shortcomings of which will become obvious later), the fact remains that the steel industry derived more gross and more net revenue in 1920 from the automotive industries than from any other source, not excluding the railroads. This is universally conceded by steel producers and very easily explained.

The automotive industries buy steel in highly finished form. The differential which automotive builders pay over ordinary black sheets for highly finished sheets, suitable for body, fender and radiator stock, is equivalent to the cost of two tons of rails for every three tons of such sheets. And this is only the differential over black sheets. When automobile sheets sold at record breaking prices last spring, a ton of this material represented a payment of approximately $350 to the rolling mill. At the same time railroads were paying $55 a ton for rails. Yet both rails and sheets are lumped as rolling mill products.

These preliminaries are merely intended to open the reader's eyes to the absurdity of a statement such as that the automotive industries consume only 3.5 per cent of the total rolling mill output. It would be just as logical to say that diamonds make up only a fraction of a per cent of the weight of the entire jewelry output.

Moreover, all these estimates are based on the weight of the steel in the finished automotive unit, multiplied by the number of such units reported to have been built in a given year. As a matter of fact, when the statement is made that the average passenger car contains 913 pounds of steel and 630 pounds of pig iron, the use of these figures as a basis to compute the amount of steel and iron purchased for the construction of this car is entirely unwarranted. The amount of scrap that results from cutting sheets to size and from machining cast or forged bars is so great that the tonnage purchased is far heavier than that represented in the finished product.

And what of the thousands of tons of steel that are absorbed by the machine tools and other equipment of automotive plants, to say nothing of tire, artificial leather and other accessory manufactories? To the steel statistician anything and everything that is tubular, is "oil country goods" wherefore he fails to credit automotive consumption with the thousands and thousands of tons of steel required to satisfy its needs in this direction. Because gasoline tanks and pumps are not part of the passenger car, truck or tractor, they have no place in his reckonings.

The course of events, however, has overtaken these statistical falsehoods and clearly established the undeniable fact that not only are the weal and woe of the iron, steel and non-ferrous metal markets indissolubly linked with the fortunes of the automotive industries but that, moreover, real, genuine prosperity in the former is predicated upon a like condition in the latter. Reviewing the trend of prices and conditions governing the markets for pig iron, steel products and non-ferrous metals in 1920, we find evidence after evidence of this. In fact, the year under review is divisible into two epochs, the first period coinciding with that of unalloyed prosperity in the automotive industries and the second marking a gradual transition from the prince to the pauper rôle. Tradition has it that the steel industry's repertory is made up of these two extreme parts and that it can play no other. If this is true, then it is condemned to play the part of the pauper until the automotive industries re-enter the stage as Lady Bountiful.

The year 1920 inherited from its predecessor a severe case of rich man's gout and this was aggravated by the utter disregard for price which those engaged in the automotive industries continued to display when it came to their quest for prompt deliveries of pig iron and steel products. It was nothing short of adding irony to insult

*Editor *Raw Materials*.

when those who were obtaining outrageously excessive prices for steel, pleaded that it was not their fault but must be charged to account of the automotive consumers, who were falling over one another in their mad scramble for supplies.

It was perfectly natural that automotive builders were anxious to maintain their production schedules and, when the railroad strikes began in April, they moved heaven and earth to obtain the necessary iron, steel, and non-ferrous metals for their operations. The transportation strikes furnished a blanket policy of insurance holding mills immune from liability for non-delivery of material contracted for. Much of this material, however, was turned out in spite of the scarcity of raw materials, and formed the sustenance of a premium market that soared and soared until its own top-heaviness caused its downfall.

The unnatural price levels established in this market together with the price schedule of the United States Steel Corporation, which remained unaltered throughout the year, and a somewhat higher range of values quoted by the representative "independents," constituted the tripartite price record that continued during the first half of the year. With the return of near-normal transportation conditions and a general awakening to the dangers of inflation, the premium market vanished and there remained the dual price condition of the Corporation and the representative "independents." This state of affairs persisted until October brought the first signs of a let-up in demand from the automotive industries and from then until the end of the year was consumed in a gradual wiping out of all differences in prices between the Corporation and "independents," with the result that the end of the year witnessed a virtually once more uniform price schedule, that of the Corporation.

A very modest estimate of the amount which the "independent" steel mills received in 1920 in excess of what they would have received, had they sold their output at the same price as the Corporation, is $250,000,000 to $350,000,000. When there is added to this the amount that was "cleaned up" by intermediaries in the form of premiums on top of premiums during the "famine" period, the amount paid by consumers for the output of the "independent" mills in excess of the Corporation's prices, may be put down as having been very close to $500,000,000. It is left to the reader's recollection of the days when it was nothing unusual to bring a "load" of steel in a Pullman compartment from Youngstown or Pittsburgh to Detroit, to estimate how much of this bill was defrayed by the automotive industries.

Course of the Pig Iron Market

With the exception of 1917, the present generation has not witnessed pig iron prices of the magnitude recorded last year. In a large measure blast furnace interests ascribe these phenomenal prices to the corresponding condition in the coke market in which July witnessed quotations of $18 for furnace coke, f. o. b. Connellsville ovens. This compares with an average price of approximately $1.75 in 1914. Aside from this influence and undoubtedly generally enhanced production costs resulting from increased freight rates, there was in evidence, however, a disposition on the part of some of the pig iron interests to force the establishment of a $50 pig iron market and to "hold it there." Foundry iron which had started the year at $38.50, valley furnace, gradually went higher and higher until in September $50 became a nominal quotation for at least a brief spell. When pig iron sellers sought to make this an actual instead of merely nominal quotation, consumers, especially automotive foundries, balked and the first of the "consumers' strikes" which have since then become fashionable, ensued. Certain pig iron interests excoriated those who dared to question the justice of and the justification for a $50 market and predicted "much higher price levels." At the close of the year, however, after 215 out of a total of 416 furnaces had gone out of blast, the price for No. 2 foundry was down to $33 and sellers were hunting in vain for buyers.

The year 1920 marked the entry into the ranks of pig iron producers of one of the large automotive interests. Reports that this factor was offering iron of his own manufacture, at prices below the general market, served to hasten the return to saner values. When the market approached the $50 level, quite a number of automotive foundries that were holding contracts for the delivery of pig iron at below $40, turned resellers.

The two grades which are chiefly used in automotive foundries established the following price record, which is compared with that of 1913, the last normal pre-war year.

Pig Iron Prices in 1913 and 1920

	Foundry No. 2 (Valley Furnace)		Malleable (Chicago)	
	1913	1920	1913	1920
January	$17.50	$38.50	$18.00	$40.50
February	17.00	41.00	17.25	42.75
March	16.50	42.00	17.25	43.50
April	15.50	42.50	17.00	43.50
May	14.75	44.00	16.00	43.50
June	14.25	45.00	15.75	43.50
July	14.00	45.00	14.75	45.25
August	14.00	47.75	15.00	46.50
September	14.00	50.00	15.00	46.50
October	14.00	46.75	15.25	46.00
November	13.50	40.75	14.75	42.00
December	13.50	33.50	14.50	33.00

History of Semi-finished Steel

From the point of view of the automotive industry, sheet bars in 1920 were more than ever the key commodity of the semi-finished steel market. This product represents the intermediate stage between the raw steel and the finished sheet and for this reason is always of greatest importance as a market criterion. But in 1920 the sheet bar assumed double importance to the large automotive interests for the simple reason that they not merely had to keep their eyes on the sheet bar market but actually were compelled to go on periodical sheet bar hunts. In the first half of the year it became almost a custom for passenger car builders to buy sheet bars from the bar rolling mills and furnish them for conversion to the sheet mills. Under normal conditions even the smallest of the sheet rolling mills were accustomed to buying their own sheet bars and selling the finished automobile sheets, making a legitimate profit not only on their conversion but also on the raw material. When the location of sheet bar tonnages obtainable at anywhere near reasonable prices became, however, a task that tried the most resourceful, these sheet manufacturers threw up the sponge and told the automotive purchasing agents that, if they wanted sheets, it was up to them to provide the bars. The latter, urged on by their production managers, lost sight completely of the United States Steel Corporation's sheet bar price of $42 and went out to get the material at any figure, with the result that many a sale of sizable tonnage was reported in June at $90 and, in a few isolated instances, sales at higher than $100 were reported to have been made. The following table of prices in 1920, compared with those in 1913, does not record these absurdly high levels which were paid in the form of a premium over the quoted market price; yet comparison with the levels that pre-

vailed in the last pre-war year, tells the story of the price orgy eloquently:

Prices of Open-Hearth Sheet Bars, Pittsburgh

	1913	1920
January	$29.25	$50.00
February	30.00	67.00
March	30.00	75.00
April	28.25	72.50
May	27.50	72.50
June	27.00	75.00
July	27.50	72.50
August	26.25	70.00
September	25.00	66.00
October	23.00	65.00
November	21.50	50.00
December	21.00	47.00

The story of sheet bars was typical of all forms of semi-finished steel, so that we may proceed to a consideration of the movement in the finished steel market.

Finished Steel Products

If automotive consumers paid swollen prices for sheet bars in 1920, they paid nothing short of a king's ransom for such automobile sheets as were obtainable in the finished state either from rolling mills or resellers. Reference has previously been made to the startling levels that were obtained for highly finished sheets but there was a brief period in mid-summer, when even ordinary No. 28 black sheets for early delivery were sought at as high as 15 cents.

According to *The Iron Age*, the total sheet production in 1920, exclusive of tin and terne plate, amounted to 2,600,000 gross tons. Of this tonnage, 85 per cent, or 2,200,000 tons, were sheets of 13 gage and thinner. Any one who followed the character of the buying last spring and summer, will concede that virtually all of the latter sheet went into passenger cars and of the 400,000 tons of sheets, 12 gage and thicker, the bulk undoubtedly was used for frames.

That the automotive industries consumed last year 2,000,000 tons of sheets, is a very conservative estimate. This is the equivalent of 4,480,000,000 pounds. At an assumed average price of 6½c. (which, in view of the price record, is very modest), this tonnage would represent an approximate outlay of close to $300,000,000, which, in itself, disposes of the absurd misstatements that the automotive industries constitute a small factor in the steel market.

The following table, contrasting 1913 with 1920 prices for No. 28 black sheets, does not record the startling premiums that obtained in the late spring and mid-summer:

No. 28 Black Sheets, Pittsburgh

	1913	1920
January	2.30	5.00
February	2.35	6.00
March	2.35	6.00
April	2.35	6.00
May	2.35	7.00
June	2.30	7.00
July	2.25	7.00
August	2.20	7.00
September	2.10	7.00
October	2.05	7.00
November	2.00	6.00
December	1.85	4.45

To cite the price records of other finished steel bought by the automotive industries, such as cold-rolled strip steel or of bolts and nuts, would be merely duplicating the performance of sheets. Up to the latter part of July, when the first indication of a slowing up in automotive cast its shadows before, any price was fair from the sellers' point of view. This was followed by a period of grim determination on the part of the independent producers to maintain the differentials which they had established over the Corporation's levels, but, in October, it became discernible to all that it was no longer possible to maintain these quotations even as purely nominal and, amid utter idleness, prices gradually shed their obesity.

Alloy Steels

The alloy steel industry, as constituted to-day, is really a creation of the automotive industries and utterly dependent upon the latter not merely for its partial support but for its very continuance. As the result of their serviceability in the making of axles, connecting rods, crankshafts, gears, steering knuckles, high tensile bolts and a variety of smaller parts, either forged or machined from hot- or cold-rolled or drawn bars, nickel-chromium steels came to the front in 1920. On the other hand, there appears to have been some diminishment in the use of vanadium in automobile steels. Metallurgical progress centered around the electric furnace and heat treatment methods and, while a number of complex ferroalloys were put on the market, none of these found practical employment in the automotive industries.

Prices for special alloy steels are and will always remain a matter of individual arrangement between sellers and consumers. They are specialties of varying analyses and into their cost enters, to some extent at least, the steel maker's reputation for metallurgical skill and accuracy. What happened in the alloy steel market last year may, however, be fairly judged by the price movement of ferromanganese which still remains the key alloy.

Ferromanganese Prices

	1913	1920
January	$68	$146
February	65	172
March	65	216
April	61	240
May	61	250
June	61	225
July	59	225
August	56	198
September	56	170
October	50	170
November	50	170
December	47	135

Non-ferrous Metals

Viewed in the retrospect, the year 1920 was one of orderly deflation in the non-ferrous metal markets. The writer of this review considers himself fortunate that he was not called upon to prepare this article last December when, under the spell of the wave of pessimism that prevailed at that time, annual résumés of the non-ferrous metal markets took on a much darker hue than appears warranted. The non-ferrous metal business is, far more so than the steel business, one of short-time financing and, whenever money becomes as tight as it did in the closing months of the year, forced liquidation is bound to give the market a funereal appearance. Then follows a calm survey of the statistical position and the invariable result is that the old law of supply and demand has once more worked for the best. Before considering the record of the market's key metal, copper, the 1920 history of aluminum may be briefly summarized because of the commanding position of the latter from the point of view of the automotive industries.

Aluminum's History in 1920

The year opened with the sun shining brightly in the automotive field and for several months the sole domestic producer could not satisfy the demand, although

working at full capacity. Here and there, odd lots of imported metal bobbed up but, up to the middle of July, the 32.75 cents price for No. 1 virgin ingots, 98 to 99 per cent pure, of the Aluminum Company of America was to all intents and purposes the market, the importers refusing to shade this price level more than a fraction of a cent, so long as it was clearly evident that the demand exceeded the supply. Fastidious automotive consumers hesitated, when foreign metal was offered to them at concessions from the domestic level. Some of the importations consisted of mixed lots that might and might not come up to analysis. The American interest announced an advance to 33 cents at the very time when the first signs of a slackening in the demand made themselves felt and then a veritable avalanche of imported aluminum began to inundate our shores. Not only England and France shipped metal and sheets here but Norway, Germany and other countries figured as sellers. Judging from some of the aluminum offers received from Germany, that country must have an even more plentiful supply of bauxite (the mineral from which aluminum is extracted) than of paper marks. Lower and lower went prices in the "outside" market until at the end of the year the metal was offered freely at 25 cents. Meanwhile, the American producer had instituted a spot price for immediate deliveries, several cents higher than the "outside" market but considerably below his contract price which was maintained intact for strategic reasons.

Imports of aluminum and aluminum manufactures in 1920 probably amounted to around $14,000,000, compared with about $9,000,000 in 1913 and $12,000,000 in 1919. The American producer is asking for the restoration of a duty of 7 cents a pound. In this, he is opposed by the consuming interests. Meanwhile, a new octopus has been born in the European aluminum industry, the Compagnie d'Alais which, after absorbing the Société Electrometallurgique Français, controls 90 per cent of the aluminum producing capacity of France, besides the works in Norway and a controlling interest in the Italian aluminum works.

The price record of aluminum, compared with that of 1913, is given here for the "outside" market:

Aluminum Prices for No. 1 Virgin Ingots, 98 to 99% Pure
(Outside Market)

	1913	1920
January	26	32
February	26	32
March	27	31½
April	27	31⅝
May	26	32
June	25	32
July	23½	32
August	22¾	32¼
September	22	35
October	20¼	29
November	19½	27¾
December	18¾	24

Copper's Eventful Course

The year 1920 inherited from its predecessor a surplus of refined and blister copper of 941,000,000 pounds and bequeathed to its successor a surplus of 874,000,000 pounds. These figures really tell the story of the movement in the red metal in a nutshell. The load inherited from 1919 was too heavy a burden and, as a result, the 19 cents price level at which electrolytic opened the year, sagged and sagged until at the close of December buyers at 13½ cents were as scarce as hens' teeth. Producers had recourse to every possible device to stem the downward course which did not become precipitate until October. They lowered refinery production from approximately 1,750,000,000 pounds in 1919 to 1,575,000,000 pounds in 1920. Ever so often the spokesmen of the copper industry would give out interviews that the demand from Europe for copper had at last set in and that it would not be long before England, France and Italy would literally eat up the surplus and, if they left any of the red metal over, Germany would lick the platter clean. But custom house returns failed to substantiate these predictions and exports showed only a slight improvement over 1919, much of the metal going abroad being strongly suspected of being shipped on consignment.

From the standpoint of the automotive consumer of copper, the most interesting development of the year was the activity of a research committee appointed by the copper producers to investigate the causes underlying the ailing copper market. This committee made the following report regarding copper consumption by the automotive industries:

> In no one industry has public ignorance of the merits of copper and brass been more costly than in automobiles. Since the first year of the war there has been a steady tendency toward iron products until the total amount of copper and brass now used in the average automobile is about 36 pounds. To this substitution in structural and working parts is attributed the tremendous increase in the automobile repair business in the last few years. The breaking down of cars turned out in the last five years is particularly noticeable in coast cities where salt air affects machinery not immune to rust. A notable exception to this war-time and post-war substitution is a certain large passenger car which the A. E. F. made famous in Europe. It contains 200 pounds of copper in striking contrast to another large and high-priced car that contains 30 pounds.

This is not the place to make suitable answer to these *ex-parte* statements which must be replied to in terms of tensile strength, elongation and specific gravity of the high grade alloy steels to which the copper committee refers as "iron products." Coming out of the mouths of the copper producers themselves, however, the fact may be put down that there has been a falling off in the consumption of copper in the unalloyed state in the automotive industries. That the tonnages of copper consumed in brass parts that enter into automobile manufacture is considerably greater than generally supposed, is certain. The statement recently made that the automotive industries consume approximately 75,000,000 pounds of brass a year or around 7 per cent of the total output, is based on altogether false premises. It takes no account, whatsoever, of the very large output of automotive castings, screw machine products, etc., that are made from secondary metal or so-called ingot metal which the foundries purchase from secondary refiners. A clear picture of the course of values in 1920 may be gained by means of the following table comparing 1920 prices with those of 1913.

Price for Electrolytic Copper, New York

	1913	1920
January	16¾	19
February	15¼	18⅝
March	15	18⅜
April	15½	18½
May	15⅝	18¼
June	14⅞	18
July	14½	18⅝
August	15⅝	18½
September	16½	18
October	16½	16¼
November	15½	14⅜
December	14½	13½

Highlights in the Tin Market

Tin is of chief interest to the automotive industries because it enters into solder and babbitt, although it is also used for the plating of radiator parts and, with copper and zinc, forms an essential constituent of bronze. The outstanding feature of the market was the tremendous accumulation of white metal alloys, such as babbitt and solder, which, when the slump came in October, were a drug on the market. The chief influences in the tin market were the kaleidoscopic changes in the value of the pound sterling, speculation both in London as well as here, and a paternal interest on the part of the Federated Malay States Government in the welfare of the Straits Settlement tin producers which led to the adoption of a quasi-valorization scheme that sooner or later must lead to disaster. Compared with 1913, the course of values was as follows:

Straits Tin, New York

	1913	1920
January	50	63
February	49	60
March	47	62
April	49	62
May	49	55
June	44	49
July	40	49
August	42	48
September	42	45
October	40	41
November	40	37
December	38	34

Ups and Downs in Lead Market

Because of the predominant use of lead in storage batteries and other automotive parts, the market for this metal was a true replica of the tide and ebb in the automotive industry. As a lead consumer, the latter is exceeded only by the paint industry. At one time there were heavy importations of foreign metal, the differential between the relatively high New York and the relatively low London market making such operations profitable for a brief spell. The entire domestic output was 525,000 short tons compared with 517,000 tons in the preceding year. Compared with 1913, the price movement was as follows:

Monthly Average Lead Prices, New York
(Am. Smelting & Refining Co.)

	1913	1920
January	4.35	8.32
February	4.35	8.75
March	4.35	9.21
April	4.40	9.25
May	4.36	8.65
June	4.35	8.24
July	4.37	8.20
August	4.63	8.83
September	4.75	8.52
October	4.45	7.47
November	4.34	6.61
December	4.06	4.94

Zinc Prices in Slow Descent

Zinc did not fare very much different from lead in 1920. The market's undertone, however, was always decidedly weak because of a considerable surplus which is an old sore in the zinc industry and which is no nearer to elimination now than it was two years ago. In spite of this millstone around the producer's neck, there were large importations during the year as the result of cheap offerings from Belgium and Germany in London. As will be seen from the following table, the market at the end of the year was very close to the levels of the pre-war period:

Prime Western Zinc, East St. Louis

	1913	1920
January	7	9¼
February	6¼	8¾
March	6	8⅝
April	5½	8¼
May	5¼	7¾
June	5	7½
July	5¼	7⅞
August	5⅝	8
September	5⅝	7¾
October	5¼	7¼
November	5⅛	6⅝
December	5	5⅞

Sundries of Metal Market

Nickel, which is used by one of the large battery producers, and also enters heavily into the manufacture of automotive steels as well as into plating of certain parts, remained virtually unchanged in price. Production has been lowered sharply so as to correspond with the diminished demand. Deputy Minister Thomas W. Gibson of the Ontario Department of Mines, referring to the expanded capacity of the nickel producing companies as one of the war's results, says that now "they feel all dressed up, but nowhere to go."

The antimony market moved from 10½ cents at the opening of the year to 5½ cents at the end, with the high at 11½ cents in February. The untoward exchange situation injured the Chinese producers more than the gradual deflation of values of which they had their first taste early in the year, when the business collapse in Japan put commercial and industrial affairs in the Orient at sixes and sevens.

The Outlook for 1921

The foregoing record of 1920 in the iron, steel and non-ferrous metal markets, together with such observations of the course of values which the interval since the beginning of the new year has permitted, afford a fairly definite basis on which to rear a sound purchasing program for 1921. While detached consideration of the price tables comparing 1913 prices with those of 1920, may in the case of pig iron and steel products lead to the conclusion that the spread between the levels which prevailed before the cataclysm of the world war, and those which marked the close of last year, is still too great, it will be well to remember that virtually all economists are agreed that there will be no complete return to pre-war commodity prices in our generation.

Further price adjustment is likely to be devoid of the spectacular and relatively slow. In many of the non-ferrous metals, values have declined to levels out of gear with the general run of basic commodities. Anticipation of reasonable wants appears to be justified, if for no other reason than that further postponement of buying is certain to lead to the accumulation of a large suppressed demand which, when it does make itself felt, can have but one result, i.e., to bring about an upward reaction in prices which would still longer delay the orderly process of a return to normal. Nothing is to be gained by a further drying up of the sources of supply. In spite of the ill-thought vaporings of this or that figure-juggling detractor of the importance of the automotive industries as a consumer of iron, steel and non-ferrous metals, the fact remains that to no other factor do the producers of these commodities look so much to make the smoke belch forth from their blast furnaces, smelteries, refineries, foundries and rolling mills than to full revival of automotive production and activity.

Present Status of German Automobile Industry

This article describes the engineering, social, and economic aspects of the German automobile industry at the present time. It points out the general tendencies in design and production and indicates the handicaps which are being encountered. 43 factories producing cars or trucks.

By Benno R. Dierfeld

THERE are at present 43 automobile factories in Germany, 14 of them building passenger cars and trucks, 20 of them producing only passenger cars and 9 factories building only motor trucks. The 34 works building passenger cars produce about 90 different models as listed in the following table:

10	car	types	below	16	brake	hp.
10	"	"	of	16	"	"
13	"	"	up to	22	"	"
15	"	"	" "	30	"	"
5	"	"	" "	35	"	"
7	"	"	" "	40	"	"
11	"	"	" "	45	"	"
16	"	"	" "	55-80	"	"

The table shows that cars of 22 to 30 brake hp. are very frequently built and that a large part of the German manufacturers obviously believe these car sizes to be most suitable for the German customers. On the other hand almost as many cars have engines of 45 brake hp. or larger, representing an opposite opinion of some of the larger factories. Thirteen works build a single model, 8 firms build 2 models, 6 firms 3 models each, and only 7 factories build more than 3 models. The stroke to bore ratio is very different and varies between 1.3 and 1.6; a united opinion about the most favorable ratio still does not seem to be existing at present, for different car types, built by one firm, show different stroke to bore ratio. The design of the German passenger cars does not differ materially from the outlines given in my article, "The German Passenger Car Industry After the War" (AUTOMOTIVE INDUSTRIES, May 27, 1920). The disk clutch is only used by five works and only one car has left-hand drive. Of course electric starting and lighting systems are applied to many cars, but the car prices then are very high. No important change can be found in the German passenger car market up to the present moment, but a car of revolutionary design now is completing its test runs and surely will cause a sensation when the first details are published; cycle cars, of course, show many innovations. The selling prices of passenger cars are not materially lower.

The 23 factories producing motor trucks build 51 truck types with the following engine powers:

4	truck	types	of	25	brake	hp.
2	"	"	"	28	"	"
5	"	"	"	30	"	"
7	"	"	"	35	"	"
2	"	"	"	38	"	"
4	"	"	"	40	"	"
5	"	"	"	42	"	"
9	"	"	"	45	"	"
8	truck	types	of	50	brake	hp.
2	"	"	"	55	"	"
2	"	"	"	60	"	"
1	"	"	"	86	"	"

An engine power of 30 to 50 hp. seems to be most suitable for the use of German customers. Eight firms only build 1 truck type, 5 firms 2 types, 4 firms 3 types, 4 firms 4 types and 1 firm 5 types. The stroke to bore ratio varies from 1.3 to 1.6, the number of revolutions from 800 to 1500 per min. Almost all cylinders have non-detachable L or T-head and the cooling is effected by pumps. Only 4 types have thermo-siphon cooling and 1 type air cooling. Pump lubrication and magneto ignition are always used. Clutches are in most cases of the simple cone design, only 1 type using double cone clutches and 7 types disk clutches running in oil. Almost all transmissions are of usual design and have four speeds and reverse, only 3 types having a 3-speed transmission; the rear axle drive is effected on 30 types by cardan shaft and bevel gears, on 20 types by two side chains, on 1 type by internal gear. One brake is arranged on the transmission and operated by pedal, the others are in the two rear wheels and operated by hand lever; the springs invariably are half elliptic and have in some cases small auxiliary springs. The steering post is located at the right side. The cast steel wheels have single plain rubber tires at the front and twin plain tires at the rear. Pneumatic tires for trucks are unknown in Germany. The loading capacity of the trucks varies from 1 to 5 tons and their speed from 15 to 60 kilometres (9.3 to 37 miles) per hour.

The economic or commercial situation of the German automobile industry is materially influenced by the exchange rate of the German mark; if the value of the mark advances the German works cannot export, for the German automobile prices are high on account of the high wages and the increasing costs of raw materials. Therefore, during the summer and autumn of 1920 a stoppage of the German automobile export occurred and the consequence was an increased supply for the home market. Dealers who formerly were very glad to receive any cars at all, were overwhelmed with car offers by the manufacturers. Sales on the home market were few. Not only has the customer's ability or inclination to buy gradually diminished, but also the customer calculated that automobile prices would drop as a result of overproduction. When old orders have been filled the only new market for trade will be the export to foreign countries. Therefore the German automobile industry wishes the annulment of the export duties, an

antiquated institution established at a time when the world market price was considerably higher than the home price, and with the purpose for preventing a clearance sale of German automobiles.

At present the value of the German mark has dropped home price, and with the purpose of preventing a clearance sale of German automobiles.

As it is impossible to import motor vehicles into Germany on account of the unfavorable exchange rate and other restrictions, some prominent American firms have successfully tried to gain a solid footing in Germany, not only on account of the German market, but also because Germany serves as a base to the large Russian market and to the other northern, eastern and southern countries. One year ago the International Harvester Co. founded at Bremen a branch and at Berlin another branch with workshops. Somewhat later the German automotive industry was alarmed by the announcement that almost 50 per cent of the shares of the preminent Caoutchouc and Guttapercha Co. at Hannover, producers of the famous Continental tires, had passed into the hands of the American Goodrich Rubber Co. Thus the American company takes advantage of the low wages in Germany (as compared with foreign wages and reference to the exchange rate of the mark), difficulties with importing the raw material are avoided and the customers buy really German built tires.

Ford Tractor to Be Produced in Germany

The American Ford Company has recently bought the Berlin factory of Ehrich and Graetz, which formerly produced lamps and during the war shell igniters, etc. At present this Berlin firm has sued for permission to import 2 trucks, 2 passenger cars and 8 sample Ford tractors, so that the German Government, farmers, etc., may be convinced of the suitability of these vehicles for German working conditions. The complete engines will be imported from America, while the other parts of the tractor will be manufactured in Germany by other German manufacturers according to the instructions of Ford.

The Ford tractor produced in Germany will be sold at 20,000 marks, if the production reaches 100 tractors a day. In the beginning, however, only 10 to 20 tractors per day will be produced and the selling price, of course, will be higher.

Later on the manufacturing of the Ford cars and trucks will be taken up; the German Ford works will provide with tractors and cars not only Germany but also the other European countries. All capital brought into Germany by the Ford company remains in the country, as does the profit arising from the enterprise. The Ford Co. also is liable to pay taxes to the German Government. Such enterprises only can be successful if the peculiar German conditions are carefully taken into account and if the factories selected for manufacturing really answer this purpose.

CAPITAL STOCK OF GERMAN MANUFACTURERS

Name of company	1914–15 marks	March, 1920 marks
Daimler Co. (Mercedes cars)	8,000,000	68,000,000
Adler Co.	13,000,000	36,000,000
Benz Co.	22,000,000	33,000,000
Hansa-Lloyd Co.	10,000,000	32,000,000
N. A. G. Co.	7,000,000	20,000,000
Wanderer Co.	3,500,000	10,500,000
Vomag Co.	5,250,000	10,000,000
Magirus Co.	2,000,000	9,000,000
Deutsche Lastautomobile Co.	1,000,000	8,000,000
Dux-Automobile Co.	1,500,000	7,000,000
Fahrzeugfabrik Eisenach (Dixi cars)	3,000,000	4,500,000
Duerkopp Co.	4,500,000	4,500,000
Presto Co.	1,500,000	4,000,000
Horch Co.	3,000,000	3,300,000
Mannesmann-Mulag Co.	2,000,000	3,000,000
Loeb Co.	2,000,000	2,500,000
Apollo Co.	1,000,000	2,300,000
Elite Co.	400,000	2,000,000

The gigantic growth of the American automobile industry raises the question as to whether the German automobile industry can remain capable of competition for the world's market, in the face of comparatively high German wages and the necessity to buy foreign raw materials at the low exchange rate of the mark.

The first and principal measure of the German industry in this respect is financial preparations for the future competition, i.e., the issue of new shares. The extent of this financial preparation may be seen from the accompanying table, representing a comparison between the share capitals of 1914-15 and the middle of March, 1920. This table is reprinted as a matter of reference.

Some of these figures have since been increased again and notice of new issues published, so that the real augmentation of the capital of the German automobile industry since 1915 may be estimated at about 215 million marks.

American Invasion Feared

The fear of the American invasion is indeed the chief reason for the financial preparation, mentioned above, and for the same reason three large German factories have formed a union with the name "Gemeinschaft Deutscher Automobilfabriken" abbreviated "G. D. A." and four smaller factories formed another union "Deutscher Automobil Konzern," abbreviated "D. A. K.," with the purpose of standardizing their designs and cheapening their production.

As the whole capital invested in the German automobile industry is not even as great as the capital of some few large American factories, it cannot hope to reach the giant American production figures and the cheap selling prices of some American cars. Therefore the only course for the larger part of the German automobile industry seems to be the production of "quality" automobiles that cannot be beaten on the world's market.

The social situation has produced very severe working conditions for the German automobile industry. Every factory must have a so-called "Betriebsrat" (factory-soviet), that is elected by the workmen representing employees and according to the law has the following duties:

The factory soviet is bound to assist the manager in his duties, to advance the performances of the workmen and the production of the factory, to further the agreement with the workmen and between workmen and manager. But in practice the factory soviets have frequently caused impossible situations from the manufacturing and financial viewpoints.

German Dealers Have Their Troubles

The situation of the German automobile dealer is rather difficult at present. While after the war the importance of the automobile increased owing to service difficulties of the railways, the automobile industry could not answer the heavy demands, because its capacity of production was decreased by very different factors: eight-hour working day, diminishing of working inclination and working intensity, numberless strikes, checking influence of the factory soviets and last but not least the coal scarcity. Therefore, the manufacturing costs were advanced to an unprecedented level, whereas the production dropped as to quantity and frequently also as to quality.

(*Continued on page 421*)

The Trend of Airplane Design

(*Continued from page* 364)

senger—that seems to have merit. This plane carries one person, handles exceptionally well and is economical. It is a biplane, powered with a three-cylinder Lawrence air-cooled engine of 60 horsepower.

Commercial Carriers.—There has been several interesting commercial land planes developed that give promise of more extensive utilization during the coming year. Among these are the Martin and the Lamson.

As predicted, however, seaplane commercial carrier development has been extensive. The Aeromarine Plane and Motor Co. are at present the prime movers in the field and have done meritorious pioneer work in converting Navy F59 and H52 L seaplanes into commercial ships. These planes are well adapted to commercial work, and will doubtless form the basis of redesigned carriers when the supply from the Navy is used up.

Miscellaneous Developments.—Considerable work has been done along the line of investigating possibilities of high speeds at high altitudes by means of engine superchargers. The present conclusion is that superchargers will be advantageous on fighting planes, where high altitudes and high speeds are a prime essential. For commercial carriers it is not believed that superchargers will come into any extensive use.

Few new engines have appeared, chiefly because there has been no great demand. Packard has developed several standard designs of merit, and the designers of the Lawrance 3-cylinder radial air-cooled engine are bringing out a 9-cylinder engine of similar construction and greater horsepower. This latter type possesses several points of great merit, and it is believed a very satisfactory plane will be produced around it.

The Army has been experimenting with variable pitch and reversible propellers. These are advantageous in securing maximum efficiency, and will decrease the landing run. These reversible and variable pitch propellors are an important development and if mechanical problems are solved will do much to advance aviation.

Many experiments are being conducted on parachutes; and out of them satisfactory and safe types are being produced. It is believed that airplanes will eventually be designed so that all occupants have parachutes; and a means of ready egress from the plane in case of necessity. Considerable educational and development work will be required, however, to bring this condition about.

Fireproofing.—Airplane fabrics previously were always inflammable. This was reduced somewhat by nitrate dopes. During the past year, however, methods of fireproofing airplane covering have been developed; and these have been shown by test to reduce the fire hazard. Gasoline, of course, is the greatest point of danger; and the hazard here can be reduced, and is being reduced by use of leak proof tanks. The future airplane will be nearly fireproof, and will carry its fuel supply either in leak proof tanks or in such a manner that it can be dropped from the ship in time of fire.

As will be noted from the preceding, airplane development is proceeding as well as can be expected under existing conditions. Government contracts are serving as the basis of the business, and manufacturers are alive to every business opportunity and carrying-on as well as circumstances merit. That the development is not up to the wild hopes of the armistice period is logical—that it will be, certain.

Specifications of American Aircraft Engines—1920-21

(Compiled for Automotive Industries by Arch. & Don R. Black)

Name and Model	Cylinder Data				Piston Displ., Cu. Ins.	Rating		Reduction Gear Ratio	Approx. Gals. Gas per Hour	Consumption per B.H.P. Hr. in Lbs.			Weight in Lbs.			Brake M.E.P. Lbs. Sq. In.	Compression Ratio	Carburetor	Ignition	Installation Dimensions in Inches				
	No.	Arrgt.	Bore	Stroke		B.H.P.	Crank R.P.M.			Gas	Oil	Total	Dry Eng.	Jacket Water	Total					Overall Length	Overall Height	Overall Width	Height Above Eng. Bed	Center to Center of Beds
Aeromarine......B	8	V-45°...	3 5/8"	5 1/8°	423	150	2275	1.75	13.0	.492	.04	.532	420	26	446	121.0	5.125	Z.....	D.....	49 11/16	36 7/8	22 3/8	21	13 1/2
Aeromarine.. L-6-D	6	Vert....	4 1/4"	6 1/2"	553	130	1625	Dir....	10.6	.51	.03	.54	442	......	......	114.0*	5.25*	Z.....	D.....	59 21/32	36 29/32	16	24 29/32	14
Aeromarine.. L-8-D	8	V-60°...	4 1/4"	6 1/2"	738	170	1600	Dir....	13.4	.49	.03	.52	500	......	......	113.0*	5.25*	Z.....	D.....	49 1/16	34 1/4	32 11/16	22 1/4	13 5/32
Aeromarine.....U-6	6	Vert....	4 1/4"	6 1/2"	553	130	1750	Dir....	11.0	.53	.03	.56	375	27	402	117.6	5.32	Z.....	D.....	57 11/32	36 29/32	16	24 29/32	14
Aeromarine.....U-8	8	V-60°...	4 1/4"	6 1/2"	737	180	1750	Dir....	13.6	.472	.011	.483	531	36	567	117.6	5.32	Z.....	Di....	49 1/16	34 1/4	32 11/16	22 1/4	13 5/32
Curtiss.........C-6	6	Vert....	4 1/2"	6"	573	160	1750	Dir....	13.5	.50	.02	.52	420	16	436	127.	5.2	Z.....	B.....	60	39 1/4	22 1/8	24 1/8	15 3/4
Curtiss........C-12	12	V-60°...	4 1/2"	6"	1145	400	2250	1.67	35.6	.50	.03	.53	685	......	......	131.0	5.46	C.....	B.....	68 5/16	40 1/8	27 7/8	24 3/16	15 3/4
Curtiss......CD-12	12	V-60°...	4 1/2"	6"	1145	325	1800	Dir....	29.6	.50	.03	.53	660	32	692	136.0	5.46	C.....	B.....	57 1/4	44 1/2	27 7/8	28 1/2	15 3/4
Curtiss.........K-6	6	Vert....	4 1/2"	6"	573	150	1700	Dir....	13.0	.52	.03	.55	417	16	433	122.0	4.91	Z.....	B.....	63	39 1/4	22 1/8	24 1/8	15 3/4
Curtiss.......K-12	12	V-60°...	4 1/2"	6"	1145	375	2250	1.67	34.2	.52	.03	.55	700	32	732	121.0	5.66	B.....	Bl....	68 5/8	40 1/8	27 7/8	24 3/16	15 3/4
Curtiss......OX-5	8	V-90°...	4"	5"	502	90	1400	Dir....	9.3	.60	.03	.63	390	......	......	114.0	4.98	Z.....	Bl....	55 3/8	31 1/2	29 3/4	17 3/4	12 5/32
Curtiss.....OXX-6	8	V-90°...	4 1/4"	5"	557	100	1400	Dir....	10.0	.60	.03	.63	412	......	......	99.5	4.85	Z.....	Di....	55 1/2	30 5/8	29 5/8	18 1/4	......
Gnome†‡.......G-V	9	Rotary..	4.33	5.9	920	100	1200	Dir....	11.5	.72	.183	.903	272	None..	272	88.1	4.9	None..	A.....	38 3/8	38 5/8	38 5/8	......	......
Hall-Scott....A-5-A	6	Vert....	5 1/4"	7"	865	160	1350	Dir....	15.0	.565	.025	.590	595	......	......	107.0	4.6	Z.....	Di....	62 1/2	42 9/16	22 1/4	27 5/16	16
Hall-Scott....A-7-A	4	Vert....	5 1/4"	7"	577	110	1400	Dir....	10.0	.58	.035	.615	456	......	......	102.0	4.67	Z.....	Di....	49 1/4	39 15/16	18 1/2	27 5/16	16
Hall-Scott.......L-4	4	Vert....	5"	7"	550	125	1700	Dir....	11.9	.598	.02	.618	385	......	......	110.0	5.25	M.....	D.....	52	41 3/4	22	20 3/4	16
Hall-Scott.......L-6	6	Vert....	5"	7"	825	200	1700	Dir....	16.0	.56	.03	.59	550	25	575	112.9	5.25	S.....	D.....	65	44 1/4	20 3/4	20 3/4	16
Hispano-Suiza†...A	8	V-90°...	4.724	5.118	718	150	1450	Dir....	14.0	.52	.05	.57	445	41	486	114.0	4.8	S.....	Di....	51 1/4	32 3/4	33 7/16	17 13/16	13 5/32
Hispano-Suiza†...E	8	V-90°...	4.724	5.118	718	185	1750	Dir....	16.0	.52	.056	.576	470	41	511	124.0	5.33	S.....	Di....	50 63/64	32 3/4	33 7/16	17 13/16	13 5/32
Hispano-Suiza†. .H	8	V-90°...	5.5	5.9	1122	317	1700	Dir....	29.7	.586	.025	.611	596	58	654	131.0	5.33	S.....	Di....	51 15/32	39 19/32	38 5/8	23 1/2	14 5/16
Lawrance‡......L-3	3	Radial..	4 1/4"	5 1/4"	225	60	1800	Dir....	5.1	.50	.04	.54	140	None..	140	120.0	5.0	S.....	P.....	20 3/8	35 3/8	35 1/2	......	......
Liberty...........A	12	V-45°...	5"	7"	1649	420	1800	Dir....	34.9	.52	.032	.55	822	46	868	115.0	5.5	Z.....	D.....	71 13/16	41 3/16	26 5/8	27	17
Liberty...........C	12	V-45°...	5"	7"	1649	380	1600	Dir....	31.6	.52	.032	.552	822	46	868	112.0	5.0	Z.....	D.....	71 13/16	41 3/16	26 5/8	27	17
Packard....1-A-744	8	V-60°...	4 3/4"	5 1/4"	744	208	1800	Dir....	16.5	.50	.03	.53	520	......	......	122.0	5.0	Z.....	D or M	49 7/8	40 1/4	27 1/8	20 1/2	14 1/2
Packard.. 1-A-1237	12	V-60°...	5"	5 1/4"	1237	345	1800	Dir....	27.5	.50	.02	.52	738	39	777	125.0	6.5	Z.....	M.....	63 3/8	35 13/16	27 1/8	20 1/2	14 1/2
Packard.. 1-A-2025	12	V-60°...	5 3/4"	6 1/2"	2025	570	1800	Dir....	43.6	.48	.03	.51	1120	51	1171	123.0	5.0	Z.....	D.....	71 5/8	46 1/2	31 1/4	23 3/4	17 3/4
Rausie.........E-6	6	Vert....	5"	6"	707	175	1650	Dir....	15.0	.50	.038	.538	514	25	539	118.0	5.5	S.....	Di....	58	46 1/2	23	30	15 3/8
Union..........3-6	6	Vert....	4 3/4"	6 1/2"	691	120	1375	Dir....	8.0	.56	.018	.578	485	......	......	109.0	5.5	Z.....	Di....	69 1/2	53 1/4	24	30 1/4	16
Wright.........E-2	8	V-90°...	4.724	5.118	719	190	1800	Dir....	15.0	.480	.02	.500	480	45	525	116.4	5.5	S.....	Di....	49 1/8	34 3/8	33 7/16	18 3/4	13 5/32
Wright.........H-2	8	V-90°...	5.5	5.91	1126	325	1800	Dir....	26.7	.50	.02	.52	625	58	683	127.0	5.5	S.....	Di....	51 23/32	39 19/32	38 5/8	23 1/2	14 5/16

*Low compression model. †Manufacture discontinued. Included because of number in use or available from Government surplus. ‡Air cooled. All others water cooled.

ABBREVIATIONS: Dir—Direct. **Carbureters: B**—Ball & Ball; **C**—Claudel; **M**—Miller; **N**—None; **S**—Stromberg; **Z**—Zenith. **Ignition: A**—A.D.S.; **B**—Berkshire; **Bl**—Berling; **D**—Delco; **Di**—Dixie; **M**—Magneto; **P**—Philbrin.

Labor Statistics Indicate Recent Industrial Trends

Strikes occurred with about the same degree of frequency during 1920 as in past years, but a larger percentage were fought over increased wages. A. F. of L. membership now 4,078,740. Number of members participating in strikes 213% greater than ever before. 3,473,466 men are out of work, and wage reductions are common. Interesting conclusions drawn.

By Norman G. Shidle

THE striking thing about any compilation of labor statistics is the absence of data concerning the really vital features of human relationships in industry. The figures available are of interest chiefly as an indication of some of the broader trends of the times and as a somewhat complete record of the activities of labor which is organized in some form.

Insofar as the activities of organized labor are similar to the thoughts and desires of all the men who work, the labor statistics available are valuable. Where these activities are merely the expression of the organized groups which conduct them, their importance is accordingly diminished. It is useless to approach any discussion of current labor statistics without a full realization of these limitations.

Certain very definite values, however, may be obtained from a survey of such statistics. It is with a view to gaining those values that the present data are presented in a form calculated to bring out the points most pertinent to the larger discussion of labor and industrial relations problems in general.

Labor unrest as manifested in its most virulent form, that of strikes, showed no signs of materially decreasing during 1920. The figures given here are complete for the first three-quarters of 1920, and were compiled by the Bureau of Labor Statistics of the Department of Labor. Following is the record of strikes and lockouts during the last five years.

	Strikes	Lockouts
1916	3,681	108
1917	4,324	126
1918	3,232	105
1919	3,253	121
1920 (¾ yr.)	2,724	67

While figures for the last quarter of 1920 are not yet available, it is probable that this quarter will show a relatively small number of strikes as compared with the corresponding period of the preceding year. The large amount of unemployment and the consequent decline in the fighting power of the unions doubtless has had an effect upon the number of strikes. Since this decrease in the number of strikes, however, is due to the change of economic conditions and not to any fundamental adjustment in the relations between capital and labor, it is fair to say that the strike records show industrial unrest to be about the same as in previous years.

PRINCIPAL CAUSES OF STRIKES AND LOCKOUTS 1916, 1917, 1918, 1919, AND FIRST THREE-QUARTERS OF 1920
(Approximate Percentages)

Matter in Dispute	STRIKES					LOCKOUTS				
	1916, per Cent	1917, per Cent	1918, per Cent	1919, per Cent	1920, per Cent	1916, per Cent	1917, per Cent	1918, per Cent	1919, per Cent	1920 per Cent
For increase of wages	35.10	35.60	42.50	30.42	45.52	10.57	13.50	13.49	19.86	29.81
Because of decrease of wages	1.00	0.80	1.07	2.46	1.18	1.84	1.59	1.93	2.48	.....
Non-payment of wages	0.35	0.40	0.98	0.28	0.84	....	0.79	.....	.....	.....
Because of increase of hours	0.08	0.40	0.19	0.25	2.25	2.67	.....	.....	.....	.....
For decrease of hours	3.02	2.89	2.48	3.26	2.02	1.84	3.97	.....	6.60	1.48
For increased wages and decreased hours	13.04	8.80	7.80	17.01	7.90	1.84	3.17	1.93	7.43	5.99
Recognition of union	9.36	6.50	5.84	11.31	6.52	20.20	31.00	33.60	25.65	25.39
Recognition and wages	3.32	3.50	3.00	3.91	3.18	1.84	3.97	1.93	4.14	7.50
Recognition and hours	0.60	0.64	0.50	0.59	0.15	0.92	0.79	.....	0.83	.....
Recognition, wages and hours	1.85	1.32	2.08	5.49	0.99	4.59	.....	.....	5.79	4.47
Recognition and conditions	.....	0.30	0.22	0.44	.....	.....	.....	.....	.....	.....
General conditions	1.58	2.25	1.70	1.76	2.89	.....	3.17	1.93	.....	4.47
Conditions and wages	1.52	1.65	1.57	1.66	1.32	1.84	0.79	1.93	0.83	4.47
Conditions and hours	0.08	0.40	0.06	0.05	0.09	.....	0.79	.....	.....	.....
Conditions, wages and hours	0.68	0.61	0.25	1.14	0.37	.....	.....	.....	.....	1.48
Discharge of foreman demanded	0.46	0.88	1.67	0.46	1.32	.....	0.79	.....	.....	.....
Because of discharge of employees	3.32	4.80	4.30	4.35	3.49	4.59	2.38	.....	.....	1.48
Employment of non-union men	2.00	1.80	1.92	.....	1.62	3.67	0.77	.....	.....	.....
Relative to agreement	1.03	1.77	1.29	1.01	0.84	1.84	2.38	.....	3.31	.....
New Agreement	1.01	0.52	0.12	1.11	0.82	2.75	1.59	.....	.....	1.48
Sympathy	0.87	1.61	1.07	3.08	2.75	0.92	0.79	0.97	.....	.....
Jurisdiction	0.52	0.47	0.50	0.46	0.46	.....	.....	.....	0.83	1.08
Miscellaneous	3.18	4.09	5.34	2.80	.....	2.75	3.97	8.70	12.41	.....
Not reported	16.00	18.00	13.55	6.60	10.54	30.30	23.80	33.60	9.99	10.50
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100 00	100.00

Fig. 1

Causes of Strikes

The causes of strikes as announced in the statistics constitute the points over which came the actual breaks between employer and employee. They do not constitute the fundamental reasons for industrial unrest.

A larger percentage of strikes was caused in 1920 by the single issue of wages than in any previous year. Forty-five and one-half per cent of all the strikes which occurred in 1920 hinged upon a demand for increased wages alone, while 59.47 per cent of the strikes involved the question of wages in one form or another.

The predominance of the wage question as the breaking point of strikes made other causes diminish proportionately. There is no other single cause which stood out prominently, the most important of the causes not involving wages in any form being the question of recognition of the union, only 6.52 per cent of

INDUSTRY GROUPS IN WHICH THE LARGEST NUMBER OF STRIKES AND LOCKOUTS OCCURRED IN 1916, 1917, 1918, 1919, AND FIRST THREE-QUARTERS OF 1920

Industry	STRIKES					LOCKOUTS					Grand Total
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	
Building trades	376	447	416	424	433	18	21	16	18	8	2,177
Clothing industries	222	483	416	301	215	5	12	18	7	10	1,689
Furniture industry	48	40	25	44	11	2	3	1	3	..	577
Iron and steel workers	72	56	72	67	23	..	..	2	8	1	301
Leather workers	34	19	15	27	19	..	..	1	5	4	124
Lumber industry	44	295	75	39	28	..	4	1	2	2	490
Meat cutting	70	38	39	67	25	..	2	..	2	1	244
Metal trades	547	513	439	527	330	14	31	23	29	9	2,463
Mining	402	418	184	170	115	3	2	5	2	1	1,302
Paper manufacturing	51	39	35	41	29	2	1	..	3	2	203
Printing and publishing	25	40	39	58	46	4	3	4	3	1	223
Shipbuilding	27	103	136	101	39	..	..	3	1	1	411
Stonework	59	26	14	13	27	2	..	..	..	..	141
Textile industry	258	242	209	258	204	3	5	3	9	3	1,194
Tobacco	61	45	47	54	22	2	2	2	2	..	237
Transportation	224	342	226	231	238	4	1	1	3	3	1,273

Fig. 2

the conflicts being precipitated on this particular issue.

An examination of the other strike causes shows a similarity in proportion to those of other years both in numbers and percentages. The chief conclusion to be drawn from a study of this table is that the questions over which the actual break in relations usually come assume about the same relative importance each year. It would seem to indicate a rather discouraging tendency on the part of both organized labor and some employers to "fight it out along these lines if it takes . . . forever."

The record of lockouts shows nearly the same tendencies. During 1920 the percentage of lockouts occasioned by demands for increased wages increased 10 per cent, but this merely indicates that many of the miscellaneous troubles of past years have been concentrated into this one point by the labor unions. The percentage of lockouts because of demands on the part of the workmen for union recognition continue in practically the same proportion, last year being 25.39 per cent and the year before 25.69 per cent.

A larger percentage of lockouts involved working conditions in 1920, 4.47 per cent being attributed to this cause.

Building Trades Lead Striking Groups

The number of strikes occurring in some of the chief industrial groups is shown in Fig. 2. In 1920 the building trades conducted the largest number of strikes, while the clothing workers suffered the greatest number of lockouts. The leading industry groups as to number of strikes conducted during the first three-quarters of 1920 line up as follows:

Building trades	433
Metal trades	331
Transportation	238
Clothing industry	215
Textile industry	204

Comparing these figures with those of past years, it becomes evident that there has been a considerable decrease of trouble in the metal trades during 1920. In 1919 the metal workers struck 527 times, in 1920 only 331. The building trades, on the other hand, though leading the list in 1920, had about the same number of strikes as in past years.

Taking a period of five years, however, including 1920, the metal trades have caused the most troubles. The list for this longer period appears in this order, including both strikes and lockouts:

Metal trades	2463
Building trades	2177
Clothing	1689
Mining	1302
Transportation	1273

There has been a fall in the number of mining strikes during the last year, but the seriousness of the situation in this industry has probably increased materially, nevertheless.

Strikes of Less Duration

Fig. 3 shows the duration of strikes during the last five years. In 1919, 29.25 per cent of the strikes listed in this table lasted from one to three months, while in 1920 this percentage was reduced to 24.65 per cent. The percentage of those lasting from 1 to 2 weeks, however, increased during 1920 from 15.78 per cent to 18.70 per cent. These two periods represent the lengths of time during which the greatest number of strikes endured.

The figures for five years bear out this tendency, as 1305 strikes during that period lasted from 1 to 3 months and 1257 lasted from 1 to 2 weeks.

The figures on lockouts indicate that once a lockout starts it has an excellent chance of continuing for a considerable length of time; a better chance, in fact, than the strike. The reason for the new impetus given to strikes after the two-week period is that the payment of strike benefits by the union begins at that time.

The figures for lockouts, however, show that in 1919 52 per cent of the lockouts lasted from 1 to 3 months, while only 29 per cent of the strikes endured that long. Similarly in 1920, 31 per cent of the lockouts lasted as long as this and only 24 per cent of the strikes. Moreover, the total figures for five years show that nearly 19 per cent of the lockouts lasted more than three months, while only 5.7 per cent of the strikes were carried on through a period of equal length. This indicates that the economic power of the employer is usually in a better position to withstand a long industrial battle than is that of the labor union. It is obvious, however, that the ability to win a strike may not constitute the *summum bonum* of a successful labor policy.

New York Has Most Trouble

New York and Pennsylvania maintain their unenviable position as leaders in the number of industrial disputes

DURATION OF STRIKES AND LOCKOUTS ENDING IN 1916, 1917, 1918, 1919, AND FIRST THREE-QUARTERS OF 1920

	STRIKES					LOCKOUTS					TOTALS		Grand Total
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	Strikes	Lock-outs	
1 day or less	179	282	227	98	37	...	2	2	...	...	823	4	827
2 days	183	111	168	64	33	2	2	3	1	...	559	8	567
3 days	146	102	124	74	22	1	3	...	...	1	468	5	473
4 days	124	61	111	73	25	1	1	1	...	...	394	3	397
5 to 7 days	330	213	247	161	52	6	3	2	3	2	1,003	16	1,019
				15.73%	18.70%								
1 to 2 weeks	408	215	264	265	105	10	4	6	4	2	1,257	26	1,283
2 to 3 weeks	224	118	151	190	40	7	3	6	9	3	723	28	751
3 to 4 weeks	99	54	70	109	45	2	4	2	...	1	377	9	386
				29.25%	24.65%								
1 to 3 months	266	185	222	493	139	6	8	10	29	5	1,305	58	1,363
Over 3 months	104	60	49	155	65	18	4	2	10	2	433	36	469

Fig. 3

NUMBER OF STRIKES AND LOCKOUTS BEGINNING IN EACH YEAR IN SOME OF THE CHIEF INDUSTRIAL STATES 1916, 1917, 1918, 1919, AND FIRST THREE-QUARTERS OF 1920

	STRIKES					LOCKOUTS					TOTALS		Grand Totals
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	Strikes	Lock-outs	
New York	577	696	668	515	459	15	15	21	7	9	2,915	67	2,982
Pennsylvania	566	481	304	265	202	8	13	7	10	5	1,818	43	1,861
Massachusetts	374	342	341	376	366	9	11	4	6	7	1,799	37	1,836
New Jersey	411	219	138	171	120	6	8	...	4	1	1,059	19	1,078
Ohio	276	265	188	214	170	14	14	9	8	10	1,113	55	1,168
Illinois	149	276	237	252	202	10	6	11	10	6	1,116	43	1,159
Connecticut	325	178	90	120	124	1	...	2	3	2	837	8	845
Washington	57	290	126	78	54	1	4	2	...	2	605	9	614
Missouri	90	117	100	63	53	7	5	5	2	...	423	19	442
Minnesota	24	52	40	49	48	6	1	...	1	2	213	10	223
Indiana	70	65	68	91	64	5	8	8	9	4	358	34	392
Michigan	66	62	59	79	44	5	2	1	...	3	310	11	321

Fig. 4

during the first three-quarters of 1920, as shown by Fig. 4. This is rather to be expected, however, since the number of strikes is always likely to vary with the degree of labor organization and both of these states are comparatively highly organized.

Michigan, an important industrial State also, is low in the list of industrial disputes resulting in strikes. This is probably due to the fact that organized labor has a comparatively small hold in that State as compared with Pennsylvania and New York. The actual number of strikes would naturally be lower in Michigan because of its smaller industrial population, but the proportionate number is also somewhat smaller.

Although fifth in the list of total strikes, Ohio has had more lockouts than any State except New York.

For five years the total number of strikes in the States that have been most troubled in this respect is as follows:

New York	2915
Pennsylvania	1818
Massachusetts	1799
Illinois	1116
Ohio	1113

NUMBER OF STRIKES AND LOCKOUTS BEGINNING IN EACH MONTH, 1916, 1917, 1918, 1919, AND FIRST THREE QUARTERS OF 1920

Year	January	February	March	April	May	June	July	August	September	October	November	December	Month not stated	Total
Strikes;														
1916	180	203	289	419	604	340	310	318	247	257	193	147	174	3,681
1917	274	204	308	431	451	313	444	353	340	317	251	184	454	4,324
1918	183	212	300	308	385	289	279	273	197	145	202	239	220	3,232
1919	184	183	175	248	388	303	360	373	377	296	145	94	127	3,253
1920	205	194	296	399	394	348	296	277	234	...	...	...	183	2,826
Lockouts;														
1916	8	3	5	15	13	14	3	8	5	4	4	2	24	108
1917	14	7	10	14	12	10	4	7	9	4	6	12	17	126
1918	8	11	11	11	6	6	6	5	10	...	5	10	16	105
1919	5	7	6	14	25	12	6	10	13	8	6	6	3	121
1920	6	5	6	5	12	14	7	15	5	...	...	...	7	83
Total;														
1916	188	206	294	434	617	354	313	326	252	261	197	149	198	3,789
1917	288	211	318	445	463	323	448	360	349	321	257	196	471	4,450
1918	191	223	311	319	391	295	285	278	207	145	207	249	236	3,337
1919	189	190	181	262	413	315	366	383	390	304	151	100	130	3,374
1920	211	199	302	404	406	362	303	292	239	...	...	...	190	2,908

Fig. 5

Most Strikes Begin in April

Fig. 5 shows the number of strikes beginning in each month. It will be noted that the largest number begin in the spring months in general and in April and May in particular. This fact can be attributed to two causes. First, that less physical hardship accrues to the workman when a strike is conducted in warm weather. Second, many union agreements terminate in the months of April and May and disputes frequently occur in the making of a new agreement.

Who Is Winning?

Figures for the half of 1920, shown in Fig. 6, indicate that the battle between employers and employees is still about a draw in so far as the winning of strikes is concerned. The figures at hand show that an exactly equal number was won by both sides during this period.

It should be noted, however, that every time a strike is compromised the employer has, in a sense, lost, since

RESULTS OF STRIKES AND LOCKOUTS ENDING IN 1916, 1917, 1918, 1919, AND FIRST OF 1920

RESULTS	STRIKES ENDING IN—					LOCKOUTS ENDING IN—				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
In favor of employers	727	382	450	624	136	21	13	6	18	8
In favor of employees	733	614	610	533	136	16	17	16	16	4
Compromised	766	698	668	789	172	11	21	17	11	7
Employees returned pending arbitration	70	131	200	42	35	3	6	5	3	..
Not reported	99	190	188	33	180	2	1	21	20	2
Total	2,395	2,015	2,116	1,961	659	53	58	64	68	..

Fig. 6

labor has gained something which it did not have under the previous *status quo*. And even when the employer wins a strike, he has lost in charges for overhead expense, lost production, etc. Thus it would seem to be apparent that the employer, at least, never has anything to gain from a strike, whether he is strong enough to "win" it technically or not.

For this reason, if not for many others, it is not likely to be advantageous to the employer to lay an excess of emphasis upon the "fighting" phases of his future labor policy. Every time there is a pitched battle, he loses. The very fact that he has capital invested in plant and equipment makes the cards stacked against him.

A. F. of L. Statistics

The statistics concerning the American Federation of Labor are compiled upon a fiscal year basis, the fiscal year of this organization being June 1 to June 1. Consequently the figures presented here for 1920 are really for 1919-1920. Fig. 7 shows the growth of the A. F. of L. as to charters and membership. A gain in membership of 818,740 is recorded during the last year, bringing the total membership up to 4,078,740.

The figures show a net gain of about 4000 charters for the year, approximately 37,000 local unions now being affiliated with the Federation. The chart shown in Fig. 8 depicts the growth of the A. F. of L. since its founding in 1881.

It is probable that some drop in membership will be noted when the figures for 1921 appear next June, since an industrial depression of the present kind always has a definite effect upon union membership. This is largely a matter of inability to pay dues and the necessity for getting work of some kind to tide over the bad times, whether it be in conformity with union regulations or not. While union officials will not officially admit that they expect a drop in membership, there is little doubt but that they realize the very strong possibility of such a change.

The strike statistics of the A. F. of L., covering a period of ten years, shown in Fig. 9, present some interesting facts. The number of strikes decreased during 1920, but the numbers involved increased 213 per cent, as compared with the number involved during the previous year. Nearly two million men were involved in the strikes conducted by the A. F. of L. during 1920, nearly two-thirds as many as comprised the entire citizen army raised by the United States to fight the war against Germany and her allies.

In other words, the A. F. of L. was able to muster 213 per cent more striking power in 1920 than ever before. And as a result of this increased striking power, it benefited 188 per cent more men than before.

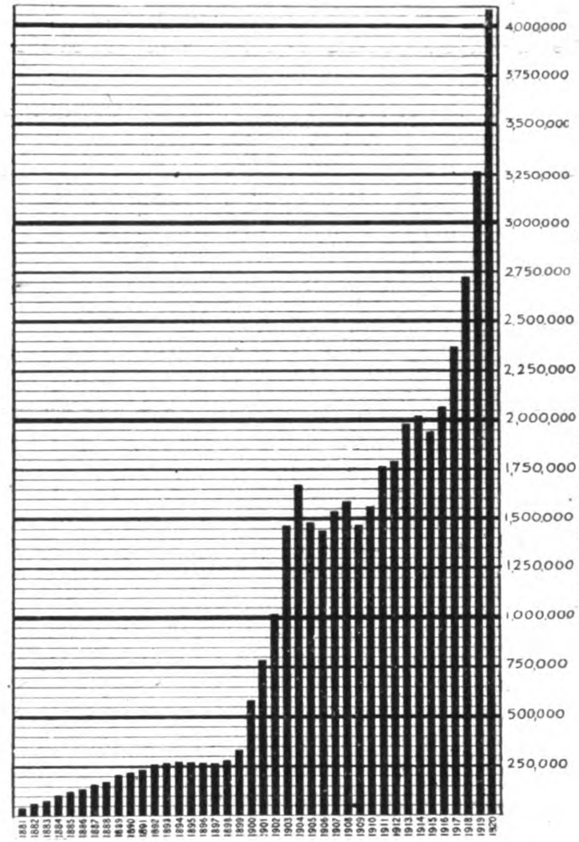


Fig. 8—Membership of American Federation of Labor 1881 *to* 1920

Cost of Strikes

The cost of conducting these strikes during 1920, although larger in the aggregate than during 1919 and 1918, was not as large as the aggregate for 1911, 1913 and 1915 when far less men were involved and benefited.

STATISTICS CONCERNING AMERICAN FEDERATION OF LABOR

	National and International Unions	Local Unions	Charters Issued	Charters Surrendered	Gain in Membership
1911	...	......	2,345	1,358	117,568
1912	112	20,964	2,388	1,422	216,012
1913	111	20,046	2,682	1,348	295,695
1914	110	21,460	2,578	1,351	62,822
1915	110	21,887	1,791	1,421	38,509
1916	111	21,711	2,699	4,403	267,152
1917	111	26,761	3,793	1,557	319,671
1918	111	27,755	2,977	1,052	591,498
1919	111	33,852	6,743	1,719	825,449
1920	110	37,000	5,449	1,639	818,740

Fig. 7

The total cost of strikes to the A. F. of L. during the last ten years has been $28,581,587. This is a staggering total when interpreted in terms of economic loss. When it is remembered that as much has probably been expended by employers, either directly or indirectly, in combating the activities of this organization the figures present a startling total, and a rather practical indictment of the present methods of conducting industrial relationships.

There is no ready made plan that can be adopted to eliminate this prodigious waste, but a constant and conscientious study of all the factors involved in human relationships in industry will gradually reduce the sums expended to organize and equip industrial fighting machines. Merely fighting the unions, without building very definitely in a constructive way, offers no solution to the labor problem; the problem which involves this enormous economic waste.

There are two ways of combating the problem. The one, to organize funds and forces with which to do battle with labor and its organizations which make certain demands inconsistent with efficient production and true economic service. The other, to study the fundamental causes which underlie industrial unrest, investigate and experiment in methods of eliminating those causes, and seek through hard work and thoughtfulness to bring human relationships in industry to a sane and normal condition mutually satisfactory to employer and employee.

Certainly the sum of about $60,000,000 expended in industrial warfare during the last ten years could have been more effectively and beneficially used if employers had been able to work out in a practical way some

AMERICAN FEDERATION OF LABOR STRIKE STATISTICS

	Number of Strikes	Strikes Won	Strikes Lost	Strikes Compromised	Strikes Pending	Number Involved	Number Benefitted	Cost of Strikes
1911	1,086	642	93	90	261	170,526	104,655	$4,709,551
1912	772	378	61	58	275	73,069	6,177	1,928,381
1913	969	554	65	89	261	294,644	186,644	3,345,721
1914	957	543	60	118	236	131,324	74,350	4,280,307
1915	1,004	552	119	115	218	144,932	99,543	3,418,831
1916	1,622	1135	49	133	305	260,015	126,181	2,708,789
1917	1,417	897	86	120	314	194,802	215,019	2,291,087
1918	922	570	43	108	201	140,042	134,033	1,295,031
1919	1,515	1030	52	170	263	234,466	203,876	1,391,833
1920	1,255	706	88	186	275	734,056	587,479	3,212,056
Totals	11,501	7007	716	1187	2609	2,377,468	1,737,957	$28,581,587

Fig. 9

method of handling human relationships which would give every man a real opportunity for individual development and a square deal in every phase of his contact with the factory and the industry.

A Comparison

While all of the strikes listed by the Department of Labor are not, of course, A. F. of L. strikes, it is likely that a good proportion of them are, since the A. F. of L. is by far the largest labor organization in this country. And the vast majority of strikes are conducted by organized labor. The graphic chart shown in Fig. 10 presents the results of strikes during the years of 1916, 1917, 1918 and 1919 as shown by the figures of the Bureau of Labor Statistics and by the A. F. of L. While it is not to be expected that these curves would coincide, it would be reasonable to expect that some similarity of proportion would exist between the two.

The relative position of the lines is of interest in connection with this chart—not the actual figures. For example, granting that strikes seldom occur except when employees are organized and that the A. F. of L. includes the vast majority of organized employees in this country, it would follow that the proportion of strikes won by employers in A. F. of L. strikes would be relatively the same as the percentage of strikes won by employers in all the strikes recorded, and similarly, in regard to the strikes won by employees and strikes compromised.

The chart shows, however, that in the case of the Bureau of Labor statistics figures the number of strikes won by employers and employees, for instance, was almost the same in 1916, while the A. F. of L. figures show the number won by employees to be about nineteen times as great as the number won by employers. The relation may be expressed in a proportion which brings out clearly the divergence:

Employers won: employees won: compromised:
1:20:3 (A. F. of L. figures)
1:1 1/58:1 5/58 (Labor Dept. figures)

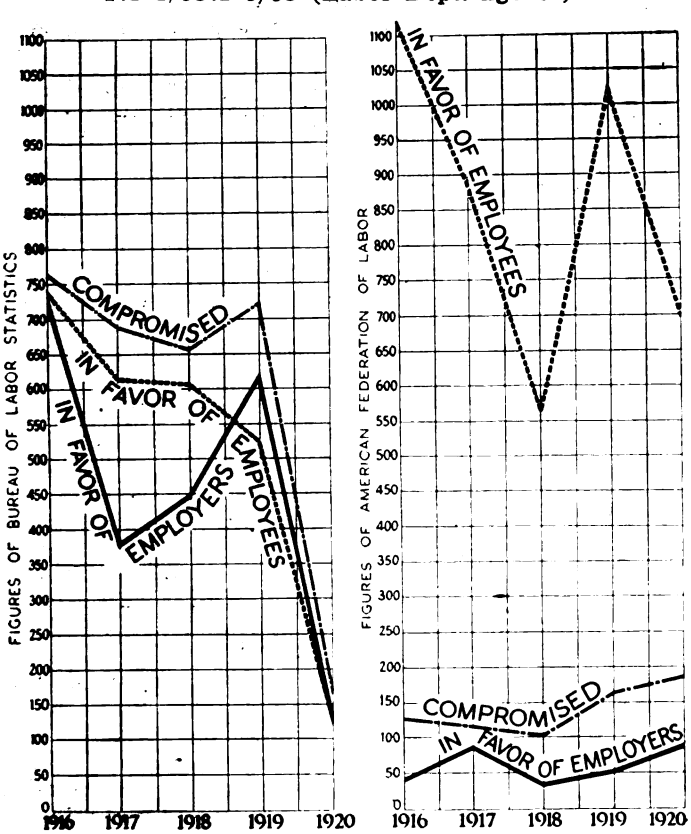


Fig. 10

A similar divergence is noted in the examination of figures for other years. The number of strikes won by employees in the A. F. of L. curve never approaches even closely the curve of strikes won by employers, while on the other chart this first line crosses the latter at one point and practically meets it at two others.

This case is cited chiefly as an example of the difficulties which are encountered in attempting to reach any definite conclusions in regard to labor problems on the basis of published statistics. The absence of standards of compilation and definition of terms renders it almost impossible to obtain anything like accurate figures in a great many cases.

Unemployment

The recent survey of unemployment made by the U. S. Employment Service presents the best figures available. This was, in fact, a survey of employment rather than of unemployment. The number of employees at work in the various plants throughout the country was determined and the total subtracted from a similar total of a year before.

It was found that 3,473,466 less persons were employed than a year ago. It is reasonable to take this figure as a close estimate of the number of unemployed in the United States at the time of the survey, which ended about Jan. 25.

This is true because all the industries and all the States throughout the country were covered by the survey. The only place men could have gone without being unemployed now is back to the farms. Since most of the extra farm work was over before the survey started, and since the survey covered the entire country, nearly this number of men must be regarded as unemployed at present.

The automobile trade showed the biggest reduction with a loss of 69 per cent, while the building trades were second with 52 per cent. Following is a list of reductions in some of the chief industries:

	Per cent
Automobile and accessory	69
Building trades	52
Textile	35.5
Leather	35
Lumber and house furniture	32
Metal trades, foundries, etc.	30.5
Packing	19
Clay, glass, cement, etc.	19

Michigan showed a greater proportion of reduction than any other State, with 82 per cent less employees than a year ago. This does not necessarily mean that all these idle men are still in the State of Michigan, but it does mean that they are probably idle somewhere. Following is the percentage of reduction in some of the chief industrial States:

	Per cent
Michigan	82
Ohio	50
Indiana	50
Illinois	44
Connecticut	43
Massachusetts	38
Wisconsin	32
New York	28
New Jersey	22

It is worth while to consider these figures concerning unemployment in connection with those concerning strikes and industrial unrest. An industrial condition such as prevails at the present time makes less blatant the voice of organized labor and in that sense promises for the time being less virulent labor trouble. It may be said that industrial depression reduces unrest so far as organized labor is concerned.

At the same time, a knowledge of human nature leads to the belief that industrial depression tends to increase unrest so far as the individual is concerned. Henry L. Doherty, president of the Cities Service Co. of New York, recently voiced this idea when he said in effect that he believed hunger to be more provocative of radicalism than high wages and plenty of work. It is natural for the man who is out of work and in trouble to come rapidly to the conclusion that something is wrong with the world. He will probably come to this conclusion through a successive series of psychological reactions than through any ordered method of reasoning, but if he is "out of luck" long enough he is almost certain to arrive there.

And just as it is necessary to work from the individual to the group in seeking to make permanent adjustment of human relationships in industry, so is the unrest which germinates and grows in a number of individuals likely in the long run to be more troublesome and potent than even the organized labor movement which begins with the group and works down to the individual.

The figures on strikes are printed in this article. The figures on industrial unrest as comprised in the more important factors of individual convictions and reactions can never be gathered. But they are none the less important and must be recognized and seriously considered, even though immediate circumstances show on the surface a cessation of active industrial unrest. It is for this reason that attention is called to them in this article, even though statistics cannot be compiled to accompany the discussion. It brings again to light the idea that a study of the individual and the proper attention to his development and desires is the first requisite in attempting to find a permanent solution to labor difficulties.

Wages and Cost of Living

Wages are now generally in a state of flux, so that wage statistics which might have been compiled yesterday would not be a true picture of the condition to-day. Moreover, general wage surveys, by whomever made, are usually open to so many criticisms and objections as to render them of comparatively minor value.

Cost of living surveys are open to the same criticism. Yet there is a certain value in surveys made at stated periods on the same basis by a single competent agency. It is almost impossible, however, to get satisfactory statistics upon which to compare in a general way cost of living and wages. It may be very possible and valuable, however, to make such comparison in a specific case or for a small unit.

With this thought in mind, the chart shown in Fig. 11 is presented. It shows the average rise and fall of the cost of living in 19 cities, all important in the automotive industry, from 1914 to 1920 inclusive. The chart has been prepared on the basis of figures compiled according to stable standards each year by the Bureau of Labor Statistics.

Similar wage scales, prepared by various other agencies, vary so materially that it has not been advisable to attempt the charting of a wage curve. It is possible, however, for any particular plant to plot its own wage curve along with the cost of living curve.

Wage Reductions

No complete data are available on wage reductions, but a survey of a large number of automotive plants reveals some general tendencies. The chief question concerns the time at which wages should be reduced and still give both employer and employee a square deal in the matter.

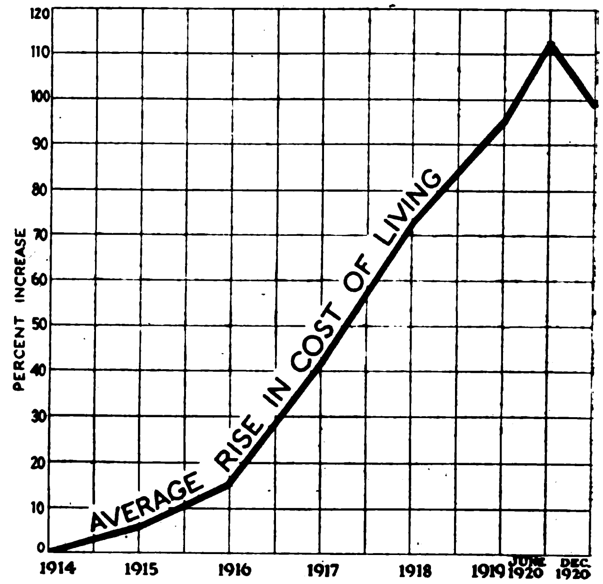


Fig. 11

Most factories have already reduced wages in one way or another. Even aside from reductions in working time, which temporarily reduce wages, a majority of firms have already made an actual cut in wages. There are still a number of firms, however, which have maintained wage scales up to the present time and which do not contemplate reductions in the immediate future unless there is a distinct drop in cost of living prices.

There has been great variation, however, both in the size of reductions made and in the method of making them. Some manufacturers have put the facts of the situation squarely before their employees and have taken considerable pains to sell them on the idea that reductions are necessary.

Others have simply posted a notice that reductions were to go into effect and stated how great the reduction would be.

Still others have discharged the men and superficially shut down their plant, to re-open it the next day and hire men back at lower rates.

Hours of Work

The question of hours has rather been reversed within recent months. Workmen have been desiring to work more hours than manufacturers have been able to allow them. This is the general condition at the present time.

In some cases, however, manufacturers have been coupling demands for increased working hours with demands for decreased wages. In other words, they indicate that the real reason for shutting down the plant is not lack of orders, but a desire to take advantage of the present situation to "put labor in its place."

This latter situation, however, does not apply to the automotive industry, so far as can be learned, and is merely mentioned as an indication of what is being done by some manufacturers in other lines of work.

Personnel Work and Shop Committees

There has been a falling off in the amount of "welfare" and personnel work being done in many plants since the beginning of the business depression. It is natural that this work should be contracted to a certain extent along with the other activities of the manufacturing plant, but in some places the curtailment in this department has been in much larger proportion than in any other department.

It will undoubtedly mean a great saving of wasted money in some plants to dispense with ill-conceived and not very effective "welfare" work. But even a superficial study of the situation shows that the over-curtailment of intelligent employment and personnel work will work great harm in the long run. As pointed out previously in AUTOMOTIVE INDUSTRIES, the present time offers an unusual opportunity for the manufacturer to put his house in order as regards industrial relations. By effective and intelligent personnel work in building his force back to normal, he can get together an organization of efficient, enthusiastic workers such as he has long been unable to obtain.

And for the very reason that many manufacturers will take advantage of the present situation to "get back at labor," the manufacturer who operates now on a real "square deal" basis will find himself in a very strong position when normal production is again resumed.

Shop committees have been abandoned in a few cases, but most plants which have had in operation an employees' representation plan for a considerable length of time are still operating on that basis. The present time will be one of real test for many of these plans, and some of those which have been operated most effectively and which were installed because the management honestly desired to consult with its employees and to give them a normal channel through which to obtain a practical working out of the "square deal" idea give every indication of weathering the present storm.

As stated at the beginning of this article, the unfortunate part about labor statistics is the utter absence of vital ones and the rather confused condition of many of those which are compiled. This is, of course, to be expected when dealing with anything so complex as the human element, but it is possible, nevertheless, for better and more valuable records to be developed in the future.

An Analysis of the Farm Lighting Plant Industry

(*Continued from page* 395)

leaving only an overcharging switch and sometimes a "restart" button exposed, the latter being used after a trouble stop has been made and the difficulty remedied. A noteworthy feature in connection with full automatic systems has been recently introduced by one manufacturer whereby the automatic control is instantly removable and may thus be sent to a service depot for repairs.

Engine Types.—Over 90 per cent of the engines used have one cylinder, 3 h.p. being the average maximum power for this class. Two cylinder engines are used with powers ranging between 3 and 8 h.p., fours between 8 and 20 h.p. and sixes for sizes larger. Only 4 per cent have two-stroke cycle engines, one is a semi-Diesel and the remainder are conventional four-stroke cycle engines, having low compression ratios to make them suitable for kerosene operation.

Air cooling is used on only 11 per cent of the models. Four are cooled by combination air and water, one uses oil for a cooling medium and the remainder are cooled by water circulating through an automobile type radiator or simple cooling tank.

The majority of four-stroke cycle engines use the poppet valve. Several use a rotating sleeve valve, one a Knight reciprocating sleeve, one a rotating disk valve.

Lubrication is most frequently by the conventional splash system. Ten per cent have pressure feed, especially the sleeve valve engines. Others use sight feeds, oil rings or oil cups. Babbitted bearings, frequently die-cast, are used most extensively although anti-friction bearings are becoming more general, being used for crank-pin bearings in some cases.

Over 25 per cent of the units are equipped with high-tension magnetos. Some of these are of the oscillating type. The remaining ignition systems consist of the plain battery-coil type.

The quality of engineering reflected by some of the engine designs compares quite favorably with the most advanced automobile practice. This is especially true of air cooling, aluminum pistons, reduction in inertia forces and the silencing of overhead valve engines.

Originally all plants were hand cranked. Now less than 10 per cent are so cranked. The progress of the present points to the development of full automatic systems. There are but 10 per cent of these now. As soon as electric plants are regarded as an electric service rather than a machine, more and more of our models will become automatic.

Present Status of German Automobile Industry

(*Continued from page* 413)

The enormous advancing of car prices, resulted in an annulment of signed delivery contracts by the factories described by me in my article of May 27, and the dealers came into a very difficult situation, because they had to arrange matters on the one hand with the customers, to whom only the dealer is responsible, on the other hand with the manufacturers. The result was many law suits and heavy expense. Consequently the German Automobile Dealers' Association was called upon to conciliate the strongly conflicting interests. The good results of the sales work done by the dealers were lost in large part. Their earnings furthermore were injured by the fact that the manufacturers endeavored to decrease the discount, in proportion to the advanced prices, in spite of the fact that the dealer had correspondingly advanced expenses.

The direct sale of army trucks and cars to the customers and to the motor traffic companies in a certain degree led to a disconnection of the automobile dealers and to a diminishing of their income. It also had the result, that casual dealers came in devoting only part of their time to the automobile trade. These men were interested only in making high profits immediately and thus lessened the earnings of the legitimate trade. In addition to this, the dealer did not receive any fuel from the government and was compelled to buy fuel in illicit trading at very expensive prices if he wanted to make a demonstration run for a customer. Consequently the German dealer has had a very hard task during recent months.

The repair shops essentially were subject to the same inconveniences as the factories, with the result that the working forces were systematically diminished or the shops shut completely.

The garage business, however, was very satisfactory on account of the large number of cars returning from the war and passing to the automobile trade.

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The 1921 Statistical Number

IN placing before you our 1921 edition of AUTOMOTIVE INDUSTRIES STATISTICAL NUMBER we have some misgivings. It is not that we have spared expense and effort to make our work all that it should be, but rather that in this fast growing industry we sometimes find ourselves in doubt as to what we can do that will be of most benefit to the industry.

Each year brings forth new phases of our industry—new industries within our own. There is still rapid development in what might be called the fundamentals of the great industry. The practice and trade lines have not as yet been stabilized to the extent of older industries. On all sides there are problems.

It has been necessary to make choice as to subjects to be developed. After making the selection every endeavor has been made to present the best information available. Care has been exercised in making this information accurate, even to the extent of excluding some last minute data which could not be checked. There may be some errors. We hope not.

We will welcome from any user of the STATISTICAL NUMBER suggestions for future editions.

The Engineering Value of Statistics

THE value of statistics to the engineer is quite generally recognized, but is worthy of emphasis and should receive even more general recognition than it is now accorded. Suppose, for example, that a manufacturer decides to put out a new chassis model. If this model is to be commercially successful and meet the least possible sales resistance it should not depart, at least in most particulars, from practice that is very generally employed and has proved most successful. Consequently it is necessary that both the engineering and sales departments have reliable information on current practice. This information may be possessed by members of the engineering force, but the industry is now so extensive that it is impossible for any engineer or engineering staff to keep up to date or keep record of any considerable proportion of changes being made by other concerns, unless recourse is had to published statistics. This need we endeavor to fill by data published from time to time in AUTOMOTIVE INDUSTRIES, and in particular in the statistical issue.

The information here published enables the engineer to know whether or not his judgment in selecting a given type of construction is confirmed by the judgment of other engineers called upon to make a similar choice. Of course the practice of following a certain procedure simply because a majority of other organizations do the same thing can be carried to excess. If the practice should be universally followed there would be little if any progress or improvement, but the value of the check which a study of statistics makes possible can scarcely be questioned.

Car manufacturers are not the only ones who benefit by the publication of statistics. The parts and accessory maker must follow the trend of competitors' design, as well as study the trend of selections made by the assembler. One of many possible illustrations will serve to prove this statement. In 1914 only 1 per cent of car models used the helical or so-called "spiral" bevel final drive. In 1915 the percentage rose to nearly 10 and in 1916 to over 55. To-day no less than 90 per cent of models employ this type of drive. No axle manufacturer could afford to overlook a trend of this character, yet if he failed in 1915 to equip his plant to supply the demand for the type of drive in question, he might easily have lost much business that would otherwise have been his in the following year.

The Need of Legislation

INCLUDED in this number of AUTOMOTIVE INDUSTRIES is a revision of the registration statistics published in the number of Jan. 13. In the present printing the numbers in several States have been changed and the total of cars and trucks has been

increased from 8,887,572 to 8,932,458. This change was made necessary for the reason that it was not possible to obtain at the time the former count went to press authorized statements from several of the State officials concerned with registrations. It was not the fault of these officials that this information was not available, but the fault of the system established by the State and which the officials are bound to carry out.

The gathering of registration statistics should be a simple task. It appears that all that is necessary is to ask the proper State official for his figures and add them to get the proper total. The task seems so simple that many persons have ventured to accomplish it. Most of these persons have learned that there is much more to it.

In the first place, the system of registration varies in each State. The classification of vehicles is different. In some States the total is not a right total at all. Some classifications must be subtracted, and in some cases classifications that look different must be included. The local meaning of re-registration, for instance, can be ascertained only by studying the law and the practice of the registration office. These factors may easily make a considerable difference in the grand total unless they are intelligently interpreted.

It is unfortunate for the great industry that there is not a more systematic registration of vehicles, and that the laws are not more uniformly enforced. As it is, a count of registrations from month to month does not in any sense indicate the purchase of motor vehicles in a given territory. Rather it indicates the degree of enforcement of the law in that territory. It also is true that a small percentage of motor vehicles escape registration while some motor cars are twice registered when they engage in interstate commerce. These factors probably balance themselves.

The remedy is obvious. It is a uniform registration law. This feature is included in the "Proposed Uniform Vehicle Law" drafted by the Motor Vehicle Conference Committee. If all States would adopt a uniform method of registration and a more uniform method of making accounts, this problem would to a large extent be solved. Another proposed solution is Federal registration. This, perhaps, would be welcome at a proper cost. Such a proposal has been made by the Secretary of the Treasury, but he wishes to charge the automotive vehicle owners $100,000,000 for this service. His plan would be merely to add another registration routine and fee to the present requirements. There already is grumbling among vehicle owners as to registration routine and fees. To add to this would draw a sharp up curve in the line of sales resistance. One can hardly believe that the States will give up the present privilege of taxing motor cars. The revenue is too great to be given up. Many municipalities now tax vehicles half as much as do the States. There must be no more taxes added.

One thing is certain: The automotive industry has within it a great political power. It is the second industry in importance and volume in the country. If this industry should unite in making a reasonable request it could not be denied. The fact that it suffers from bad legislation is its own fault. If the entire industry would place itself whole-heartedly on the side of fair and uniform legislation, it would get its desserts. This is the possibility. The facts are different. There is frequently division in the ranks of the industry as to legislation. Selfishness as to results sometimes crops out before the first score is made. If ever a situation required team work, it is the present situation as to automotive legislation. Forget details for the present and get behind the movement as represented by the Motor Vehicle Conference Committee.

Labor Statistics

THE exact meaning of any particular set of labor statistics is always difficult to determine for two reasons:

First: No clear definition of terms has become general; there is little standardization of terminology in this field of industrial organization, and consequently the statistician may be talking about one thing and his listener be thinking of another.

Secondly: The really vital factors of the labor and industrial relations problem have not yet been reduced to a definite and concrete form which will lend itself to statistical treatment. So many of these fundamental things lie within the minds and the psychological reactions of numerous individuals that in only isolated instances has their very presence been recognized; and in still fewer instances has a thoughtful, intelligent, and sustained effort been put forth to analyze them carefully and to determine what manner of things they actually are.

The chief value of labor statistics that are available—and of any that are likely to be available for many years—is that they do indicate in a general way certain broad facts and tendencies. The fact that there were more than two thousand strikes during the first nine months of 1920 indicates, of course, that an active industrial struggle is taking place, but the frequency of the strikes is no gage whatever as regards the increase or decrease of fundamental industrial unrest. It is merely a gage of the fighting strength of the unions and the employers.

So with figures showing the causes of strikes. These causes were merely the technical point over which the strikes broke in each case, and bear only a distant relation to the underlying causes, which must be traced back into the reactions of the various individuals comprising the employer and employee groups involved.

Present labor statistics, then, are useful as indicators of general trends of certain particular phases of the labor problem. They are of distinct value when put to such a use, and can be profitably studied from that standpoint. It is a mistake, however, to attempt to use them as accurate and detailed guides in any sense of the words.

It is an unfortunate fact that in utilizing any set of labor statistics for purposes of analysis, it is necessary to examine rather carefully the agency by which they were prepared and to understand the basic standards on which the final results were computed.

Concerted Tax Stand Is Essential

Industry as Whole Must Unite on Plan

Congress Sentiment Leans Heavily Toward New Levies on Motor Vehicles

WASHINGTON, Feb. 12.—Thorough inquiry into the attitude of Congressional leaders toward the tax problems of the automotive industry indicates strongly that unless there is a marked change of sentiment, a major portion of Secretary of the Treasury Houston's plan for additional taxes will be accepted without appreciable revision. Sounding out sentiment of Senators and committee leaders of the House revealed an unmistakable tendency to impose a tax which would check purchases of automobiles by individuals of small means. There are legislators who believe that imposition of additional taxes on motor cars would put the brakes on inflation which, they claim, is brought about by hundreds of thousands who buy machines on credit and cannot afford it.

These statements are based on personal opinions of Congressional leaders whose chief object is to raise revenue. Confidence seems to prevail throughout the industry that the recommendations of Secretary Houston for a 50c per horsepower tax would fail because of the inevitable opposition of 8,000,000 car owners. There are Congressmen who admit that such a tax would be inimical to the development of a great industry, but in the next breath say that it is the only logical way to reduce extravagance. With few exceptions, the advocates of this plan concede the essentiality of the automobile, but they claim that if horsepower and gasoline taxes were thus levied they would serve to stabilize general business through deflation. It is believed that the most effective opposition to the Treasury program will come from farming communities, where the effects of the tax would be quickly felt.

Will Act in New Session

The question of taxation will not be taken up until the next session, which probably will be called for March 14. Chairman Fordney of the House Ways and Means Committee advised AUTOMOTIVE INDUSTRIES to-day that tariff legislation would be disposed of and then attention devoted to questions of internal revenue. He stated that his time had been completely taken up with tariff matters so that he has made but little study of the probable effects the adoption of the Houston program would have on the automotive trade.

He declared that representatives of the industry would be allowed sufficient time to present their arguments as to taxation. Chairman Fordney pointed out that the committee was concerned solely with the problem of producing a yield of $5,000,000,000 or $8,000,000,000, a sum which is required to maintain the Federal Government and retire financial obligations during the next fiscal year.

The proposals of Secretary Houston, which would assess the automobile industry $290,000,000 over and above its present contribution to the public revenues, were suggested as a means of bringing more money into the Treasury. Recognizing the economic movement which must inevitably result from the new levy, certain Congressional leaders, stressing the necessity for economy in Governmental and private enterprise, have seized upon it as an effective weapon to force deflation.

Would Make Cars Luxuries

The attitude assumed by these agitators, whose methods of economy border dangerously on parsimony, is reflected in the statement of an influential legislator who said:

"There are thousands of people driving cars to-day who cannot make their payments and are so situated that they may never own the machine outright. This condition only helps inflation when it is deflation we want. If a man finds an automobile an essential utility then he

(Continued on page 434)

$290,000,000 NEW TAX ASKED OF INDUSTRY

These are the tax recommendations made by Secretary Houston which are of special interest to the automotive industry:—

1. Increase of the sales tax from 5 per cent to 10 per cent, which, it is estimated, will make an increase of	$100,000,000
2. A Federal license of cars based on 50 cents per hp.	100,000,000
3. A consumption tax on gasoline at 2 cents per gallon	90,000,000
4. The truck sales tax will be continued at 3 per cent, despite efforts to have it eliminated.......	
New taxes from industry..	$290,000,000

Organizations Will Confer on Program

General Sentiment Favors Sales Tax—N. A. C. C. Formulates Plan of Action

NEW YORK, Feb. 14—Efforts are being made to bring together all branches of the automotive industry for concerted action in opposition to proposals for levying additional Federal taxes on motor vehicles. The impression has gained ground here that there was little probability of serious consideration being given by Congress to the proposals made by Secretary of the Treasury Houston along this line but it is becoming evident that an additional burden will be placed upon the industry unless there is a determined stand against having the automotive industry made the taxation goat.

The tax committee of the National Automobile Chamber of Commerce already has evolved a plan for presentation to the ways and means committee of the House at the special session which probably will be called for March 14. Taxation will be the most important question considered at that session and the hearings on this subject will begin in April. The recommendations of the N. A. C. C. were made after consultation by the committee with financiers and economic experts.

The program outlined calls for relentless handling of the pruning knife in government expenditures and points out ways in which $1,000,000,000 could be saved. The committee contends that if this amount were eliminated from government expenditures, no additional taxation would be necessary, but if further funds were required, they should be obtained by a tax of 1 per cent on all retail sales.

Will Seek Wide Endorsement

This program has not been approved by any other automotive organization although nearly all of them are in favor of some kind of a sales tax. It is the plan of the N. A. C. C., however, to ask every chamber of commerce in the United States to endorse the plan it has formulated or propose a program of its own and every effort will be made to arouse sentiment in favor of a sales tax.

This form of taxation already has been commended by various organizations as well as by prominent bankers and economists. The chief objection to it is that it would be paid by the ultimate consumer and many unscrupulous dealers would use the excuse of a 1 per cent tax to add several times that amount to retail prices. This consideration may weigh

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Ford Reorganization Assumes Form

Campbell Probable Choice as Treasurer

Sorenson Mentioned as General Manager—Bankers Discredit Company's Independence

DETROIT, Feb. 15—Shifting of the proposed line-up of the reorganization at the Ford plant puts W. R. Campbell in the office of treasurer. While there is no official confirmation of this report, a statement made to AUTOMOTIVE INDUSTRIES to-day by Campbell, the first he has made since he was asked by Henry Ford to accept the general managership, virtually was an admission he would assume the office of treasurer.

Campbell has been in nominal control at Highland Park for a month and has been at the plant all of every day during the period "simply helping to get things straightened out and in shape for quantity production when the plant starts," as he expressed it.

Although Campbell declined when the position of general manager was offered him, Ford would not accept his refusal and used his persuasive powers to such good effect that Campbell is thought to have given in and Highland Park officials declared it certain he would succeed to that end of F. L. Klingensmith's duties with the office of general manager, also held by Klingensmith, given to some other official.

The new alignment is believed to mean that Ford will act on his first impulse and give the position of general manager to Charles E. Sorensen, now in charge of the Dearborn and River Rouge plants. Some persons still contend Ford will go outside the organization to get a new general manager but the feeling among Highland Park officials is that Sorensen will be named.

Statement Promised Next Week

At any rate, details regarding organization, personnel and plans are promised by Campbell the latter part of next week. Campbell, who is regarded as one of the big men in the industry, has a pleasing personality, is easily approached and accessible when not surrounded by the safeguards of private secretaries and other buffers placed by Ford to ward off newspaper men and others seeking information.

Campbell talked freely although he was reticent regarding his own and the Ford company plans, explaining that his was a delicate position and that it was hardly proper under the circumstances for him to make a statement.

"I have had several propositions put to me," said Campbell, "but I have reached no definite decision. There are several things that must be done before any announcement can be made. Under the circumstances it would hardly be proper for me to make any statement regarding the company, its present operations or future plans. Mine is a rather delicate position and while I have been at Highland Park for the last month I must ask you to wait till definite announcements are ready."

Asked about the report that he would become treasurer rather than general manager, Campbell declared latter position is fraught with many handicaps and difficulties not to be encountered in any other office and added:

Campbell to Make Decision

"But I have not made any decision. I think I can promise you something official the latter part of next week when, if I accept any of the propositions presented, a statement of policies and plans will be in order."

The "relief" shift, declared by Henry Ford in an authorized interview to number 10,000, went to work at Highland Park, Monday, succeeding what he termed a like number who had been at work the two preceding weeks. The present shift will work two weeks and be replaced by the first shift, thereby giving 20,000 employees work two weeks each month pending full resumption.

Reports persist that the alternating shifts aggregate not over 5000 each but no official will make a statement, referring all inquirers to Ford's authorized interview, the only feature of which, aside from the cowless milk theory and the reiterated statement that he does not want borrowed money, was a paragraph outlining the alternating 10,000 shift plan. Officials will not say how the men are employed or the amount of production, if any, but the best information is that the force is working exclusively on parts for dealers rather than building for the assembly line. The Highland Park office is practically cleaned out even to stenographers, clerks and office boys.

Guides also have been eliminated and many Detroit visitors seeking opportunity to go through the big plant are disappointed at their inability to secure admission.

"Why Doesn't Plant Operate?"

Despite Ford's statement that he does not need money, representatives of Eastern financiers continue to visit Detroit and presumably confer with the manufacturer. Local bankers only smile when reference is made to Ford's statement of financial independence. If prodded they ask, "Why doesn't the plant open if 67,000 cars were sold in January as stated in his interview, for at same ratio it will be but few weeks before the supply on hand is exhausted?"

Seiberling Urges Stockholder Support

Says Goodyear Will Show Profit for Year if Financing Is Consummated

NEW YORK, Feb. 15—A special meeting of the stockholders of the Goodyear Tire & Rubber Co. will be held in Akron on March 4 to act on the plan for recapitalization and readjustment of the company's finances. In a letter to stockholders, urging them to attend the meeting, President F. A. Seiberling says:

"The plan for readjusting the debt and capitalization of the company has been approved by the Board of Directors and already many of the largest creditors and holders of a majority of common stock have indicated their assent to it.

"As will be seen from the statement of the company's indebtedness set forth in the plan, the position of the company is exceedingly precarious. Since the annual statement of Oct. 31, 1920, the company's indebtedness (including contingent liabilities, most of which will have to be met) has increased to nearly $66,000,000.

"Notwithstanding the discouragements of the early months of the current fiscal year, it is expected that if the plan is consummated, operations of the recapitalized company for the remainder of the fiscal year will show a considerable margin of profit over all fixed charges, including contemplated sinking funds, and over dividends on prior preference stock."

In the last analysis it will be the merchandise creditors who will determine the fate of the Goodyear company. If they accept the plan a receivership will be avoided, but if they fail to do so, it probably will be inevitable. A letter sent to them by the merchandise creditors' committee says:

Plan Holds Better Promise

"Financial difficulties of Goodyear Tire & Rubber Co. have been generally known for some time. When the merchandise creditors' committee was appointed late in December of last year a receivership was imminent and seemed inevitable, and it has thus far been avoided only with great difficulty. After a thorough canvass of the situation, the committee is advised that the present plan is the only available method of avoiding a receivership, and that a receivership would cause great delay and hold out no promise of as favorable an outcome for the creditors."

It is understood that Goldman, Sachs & Co. and Dillon, Read & Co. have agreed

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McCord Management Taken by Creditors

Schlack to Conduct Affairs of Company Under Committee —Will Extend Claims

DETROIT, Feb. 12—Joseph D. Schlack, former vice-president of the McCord Mfg. Co., has been named general manager to operate the concern by an advisory committee of creditors named yesterday. L. M. Hamlin, present secretary and treasurer of the company, will continue in that capacity. President A. C. McCord and his brother will retain membership on the Board of Directors, but will relinquish their salaries and will have no voice in the management of the company, other than as board members acting under instructions of the advisory committee.

Approximately 100 merchandise creditors and representatives of a half dozen banks attended the meeting yesterday and subscribed to the agreement submitted by a committee of bankers and larger creditors, which contemplates operation of the concern pending adjustment of financial difficulties. The agreement provides that all claims of the company will be extended six months with privilege of renewal for a similar period, all claimants to be given notes bearing interest from the date the agreement becomes effective. The period of extension is a matter entirely in the control of the advisory committee, which has authority at any time and for any reason to declare a claim due.

The committee named is as follows:

L. H. Jones, Detroit Copper & Brass Co.; A. B. Seelig, Michigan Copper & Brass Co.; A. White, Pratt & Letchworth, Montreal; C. H. Harris, of C. H. Harris, Inc., New York; H. S. Hayden, of Hayden-Westcott Lumber Co., representing the merchandise creditors, and Ralph Van Vechten, Continental and Commercial Bank, Chicago; F. G. Smith, First & Old National Bank, Detroit; Walter Dunham, Dime Savings Bank; Averill Tilden, Merrill Cox Co., Chicago, and John Fletcher, Fort Dearborn National Bank, Chicago, representing the banking creditors, with Fletcher as chairman of the committee.

Officers Under Committee

Under the agreement officers, directors and stockholders will abide by the instructions of the advisory committee, and will perform any duties or execute any orders issued by the committee. The McCord family interests, which own 65,000 shares of no par common stock, under terms of the agreement, will transfer that stock to trustees named by the advisory committee to assure the committee voting power. Hamlin assumes the position of comptroller for the committee, the agreement stipulating that the concern be operated pending readjustment under active control of a general manager and comptroller named by the committee.

The bank creditors, under the agreement, will furnish capital sufficient to operate the plants of the company, prorating the advances among the banks, which new loans, together with payrolls and new material purchases, will constitute a prior lien against the company. The banking indebtedness is unsecured save by the endorsements of the McCords.

While all creditors represented yesterday signed the agreement, their claims have not been adjusted to market values, and that matter under the agreement is left in the hands of the advisory committee. In a statement filed by accountants approximately 20 per cent was deducted from the merchandise inventories to represent shrinkage in market values, and the committee will take similar action in arriving at credit value of claims of merchandise creditors. It was brought out at the meeting that the West Pullman unit of the company, which makes railway supplies, was the one big handicap to successful operation, that plant losing approximately a half million dollars last year, while the other plants of the company showed fair profits.

Declare Conditions Hopeful

The drain caused by the West Pullman losses, together with dividends paid by the company, are held to be responsible for conditions, which, Chairman Fletcher declared, were found to be such ten days ago as to make quick action imperative. Fletcher said, however, the company's condition was not such as to cause serious concern if co-operation of the creditors could be secured, and added that the McCords had been in every way fair throughout all proceedings and very willing to abide by any suggestion the bankers made looking to a fair and equitable adjustment of difficulties.

It was announced by Fletcher that the West Pullman plant now is closed, and that steps looking to the disposal of that unit would be taken immediately. The Racine unit, which builds bodies, and the radiator and axle plants in Detroit are in good condition and have shown profits right along, Fletcher said.

The company's banking and merchandise liabilities amount to approximately $5,000,000, divided about evenly between banks and manufacturers. All of the creditors showed willingness throughout the meeting to co-operate in any way to bring about a fair adjustment, and the feeling was apparent that the McCords were taking the only fair and reasonable course for protecting all concerned.

RECEIVER TAKES SUBSIDIARY

SANDUSKY, OHIO, Feb. 14—H. R. Greenlee, receiver for the Erie Tire & Rubber Co., has been appointed receiver for the Sandusky Land & Building Co., to which the tire company advanced out of its treasury more than $300,000. The receiver was given authority by the court to complete two large apartment houses started by the land company. The tire company owns 95 per cent of the stock of the building company.

Fort Wayne Creditors Ask Receivership

Charge Heavy Shrinkage in Assets of Company — File $110,000 in Claims

FORT WAYNE, IND., Feb. 14—The reorganization of the Fort Wayne Tire & Rubber Co., which has been proceeding for several months after the election of new directors and the elimination of contracts held by the promoters who formed the company, has received a setback through the filing of three suits on account, demanding $110,000 and asking for the appointment of a receiver for the company.

The plaintiffs and the amounts of their claims are as follows. Jenckes Spinning Co., $60,000; Fred Stern & Co., $48,000; Majestic Tire & Rubber Co., $3,000. The complaints recite the history of the company and declare that after the recent reorganization was completed the creditors agreed to an extension of credit until Jan. 31 to permit the new management to raise $250,000 among the stockholders to meet the company's immediate obligations.

The complaint states that so far this has been unsuccessful. The complaint further states that a recent audit showed $200,000 in fixed assets, real estate, etc., $200,000 in material, and $45,000 in accounts receivable, making total assets of $445,000. The liabilities were then established at $275,000.

The petitioners set out that the accounts receivable shown in this audit are uncollectable, that the value of the plant and real estate has decreased through lack of a market and is worth only $100,000, and that the material on hand has decreased to a total value of $125,000, making the total assets at present but $225,000. The charge is also made in the complaint that the new management, in its efforts to obtain funds, sold the company's products below cost, and by introducing the "flying squadron" method in manufacturing, produced tires at a cost in excess of their value on the market.

FINANCE COMPANY FORMED

MILWAUKEE, Feb. 14—The Automotive Finance Corp. of Milwaukee is the name of a new corporation organized under the laws of Wisconsin to handle motor car, truck and tractor securities, notes, etc. The initial capitalization consists of $100,000 preferred stock and 500 shares of common stock without par value. The incorporators are T. J. Maher, William J. Sarres and Leonard M. Broenen, Milwaukee.

NEDOMA-NAJDER CHANGES NAME

NEW YORK, Feb. 14—The name of the Nedoma-Najder Motor Syndicate has been changed to the Nedoma-Najder Patent Syndicate, and new offices have been opened at 299 Broadway.

Extension on Claims Sought for Willys

Committee Outlines Advantage of Co-operation — File Claims Against Chrysler Plant

NEW YORK, Feb. 15—Creditors of the Willys Corp. have been asked for an extension on their claims until May 1. A letter outlining the position of the company and urging that the extension be granted has been sent out by the committee headed by Theodore Beran of the General Electric Co., which represents merchandise and construction creditors. This committee will co-operate with the bankers' committee, which has taken charge of the company's finances.

The letter states that the company is solvent and has very substantial assets in excess of liabilities. The abnormal industrial conditions which have prevailed for the last few months have made it impossible to arrange new financing. The committee recommends that claims be deposited with the Bankers Trust Co., which is the official depository.

When a sufficient number of claims have been deposited to make the plan effective, it is proposed to give a three months' extension in which to pay the indebtedness and where this indebtedness is represented by acceptances the creditors are expected to authorize the committee to take new acceptances maturing May 1. The company has informed the committee that it hopes to be in a position before that time to make a definite settlement of claims with creditors. The proposed agreement provides that no further extension shall be given and no settlement made at less than the amount of claims in cash without first submitting the offer to the creditors.

A considerable number of the creditors claim the right to file mechanics' liens against the plant now nearing completion at Elizabeth, N. J. The committee has retained lawyers to file liens on behalf of creditors who deposit their claims. When these claims are filed, the committee may agree with the company to extend the time for the enforcement of them beyond May 1.

Unwise to Force Claims Now

The letter says the committee is convinced it would be most unwise to attempt to force claims at this time. Any attempt by one creditor to obtain a preference would necessitate action by the other creditors. This, in the opinion of the committee, would have a very disastrous effect upon the value of the assets and would be most harmful to the industry in general.

The letter states that the committee will examine the assets and commit itself to no definite policy until the facts have been studied, but it has been advised that the creditors ought to receive payment in a reasonably short time.

WILLYS CORPORATION BALANCE SHEET SHOWS TOTAL ASSETS OF $53,694,153

NEW YORK, Feb. 15—Following is the balance sheet of the Willys Corp. as of Nov. 30, 1920:

CURRENT ASSETS			
Cash		$2,330,595	
Securities of other companies, including 739,866 shares of the Willys-Overland Co., valued at $8 per share		10,680,321	
Notes and accounts receivable		4,281,827	
Inventories		8,572,470	
Miscellaneous		301,024	
			$26,166,237
CONTINGENT ASSETS			
Equity in book value of securities at present market value		$11,059,279	
Good will and patents		890,134	
Redemption fund, including preferred stock, land, bldgs. and equipment	$18,279,080		
Less reserve for depreciation	2,700,577		
		15,578,503	
			27,527,916
Total assets			$53,694,153
CURRENT LIABILITIES			
Accounts payable		$2,958,445	
Notes payable		11,450,000	
Accrued accounts payable		234,152	
Dividends payable		4,075	
Miscellaneous		23,848	
			14,670,520
DEFERRED LIABILITIES			
Scrip dividend on first preferred stock		$298,000	
Reserve for taxes		347,294	
Premiums on preferred stock		23,290	
Capital stock outstanding, (first and second preferred and common)		38,355,049	
			$39,023,633
Total liabilities			$53,694,153

Reynolds Receiver Makes 20 Cent Offer

MOUNT CLEMENS, MICH., Feb. 15—An offer to pay all creditors of the Reynolds Motor Truck Co. 20 cents on the dollar of their claims has been submitted to them by Charles J. Reimold, the receiver appointed in Superior Court. The receiver has notified all creditors to file their claims within 90 days and that the assets will be distributed as soon as practicable after that date without reference to claims not proved when dividends are made. The creditors' committee headed by Harry S. Graves, which sought unsuccessfully to have a co-receiver named, has not yet decided upon the advisability of petitioning the company into bankruptcy.

BEARINGS COMPANY RESUMES

WORCESTER, MASS., Feb. 15—Receivers for the Massachusetts Oilless Bearings Co. have resumed operations in the wood bearings department and are rapidly completing uncancelled orders and taking on new work. Their operations have been interrupted because the safe containing the records of the company has not yet been recovered from the wreckage of the Knowles building in which their offices were located and which was destroyed by fire on Jan. 19.

Revere Seeks Funds To Continue Plant

LOGANSPORT, IND., Feb. 14 — Stockholders of the Revere Motors Corp. have elected a new board of directors to devise ways and means to place the company on a solvent basis by the floating of a bond issue. The company now is in the hands of a receiver in a friendly suit brought by U. S. Hoffman and Charles Hanna, stockholders.

The new directors elected are C. C. Bishop, Charles Young, A. L. Jones, M. L. Fansler, A. A. Seagraves, Edward W. Kelly and E. F. Metzger. They propose to issue first mortgage bonds to the amount of $250,000. The indebtedness of the company at present is given as $217,000, and several suits are pending against it for breach of contract. About 75 per cent of the stockholders are residents of Logansport. It is believed that if a bond issue can be floated the company will be re-established on a firm basis.

TO PAY PATHFINDER CLAIMS

FRANKFORT, IND., Feb. 15—Creditors of the Pathfinder Motor Co. of America have been notified by Harry C. Sheridan, referee in bankruptcy, that a final dividend of approximately 20 per cent will be paid them on Feb. 24.

Packard Under Way With 1000 Employees

Non-union Workers Replace Strikers in Body Plant—Sales Show Increase

DETROIT, Feb. 14—Approximately 1000 employees among those laid off at the Packard plant, Jan. 30, returned to work Friday. No discrimination is being made as to married men or men with dependents, employment officials simply notifying the men needed in various departments to again get the plant under way.

The men on strike in the painting and trimming room in the body department still are out, but sufficient non-union workmen have signed up to assure steady operation of that department permitting of resumption in other divisions. Packard officials also said many men who had been members of the union had given up their cards and signified their desire to get back on the job.

Announcement of the reopening of the plant was made in the following formal notice: "Packard Motor Car Co., simultaneously with declaration of the regular dividend of 1¾ per cent to preferred stockholders, announces to employees that increases in sales and great improvement in spring business is responsible for a decision to put on 1000 employees immediately."

About 3000 men were laid off when the plant went down, and while Vice-President Roberts expressed hope of resumption in ten days, employees were informed that the shut-down might last thirty days. The action was taken, Roberts said, to permit of balancing inventories. The announcement to-day disposes of rumors that the March dividend would be passed.

Sinclair to Sell Its Motorcycle Business

NEW YORK, Feb. 14—Sidney S. Meyers, general counsel of the Motor and Accessory Manufacturers Association, has been informed by Charles Margerum, trustee in bankruptcy for the Sinclair Motors Corp., that an agreement has been entered into with a firm of New York attorneys, under which the assets of the company applying to the manufacture of motorcycles, together with the property in the Springfield plant, consisting of equipment and machinery, will be held intact until April 21 to permit the attorneys to submit an offer for the purchase of the assets or settlement with the creditors. The terms of this offer have not been made definitely, but it can be stated an effort is being made to interest capital in the reorganization of the motorcycle business.

Margerum stated that this offer, together with the funds which will come in from the sale to the Winther Motor Truck Co. of a Government contract for the manufacture of seventy-five Militor trucks, will be sufficient to permit payment of about 30 cents cash on the dollar to the Sinclair creditors and 70 cents on the dollar in second preferred stock in a new corporation which will be formed to take over the motorcycle business. Sinclair will get $90,000 for the transfer of the truck contract together with the dies, tools and materials owned by the company.

Margerum has been authorized to effect a compromise with the Knox Motors Corp. by an entry of judgment for the plaintiff in seven replevin suits pending in Superior Court. There are now on hand sufficient funds to cover the claims of workmen for wages for the week ending Oct. 9.

Oneida Official Finds Truck Outlook Better

GREEN BAY, WIS., Feb. 14—On his return from a month's business trip through the Pacific Coast region, Lafayette Markle, president and general manager of the Oneida Motor Truck Co., Green Bay, Wis., reported a most encouraging condition in respect to the motor truck market. Markle and his assistant, J. E. Johnston, established Oneida dealers in a number of the principal cities of California.

"California is one of the best fields in the world for motor truck manufacturers," said Markle. "It is an all-year-round market. The business men are enthusiastic over the truck. Fine roads and climate make it possible to use the commercial as well as passenger car twelve months in the year. In one instance motor bus lines put out of business a 50-mile railroad running south out of San Francisco. Figures compiled from sales sources show that the average sale of trucks in southern California alone is between 550 and 600 trucks every month. Organization of new bus line companies, enlarged operations in power development, road construction and general freight and passenger traffic call for a large number of new trucks.

It was announced upon Markle's return that the Oneida company will soon place in quantity production a new type of light truck designed for the needs of farmers and business men. Up to this time the Oneida truck has been built in sizes from 2½ tons upwards.

CREDITORS SUE SANDOW

BOSTON, Feb. 11—A creditors' petition in bankruptcy was filed to-day in the United States District Court against the Sandow Motor Truck Co. of New England. with claims against the company of $61,642. Creditors are the Commercial Finance Corporation of Boston with a claim of $39 986, and the Detroit Auto Radiator Co. of Boston with a claim of $16. The petition alleges that at a special meeting of stockholders held Feb. 7 it was voted that the treasurer of the company, S. D. Griffiths. express in writing the company's inability to pay its debts and its willingness to be adjudged bankrupt.

Pierce-Arrow Ready to Resume Schedule

Factories Completely Reorganized to Manufacture New Models—Will Employ 5000

BUFFALO, Feb. 11—Completion of the vast amount of work preliminary to the establishment of regular production schedules for its new passenger cars and truck models was announced yesterday by the Pierce-Arrow Motor Car Co. Both passenger cars and trucks have been produced in a limited quantity during the last few months, the work of preparation for normal production progressing simultaneously.

"Few appreciate the enormous amount of detailed planning and physical work necessary to rearrange a big factory, install new machinery and produce new tools, dies, jigs, templates and other essentials required when new motor car and motor truck models are launched," said George W. Mixer, president of the company.

"This work requires a large force of men, and for that reason a large payroll was maintained by the factory during the last few months when other plants have found it necessary to curtail or to shut down."

The task of preparation having been accomplished, says Colonel Mixer, the company has effected a readjustment of its factory forces. About 500 who have been engaged in work of preparation are being laid off, but the bulk of the factory force, numbering 5000 workers, will continue regular production.

Interlocking Creditors Request Liquidation

AKRON, Feb. 11—Complaints of creditors of the Interlocking Cord Tire Co. that the affairs of the company were hopelessly muddled and asking for the appointment of a permanent receiver that the affairs of the company may be liquidated at once, will be heard by Judge Wright on Feb. 28. He has instructed that a meeting of the company's 5000 stockholders be held before that time to consider the situation.

Through this action the creditors and 400 stockholders who originally petitioned for the appointment of a receiver, practically abandon all plans for a reorganization of the company. The creditors asking the liquidation of the company hold claims aggregating $120,000. The officers of the company are under indictment for alleged violation of the Ohio blue sky laws.

FORD-CAMBRIDGE REOPENS

BOSTON, Feb. 11—Operations have been resumed in all departments of the big Ford Motor Co. assembling plant at Cambridge. The plant has been closed following the closing of the parent factory in Detroit.

Iowa Stages Show to Break Depression

Gradual Liquidation of Crops Expected to Start Buying—Many Cars Warehoused

SIOUX CITY, IOWA, Feb. 14—Automobile, truck, tractor and accessory dealers opened today their first show in four years—a show which is expected to revive, in a measure at least, a business which has been virtually dead since Ford cut his prices last September. In fact, sales here have been all but negligible since April, 1920, when the tightening of bank credits began, but the Ford price-cut proved the cap-sheaf of a steadily rising wall of sales resistance, which has reduced country dealers to the state of garagemen, storekeepers, bankers or whatever they were before they undertook automobile agencies, and which has forced dealers in the city to live on the profits of 1919 and early 1920.

It seems incredible that this richest agricultural center of the country, marketing point for a large area of wonderfully fertile lands in Iowa, Nebraska and South Dakota, could have suffered such a business depression, but it has. The trouble lies in the sharp decline of farm produce prices, weakening the farmer's buying power and creating a resentment against the slower trend downward of other prices which has virtually taken the farmer out of the market, and in the withdrawal from this territory of millions of dollars which the overprosperous farmers, merchants and wage-earners—and even some of the bankers—invested during the boom period in stocks which are now worthless, or nearly so.

There were some local promotions which absorbed huge sums of local capital—for instance, a packing plant which is now in receiver's hands—but much of the money invested in securities whose promoters promised big dividends has gone East or West with the promoters, who lost little time in seeking climes which would be healthier—for them. The money is gone, $200,000,000 from Iowa alone, it is said here, and another harvest will have to be marketed before anything like normal conditions can prevail.

Bank Loans Due March 1

There is prospect of some improvement in the situation after March 1, when banks generally are calling farmers' loans long overdue, thus forcing the agricultural community to disgorge last year's and even some of the 1919 crops stubbornly held in hope of higher prices. The crop liquidation movement is now under way, proceeding about as fast as the elevator men can handle it, and it is on this break in the tight money wall that the automotive men are pinning their faith—and holding a show to exhibit their faith to the community.

Dealers here do not see any possibility of big business this year and this is why: First, they must move a considerable stock of goods in warehouse, a stock which some manufacturers forced into the territory even after the then slow sales came to a complete halt in September. Then they must combat an organized movement of farmers not to buy—anything. Farmers are organizing to use each other's machinery in turn, which necessitates the most vigorous sort of sales effort by the tractor and implement men.

Crops Fail to Pay Rent

The farm situation is something like this: The renter, who depends on his crops to pay the landowner, got a price so low, if he sold at all, that he couldn't pay his rent or his grocery or garage bill or his loan at the bank on machinery or seed. The farm-owner, in many cases, bought stock which is paying no return or took part in the frenzied land speculation which inflated values from $200 to $900 an acre.

The farmer borrowed from the bank to buy the stock or the land, giving notes on his outright holdings. He hasn't paid the bank either, in many cases because he refused to raise the money by selling at forty cents corn which he planned to sell at $1.40 when he borrowed and spent the money he was going to get for his crops. The result is no money to loan in the country banks or in the city banks to which they are tributary, and the final result of all this is business stagnation.

But big business men here, including some of the automobile men, are counting on the farmer to come back into the market when he sees the 1921 crop breaking through the ground. With the banks pressing him to take up his notes, it is believed that the natural inclination to sell the old crop when the new one begins to grow will be in evidence, that the farmer will accept his loss, forget some of his resentment and buy some of the things he needs and wants.

In the used-car field there is no market and dealers have some stocks. Low-priced cars, like used cars, are in low demand, too, because it was the renters largely who bought them. And the higher priced car field has to face the opposition of bankers who have repeatedly threatened to force payment on a farmer's notes when the word got around that the farmer was going to buy a car. It has happened even in cases where a farmer worth $100,000 owed the bank only $20,000, but the bank needed the money, and the farmer, who would have sold $2,000 or $3,000 worth of produce, even at a sacrifice, refused to let go $20,000 worth—still hoping for higher prices—so he bought no car.

Potential Trade Large

However, there are in this territory thousands of rich farmers, elevator men, live-stock men and merchants, men who are rich in the huge profits of the war period, despite their losses of the past ten months. Dealers in cars, trucks, tractors and accessories are going to sell to them and get a fair volume of business until the next harvest sets this country on its feet again.

Favorable Influences Help Trade in South

Atlanta Reserve Bank Finds Return to Stable Conditions Well Under Way

ATLANTA, Feb. 12—The most recent report of the Federal Reserve Bank of Atlanta for the Sixth Reserve District, which comprises most of the Southeastern area, indicates a gradual improvement in virtually all lines of business throughout the district, officials of the bank declaring that this fact may be taken as evidence that the period of depression and readjustment has passed and that the return to normal, or what might be better termed a more stabilized condition, is under way.

Numerous manufacturing plants throughout the Southeast that have been shut down for several weeks, some of them for months, have resumed operations since the first of the year and this, too, is indisputable evidence that business is improving. The reopening of numerous textile mills in the South will undoubtedly have a favorable effect on the cotton market, and it is already noted that the price of the South's greatest product is beginning to climb.

This, in turn, will have its effect on the automobile industry in this section and will greatly stimulate sales when cotton prices have climbed back to a reasonable figure.

Atlanta dealers continue to enjoy what can be termed a fair volume of business. As compared with November and December of 1920, the total volume of January business among Atlanta dealers was very good, though, of course, considerably below normal. The increase in business experienced during January is taken by the dealers to mean better things to come and continual improvement from now on.

Spring Weather Helps Move Milwaukee Cars

MILWAUKEE, Feb. 15—The glutted condition of the used car market is gradually being overcome by the vigorous efforts of dealers, which have been supported by a natural advantage of spring-like weather, especially during the last week to ten days. Attention, of course, is also being given to merchandising new cars, but primary consideration is directed at used vehicles to prevent any further accumulation, inasmuch as from 70 to 80 per cent of purchases of new cars are involving trade-ins.

Climatic conditions all winter have been wholly unusual in being extremely mild, and if this condition continues until spring arrives by the calendar, it is felt that the usual seasonable demand will be not only advanced considerably but assume excellent proportions. When people talk of "spring fever" in the middle of February, the psychological attitude necessarily is advantageous to the trade.

Italian Factories Increase Exports

Fiat Creates Production Record in December — Communist Movement Loses Ground

TURIN, Feb. 5 (*Special Correspondence*)—All trace of the Communist movement of last September in the Italian automobile factories has now disappeared, and work is being carried out in every case under the old management and with more vigor than ever. The Government decree fixing the appointment of joint shop committees does not appear to have made any appreciable change.

The committees exist and are recognized by the employers, but they have not been the means of giving the workers any real power in the control of the works. The present arrangement is only temporary, and a more permanent scheme is being prepared. The claims of the extremists for power to decide the condition of contracts, to make purchases, and to determine the rates of wages have all been abandoned.

General conditions in the industry appear to be much more favorable than in other European countries, which is doubtless owing to the fact that Italy has a substantial export business and is able to hold foreign markets at the present by reason of her rate of exchange. At the Fiat factory, which is the biggest in Europe, it is declared that the month of December showed a record output for the year, 70 cars per day being maintained for the entire month. Probably 85 per cent of these were sent abroad.

Fiat is pushing forward work on its new 5-story factory at Lingotto, which was begun during the war. This is by far the biggest factory devoted exclusively to automobile production in Europe. At the present time only the forges, forming an addition to this factory, and the body shops are in operation, all other work being done in the old factory.

Trucks and Tractors Dull

Fiat is working principally on passenger cars, for the truck market is very dull and there is also a slackened demand for agricultural tractors.

A few months ago the Ansaldo company, one of the biggest general engineering concerns in Italy, produced a light 4-cylinder overhead valve job, designed for economical production. This is being built in Turin, and although a few have been put on the market, there are no indications that Ansaldo is going to spread to any extent in this business. The intentions of the company are not known, but it would appear that the present is not considered a suitable time for coming into competition with existing and well established firms. The Spa company, which is specializing on two high-class models, is under the financial control of Ansaldo.

Lancia is continuing work on his 4-cylinder model and is maintaining his output. A year ago he exhibited a high-class 12-cylinder job, and promised deliveries for the middle or fall of 1920. Changed conditions, however, have decided him to hold back the 12, for the market for this class of car has shrunk and production costs have considerably increased. Isotta-Fraschini has got into production on the high-class 8-cylinder in line exhibited at the recent show.

Maxwell Merger Plan Opposed in New Suit

WILMINGTON, DEL., Feb. 16—Charles J. True, a resident of Illinois and owner of 400 shares of the first preferred stock of the Maxwell Motor Co., has filed a petition in United States Court here for the appointment of a receiver and an injunction against the consolidation of the company with the Chalmers Motor Co. A subpoena was issued returnable March 7.

Minority Action Expected

NEW YORK, Feb. 16—Filing of a minority stockholders' suit against the Maxwell company occasioned little surprise here because it had been expected for several weeks that such action would be taken. A considerable amount of the stock has not been deposited under the reorganization plan. It is not expected that the courts will grant the petition, for it would militate seriously against the success of the merger.

W. R. Wilson May Head Maxwell Combination

NEW YORK, Feb. 16—Dwight E. Lee, general manager of the Motor Products Corp., left for the East to-day. One of the purposes of his trip is to confer with the Maxwell-Chalmers management committee on the question of taking charge of production for the corporation. The subject has been broached to him before, but it is understood he is not eager to accept.

Another man who has been suggested for the position is W. R. Wilson of the Irving National Bank, New York, who formerly was connected with Dodge Bros.

While reorganization of the personnel of the Maxwell-Chalmers combination is being given serious consideration by Walter P. Chrysler, chairman of the management committee, no announcements have been made, and it is understood here several weeks may elapse before a selection is made.

Franklin Production Back to 100 Per Cent

SYRACUSE, Feb. 14—H. H. Franklin Mfg. Co. resumed production at 100 per cent capacity on Feb. 10, employing approximately 300 persons. Orders for January delivery exceeded January production by 15 per cent, and on Feb. 1 the company had on hand 426 unfilled orders. Price increases of from $100 to $150 will become effective March 1.

Dunlop Deprecates Stability Attacks

Takes Steps to Protect Interests in American Company—To Raise New Funds

(*By cable to* AUTOMOTIVE INDUSTRIES)

LONDON, Feb. 14—A meeting of the stockholders of the Dunlop Rubber Co. yesterday was largely attended. There was much interest in the proceedings, and an amicable feeling prevailed at the end. Irish stockholders insisted on the protection of their interests but they were satisfied with the promise of F. A. Szarvasy, temporary chairman of the board, that the assets were more than sufficient at the present time to meet liabilities and to pay all stockholders twenty shillings on the pound.

Szarvasy deprecated reports that the company was in a serious position. He said some of the recent offering of 3,000,000 pounds sterling in stock was subscribed for by persons who were without adequate resources and who had to realize on their purchases indiscriminately. It is the apparent intention to raise 5,000,000 or 6,000,000 pounds by the sale of debentures.

Stockholders were informed proposals for financing the American Dunlop Co. could not be carried through, and it was decided to remit the sum of 806,000 pounds to avert a receivership and give time for further negotiations. A committee of the directors went to America to arrange a bond issue of $6,000,000 and safeguard the position in America, but further working capital is required. It was the original intention to issue bonds for $12,000,000 or $14,000,000 to redeem bonds and provide working capital.

Reports indicate that the American business ought to prove a big success. If the parent company had not taken the steps it did, the alternative would be to abandon interest in it and to risk the acquisition of the United States factory by rivals with the right to use the Dunlop name. The meeting authorized the directors to guarantee payment of bonds and to increase the preference share interest.

The press indorses the action taken as the best way out of an uncomfortable position, and characterizes it as a personal triumph for the tact and business ability of Szarvasy.

RAPID RIM PETITION FILED

FORT WAYNE, IND., Feb. 14—Petition has been filed in the local Federal court before Clerk T. J. Logan to have the Rapid Rim Co., of Huntington, Ind., declared bankrupt. The petition was filed by Albert L. Heinns, Henry F. Meyers and J. Archie Borland, who was formerly president of the company. It is declared in the petition that the company owes its creditors more than $100,000. A large number of Fort Wayne firms are among the creditors of the company.

Army Truck Dumping Opposed in Senate

Will Seek Allocation to States for Highway Purposes Under New Bills

WASHINGTON, Feb. 15—Strong opposition has developed in the Senate to the plan sponsored by Representative Anthony of Kansas to dump surplus army trucks, passenger cars and tractors on the open market, to such an extent that it is quite likely that the tentative legislation will fail. Three Senators have introduced separate measures having for their express purpose the transfer of this material to the highway organizations of the different states.

Senators Ball, Delaware; Norris, Nebraska, and Dial of South Carolina, have submitted bills which incorporate all the features of the Reavis bill introduced recently in the House to authorize the transfer of all surplus motorized equipment to the Bureau of Roads and the various States. Proponents of this legislation have obtained nation-wide endorsement from State officials. The Norris measure is offered as an amendment to the Army appropriation bill.

It is said that Senator Ball has undertaken a study of the situation, and, as a result, will convince the Senate of the economic advantages to be derived from transfer to various States rather than open sales. Because of the evident desire of numerous Senators to support the transfer legislation, it is probable that the Anthony rider will be eliminated before the Army bill is reported to the Senate.

The fact that three Senators representing different political parties and widely separated sections introduced three measures for the transfer of the surplus material indicates that the interest in the proposed sale of motorized equipment is national in scope. The Army appropriation bill as it passed the House and is now pending in the Senate Finance committee, directed the War Department to sell 10,000 trucks and 1000 automobiles.

Would Sell 2000 Tractors

The fortifications appropriation bill reported out to the House by Representative Slemp of Virginia, carried a paragraph authorizing the expenditure of $600,000 for alteration and maintenance of mobile artillery, including the purchase and manufacture of tools, machinery and materials and expenses of mechanics engaged in the work. But the sub-committee inserted a proviso which would make it impossible to spend this sum unless the 2000 tractors were sold. As new legislation it will be subject to a point of order when under consideration in the House late this week and may be eliminated.

Senate leaders advised AUTOMOTIVE INDUSTRIES to-day that the pressure of other legislation would undoubtedly block the consideration of the Army appropriation bill at this session. Though the President-elect has requested that the decks be cleared for taxation measures at the new Congress, it is unlikely that pending measures can be disposed of before adjournment March 4. It is learned that majority leaders are desirous of having the Army bill last on the calendar, if possible, because of the signs of a filibuster in event an effort is made to continue the House plans for selling motorized equipment.

Hicks-Parrett Tractor, Formed by New Merger

CHICAGO, Feb. 16—The Parrett Tractor Co. (wheel type) and the Hicks Tractor Co. (crawler type) have been merged into the Hicks-Parrett Tractor Co., the merger being effected so that the two types of tractors to meet differing local conditions could be manufactured in the one factory.

The company is capitalized for $3,500,000 and occupies 147,000 ft. of floor space at its factory here. The officers of the new company are Vincent Bendix, president; Robert Barbour, vice-president; George A. Gibson, vice-president and general manager; R. P. Hicks, vice-president in charge of engineering; J. E. Tracy, vice-president; Russell A. Reed, vice-president and head of the export department; Herbert L. Scharlach, treasurer; Walter J. Buettner, secretary.

The directors include Barbour, Scharlach, Tracy, Hicks, Gibson, Bendix, Warren Barbour, Henry A. Rudkin and B. A. Tomkins. The company also manufactures a line of motor trucks.

Harvester Increases Akron Truck Schedule

AKRON, Feb. 14—The Akron motor truck works of the International Harvester Co. this week started on a production basis of 150 motor trucks weekly. One order of 500 trucks for foreign shipment will be completed within the next two weeks. The company is also operating on a basis of production of 6000 thresher machine engines this year, and contemplates increasing its factory forces materially in March.

NAPOLEON ELECTS OFFICERS

TRAVERSE CITY, MICH., Feb. 11—Stockholders of the Napoleon Motors Co. at the annual meeting here elected the following board of directors: W. G. Rath, C. D. Peet, Frank Trude. E. G Arntz, W. J. Chase, L. W. Smith and Frank Brooker. Officers remain as last year except that W. G. Rath was elected secretary-treasurer to succeed Frank Trude, and C. D. Peet succeeded W. G. Rath as general manager.

The business situation of the company was considered satisfactory with current assets more than five times current liabilities. The directors announced the payment of a 10 per cent dividend on all outstanding common stock; 8 per cent in stock and 2 per cent in cash scrip, payable Aug. 31.

Protest Increases in New York Fees

N. A. C. C. and Dealers' and Truckers' Organizations to Combat Proposed Legislation

NEW YORK, Feb. 14—At a meeting called by the Motor Truck Association of America here today at the Café Boulevard and attended by representatives of the N. A. C. C., the Commercial Truckers' Association of America, the Long Island Automobile Club, the New York State Association of Automobile Clubs and the New York Dealers' Association, besides several large individual users of trucks, such as the U. S. Trucking Corp., it was decided to form a joint legislative committee of all the associations represented and others to carry direct to Governor Miller a protest against any increase in the license fees for either motor trucks or passenger cars.

Evidence presented at the meeting seems to show that the total income from license fees in the State of New York last year totaled approximately $9,000,000, whereas the cost of road maintenance and construction amounted to only $7,500,000.

Aside from all other economic considerations which should be taken into account in regard to both passenger cars and motor trucks, the legislative committee will claim that there is no justification in raising license fees at this particularly critical period in our reconstruction, so long as the total license income exceeds the cost of road maintenance and reconstruction.

The following statement has been prepared by the Merchant Truckmen's Bureau with reference to the proposed legislation:

"The move to tax the heavy motor truck from State roads is out of line with the general policy of present-day transportation.

"The motor truck has brought outlying communities into closer touch with the metropolitan district, has served as a communicating link between cities and, under the stress of emergency, has taken up the long haul of railroads when their services, because of labor difficulty or congestion, became inadequate.

Trucks Cut Cost of Living

"The motor truck brings perishable commodities to the cities in large quantities, and, when green vegetables were held at prohibitive prices by commission merchants, it was the motor truck which went out into the country and brought in produce, forcing concessions in prices.

"The motor truck has become a part of our transportation system because it has demonstrated its ability to do certain work more economically and expeditiously than can be done any other way.

"Instead of discouraging the use of motor trucks for the preservation of roads, the motor truck should be recognized as a national necessity—a part of our transportation."

Good Roads Congress Urges Speeding Work

Exemplifies Need of Wise Expenditures in Year's Program —Available Funds Large

CHICAGO, Feb. 14—Scarcely had the doors of the Coliseum closed on the national automobile show than they swung open on the eleventh American Good Roads Congress, the eighteenth annual convention of the American Road Builders' Association and the twelfth National Good Roads Show. Some dealers who attended the automobile exhibit remained over this week, so intimate is the relationship between good roads and the industry, and the Chicago Automobile Trade Association interested itself in helping to entertain the visiting good roads delegates.

The question which confronts the road builder, it was shown from the discussions, is not where to get the money for improvements but how wisely he can spend it. It is realized that with the changed traffic conditions greater study should be given to the character of roads to be built and the kind of maintenance to be given those highways already constructed. There is a feeling that maintenance should be kept at 100 per cent, regardless of mileage contemplated.

Immediate construction on roadwork was urged. The discussion of sub-grades was one of the most important on the program.

"The crying need, as far as that need can be seen at the present time," said H. G. Shirley, secretary of the Federal Highway Council, "is to build a road that will have a uniform strength, so as to carry a specific load over its entire length without danger to its structure. We all know that on gravel soils with a high bearing power a thick surfacing will not be required, whereas on soil consisting of clay a very much thicker surfacing will be required to carry the same load certain seasons of the year. Why, then, should we persist in laying the same thickness of surfacing over the clay soils that we lay over gravel and other more stable materials? Millions are wasted annually in placing a greater thickness of material in places where it is not needed than in other places where a greater thickness is essential."

Must Show Earning Capacity

In speaking of the big program planned, Thomas H. MacDonald, chief of the United States Bureau of Public Roads, said, "Just now we have literally a pocketful of money. Funds have been made available in large amounts by the Federal Government, the States, the counties and even smaller districts which have accumulated because of non-expenditure. The earning capacity of our roads must be demonstrated, however, for we should not be hypnotized into the belief that this condition will continue to exist."

The fundamental engineering problem, MacDonald stated, was the inter-relation of the motor truck and the road.

"There is no doubt," he said, "that the design of motor trucks has been treated largely from the mechanical consideration of the construction of the vehicle itself. The development of these vehicles has taken place so rapidly that the adaptation of the vehicle to the roadways over which it is to be operated has been seriously neglected. On the other hand, the highway engineer is forced to give some consideration in his design of modern highways to the vehicles which are to be operated over them, and it is now time that the inter-relationship of the design of highways and the design of motor vehicles be recognized as a fundamental engineering problem without which the development of neither can go forward in a manner that will bring to the public the greatest service."

The Good Roads Show, which occupied the major part of the Coliseum, was given over to the display of road-building machinery, with a large number of trucks placed on view.

H. S. Berlin Elected President of Victor

SPRINGFIELD, OHIO, Feb. 15—H. S. Berlin, of Akron, has been elected president and general manager of the Victor Rubber Co. by the board of directors. The other executive officers chosen were: Vice-president, W. L. Timmons of Cleveland; secretary and treasurer, H. S. Burr, of Springfield; factory manager, Frank R. Talbott, of Springfield; sales manager, C. A. Swinehart, of Springfield. The new president and general manager has been in charge of one of the plants of the Firestone Tire & Rubber Co. of Akron, and has had extensive experience in the rubber industry. He succeeds H. H. Burr in the reorganization.

Announcement is made that orders for tires are being received by the Victor Co. in increasing volume. The factory is now running about 60 per cent on tires.

EDMUNDS & JONES SHOWS GAINS

DETROIT, Feb. 14—Profits of $108,226.01 for the year ending Dec. 31 are shown in the annual report of the Edmunds & Jones Corp. Assets aggregating $2,347,382.27 compare with $2,395,080.91 at the close of 1919. Current assets of $1,319,714.47 and current liabilities $532,746.98 compare with $1,468,791.64 of current assets and $479,733.00 current liabilities the previous year. Working capital in 1920 was $786,967.49 compared with $989,058.64 in 1919. Plant investment is given at $990,940.03, an increase from $900,558.79.

Surplus representing the book value of 40,000 shares of no par common stock after allowances for Federal taxes and deductions of dividends of 7 per cent on preferred and $2 on common was $959,409.15, compared with $1,016,997.83 at the end of 1919. Outstanding preferred was reduced from $890,400 to $843.200 by purchase and redemption, making $156,800 retired by that method.

Highway Educators Meet at Ann Arbor

Many National Figures to Address Conference—Ex-Secretary Redfield on Program

ANN ARBOR, MICH., Feb. 11—Under the auspices of the permanent committee on Highway and Highway Transport Education, the University of Michigan and the Michigan State Highway Department, a mid-western conference on highway and highway transport education will be held here Feb. 23. The program will be as follows:—

Morning session, 10:00 A. M., Auditorium, University Hall; Dr. P. P. Claxton, U. S. Commissioner of Education, presiding; "The Highway and Social and Economic Welfare," by Dr. Claxton, chairman of the permanent committee; "The Educational Activities of the Permanent Committee," by Professor C. J. Tilden, director of the permanent committee; "The Economics of Highway Transport," by Roy D. Chapin, vice-president, National Automobile Chamber of Commerce; "Highway and Highway Transport Education in Secondary Schools," by George C. Diehl, chairman, good roads board, American Automobile Association; "Safety First Education in Secondary Schools," by Harriet E. Beard, Supervisor of Safety Education, Detroit public schools.

Afternoon session, 2:00 P. M., Auditorium, University Hall, Dr. P. P. Claxton presiding: "The Measure of Highway Accomplishment," by Thomas H. MacDonald, Chief, United States Bureau of Public Roads; "The Army's Highway Transport Problem," by Col. Mason M. Patrick, Corps of Engineers, U. S. Army; "The Interrelationship of Waterway, Railway and Highway Transport," by Professor Henry E. Riggs, Professor of Civil Engineering, University of Michigan; "Snow Removal from Transport Routes," by Charles J. Bennett, State Highway Commissioner of Connecticut; "The Economic Value of Highway Transport Surveys," by Professor Arthur H. Blanchard, Professor of Highway Engineering and Highway Transport, University of Michigan.

Dinner will be served in the banquet hall of the Michigan Union at 6:00 P. M., Dr. Mortimer E. Cooley, president of the Society for the Promotion of Engineering Education, presiding. After dinner addresses will be "Highway Transport and the Industry," by Tom Snyder, secretary, Indiana Highway Transport & Terminal Association; "Interrelationship of Highway Transport and the Back-to-the-Farm Movement," by A. R. Kroh, Development Department, Goodyear Tire & Rubber Co.

At the evening session, with Dr. Marion L. Burton, president of the University of Michigan, presiding. "The Trinity of Transportation," will be, discussed by William C. Redfield, former Secretary of Commerce of the United States.

GASOLINE QUALITY HIGH

WASHINGTON, Feb. 11—Improvement in the quality of motor gasoline has been reported by the Bureau of Mines after a study of samples taken from representative garages throughout the country.

Seiberling Urges Stockholder Support

Merchandise Creditors to Take Shares If Not Sold—Stock Values Improved

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to head a syndicate to underwrite the $25,000,000 20-year 8 per cent sinking fund bonds, proceeds of which will go toward paying off the bank debt. While no decision has been reached in the matter, it is not unlikely that the balance of the financing, consisting of $25,000,000 10-year 8 per cent sinking fund debentures, 250,000 shares of common stock and $35,000,000 8 per cent prior preference stock will be underwritten by another banking group. The $25,000,000 debentures, 250,000 shares of common stock and $35,000,000 prior preference stock is to be offered for subscription to existing common and preferred shareholders of the company at prices to be determined by the committees in charge of the plan, and these securities or the proceeds from their sale will be used to satisfy other claims and for other corporate purposes.

Under the plan, if none of the prior preference stock is sold, practically the entire $35,000,000 will be divided among the merchandise creditors, who are split into two groups.

One group represents creditors to whom the company's indebtedness existed on Jan. 1, 1921, and whose claims aggregate $15,395,660. They will receive 125 per cent of their claims in prior preference stock, or $19,244,575 par value.

The other group represents creditors with whom the company has made commitments for merchandise not delivered prior to Jan. 1, 1921, but for which specifications and prices have been fixed. Their claims aggregate $54,959,503, for which they will receive 75 per cent in cash, payable not later than the tenth of the month following shipment from American point of shipment, and 28 per cent in prior preference stock, which amounts to $15,388,660 par value.

Will Write Down Inventory

The company contemplates "writing down" its inventories and commitments, and converting part of the difference between the cost and market value of raw materials into prior preference stock, so that the company's earning ability may be immediately enhanced and also so as to bring nearer dividend payments.

The refinancing wipes out the company's deficit, and will enable it to operate on costs based on present market value and to resume earnings.

"While the present low market prices of our stocks do not look good to those who hold them, we feel that the value of these stocks is made more secure and the future prospects are made brighter by the plan which proposes to relieve us of the dangers of pressure by our creditors," says a Goodyear statement.

EMPLOYEES AGREE TO WAIT FOR WAGES

DETROIT, Feb. 14—Penberthy Injector Co., which has been working on a two-day week schedule, began work to-day on a five-day schedule under a deferred wage payment plan submitted by officials and accepted by employees.

Under the plan employees will be paid cash for three days each week and the balance credited to their accounts. Cash on the deferred wages will be paid on a sliding scale proportionate to the volume of business as it increases.

The plan was proposed to give opportunity to all employees to make sufficient money to maintain themselves, and to give the company an opportunity to work up its stock in materials, which is estimated to last six months. Officials of the company are confident of early improvement in business and look forward to paying the deferred wages within a few months.

Willys-Knight Output of 2 Daily Scheduled

TOLEDO, Feb. 14—The Willys-Overland Co. posted its first production schedule this year to begin to-day of two Willys-Knight sedans daily.

This schedule will keep the small force of men, about 1600 now employed at the plant, busy. Parts of the cars are already built. Men have been busy rectifying some cars in the factory for several weeks.

That the market at the present time in the whole country is just at the balance point where talk of further price reduction, new models, or other disturbing elements might set the industry back several weeks is the thought of Mr. Wilson, in charge of Overland operations.

He feels that the industry has made a move in the right direction during the last two weeks and that conditions appear to be coming right.

Industry has picked up about as much as bank clearings, three per cent. That's the general opinion of the Overland officials.

CHARLES R. STEPHENS DIES

MOLINE, ILL., Feb. 14—Charles R. Stephens, son of George W. Stephens, founder of the Moline Plow Co., and for 27 years intimately associated with the business, died suddenly Wednesday at his home in Los Angeles. Mr. Stephens had not been interested in the company since it was acquired in 1918 by the Willys interests.

He was superintendent of the plant for 18 years, a director of the company nearly as long and in later years director of the foreign sales department. He made a notable record as shop superintendent. Mr. Stephens was born in Moline, June 8, 1862.

Bosch Wage Scale Cut 12½ Per Cent

Company Takes Conservative Position on Dividends—Extension of Markets Helpful

SPRINGFIELD, MASS., Feb. 15—The American Bosch Magneto Corp. has announced a wage reduction of 12½ per cent affecting all factory employees whether on a weekly or piece work basis. Operations in the plant are being steadily increased and several hundred men are now employed.

The directors of the company will meet late this week for action on dividends and it is reported payments will be reduced. Although the company has about $6,000,000 of orders on hand it is said the directors are inclined to take a conservative position on the dividends pending improvement of business conditions.

Arthur T. Murray, president of the company, has sent out a review of the corporation's business since its inception. This shows that in 1916 sales were slightly more than $4,000,000 and that in 1918 under the old company and the alien property custodian they had fallen to $3,656,000. The sales of the new American company in 1919 were $5,982,000 and in 1920 they had increased to $8,805,000.

Murray devotes considerable attention to the taking over of the management of the Gray & Davis plant at Cambridge and its lamp factory at Amesbury under terms most favorable to the American Bosch Magneto. The product of the Bosch company is now very diversified. The magneto department is depending on the automobile trade for not more than 20 per cent of its business.

The growing demand is in the field of farm engines, tractors, trucks, marine engines and other trades in which the internal combustion engine plays an important part. The company also is equipped to enter the automotive field with battery ignition systems, starting and lighting systems, spark plugs, etc.

R. & V. MAKES WAGE REDUCTION

EAST MOLINE, ILL., Feb. 14—Wage reductions approximating 15 per cent have been adopted by the R. & V. Motor Co., affecting men in all departments and those upon a piece work basis. Employees laid off and returned to work during the period of the depression accepted the lower scale upon their return. H. A. Holder, president of the company, announcing the reduction, told employees that there is absolute necessity for readjustment of costs.

BUFFALO S. A. E. TO MEET

DETROIT, Feb. 11—The Buffalo Section of the Society of Automotive Engineers will meet at the University Club, Buffalo, Feb. 23, at 8 p. m. Ferdinand Jehle, of the Aluminum Mfg. Corp., Cleveland, will present the paper.

Industry as Whole Must Unite on Tax

Destructive Effects of Proposed Action Must Be Shown at Congressional Hearings

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can easily pay the tax and the man who has no business to run a car because of his circumstances must let go." The pernicious effect of this assumption is readily apparent when it is remembered that these views are handed out to other legislators.

The problems of the present session have been too perplexing to allow Senators and Congressmen to give adequate study to the ultimate effects of the Houston program. It will be the duty of representatives of the industry to enlighten them at hearings which probably will be held early in April. Officials of the Treasury Department already have appeared before the Senate and House committees. Senator Curtis and other leaders have stated that the books must be balanced before July, indicating that discussion of internal revenue matters will be limited and the most appealing plans will be accepted.

The Secretary of the Treasury in suggesting sources of additional revenue advised Congress that "the suggested list of consumption taxes have not been selected because their use is particularly harmful OR IN ANY SENSE LESS LEGITIMATE THAN THE USE OF ARTICLES NOT SO INCLUDED."

The Secretary has declared that consumption taxes must be considered from practical standards. Sentiment has developed in favor of the Treasury program chiefly because it affords the easiest way out of a tremendous problem. Imposing heavy taxes on a selected list would eliminate legislation for petty taxes and Congress does not intend to hunt for work. There has been considerable agitation for a sales tax, however, and the movement seems to have gained headway.

Information has reached numerous Congressmen that the automotive industry is disposed to treat the Treasury plan lightly. Legislators have stated that the most serious thought will be given the Secretary's plans because he is in a position to know the nation's needs. It also has been asserted that the proposed tax of 2 cents per gallon on gasoline at refineries would be defeated because of the influences of the oil interests but there is nothing to support this encouraging assumption.

Organizations Will Confer on Program

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heavily with Congress because of the political dynamite it contains.

C. C. Hanch, chairman of the N. A. C. C. tax committee and former general manager of the Maxwell Motor Co., who has been devoting much of his time to the formulation of the tax program, expects to spend several days consulting with representatives of other automotive organizations concerning their tax ideas. Hanch and his committee have not determined whether protest against additional taxes on automobiles would carry greater weight at Washington if they were presented by the industry as a whole or by each organization separately on a different hearing date. No decision has been reached as to who will make the argument for the N. A. C. C. before the ways and means committee. Some members of the tax committee feel it should be presented by an expert on economics rather than by a lawyer.

M. A. M. A. to Discuss Action

Directors of the Motor & Accessory Manufacturers Association will consider the tax question at a meeting here Friday and it is probable a special committee will be appointed to take up the question. Sentiment in this organization is in favor of some sort of sales tax. M. L. Heminway, general manager, feels that concerted action should be taken by the industry against such a menace as heavier Federal taxes. He is willing to go to any reasonable length to bring about such action.

The tax committee of the Rubber Association of America also is committed to a sales tax but on a somewhat different basis from that proposed by the N. A. C. C. A. L. Viles, the general manager, is firmly convinced that arguments in Washington will carry much greater weight if they come from the industry as a whole rather than from different branches of it.

The National Automobile Dealers Association adopted a resolution at its recent convention in Chicago declaring that it was in complete accord with the program of the N. A. C. C. calling for the reduction of war-time expenditures by the Federal government and a return of the government to normal. Harry G. Moock, the general manager, says the two associations will work in complete harmony on the question of tax policy. He has under contemplation a plan whereby the dealers will appoint a tax committee to meet the tax committee of the N. A. C. C. and learn how the two organizations can work together.

The American Automobile Association is expected to stand with the N. A. C. C. on the tax question.

N. A. C. C. Firm for Plan

It is probable a conference of representatives of various organizations will be held in the near future to discuss the possibility of united action. It is not known whether the N. A. C. C. would be willing to modify its program if it does not meet with the entire approval of the other organizations. It has been suggested that the Motor Vehicle Conference Committee or a similar organization representing all branches of the industry might be used in future to map out action on questions which involve the industry as a whole.

Post Office to Probe Junker Plane Loss

Accident in Which Three Lives Were Lost to Be Given Thorough Investigation

WASHINGTON, Feb. 11—Officials of the Air Mail Service announced today that a thorough investigation would be conducted into the explosion of the Junker plane at LaCrosse, Wis., yesterday, which resulted in a loss of three lives. Chief of Flying Operations Collier stated that the mechanical faults which had been responsible for the destruction of other J L planes had been eliminated, so that it was difficult to determine the cause of the fatality.

The mechanicians employed by the Postal Service are unwilling to believe that it was the fault of the gas system. The wrecked plane had been completely overhauled and a new fuel feed system installed following accidents to other planes. The fuel system was known as "fool-proof." It was devised to allow leaking gas to fall to earth rather than in the fuselage and invite explosions.

The machine, J L 301, had been in service four months. The authorities have two theories to advance. Either the pilot lost control of the elevators or some difficulty caused loss of flying speed and the machine crashed to earth as a result. Reports establish the fact that there were no signs of fire before the machine was smashed.

Because of the defense of purchases of these planes made by the Postmaster-General and endorsement of their superiority over American planes, it is expected that the latest accident will incite an attack against encouraging foreign aircraft makers as against the new industry in this country.

Larsen Defends Plane

NEW YORK, Feb. 15—J. L. Larsen, sales agent in this country for Junker planes, has sent out a statement in which he asserts that the mail airplane which crashed at La Crosse did not catch fire in the air. He asserts that the machine circled twice across the landing field, losing altitude preparatory to landing, with the motor hitting perfectly, but when at an altitude of 500 ft. it nosed down for some unknown reason and crashed, taking fire after it struck.

Larsen complains that undue prominence has been given to this accident in contrast to the small space given an accident to a De Haviland on the same route a week previously when the pilot was killed and the mechanic seriously injured. He asserts that the German plane was making its first trip over the Chicago-Minneapolis mail route with men new on that line. Larsen adds that mechanical changes made by the air mail service were not in accordance with the German practice, so he is not in a position to state whether the machine was safe for flying.

Business and Sport Share S. A. E. Program

West Baden Springs Hotel Offers Unusual Facilities for Meet —To Push Researches

NEW YORK, Feb. 15—Following the custom of previous years, the Society of Automotive Engineers, at its annual summer meeting, will hold but one engineering session each day, the remainder of the time being given to sports and recreation with a series of house lectures and dancing in the evenings. The engineering sessions will be from 10 to 1 o'clock. The meeting this year is to be at West Baden Springs, Indiana.

The West Baden Springs Hotel with accommodations for 930 guests is well suited for the special meeting because of its isolation among the hills of southern Indiana. It provides every facility for golf, horse back riding, tennis, bathing and field sports as well as for summer meetings. The hotel is circular in shape, six stories high and has a glass covered central court which is the largest room of its kind in the country.

West Baden is famed for its mineral waters and mineral and mud baths, all of which are a part of the hotel system. The hotel has a large swimming pool and a complete bath equipment. Within five minutes walk of the hotel is a sporty 9 hole golf course. There are two other golf courses within five miles of the hotel.

West Baden is on the Monon Railroad, 126 miles southwest of Indianapolis and 60 miles north of Louisville. Good roads radiate in nearly all directions.

The meetings committee for 1920 under the chairman, C. F. Scott, has already drafted a comprehensive program based on one session of three hours for each subject. The opening day, May 24, will be given over entirely to standardization and meetings of the standards committee. Other subjects to be considered are aviation, farm tractors and fuel research. Research work this year will play a more important part than ever before in the activities of the S. A. E. in view of the appropriation of $30,000 which has been made to foster it.

Committee to Engage Man

During the past year the S. A. E. has worked on fuel research and this will be continued but there are many other research activities which may be carried on, among them radiator temperatures and gear tooth pressures. Additional subjects are being considered by the research committee headed by H. M. Crane.

A special research man will be engaged to handle the work under the direction of the research committee. He will be an expert familiar with all branches of research. Some effort will be made to obtain the co-operation of companies engaged in various lines of research. It has been estimated that there are as many as a dozen of these companies. It is not the intention of the S. A. E. to open a laboratory but its work will be carried on in laboratories of companies in the automotive field. Co-operation of government bureaus such as the Bureau of Standards and Bureau of Mines will be obtained as well as that of Universities and engineering schools.

Crane and his committee have not drafted any comprehensive line of research but the program will grow gradually and committees will be organized as it progresses along lines similar to the expansion of the standards committee during the past nine or ten years. Members of the committee besides Crane are E. A. Johnston, C. F. Kettering, H. L. Horning, J. G. Vincent, H. W. Alder, Dr. H. C. Dickinson, T. C. Menges, Joseph Van Blerck, and O. C. Berry.

Midwest Tire Makers Hear Cooperation Plea

CHICAGO, Feb. 15—The Midwest Rubber Manufacturers Association held its regular monthly luncheon and meeting at the Chicago Athletic Club to-day. The principal speaker was Thomas Whitehead, president of the National Tire Dealers Association, a new association formed during the Chicago automobile show for the purpose of bringing into one national organization the best tire dealers of the country.

Whitehead's remarks inspired those present with the feeling that before long every community of any size will have its local chapter, the purpose of which will be to eliminate the "gyp" method of selling tires so prevalent in the past. Whitehead assured the tire manufacturers present that an ever-ready spirit of co-operation would be found by the members of the association to bring the merchandising of tires to a higher plane than ever before but demanded that a like spirit prevail among the manufacturers to do their part in the work.

AUTO BODY SHOWS GAINS

DETROIT, Feb. 14—Assets of $2,674,-906.02 and surplus of $48,035.28 are given in the balance sheet of the Auto Body Co., as of Dec. 31. Current assets were $1,515.006.50 and current liabilities $1,070,490.69 compared with current assets of $1,211,709.04 and current liabilities $714,934.39 in 1919. Working capital at the end of 1920 was $444,515.81 against $496,934.63 a year ago. Fixed assets were $1,095,329.57 against $1,090,743.06 in 1919. Outstanding preferred stock amounted to $531,500, an increase from $527,600 during the year, and outstanding common was $1,018,500, an increase from $1,017,400. Total assets for the previous year were $2,339,216.29 and surplus, $49,782.

DANIEL SOUTHERN RECEIVER

GREENSBORO, N. C., Feb. 14—Garland Daniel of Greensboro has been named as receiver for the affairs of the Southern Truck & Car Corp., large manufacturers of commercial motor trucks, the action being taken as a protection to the stockholders of the company. The corporation is capitalized at $1,000,000.

METAL MARKETS

ALMOST every new transaction in the iron and steel market, if at all representative in point of tonnage involved, records lower price levels. This successive shading of prices, however, does not denote a fresh downward readjustment of the market. It is but the consummation in actual sales of what has been a theme for abstract discussion since last November. To be still more precise, it is the beginning of this consummation. As to its culmination, there is no telling. The manner in which prices are beginning to tell the market's readjustment, is, however, no less gratifying to the seller than to the buyer. For weeks and weeks iron and steel producers found it utterly impossible to secure orders at any price. They knew this and continued to quote unchanged prices because concessions would have proved useless bait. In the last few days it has become evident that there is some business to be had, not spectacular in tonnage but actual, honest-to-goodness orders. To "land" this business, it was necessary to quote prices in keeping with the changed order of things. It was the first reawakening of genuine consuming demand and steel producers were too pleased at sight of this blossom, tender as it still is, to lose very much sleep about how sharp price cuts would have to be in order to get this business on their books. In fact, for some time the instructions of all "independents" to their sales executives have been to corral all business in sight, at whatever price it was necessary to quote. The only reason that the "independents" did not cut under the Corporation's levels before, was that there was no business to be had at any price. Press reports from the Youngstown district of sharp price reductions by one of the leading independents, were largely for the benefit of labor agitators who, otherwise, might have taken reductions in wage scales with less grace. To sum up the situation, the Corporation's prices have now become obsolete, in so far as new business is concerned. Quotations of independents are sufficiently elastic to include serious consideration of any and all bids that consumers might be tempted to make, so long as specifications are attractive.

Pig Iron.—With basic pig iron offered at as low as $25, furnace, the price of foundry and malleable suitable for automotive foundries, is problematical. Sales of the latter have been made in small tonnages at around $29, valley. Practically all of the automotive buying is in carload lots.

Steel.—Most of the buying by automotive interests consists of filling in or matching up tonnages. Fair-sized tonnages of sheets, however, are reported to be going forward from Pittsburgh district mills to Detroit passenger car builders, especially to those manufacturing medium priced passenger cars. The Reo Motor Car Co. and Buick Motor Co. are among those who have been ordering sheet shipments forwarded.

Aluminum.—Placing of orders with automotive foundries for aluminum castings is reflected in a somewhat better demand for No. 12 alloy. The "outside" market for virgin ingots, 98 to 99 per cent pure, has receded to around 24½ cents.

Lead.—The American Smelting & Refining Co. reduced its official quotation $3 a ton to a basis of 4.60c., New York and East St. Louis. In the "outside" market the New York quotation is on a parity with that of the chief interest and East St. Louis is quoted at 4.30c.

FINANCIAL NOTES

D'Arcy Spring Co. plans to increase the capital stock from $75,000 to $1,000,000. Of this amount $650,000 will be common stock and the balance of $350,000 will be 8 per cent preferred stock. Application has been made to the Michigan Securities Commission allowing the proposed increase. Up to this time the D'Arcy Spring Co. has been a closed corporation, but the new stock will be offered to the public, and it is planned to give the new shareholders representation on the board of directors. Preferred stock to the value of $150,000 will be offered first.

Knickerbocker Motors, Inc., Poughkeepsie, N. Y., has filed schedules in bankruptcy with liabilities of $200,771 and assets of $89,678 and other assets of value unknown. Machinery, etc., is valued at $16,047; accounts $72,736. and deposits in banks, $894. Among the creditors are the estate of Herbert G. Streat, $72,569; First National Bank of Poughkeepsie, $15,919, and Irving National Bank, $20,770.

Stewart Warner Speedometer Corp. reports net income for 1920 of $2,728,472, as compared with $2,331,915 for the previous year. The amount available for the capital stock, $2,210,000, was smaller than in 1919 owing to increased taxes and a large amount of stock outstanding. This was equal to $4.83 a share on the 457,525 shares, as against $4.90 on the 400,000 shares outstanding at the end of 1919.

Pierce-Arrow Motor Car Co. stockholders, both common and preferred, numbered 4730 on Jan. 1, an increase of 1210, or about 35 per cent above the total of Jan., 1920. The number of holders of common were 2880 and preferred 1850, compared with 1800 and 1720 the year before.

Supreme Motors Corp. is offering through W. A. Fennell & Co., Cleveland, $1,500,000 first mortgage 8 per cent convertible bonds due annually Jan. 1, 1923 to 1929, inclusive. The proceeds will be used to retire current indebtedness and increase working capital.

Federal Motor Truck Co. reports profits before Federal taxes of approximately $745,878.66 for 1920. Taxes are estimated at $200,000. Total sales were $10,628,742.09 Total assets are $4,525,340, and the surplus for the year $806,812.

Hill Insulating & Mfg. Corp., New York, has filed a petition in bankruptcy with liabilities of $24,161 and assets of $6,079, the main items of which are stock, $2,500; machinery, etc., $2,000, and accounts, $1,494.

Rey Wheel Co. has increased its board of directors from five to eight, adding James C. Kempton, of the Detroit Sales Co.; William Roberts, of Roberts Tube Works, and C. R. Aikman, of Amherstburg, Ont.

Packard Motor Car Co. declared the regular quarterly dividend of 1¾ per cent on the preferred stock payable March 15.

Parker Creditors Vote Confidence in Officers

MILWAUKEE, Feb. 11—Absolute confidence in the present officers and directors of the Parker Motor Truck Co. is voiced by the creditors' committee appointed on Dec. 13 which has been investigating the conditions of the corporation. It is felt that with the consent of the creditors the affairs of the company can be carried on without recourse being taken in the appointment of a receiver.

The company is a reorganization of the Stegeman Truck Co. which two years ago found itself in financial difficulties. The new company took over and assumed all accounts of the Stegeman company and has paid about 75 per cent of them.

A large amount of money was found necessary in entirely rebuilding and redesigning the Stegeman product to bring it up to its present efficiency.

Emerson-Brantingham Shows Drop in Earnings

ROCKFORD, ILL., Feb. 11—With the plants of the Emerson-Brantingham Co. operating at the present time at about 75 per cent of capacity, a moderately profitable business for this year is forecast in the annual statement of President C. S. Brantingham.

Earnings of the company during the past year were materially reduced but the company transferred $20,768 to profit and loss surplus after payment of the 7 per cent preferred stock dividend. In the previous year there was a surplus of $470,484. The income account for the fiscal year ended Oct. 31, 1920, together with the balance sheet at the end of that period, compares as follows:

INCOME ACCOUNT

	1920	1919
Op. profit, after tax	$1,512,857	$1,837,225
Other income	412,695	409,785
Total income	1,925,552	2,347,010
General expenses	*419,329	403,311
Net income	1,506,226	1,843,699
Interest	453,087	339,444
Depreciation	180,435	181,835
Net profit for year	872,703	1,322,419
Preferred dividends	851,935	851,935
Surplus for year	20,768	470,484
Previous surplus	2,542,089	2,071,605
Total surplus	2,562,857	2,542,089

*Including $176,713 loss on exchange.

BALANCE SHEET
ASSETS

	1920	1919
Property account	$8,265,364	$7,421,105
Patents, goodwill	4,614,402	4,614,403
Treasury stock	669,075	476,553
Inventories	14,545,827	11,761,034
Notes and accts. recbl	5,910,392	4,201,483
Sundry debtors, etc	......	253,265
Liberty bonds	316,700	328,486
Cash	1,104,453	617,741
Realty and advances	27,286	43,917
Deferred charges	224,853	87,044
Total	$35,678,352	$29,865,031

LIABILITIES

	1920	1919
Common stock	$10,132 500	$10,132,500
Preferred stock	12,170,500	12,170,500
Notes payable	7,915,285	2,978,209
Accts. pay., inc. fed. tax.	1,767,726	1,008,602
Contingent reserve	1,129,484	1,003,131
Surplus	2,562 857	2,542,089
Total	$35,678,352	$29,865,031

PEERLESS REDUCES DIVIDEND

CLEVELAND, Feb. 14—The cut in the dividend rate of the Peerless Motor Car Co. is ascribed by directors to the desire of the company to protect its future interests. The cut is the second that has been made and reduces the rate to 4 per cent on the par value of $50.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Feb. 17—The local money market eased the latter part of last week. Call money ruled at 8 per cent the first two days of the week and at 7 per cent thereafter. The range for the week was 7 per cent to 8 per cent as against 7 per cent to 9 per cent the week before. Time money was firm with a light supply. Sixty and ninety days' and four months' paper was quoted at 7 per cent, and five and six months' paper at 6¾ per cent, the same as the week previous. One of the principal causes of this firmness was, apparently, the large withdrawals by the South and the West, as indicated by the week-end bank statements.

The statement of the New York Associated Banks showed further contraction and may explain to some extent the easier call money towards the close of last week. The excess reserves over legal requirements increased $4,250,480, and loans declined $72,943,000. This is the largest reduction in loans since the second week of January.

The New York Federal Reserve Bank, in contrast with the previous week's operations, showed an improved reserve position. Gold reserves increased $10,328,000, and total cash reserves $15,167,000. Total bills on hand declined $25,198,000, and total earning assets $22,896,000. Federal Reserve notes in circulation in this district declined $8,554,000, while Federal Reserve bank notes increased $4,314,000.

G. M. C. Sales Increase; Net Profits Decrease

NEW YORK, Feb. 17—A preliminary report of the General Motors Corp. for the year 1920, issued to-day, shows a gross business of $565,000,000, an increase of $56,000,000 over the preceding year and the largest in the history of the company but the net profits of $48,262,000 available for dividends, were $11,800,000 less than in 1919. Total current assets were $263,939,000 and current liabilities $115,554,000. This left a net working capital of $148,395,000. Cash in banks on Dec. 31 totalled $49,278,000 and sight drafts, notes and accounts receivable to $48,661,000. Notes payable amounted to $72,225,000 and accounts payable and trade acceptances to $25,794,000.

The finance committee of General Motors Corp. is considering the advisability of wiping out bank loans of approximately $75,000.000 through the sale of new securities. General Motors has no immediate need for funds for any purpose other than the elimination of its loans and it is simply a question of policy whether the banks should be paid off at this time.

The company is considering sales of some of its factories and W. C. Durant is reported as having made offers.

MEN OF THE INDUSTRY

Homer Hilton, sales manager of the Oshkosh F. W. D. truck, who is leaving that organization, has been sent to Detroit to take charge of the office of the National Association of Truck Sales Managers, pending the selection of a successor to H. D. Dabney, secretary. Dabney joined the organization last June, and his resignation will become effective March 15. He said he was not ready to announce future connection. A committee from the association now is in communication with several applicants for the position, and announcement of an appointment is expected shortly. Hilton, who is one of the best known members of the association, will spend a month or two in the local office inducting the new secretary before assuming other duties which he now has in mind.

W. J. Corr has been elected secretary and treasurer of the Maibohm Motors Co., Sandusky, Ohio, succeeding I. O. Bormann, resigned. Corr has been director of purchases for the Maibohm company for the past year and is widely known in the automotive industry. He was with the General Motors for the first two years following its organization, doing purchasing, cost and systematizing work at the Northway, Cadillac and Oakland plants. For the following two years he was director of purchases of the Apperson Brothers Automobile Co., then for two years director of purchases of the Falls Motors Corp. For nearly three years prior to joining the Maibohm organization he was purchasing agent for the Detroit plant of the Aluminum Castings Co.

Fred R. Wilhelmy, for many years with the Standard Parts Co. of Cleveland and its predecessor, the Standard Welding Co., in the financial and credit end of the business, has announced his resignation from that company, effective Feb. 15. Wilhelmy has always been active in get-together affairs of the trade, particularly where credit men were concerned, and is well known throughout the industry. His future plans have not been divulged.

K. T. Keller has been appointed manager of manufacturing of the Chevrolet Motor Co., succeeding F. W. Hohensee, who resigned to join the new Durant Motors organization. Keller has been in the General Motors organization since 1911, having served as superintendent at the Northway Motor & Mfg. Co., general master mechanic at the Buick Motor Co. and as a member of the general operations staff at the corporation offices in Detroit.

L. Grant Hamilton has just joined the staff of the Akron Advertising Agency, Akron. Hamilton, since the war, has been in active charge of the advertising of the Federal Motor Truck Co. Prior to the war, Hamilton was with the Campbell-Ewald Agency. He also served as advertising manager of the Regal Motor Car Co. and was a member of the advertising and sales promotion departments of Studebaker.

T. B. Blakiston has succeeded J. H. Quackenbush as general sales manager of the American Hammered Piston Ring Co., of Baltimore. Blakiston was formerly sales manager for the southeast district. S. A. Barclay was appointed to succeed Blakiston in this territory. A. N. Merrifield has been placed in charge of the western and Chicago sales districts, replacing D. T. Preyer.

B. F. McDonald, former works manager and lately general superintendent of the Moline Plow Co., has joined the Rock Island Plow Co., as factory manager. T. B. Fuller has succeeded him as works manager in the Moline Plow and A. C. Blair has been named general superintendent of that organization.

Roy M. Hood, purchasing agent for the Maxwell Motor Co., has left that organization and has been succeeded by A. C. Downey, formerly of the Willys-Overland staff at Toledo. Hood said he had several plans under consideration, but would not be ready to announce them for several days.

A. J. Riggs, of Racine, Wis., has been appointed general sales manager of the E. L. M. Tire & Rubber Co., of Racine, a new $200,000 corporation organized a few months ago to manufacture tires, tubes, mechanical rubber goods, etc., using as a plant nucleus the E-Z Rubber Heel Co. factory in that city.

M. F. Emrich, formerly vice-president and general manager of the Campbell Paint & Varnish Co. of St. Louis, a subsidiary of the Glidden Co., has recently been appointed general sales manager of the industrial division of the Glidden Co., with headquarters at Cleveland.

R. M. Guyer, formerly with the Dort Motor Co., has been made general manager of the Miller Auto Top & Body Co., of Caro, Mich. The following officers have been elected: President, George Van Tine; vice-president, P. A. Miller; secretary-treasurer, M. G. Atwood.

Guy C. Core, who has been advertising manager for the Jackson Motors Corp. for about a year, has resigned from that organization. Core has announced no future connection, and no appointment has been made to the vacancy in the Jackson office.

Earl L. Woods has been elected a director and vice-president of the Horse-Shoe Rubber Co., St. Louis and Kansas City, and will assume charge of the Kansas City territory. Woods was formerly sales manager for the J. I. Case Plow Co.

Edmund Otto, formerly secretary of the Hardware & Supply Co., has joined N. B. Payne & Co., New York, and will be connected with the department handling portable conveyors, coal elevators and other machinery.

D. H. Roberts, sales manager of the Latex Tire & Rubber Co., Fond du Lac, Wis., has been promoted to the post of general manager, in charge of operation, production, as well as sales and advertising.

Bob Crowthers has resigned his position with the Gary Motor Truck Co. and has joined Master Trucks, Inc., Chicago, in the capacity of advertising manager and assistant sales manager.

C. M. Eason, vice-president in charge of sales for the Hyatt Roller Bearing Co. resigned, effective Feb. 1. Ben G. Koether has succeeded Eason in charge of sales at the Hyatt factory.

R. C. Huddle has been appointed purchasing agent of the O. Armleder Co., Cincinnati, succeeding W. R. Hill, resigned.

W. J. O'NEIL DIES

AKRON, Feb. 14—William J. O'Neil, founder and president of the O'Neil Rubber Co., of Akron died suddenly of apoplexy, Thursday, while en route to his office. Mr. O'Neil was riding in the machine of A. H. Palmer and suddenly slumped forward, life being extinct before Mr. Palmer could summon aid.

Mr. O'Neil resigned from the B. F. Goodrich Co., eleven years ago to establish the company.

INDUSTRIAL NOTES

Palmer Tire Corp., Poughkeepsie, N. Y., has discontinued rebuilding tires and will build an addition to the factory for the manufacture of 30 x 3½ tires and tubes exclusively. The new product will be known as the Henry tire and tube. C. J. Davis, Akron, has been engaged to assume charge of manufacturing. A New York office will be opened at 5 Columbus Circle.

Caddenhead Auto Rim Co. has begun construction of its $100,000 plant at Tarrant City, Ala., where automobile rims and steel products will be manufactured, the daily capacity of the plant to be 3000 rims. Initial production will be about 400 or 500 rims daily. The company is headed by J. T. Caddenhead, prominent in business circles in the Birmingham district.

Atlas Metal Stamping Co., Inc., has taken over the business of Isidor Blickman. Noah Wollman Amdur will be president under the new organization of the company, and Mr. Blickman, treasurer. The headquarters of the company have been moved from New York to Brooklyn.

Highway Motors Co., Defiance, Ohio, will soon start the erection of a plant for the manufacture of tractors and truck motors. Charles H. Kettering of Dayton is president of the company, which has been making passenger cars exclusively.

Acme Wire Co., New Haven, Conn., has opened a Chicago office in charge of H. B. Bassett. The company also maintains branch offices at Cleveland, in charge of J. T. Crippen, and in New York, in charge of H. S. Glasby.

American Tire Fabric Co. closed operations Saturday. How long it will continue the officials here are unable to say, but they believe it will be for two weeks at least. About 300 hands are employed at the mills.

Dodge Mfg. Co. has taken over the Burnoil Engine Co. of South Bend, Ind., and sales of this product will be handled by the Oil Engine Division of the Dodge Sales & Engineering Co., Mishawaka, Ind.

O. Armleder Co. has opened a branch to serve the New York district at Third Avenue and Butler Street, Brooklyn. John S. Hyatt will be manager and A. W. Christopher sales manager.

Hoosier Auto Parts Co. has changed its name to the Hoosier Clutch Co. The business of the company will be continued at Muncie, Ind.

Kroyer Motors Co., Stockton, Cal., has awarded contracts for a factory unit in which will be manufactured the Wizard 4-pull tractor.

CLIMAX RUBBER MOVES PLANT

COLUMBUS, Feb. 14—The annual stockholders' meeting of the Climax Rubber Co., held at the home office here approved plans as submitted by officials. The company recently sold its Huntington, W. Va., plant and secured the plant of the K. & W. Rubber Co., at Delaware, Ohio, to which the machinery and equipment from the Huntington plant were removed. The Delaware plant has now become the main plant. Irving S. Hoffman was elected president; Herman A. Longshore, vice-president; Clyde B. Turner, secretary and treasurer, and E. W. Pavey, sales manager.

Calendar

SHOWS

Feb. 19-26—San Francisco, Fifth Annual Pacific Automobile Show, Exposition Auditorium, George Mahlgreen, Mgr.

Feb. 21-26—Louisville, Annual Automobile Show, Louisville Automobile Dealers Ass'n, First Regiment Armory, C. L. Alderson, Secy'.

Feb. 21-26—Salt Lake City, Annual Automobile Show. Intermountain Automotive Trades Ass'n, W. D. Rishal, Mgr.

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Atlanta, Annual Automobile Show, Atlanta Automobile Dealers' Ass'n, Auditorium, Virgil Shepard, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 5-12—Atlantic City, Annual Automobile Show, Automobile Trade Association of Atlantic City, Million Dollar Pier, A. H. Generatzky, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 7-12—Nashville, Annual Automobile Show, Nashville Automobile Trade Ass'n, Page Bldg.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

Mar. 14-19—Washington, Annual Automobile Show, Washington Automobile Dealers' Ass'n, Rudolph Jose, Chmn.

Mar. 19-26—Detroit, Annual Automobile Show, Detroit Automobile Dealers' Ass'n, Morgan-Wright Building.

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April— Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

October—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council

Oct. 12-14, 1921—Chicago, Twenty-Eighth Annual Convention National Implement & Vehicle Ass'n.

Mexico City Exhibit to Start April 10

NEW YORK, Feb. 14—The automobile show which will be held in Mexico City will be opened on April 10 and continue for fifteen days. The show was originally scheduled to be held in March, and automotive manufacturers have been at some difficulty to ascertain the exact time of the exhibition. However, according to advices just received, the time has now been definitely set.

Three of the main salons of the new National Theater will be devoted to the showing, and the expectation was expressed that a majority of the 42 American cars represented in Mexico would be on display. The National Theater is described as a building which has cost $20,000,000 and which has been under construction for a number of years. It is now nearly completed and its use for the automobile show has been granted by the Government.

The show will be under the auspices of Señor Pascal Ortiz Rubio, Mexican Secretary of Communications. The show manager is Señor Gustavo Alana, Mexico City publisher and one of the officers of the Automobile Club.

Walker to Increase Engine Production

CLEVELAND, Feb. 14—Announcement was made at the annual meeting of stockholders of the Walker Motor Co. in this city yesterday that production is running from 10 to 15 engines a day now and that by March 1 it is expected production will have been doubled. Officials of the company are working on a program that calls for maximum production of 100 engines daily, and they expect to attain their goal later in the present year. At present the Grant Motor Co. is taking the bulk of the Walker factory output.

The stockholders yesterday elected as directors H. A. Tremaine, F. H. Blackburn, D. A. Shaw, Ben F. Hopkins, Robert L. Gale and George Salzman. Tremain and Blackburn, of the National Electric Lamp Co., are new directors. Officers will be elected in two weeks.

Purchasing Agents Meet to Devise Fuel Contract

PITTSBURGH, Feb. 18—Members of the fuel committee of the National Association of Purchasing Agents are meeting at the William Penn Hotel today to discuss a fair, equitable and inviolate form of contract governing the purchase and delivery of coal. The meeting was called by President W. L. Dodge. Ernest H. Hawkins of the E. I. duPont de Nemours Co. is chairman.

It is the purpose of the fuel committee to reach some form of contract which may be standardized, and at a later meeting the Advisory Council will meet with representative coal operators, distributers and purchasers to secure their advice and co-operation.

KELSEY ELECTS OFFICERS

NEWARK, N. J., Feb. 11—At the annual stockholders meeting of the Kelsey Motor Co. the following officers and directors were elected: Ernest B. Slade, president; C. W. Kelsey, vice-president; Thomas J. Stewart, treasurer; F. D. Dorman, secretary and assistant treasurer. Directors, E. J. Churchill, A. E. Jennings, John R. Thomas, Charles W. Hoyt, Charles Abbott, E. I. R. Cadmus, and L. S. Tyler.

ERNEST H. FULLER DIES

SYRACUSE, Feb. 14—Ernest H. Fuller, treasurer of the Automotive Service Association of Syracuse, died here after an illness lasting six weeks. John H. Sickeninger has been elected to fill the vacancy.

Belgium to Again Add to Import Tax on Cars

PARIS, Feb. 14—The Belgian Government proposes a further increase in the import duties on automobiles which were trebled last June. Importers representing large American interests are fighting the proposal, but Belgian manufacturers insist on protection.

The Peugeot Automobile Co. has no intention of using its own capital for the erection of a factory in the United States, but it is negotiating with an American group for the sale of a license to construct its cars. The Americans have not yet obtained the necessary capital and the plan is in abeyance.

Pennsylvania Rubber Re-elects Officers

JEANNETTE, PA., Feb. 14—At the annual meeting of the stockholders of the Pennsylvania Rubber Co. the following directors were elected for the ensuing year: Herbert DuPuy, Charles M. DuPuy, Seneca G. Lewis, George W. Daum, and A. H. Price.

The directors subsequently re-elected the following officers: Herbert DuPuy, chairman of the board; Charles M. DuPuy, president; Seneca G. Lewis, vice-president and general manager; George W. Daum, assistant general manager; A. H. Price, treasurer; James Q. Goudie, general sales director; George W. Shiveley, secretary; C. G. Morrill, assistant treasurer, and H. H. Salmon, purchasing agent.

PARTS MAKERS HEAR FRITZ

CHICAGO, Feb. 11—The Chicago Association of Automotive Equipment Manufacturers is making a drive for increased membership. At the present time there are 50 members enrolled. At the last meeting of the association an address was made by George Fritz.

AUTOMOTIVE INDUSTRIES
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Chicago Favored for Next National Tractor Show

Aftermath of Columbus exhibit not favorable except as to local attendance. Capacity for producing farm products in greater quantity considered the best argument for the sale of tractors.

By David Beecroft

NEVER before at a national tractor exposition has the attention of tractor manufacturers been concentrated on one particular individual as at the National Tractor Show held at Columbus. That particular individual was a farmer. He was and still is the enigma of the tractor manufacturer as well as of the retail merchandiser of farm equipment.

The exposition assisted in crystallizing opinion as to the farmer and the very general conclusion is that he is still very much a creature of environment and climatic conditions. In winter when nature sleeps he enters into a period of business somnambulance, a condition of business coma, which continues until the spring sunshine, when he again becomes a part of the business world and changing his habits becomes a different kind of individual, thinking as business men think. Seeing the tasks of the season ahead, he realizes that nature in its seasonal cycles will not wait for him and so he gets onto the band wagon, ends his buyers' strike, and comes into the buying market.

This opinion of the farmer is shared largely by tractor manufacturers and subscribed to by farmers, some of whom for 40 years have been tillers of the soil, and know their fellow farmers as the business man knows his fellow business man.

The farmer, like the manufacturer, is just emerging from that great national drunk and joy ride of money-making and luxurious spending which has spread over the country since the armistice. On awakening the morning after he is a little bewildered and requires time to collect himself.

The farmer stopped buying last fall when wheat fell from $2.60 to $1.50 per bushel; when corn dropped from $1.57 to 40 cents; when wool tumbled from 75 to 20 cents per lb.; when milk sold to the condensing factories at $3.40 for 12.5 gal. went to $1.70 and all the condensing factories closed with the sides literally bulging out of the condensed milk storage warehouses; when cotton dropped from 30 cents to 7, and when livestock reached lower records.

This farmer is no more disgruntled than bankrupt. He is akin to the man who did not buy stock at the lower level of prices and sees himself having failed to make a good deal of money when the price rose. These farmers are poor in bookkeeping mathematics rather than in actual values. Too many of them are counting their losses based on a book value of wool at 75 cents per lb. rather than 25 cents. In calculating just how poor and psychologically bankrupt they are many are endeavoring to figure out what it has cost them to raise a bushel of corn on what they have cultivated on land worth $400 an acre 10 months ago and to-day worth little over $200 per acre. They are doing all of their calculating on the high level of prices to arrive at their losses.

These farmers are not bankrupt, far from it. They are in many cases short of ready cash—they did not sell wheat or corn when the market was at the top. They were badly advised in many instances by county agents who urged them to hold for $2.00 wheat. To-day not a few of these same county agents are advising them not to buy agricultural machinery until the price comes down; even worse in some agricultural states, rumors have been spread to the effect that certain branch houses and distributors of farm machinery were refusing to sell repairs in order to force the farmer to purchase new machinery. It is scarcely necessary to state that such malicious tales have been traced down and the farmer convinced of their falsity.

Farmers Badly Advised

The farmer has been badly advised in many parts of the country. He is literally to-day a very miserable person and reminds us of the old adage, "If you wish to be miserable you must think about yourself, about what you are, what you do, what other people think of you, and then you can be as miserable as you choose." The winter months have given the farmers too much opportunity to discuss their troubles with their neighbors. They have fed each other discontent. They cannot see why wholesale prices of mercantile commodities have been reduced 64 per cent and retail prices have only fallen 14 per cent. Farm production has been cut over 40 per cent in many products during the past eight months.

The farmer is thinking financially to-day as he never did before. He is comparing the cost of farming with horse and tractor more than in the past. He is also figuring the cost of raising a bushel of wheat or corn more closely than formerly. Herein is a clue to tractor sales—a clue advised by farmers at the Columbus show, and a clue agreed to by many manufacturers.

Tractors as Production Aid

The sound method of selling tractors is on the basis of an increased yield per acre due to tractor cultivation as compared with horse cultivation, and the shorter time necessary for such. In short, it is production farming. An Illinois farmer, Francis Mann, with 42 years farming record behind him, is authority for the statement that selling a tractor on the basis of cultivating an acre of ground by tractor as compared with horse is unsound, and detrimental to the general advance of tractors. He recommends selling a tractor on the increased yield in bushels from an acre of grain and the shorter time the ground can be cultivated with tractors and the ability to do this cultivation when it produces best results. An agricultural university after investigating tractors declared that farmers with tractors in that territory were plowing the soil 2 in. deeper than with horses, and the yield was 25 per cent per acre greater. This yield was partly due to deeper plowing, and partly due to the plowing being done when the soil was benefited most by the cultivation. It is well known that statistics over a period of 20 years show that there is a greater yield of winter wheat per acre in Kansas when the land is plowed late in July or early in August than if plowed late in August or in September. In July the soil is hard and dry and the temperature 110 Fahr. It is good tractor plowing weather but impossible horse plowing weather.

Similar conditions apply in regard to other crops and in other states in varying degrees. In Illinois corn planted before May 15 invariably yields more per acre than if plowed after that date. Several Illinois farmers have declared that it is impossible for a successful farmer to maintain enough horses to care for the spring plowing peak, and get the work done when it should be done. Here is another chapter on production farming. What is needed most for the tractor manufacturer is to largely revise tractor selling arguments to farmers and discuss the effect on soil and crop fundamentals and sell tractors on the basis of increase in production made possible by these factors. Sell the farmer tractors on a basis of ability to produce more bushels per acre at a lower cost per bushel and not on how much it costs for kerosene to plow an acre as compared with how many bushels of oats horses consume and how many pounds of hay are required to plow the same acre. To-day the farmer will not be slow to tell you that a bushel of oats is not worth more than a gallon of kerosene. You will find it a poor sales argument. The farmer must be sold the tractor as a production machine, one that does the farm work quicker than horses, does it better than it can possibly be done with horses, does the work when it should be done, giving more in return for effort expended, and permits the farmer to cultivate more land and produce a greater yield than is possible if he uses horses.

Production Per Man High on American Farms

The American farmer has a 5 to 1 advantage and greater producing value than the European farmer. In this country the average farmer cultivates 50 acres. In Europe he cultivates five acres. It is true the yield from European soil is twice that of our soil, but a little mathematics will demonstrate that even with the yield doubled our farmer cares for ten times the area of his European cousin, and with only 50 per cent yield he still is producing five times as much per person as the European. Tractor farming on a production basis is going to increase this yield, and give our farmer a still greater advantage.

In spite of what the world says our farmers have been making gains. In 1850 our farmers raised only 4.75 bushels of grain per capita. To-day they raise 9.2 bushels per capita. Improvements in farm machinery have largely contributed to this increase, but it must not be forgotten that since 1850 the agricultural valley of the Mississippi has come under the control of farming and the possibilities of production are greater there per man than in that part of the country further east cultivated in 1850. Our task is to increase still more the number of bushels per capita which the American farmer can raise. To do this it is not so much a problem of stopping the drift from the farm movement and encouraging a movement back to the farm, so much as increasing the producing capacity of the man on the farm. Those countries where agricultural population is greatest and where farming might be described as most intensive produce much less grain per person than the American farmer. Production in our factories has been stepped up by production machinery and production methods rather than by increasing the number of workers. Let us apply the same policy to agriculture.

Enormous Increase in Value of Farm Products

Some recent figures shed light on the value of the 1920 American crop and give an indication of the financial stability of the farmer. In 1920 the total value of farm products, which included grains, live stock, dairy products, cotton, wool, etc., was 100 per cent greater than the value in 1914. These figures are based not on the high price levels of July, 1920, but on the lower levels of 1921. In 1919 the total value of farm products in this country was $19,856,000,000. In 1920 it was

$5,000,000,000 above this. With these figures in mind and with the further fact that since 1914 the farmer has enjoyed unprecedented prosperity it is possible to arrive at a sane reason as to why the farmer will come back into the market when he completes his winter hibernation and gets busy with the work of the year.

The farmer is not being treated so severely on the price situation as he imagines. From 1913 to 1918 inclusive the price of farm machinery advanced 72 per cent. During this period the price of all other commodities sold to the farmer advanced 97 per cent. During this period the price of all farm produce sold by the farmer advanced 118 per cent. During this same period labor advanced 115 per cent, and freight rates increased 100 per cent. In his winter season of discontent the farmer has forgotten many of the advances of the last six years and has failed to get the correct perspective. He argues that the increased cost of labor was responsible for his present troubles. He should bear in mind that 60 per cent of all farm labor is tractor or horse and 40 per cent man. Investigations have also revealed that there has not been so much hired help on the farms because it was not available, except in 1920.

The Columbus Tractor Show

As a display of tractors, tractor parts, and power machinery to go with the tractor, the exposition was truly national and an unqualified success. As a national show for farmers or consumers it was not successful but merely a local show for Ohio farmers. An investigation of one bulk of 500 farmer registration cards selected at random from those received at the registration booth showed that 95 per cent of the farmers lived in Ohio.

As a national show attended by distributers and dealers it was not a success. A majority of the dealers attending were from Ohio and adjoining states. On the opening days, Monday and Tuesday, following the close of the Chicago motor car show practically all the dealers that registered at Columbus were present. From that time the dealer attendance fell off almost precipitously, indicating that perhaps a large proportion of those dealers attending were at the Chicago motor show and stopped off at Columbus on their homeward journey. It is a matter of regret that there should have been such an excellent display of tractors and parts and machinery, filling seven buildings at the fair grounds, and yet such a poor attendance of distributors and dealers both of whom are needed in the tractor field.

Chicago Ideal for National Show

You cannot hold a purely national tractor show except in Chicago or New York City. Chicago is first choice. The best time is the week of the Chicago motor show or if not then the week following. During the Chicago week there is the greatest gathering of dealers of any place during the year. Chicago has two buildings large enough to house the tractor show, the Municipal Pier, which has now been brought literally into the heart of the city by the widening of Michigan Avenue north to join Lakeshore Drive together with the new bridge construction and also by the erection of the Drake Hotel on the lake front. Dexter Pavilion in the Union Stock Yards is another possible exhibit space.

We are not going so far here when we suggest a national tractor show for New York City. New York City is the front door of the country through which a goodly part of the world enters. It is very largely our shipping door for export trade. As our export trade develops, as the bankers are determined it shall, and as our economists say it must, a tractor show in New York City would carry an international character and bring buyers from the shores of the seven seas. New York City offers the ground for a close introduction of the tractor to financial and business interests.

It is doubtful if at any future national tractor show there will be such a representative display of many tractor components, not a few murmurings of discontent having been heard from several exhibitors at Columbus. Many of these parts and component firms did little business, and several were asking the reason why they should attend a tractor show when they do not find it necessary to attend the national motor vehicle shows. In the formative days of the motor car industry they were at the national shows but during the past ten years their representation has constantly dwindled and the motor shows have become more exhibits of motor vehicles.

Were the national tractor show held during the motor car show week in New York these parts makers from headquarters at hotels could serve the entire tractor clientele as they do the motor car and motor truck clientele at present. The tractor industry is capable of making a very comprehensive display without these parts people. The exhibit at Columbus was almost too big. It resembled some of the tractor demonstrations held two or three years ago at which 90 or 100 tractors lined up across the end of a square mile of prairie and by the time they had finished plowing you had scarcely opportunity to walk across the field and had not enough opportunity to critically observe many of the machines. Seven buildings at the Columbus Fair Ground filled with equipment was representative of our agricultural prominence but was a hard task on the visitor who wanted to spend one day at the show. A more useful display would be one of the tractors and power farm equipment compactly placed side by side in one large building. This could be accomplished in the Municipal Pier or Dexter Pavilion, Chicago. The absence of two score or more parts makers would detract very little from the value of such an exposition. Nobody can say that the value of the motor car show fell off when many parts makers withdrew years ago. Such a national show should be conducted by the National Implement & Vehicle Association. It is the proper organization and the show is one of its legitimate activities.

Industrial Use of Tractors Increases

The Columbus show furnished a good initiation into the vastly increased use of tractors in industry outside of agriculture. It amazed some tractor manufacturers to find developing fields for creeper and wheel types in road-building, lumber camps, petroleum areas, mining sections and in other industrial uses. Naturally, the creeper type is practically dominant in these fields or most of them. Holt has gone almost entirely into the industrial field. Best, from California, found an unexpectedly great industrial demand at Columbus, one that greatly exceeded the agricultural demand. It has been known for several years that Cletrac has been one of the most active in developing the industrial uses and recent sales to municipalities and industries have been witnesses of the success of the policy. The enormous road-building programs are appealing to tractor manufacturers, as are snow removal and municipal uses.

The Columbus show gave evidence of a crystallizing movement in the tractor manufacturing field. While formerly there have been upwards of 70 tractor manufacturers at the national shows, this year there were fewer than 50. A few were kept away because their tractors are more suitable for areas West of the Mississippi than

east of the Mississippi, but the majority of those absent were absent because of financial stringency. In some cases companies have arrived at the conclusion that perhaps they are not national from a distribution standpoint. This reduced attendance gave indication of a possible mortality during the next year, a movement which has been under way in the motor car field for several years.

Another trend of the industry which has assumed prominence during the past year is the widening list of models of tractors furnished by not a few of the manufacturers, following a policy adopted years ago by several of our strongest truck manufacturers. Thus J. I. Case T. M. Co. has four models which serve the needs of a farmer using from two to twelve plows.

The presence of half a dozen makes of motor trucks intended for farm use gave a new interest to the tractor show and gave proof of the purpose of many tractor manufacturers to furnish their dealers with a complete line of farm equipment. During the past year such tractor manufacturers as Case, Avery, Wallis, Rumely, Moline, Twin City, Samson and some others have developed farm trucks. These were all on exhibition with the tractors and farm equipment machinery. Two firms, Graham and Atlas, exhibited trucks only.

The majority of these trucks are of the 1, 1¼, 1½ and 2-ton sizes especially designed for farm work. Most of them are fitted with pneumatic tires, although some are not. The question was frequently raised during the show as to whether these farm trucks fitted with pneumatic tires of a size larger than 5 in. might not meet with premature destruction due to the average ruts on country roads and in farms being made by a 5-in. tire. If such were true then there would be premature destruction of tires of 7 and 8-in. section.

Dealer the Weak Link in Merchandising

The dealer is still the weakling in the chain of power farming merchandising. He does not measure up to the needs of the hour. Too often he is a poor salesman, a poor financial man, and too unfamiliar with what tractor service means or must consist of. Just at the moment he is an especially weak and inactive link in the chain. Nearly every tractor manufacturer is looking for good dealers and not a few are in search of good distributers. The old time implement dealer with his warehouse shed near the railroad depot, has, as an active tractor dealer, almost passed out. Service was too incomprehensible to him, and when tractors became numerous the factory discovered it could not through its branch houses give the service which the dealer was the logical person to give. To-day a dealer is measured by his capacity to give service, and whether he is known as an exclusive power-farm dealer, an automotive dealer, or a general dealer, the yardstick that the manufacturer must use in estimating his ability is calibrated to measure service. The dealer must have three qualifications, ability to give service, ability to sell, and ability to secure the necessary financial support.

Tractor manufacturers are still unsettled, and divided as to the field in which the best dealer is found. It is only natural that such firms as Fordson, Cletrac and Samson, originating from the motor field, should largely put the selling and maintenance in the hands of motor dealers, some of whom have given up motor car sales and launched exclusively in the tractor fields. Whether they have done this or not they bear the stamp of the motor car dealer and have his conception of service and sales. Fordson went very largely last August to the Ford dealers. Samson has swung largely to Chevrolet, Buick and other General Motors dealers. Cletrac has many distributors from the car and truck field and for dealers they are looking for men who can qualify in service, sales and finance. In many sections they are largely automotive. The eventual dealer irrespective of what he may be called, must qualify according to the three requisites mentioned. Some tractor manufacturers are convinced that the exclusive tractor dealer is best, and cite average of sales per dealer proved their case. Others frankly admit that the dealer problem is still an unsettled one, and that they do not care from what source their dealers are recruited provided they can meet the requirements of the hour.

An Economic Commission Needed

What is needed most is that tractor manufacturers better educate their distributers and dealers on the fundamentals of tractor sales. Each distributer should know the soil conditions in his distribution area, and his dealers should be familiar with the character of soil cultivation that produces greatest yield in bushels per acre cultivated. The distributor and dealer should sell tractors on the production farm basis rather than on the relative cost of cultivating by horse or tractor. Agricultural colleges in many sections have the necessary information to enable merchandising tractors on a sound economic basis. The manufacturer should get this to the distributer and the distributer instill it into the dealer. To-day is the time when tractors must be sold on a basis of production ability. Intelligent farmers admit that while the dealer in the past has not sold them the tractor on this basis that they have purchased it on such a basis. Let us sell the tractor the easiest way. It is useless to start general propaganda to the farmers on how to buy tractors without first getting to the distributer and dealer the fundamental arguments.

The appointment of an agricultural engineering economic commission in connection with power farming might prove one of the most constructive steps that manufacturers could take. In the transition from operating a farm on an animal power basis to a mechanical power basis many considerations must be kept in mind.

As they are to-day many farms are not divided in the most suitable way for power farming. The division in the field has been arrived at on the basis of animal power farming.

Already there are some farms with too much mechanical equipment, witness a northwest farmer on 250 acres, with two tractors, two motor trucks, six stationary gas engines, one houselighting equipment and two motor boats.

It may be necessary for the farmer to erect a miniature factory with his power generator coupled to line shafting so that his belt work is concentrated, and his mechanical power furnished as efficiently as in a large factory. Our production factories with a centralized power house are recent creations. We would not mark the efficiency of a factory very high that had one power unit for each department. Yet this is what some farmers have been buying.

Closer co-operation of all those manufacturers producing machinery for the farm is necessary, so that an economic equipment of desirable machinery is obtained. That farmer is the nation's best asset who is correctly equipped with power machinery for the work to be done. If he is oversold he becomes a liability. If he is undersold he has not reached his possible production capacity. It might well be the work of an agricultural engineering economic commission to act in advisory capacity in this work and stimulate the necessary research.

An Engineer's Impressions of the Tractor Exhibit

By P. M. Heldt

SOME very good merchandising features were in evidence. The Bates Machine & Tractor Co. repeated its success at Kansas City last year. The Kansas City picture was a plowing scene, depicting a rural home for a background and a Bates Steel Mule tractor with plow on a platform laid with furrowed sod in the foreground. At Columbus, this company showed a tractor fitted with a snow plow, at work upon a snow-covered platform and in the background a painting of a rural winter landscape. A canopy was rigged up over the platform, supported a mechanism producing an artificial snow which fell in large light flakes in front of the painting, in close imitation of the real article. The picture was a pleasing one, but it did not attract as much attention as the plowing scene last year, which indicates that the farmer is concerned more with plowing than with snow removal.

Tractor chassis and power units on revolving stands were numerous. While the scheme of thus presenting a more or less complicated mechanism is excellent, it has lost somewhat as a drawing card as its adoption has been extended. The Cleveland Tractor Co. showed one of their Cletrac tractors with the chain track extended on the floor, an attendant slowly moving the tractor back and forth over the track by hand to demonstrate its easy running qualities. As at previous shows, the Heider friction tractor was again being maneuvered on a pair of planks on the floor, to demonstrate the ease of its control.

At the stand of the Allis-Chalmers Company, where three models of tractor were exhibited, demonstrations of the quick demountability of the engine were given at different hours of the day and always caused a considerable crowd to collect. The engine was placed on a stand on an elevated platform for the purpose, and the demonstration could be readily followed from some distance.

At the International Harvester Co.'s stand there were service booths at which instruction on ignition service and on the lubrication of the concern's tractors was given for the benefit of dealers and service men.

Moving Exhibits

Many of the exhibitors had tractors mounted on elevated platforms so that they could be conveniently inspected by visitors. Most of these show specimens—for they were specially finished in almost every case—were being turned over by electric motors, so as to help the salesmen in explaining their operation.

The most notable of the new designs were models brought out to extend or complete an existing line. This applies to the new Hart-Parr, Case, Twin City, Bates, Allis-Chalmers and LaCrosse. These new tractors in almost every instance embody all the features of previous models of the respective makers, and are merely reductions or magnifications of these earlier models.

Three Foreign Tractors

Three foreign tractors, the Somua, Fiat and Renault, were exhibited for the first time in this country, but are not new to readers of AUTOMOTIVE INDUSTRIES, as all of them have been illustrated and described in our columns. The Huber Mfg. Co. exhibited the Huber "Super Four" in addition to the Huber Light Four, manufactured for several years, the principal change in the new over the older model being that the former has a Midwest engine.

A tractor exhibited for the first time, and also quite out of the ordinary in several respects, is the Hicks, which is to be manufactured by the Hicks-Parrett Tractor Company—a recent merger of the Hicks Tractor Company of Milwaukee and the Parrett Tractor Co. of Chicago Heights, Ill. The company will be located at Chicago Heights and will continue the Parrett tractor in addition to the new Hicks.

Another new model so far as visitors to the national tractor shows are concerned was the Once Over Tiller made in Minneapolis. This machine, which combines a tractor with a plow and a pair of revolving soil millers or pulverizers, was developed by the Scientific Farm Implement Company. The Somua French tractors were shown in two sizes, one corresponding in power to an ordinary three plow tractor and the other to a garden tractor, the latter being of the soil miller type. It carries at the rear a drum which carries a number of prongs of spring steel and is rotated at a rapid rate by a positive drive from the transmission of the tractor. The drum can be raised and lowered at will and it is claimed that the soil can be loosened to a depth of 10 inches, if desired.

New Garden Tractors

Many of new models were to be seen in the garden tractor class. There are some machines made now which take the place of the ordinary hand cultivating tools often used in the home garden. These are very similar in appearance to the hand-operated cultivator, comprising a single wheel, a pair of handles, cultivating tools suitably connected to the frame of the implement and a small gasoline engine set on the frame and geared to the single driving wheel. As human muscular power is the most expensive form of power in common use, these little machines should prove highly economical wherever there is sufficient work for them to do.

An inspection of the show with respect to mechanical tendencies and developments does not convey the impression that the experimental departments of the tractor manufacturers were very active last year. It is, of course, generally known that sales have not been brisk lately, and the general impression is that considerable stocks of completed tractors have accumulated, which must, of course, be disposed of before anything new can be brought to the attention of the public. On the other hand, several of the leading manufacturers have well-developed, standardized lines and are hardly likely to upset their manufacturing routine by radical changes in design.

The changes in existing models which have been made and entirely new models brought out, point to the conclusion that the automobile type of construction will prevail; that is, the tractor with a four-cylinder engine, cut gearing, enclosed drive, anti-friction bearings and divided axle steering.

Anti-friction bearings are coming into extensive use even on the older style of tractors, and one of the most frequently heard sales argument for a tractor is that it contains so many ball and roller bearings. To judge by present tendencies, it will not be many years before it will be impossible to sell a tractor of two-plow size or over that does not have ball or roller bearings throughout except in the engine. It is therefore no wonder that the anti-friction bearing industry has become a powerful factor in the tractor industry, ball and roller bearing manufacturers being very conspicuous at the tractor shows and demonstrations.

It seemed last year at Kansas City that henceforth farm light outfits would form an important part of the tractor

show, but this year there was a decided retrogression in the representation of farm lighting sets, only three or four of the seventy or more sets on the market being shown. None of the farm lighting manufacturers allied with some of the big tractor makers, like the Sunnyhome Electric Co., the Domestic Engineering Co., and the Willys-Overland Co. exhibited. Whether this is due to non-solicitation by the show management or to a conviction that people who attend the show are interested primarily in farm tractors and not in lighting sets, is an open question. Owing to the slight competition and the large farmer attendance, the few makers of lighting sets which were represented should reap excellent results from the show.

There was again an excellent line of stock engines for tractors shown, including the Waukesha, Wisconsin, Hercules, W-S-M, Weidely, Climax, Stearns and Midwest. The LeRoi Co. had space at the show, but owing to delays in transportation no exhibits were on hand. While there was thus quite a variety in engines from which the tractor builder might make his selection, there was this year only a single transmission exhibit, that of the Nuttall Gear Company. Among the parts exhibitors, manufacturers of carburetors and ignition appliances were prominent.

Ignition appliances in connection with tractors means, of course, magnetos. Reference was made above to merchandising features in connection with complete tractors, and something should be said of merchandising features in connection with parts. In this respect the magneto manufacturers were easily the leaders among parts exhibitors. Several showed magnetos in operation under glass domes with a current of fine dust or a spray of water constantly playing on the magneto, to demonstrate its dust-proof and water-proof qualities. The K-W Magneto Company demonstrated two magnetos from which two of the magnets had been removed, being turned over slowly by means which were not apparent to the eye. One of the magnets was suspended from tubular posts by two chains and the other was mounted on a platform resting on a tubular post, which latter was sectioned to show that there were no wires running up inside. No wire connections could be seen on the outside, yet the magnetos kept turning at a slow, uniform rate and generating sparks, and the method of driving them was the cause of considerable speculation among technical men.

Final Drive Tendencies

In final drives there seems to be an increasing tendency to use a worm and wheel for the first reduction and a spur on internal pinion and wheel for the second. Among others, the new Farquhar has this form of drive. It combines the advantage of simplicity with efficiency, owing to the favorable working conditions, as the worm need not be subjected to excessive tooth pressures.

In the new Uncle Sam 12-20 model both the transmission and the final drive are by roller chains. The chains being completely enclosed and running in oil, the conditions of operation are, of course, much better than when exposed chains are used. Owing to there being two chain drives in tandem, and also two in parallel, it is quite difficult to provide means of adjustment, and none are provided in this case. The familiar "stretching" of exposed chains, which calls for frequent adjustments, is due to wear of the links, and in order to minimize this, unusually large chains are used. This experiment of introducing enclosed chains running in oil for tractor drives will be watched with interest by tractor engineers. The enclosed chain has not proven very satisfactory on motor trucks, but it must be remembered that on a motor truck it is much more difficult to enclose a chain, owing to the fact that spring play must be provided for.

Moving pictures showing tractors doing various kinds of work were another of the show attractions. One film illustrated the use of the Holt Caterpillar in logging work in Oregon and proved of great interest to the visitors, most of whom evidently were entirely unfamiliar with this class of work. The room in which the pictures were shown was entirely too small to take care of the crowds.

Descriptions of New Tractors Exhibited

Case 40-72

The J. I. Case Threshing Machine Co. showed for the first time a 40-72 hp. tractor on modern lines, and now has revised its whole line, which consists of four models. The new 40-72 hp. machine follows the other Case designs in having all the transmission shafts parallel with the engine crankshaft, and using open gears only for the transmission of power to the rear axle. All other gears are inclosed and run in an oil bath, which is a new feature for a tractor of this size. Engine, transmission and rear axle housing are separate units, which are bolted down to the channel steel frame by means of turned bolts. The frame consists of 8-in. and 10-in. channels, hot riveted. At the point of greatest strain the 8-in. channel is carried underneath the 10-in. channel, the two being reinforced by a 3/8-in. plate 18 in. deep, which is riveted to both. The 8-in. channels are extended to carry the platform and wheel guards.

The four-cylinder engine has 7 x 8-in. cylinders and runs at a governed speed of 750 r.p.m. Operating on kerosene it develops a maximum output of 90 hp. Two speeds are provided, 2.07 and 3 m.p.h. Characteristic of the robust construction is the 4-in. crankshaft, which has 4 x 4¼-in. crankpin bearings and main bearings of the following dimensions—4 x 7⅜ in. next to the belt pulley, 4 x 5⅜ in. at the opposite end and 4 x 5½ in. at the center. The length of the pistons is 9 in. The piston pin bearings measure 2 x 3½ in. Valves are 2¾ in. in diameter and have a lift of ½ in. Connecting rods are 17 in. long or more than twice the length of the stroke. The camshaft has a bearing diameter of 2¼ in. and the total length of its three bearings is 13½ in. The width of the cam face is 1⅛ in.

Pressure lubrication is employed, the oil being forced directly to the main bearings, camshaft bearings and crankpin bearings. A gear type of pump furnishes the pressure; it is driven by helical gears from the camshaft and is submerged in oil in a depression of the oil pan. The crankshaft is drilled for oil feed to the crankpins. An adjustable relief valve is provided, as well as an oil pressure gage, which latter is located in direct view from the driver's seat. A four-lead pump delivers fresh oil to the cylinder barrels at all times. A circumferential groove is cut in the cylinder liners so that the oil thus fed will be distributed all around the cylinders.

The belt pulley is mounted directly on the crankshaft. It measures 19½ in. in diameter by 10 in. width of face. A double disk type of clutch is fitted and serves to control both the belt power and the driving power.

The cylinders are cast in pairs and are fitted with renewable liners. Each pair of cylinders has a separate removable head casting. These head castings contain the

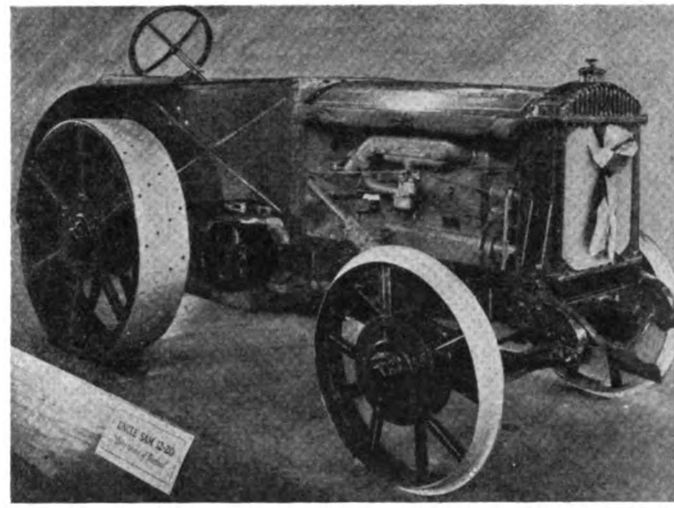
valves and the spark plug holes. A truck type of radiator, without soldered joints in the tanks, is fitted. Behind the radiator is a gear-driven fan in a fan shroud. The centrifugal water circulating pump is located in an accessible position. The differential gear is of the spur type, which is claimed to possess decided advantages for large powers, as it develops no side thrust and no thrust bearings are required in the differential. The differential is mounted on the bull pinion shaft, which is 3½ in. in diameter at the bearings, each shaft being supported by two Hyatt heavy duty bearings. The bull gears are 42 in. in diameter by 4 in. face and have cut and hardened teeth of 1¾ in. diametral pitch. These gears are inclosed in dust proof housings.

The rear wheels are 72 in. in diameter and 20 in. wide and are mounted on a 4-in. live axle rolled of special stock. This axle is carried in two Hyatt roller bearings. The front wheels are 48 x 10 in. and are mounted on Timken roller bearings. The Case 40-72 Tractor has a wheelbase of 124 in., an overall length of 200 in., a width of 105 in., a height of 110 in. and weighs 21,200 lb.

Once-Over Tiller

The Once-Over Tiller is a new form of farm implement that prepares a seed bed in one operation. It combines a tractor with a pair of plow bottoms and a pair of revolving implements, one at the side of each plow bottom, which break up or pulverize the soil as it is being turned over. The concern making this machine was formerly known as the Scientific Farm Implement Co., but in June, 1920, was reorganized as the Once Over Tiller Corp. The machine somewhat resembles the motor plows made in several European countries, in that the plow is combined directly with the tractor. There are two front driving wheels and one rear trailing wheel, and the engine overhangs the front wheels a considerable distance. The power plant consists of a Stearns four-cylinder 4½ x 6-in. engine, the equipment including a 1¼-in. Stromberg carbureter and a Splitdorf magneto with impulse starter. The transmission is of the company's own design and manufacture and is of the sliding gear type, giving three forward speeds and one reverse. The three forward speeds are 1¾, 2½ and 4 m.p.h., the intermediate speed being the plowing speed. All gears are cut and heat-treated, are inclosed and run in a bath of oil. The final drive is through internal gears, which are also inclosed. Both ball and roller bearings are used in the transmission and on the axle. The differential gear can be locked when desired.

The rotors on which the tilling knives are carried are driven from the tractor engine through a separate clutch and a pair of universal joints. The tiller gears are cut from carbon steel, case hardened and inclosed in an



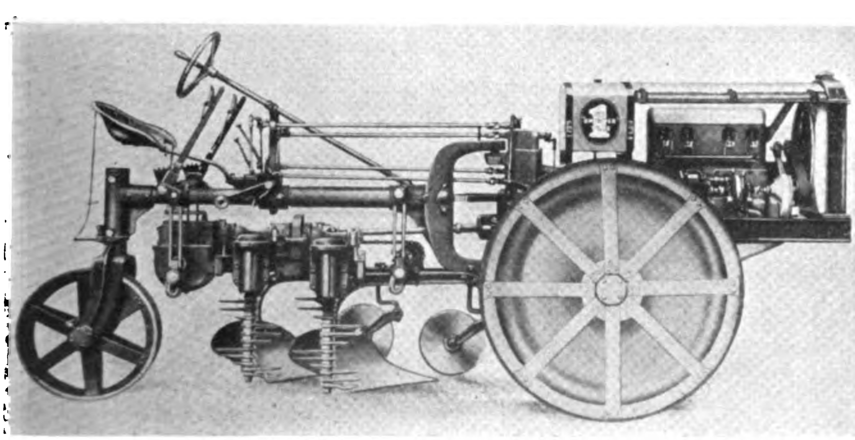
Uncle Sam 12-20 tractor

cil-tight case. The shafts of these gears are mounted on Hyatt heavy duty bearings. The knives of the rotor are made of crucible steel; a spring arrangement is provided which allows large stones to pass the knives without damaging the machine. A standard two-bottom Vulcan gang plow is used. It is lifted by a special mechanism, which is operated by the power of the engine directly instead of through the plow wheel. This makes the lifting mechanism positive.

Steering the Once-Over Tiller

Steering is by a rack and pinion mechanism and the driver's seat and controls are mounted on the tube extending back from the steering yoke. All controls of both the tractor and the plow are within easy reach of the operator. Ordinarily steering is accomplished by means of the hand wheel, which swings the driving wheels to one side or the other relative to the rear structure. But when it is desired to make a specially short turn, the operator can make the rear wheel a caster wheel by pulling a trip, and then by applying a brake to the front wheel on the side to which he wants to turn, he can make the machine turn on its own axis, it is claimed.

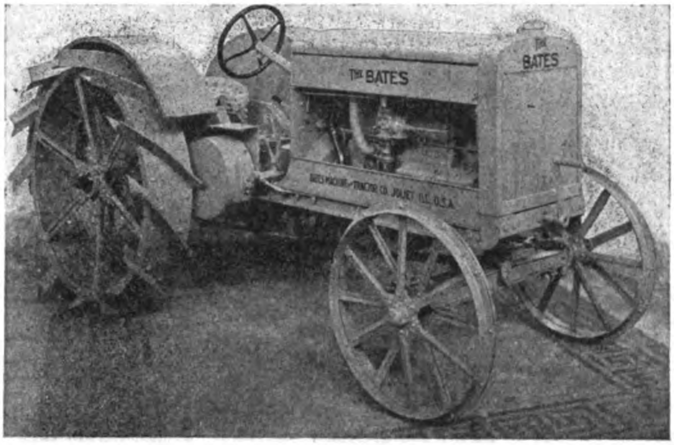
Following are some of the more important dimensions of the machine: Wheelbase, 116 in.; overall length, including plows, 196 in.; total width, 65 in.; total height, 75 in.; minimum ground clearance, 24 in.; drive wheel dimensions, 54 x 10 in.; belt pulley dimensions, 13 in. diameter by 7 in. width of face. The belt pulley is driven at 900 r.p.m. and is controlled by a Twin Disk clutch.



Once Over tiller

U. S. 12-20 Model

The U. S. Tractor & Machinery Co., which heretofore has specialized on its 20-30 tractor, has added a 12-20 model which embodies quite a number of features not found in the 20-30. It is an assembled machine in so far as it has a stock engine, but the transmission is of special design and is made by the U. S. company itself. The engine is a Weidely and is mounted at the front in the usual way. Cylinder dimensions are 4 x 5½ in., and the governed speed is 1200 r.p.m. A Bennet air cleaner and carburetor are fitted and ignition is by a Splitdorf magneto with impulse starter. The transmission is by a pair of bevel gears to a first



Bates wheel tractor

cross shaft, then by one or the other of two roller chains to a second counter shaft and then by another roller chain to the rear axle. The entire transmission is inclosed in a cast iron case and runs in an oil bath, and it is claimed that, owing to the fact that the chains are always well lubricated and protected from dust, they do not wear and stretch. Timken roller bearings are used throughout the drive and on the front axle as well. The front axle is of the automobile type and carries the frame on a semi-elliptic spring. The frame is built up of 4-in. steel channels. The belt pulley, which is located in a convenient position ahead of the drive wheel, is 14 in. in diameter and has a 6 in. face. It is equipped with a separate clutch and can be run in either direction. One of the features of equipment is a bucket seat similar to that furnished on the Uncle Sam 20-30. The machine is rated to pull two plows under all conditions and weighs 3000 lbs. Its two forward speeds are 2½ and 3½ m.p.h. The drive wheels measure 45 x 10 in. and the front wheels, 34 x 5 in.

Bates Wheel Tractor

The Bates Machine & Tractor Co. has added to its line a wheel tractor. The new model is identical with the older one from the front back to the rear axle. The Bates company has adopted the Midwest engine. The rating is 15-25 hp. engine, clutch housing and transmission are bolted rigidly together, forming one solid block which is mounted on roller-bearing axles. The transmission affords two forward speeds, 2 1/3 and 3½ m.p.h. The drive wheels are 48 x 10 in. and the front wheels 30 x 4½ in. The over all dimensions are: Length, 131 in.; width, 63 in.; height, 60 in. The tractor complete weighs 4000 lb. One clutch operates both the tractor and belt pulley and is controlled by a hand lever. This pulley is 16 x 6½ in. and gives a belt speed of 2450 ft. per min. All bearings of the transmission and axles are Timken. All gears are machine cut and run in oil. Although the engine and transmission case are bolted together, the frame is not dispensed with.

Hart-Parr 20

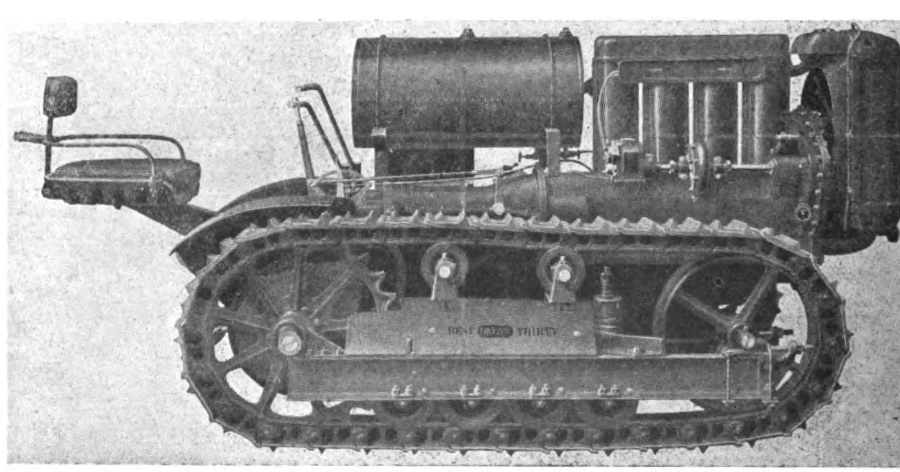
Heretofore the Hart-Parr Co. has had only a single model of 30 belt hp. rating. Now a 20 hp. model has been added. This is a replica of the earlier model on a smaller scale. The two cylinder engine has a bore of 5¼ in. and a stroke of 6½ in. and the tractor is rated to pull two 14 in. bottoms. Both cylinders are in one casting and the valves are in the head. The crankshaft main bearings are 2½ x 4 in. and the connecting rod bearings, 2½ x 2¾ in. Lubrication is by a mechanical oiler with six leads. A float feed carburetor in combination with the Hart-Parr shunt is used, and the tractor is designed for operation on kerosene. Ignition is by high tension magneto with impulse starter. The clutch is a Hart-Parr contracting band type and the transmission is of the selective sliding gear type furnishing two forward speeds, 2 and 3 m.p.h. All transmission shafts run on ball bearings. The drive wheels are 46 x 10 in. and the front wheels, 28 x 5 in. The frame consists of a single steel casting which is heat-treated. The machine measures 120 in. in length over all and 66 in. in width, has a tread of 62 in. (measured from outside to outside of wheels) and a shipping weight of 3500 lb.

Best 30 Track-layer

A very modern looking type of track-layer tractor is the Best 30 of which the first machine completed was exhibited, according to report. Engine, clutch housing and transmission are bolted together into one unit which is spring-supported on the track-layer frame not far from its center of gravity; so that nearly the whole weight is sprung. The engine is a Best four-cylinder, valve in head type with separately cast cylinders and a single removable head casting. The cylinder dimensions are 4¾ x 6½ in. An inclosed centrifugal governor is fitted and governs the engine at 800 r.p.m. Lubrication is by pressure from a gear pump. The Ensign gasoline carburetor is fitted and ignition is by high tension magneto. The piston pins are floating. The crankshaft is 2⅝ in. in diameter and the camshaft, 1¼ in. The cooling fan is gear-driven through a friction clutch.

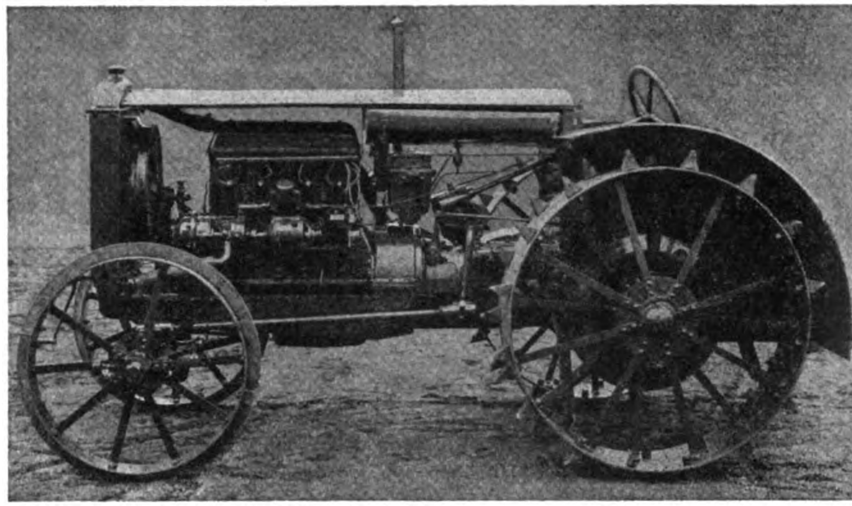
Steering is effected by applying power to one truck only by means of a large multiple disk clutch operated by long levers extending transversely across the frame. The trucks are spring-mounted, each oscillating independently of the other. Hardened steel rollers mounted on roller bearings carry the tractor. The track center distance is 41¾ in., the standard equipment consisting of 11½ in. shoes with a track length of 61 in. The track links are drop-forged and heat-treated. A double flanged front idler contacts with the spools of the track. The final drive is through 3½ per cent nickel steel, cut and hardened gears which are inclosed and operate in oil.

The total length of this tractor is 112 in., the height to the top of the radiator, 59 in.; the over all width, 53¼ in., and the width inside the tracks, 30¼ in. The ground clearance is 11½ in., the draw bar height, 16½ in. and



Best "30" tracklayer tractor

the ground pressure, 5.2 lb. per square inch. A 12 x 7 in. pulley is provided, which at 800 r.p.m. gives a belt speed of 2513 ft. p.m. The tractor carries 28 gal. of fuel (either gasoline or distillate, though kerosene equipment can be furnished as an extra). The weight of the tractor is 7400 lb. An upholstered seat with spring-supported, upholstered backrest is an attractive feature of this machine.



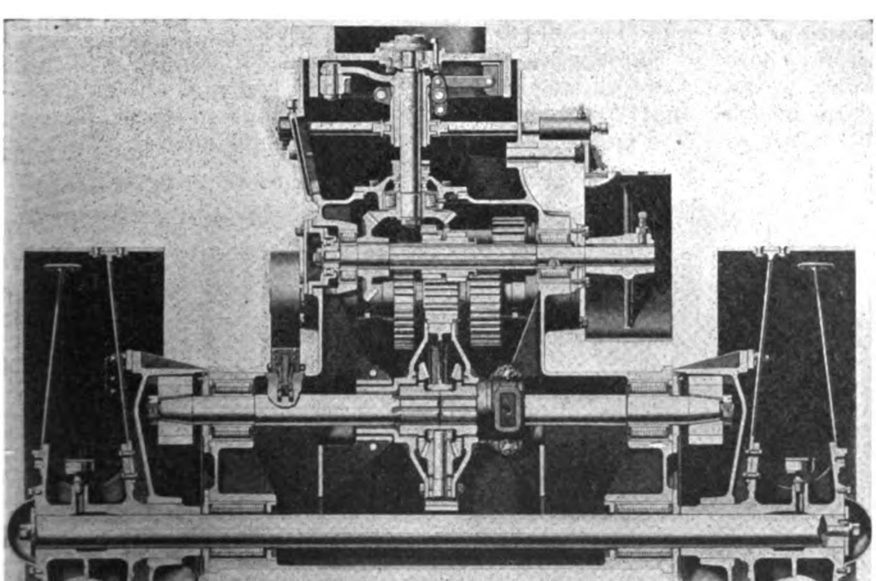
Allis-Chalmers 12-20 *tractor*

Allis-Chalmers 12-20

The Allis-Chalmers Co., which heretofore has been manufacturing a four-plow 18-30 and a single plow 6-12 model, has just added an intermediate size having a 12-20 rating. This machine is of the frameless type and is, of course, completely manufactured by the Allis-Chalmers Co. This concern has evidently decided to get out a full line of farm tractors and become an important factor in the tractor field. At the show a demonstration was given several times a day of the rapidity with which the Allis-Chalmers engine can be taken apart and reassembled, the former operation requiring 10 min. and the latter 15 min., more or less. Needless to say, the two mechanics making the demonstration worked rather harder than the average garage mechanic doing work on an hourly charge basis, and seemed to be about "all in" after the demonstration.

The new tractor model has a four-cylinder engine of 4⅛ in. bore and 5¼ in. stroke, governed to 1100 r.p.m. by an inclosed centrifugal governor. The engine is designed to run on gasoline and a supply of 20 gal. is carried in a tank over the transmission. A siphon type air washer cleans the air before it enters the carburetor. Fuel is fed to the carburetor by gravity. Lubrication is by pressure. The clutch is an expanding type and the transmission gives two forward speeds and one reverse. These speeds are 2½ and 3¼ m.p.h. The final drive is by inclosed internal gears, and a non-locking differential is fitted.

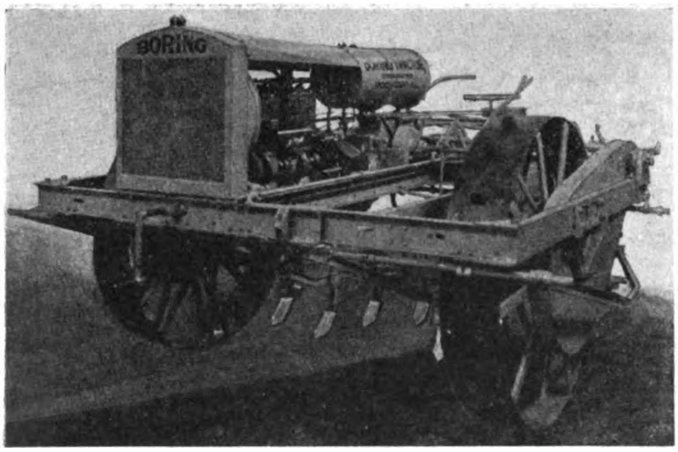
The belt pulley measures 12½ in. in diameter by 6½ in. face and the belt speed is 3250 ft. p.m. The same clutch that is used for driving controls the belt power. A brake is provided to act on the belt pulley. Following are some of the more important dimensions of this tractor: Total length, 135 in.; total width, 66 in.; total height, 60 in.; wheel base, 78 in.; minimum ground clearance, 13 in. The net weight of the tractor is 4400 lb. The clutch is operated by a hand lever at the driver's left and the brake pedal is located adjacent to this lever. The front axle is in the form of a casting of hollow section and is pivoted to the engine crankcase at the front, the gear case cover being extended to form a yoke for the axle. Radius rods extend from the ends of the front axle to a balance lever at the forward side of the flywheel bell housing. A spring keeps the fan belt automatically under tension. One-half of the bell housing is cast with the lower and one-half with the upper part of the crankcase. A bracket mounted on the transmission housing supports the steering column and the control levers.



Transmission and rear axle of Allis-Chalmers 12-20

Boring Convertible Tractor

The Boring tractor is somewhat different from the ordinary run of tractors in that it is a combination tractor and cultivator having a ground clearance sufficient to permit it to pass over corn 35 in. high, and having an adjustable wheel extension which will permit the machine to span two rows of corn. As a tractor the machine pulls three plows. It is of the three-wheel type having its two driving wheels at the front and a caster wheel used for steering located at the rear. When plowing and cultivating the implements are always in front of the operator, being located between the front and rear wheels. By means of the frame extension the wheel tread can be varied, from a minimum of 54 in. to a maximum of 79 in. This is accomplished by turning a crank located on the front cross member of the frame. The rear caster wheel is operated by a conventional steering gear enabling the tractor to be turned in a radius of 7 ft. The drive wheels are 54 in. in diameter and are 10 in. wide. The power plant consists of a four-cylinder 4⅜ x 5¾ in. Waukesha engine. This engine has a hollow crankshaft for force feed lubrication. The transmission has two speeds forward and one reverse. The high gear gives a normal plowing speed of 3½ miles per hour. A Bennett carburetor is fitted and it is claimed that



Boring convertible tractor-cultivator

the tractor can be run on either gasoline or kerosene. A Bennett air cleaner is used, this being of the centrifugal type. The power take-off is on the right side of the tractor and on the outside of the frame. It is independent of the engine clutch and the pulley turns only when the belt power clutch is engaged. Its speed is 41/100 that of the engine. The tractor weighs 3400 lb. and of this weight 3000 lb. rests on the front drivers and 400 lb. on the rear caster wheel.

Farquhar Three-Plow Tractor

A. B. Farquhar, the implement maker, this year exhibited a four-wheel tractor rated as a three-plow job of 15-25 hp. The tractor is assembled from well known units including a Buda engine. The drive is through an intermediate shaft to the transmission, which is located over and slightly back of the rear wheel axis. The tractor is steered and operated in the conventional way. The final drive to the rear wheels is through completely inclosed spur gears. The power plant of this tractor is a four-cylinder 4½ x 6 in. Buda engine located longitudinally. A K-W magneto is used for ignition. The carburetor is of Kingston make and two fuel tanks are provided, one for 5 gal. of gasoline and the other for 25 gal. of kerosene. An air preheater is located back of the engine just over the bell housing. Engine speed is controlled by a Pierce governor, operating normally at 900 r.p.m. A Borg & Beck clutch is located within the flywheel housing and is completely inclosed. A short shaft driving through two Hartford universals connects to the Timken-David-Brown worm gear first reduction. Two forward speeds are provided through sliding gears. These gears, together with the worm and worm wheel, all operate in an air tight oil bath. The cross shaft of the transmission is fitted with pinions meshing with drive wheel bull gears.

Steering is by a worm and wheel mechanism. The spark and throttle levers are located on the steering post center. The belt pulley is accessible from the driver's seat, and is driven by a chain. The driving wheels are covered with large fenders and no moving parts are within reach of the driver's feet. The tractor weighs 5700 lb. Its overall length is 162 in.; its width, 67 in. The wheel base is 83 in. and the ground clearance, 12 in.

The Hicks Crawler Tractor

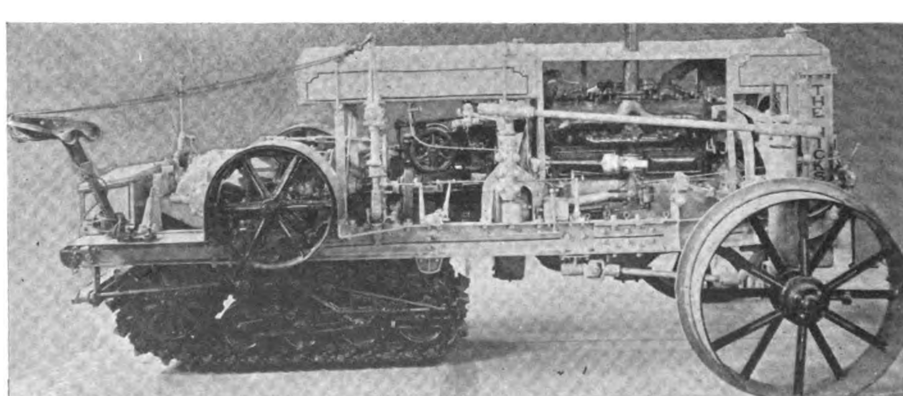
The Hicks is of the combined wheel and crawler type, having two front wheels for steering and two chain tracks at the rear for driving. The engine is a Buda four cylinder 5 x 6½ in. running at 800-900 r.p.m. Either gasoline or kerosene can be used as fuel. Fuel feed is by gravity, and ignition by a high tension magneto with impulse starter coupling. Engine speed is controlled by a fly-ball governor. A radiator of the built-up type is located at the forward end of the tractor. The transmission is of novel design, it is claimed, comprising cut gears of alloy steel whose shafts are mounted on annular ball bearings. All of the gears remain in mesh constantly and operate in an oil bath. Two forward speeds may be had, namely, 2.4 and 3.4 m.p.h. There are two chain tracks which are centrally located and are flexible in a vertical direction to allow for unevenness of the ground. These chain tracks are driven through a centrally located drive gear, both track sprockets being keyed to the drive gear shaft.

One of the most interesting features of this tractor is its steering mechanism. Steering is effected by engine power through a set of three bevel gears. The driven bevel gears are loose on their shaft but can be made to turn therewith by means of two cone clutches. These clutches are controlled by means of the driving lines. In order to start the tractor when the gear is in the neutral position, the driver gives a slight jerk on both lines. A pull on either of the lines turns the front wheels. There are two belt pulleys, one on each side of the tractor. These pulleys are controlled by expanding clutches. The overall dimensions of this tractor are as follows: Length, 132 in.; width, 78 in.; height, 72 in. The tractor complete weighs 7850 lb.

La Crosse Line-Drive Tractor

A small tractor with the line drive feature was shown by the La Crosse Tractor Co. This model has a 6-12 hp. rating and weighs in the neighborhood of 3000 lb. It will pull two bottoms, and the manufacturers figure that it will take the place of five horses under average horse working conditions. It has been hooked up with practically all implements that horses now handle, and one of the selling arguments put forward by the manufacturers is that it is not necessary with this tractor for the farmer to buy special equipment. In addition to the line drive this tractor has friction drive, which, however, is not of the disk and wheel type but consists of a friction roller which is adapted to engage with either of two concentric friction drums, one giving a forward speed and the other the reverse.

The engine has two horizontal cylinders of 4 in. bore and 6 in. stroke. It has two ball bearings on the crankshaft and reinforced die-cast bearings on the crank pins. The valves are located in the cylinder heads and are in-



Hicks tractor with power steering

closed. The front wheels turn on steering knuckles operated by the lines. Differential brakes are automatically applied by the steering mechanism and the applying mechanism can be adjusted to put these brakes on when the steering wheels have been swung around through any desired angle. There are only two speed reductions from the engine crankshaft, first through the friction wheel and drum and then through a lantern wheel and internal gear. The latter is cast in eight sections.

Some New Garden Tractors Exhibited

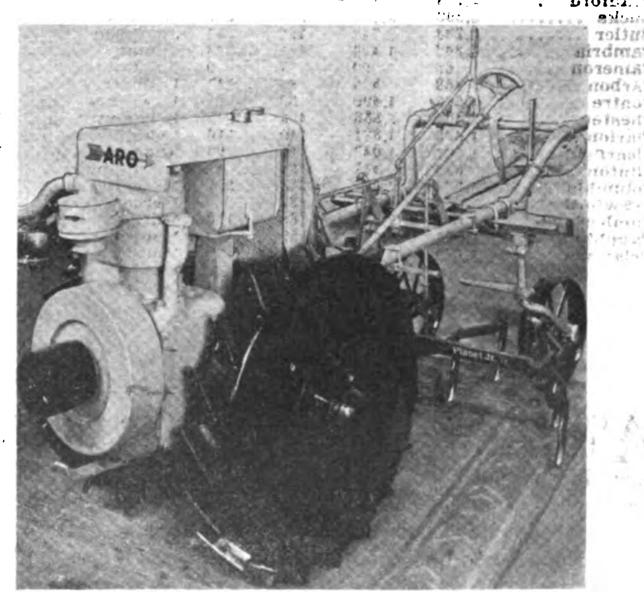
THE Spry Wheel, made by H. C. Dodge, Inc., is a single wheel tractor and cultivator combined. It has a frame 37½ in. long and 7 in. wide, with side members of pressed steel, on which is carried the single cylinder two-stroke air-cooled engine. The cylinder of this engine is cast with cooling flanges and is heat treated before the final grinding at a temperature of 1150 deg. Fahr., so that it will not warp after being finished. Two flywheels of semi-steel are keyed to the crankshafts, the crankpin being secured into their webs to make a built-up crankshaft. The piston, which is 2½ in. in diameter, is provided with three rings. A vaporizer is used instead of a carburetor, and ignition is either by a Bosch high tension magneto or a non-vibrating coil and three dry cells. The transmission is through a chain to the intermediate shaft and thence through a pinion and internal gear to the single 20 x 3½ in. drive wheel. There are two adjustable cast wheels toward the rear of the frame, and the tool carrying equipment, which is adjustable for various depths of cultivation, is suspended directly behind these wheels. The handles are bolted to the frame just forward of the drive wheel axis, and the one-gallon fuel tank is carried on them. The spark advance lever and ignition switch are located at the curve of the handles, and it is claimed that with these control devices alone a speed variation from 1½ to 4 m.p.h. can be obtained. The standard tool equipment consists of a 12 in. rear tool holder with adapter plates by means of which the tool spread can be extended to 18 in.

The Aro tractor is a machine designed to do any kind of one-horse job. Unlike most of the smaller machines so far made, it is a riding tractor. The power plant consists of a single cylinder 4½ x 5 in. engine running normally at 800 r.p.m. The crankshaft is 2 in. in diameter and is mounted in Hess-Bright ball bearings. The connecting rod bearing is 2¼ in. in diameter by 3 in. in length. Gasoline is used as fuel and a supply of 2 gal. is carried in the tank. Fuel feed is by gravity to the Schebler carburetor and ignition is by a high tension magneto. Lubrication is by splash, with circulation by a plunger pump, and the cooling water is circulated by thermo-siphon action. The flywheel is mounted at the front of the engines. A shoe type of expanding clutch is fitted. The belt pulley is on the flywheel and is 6 in. in diameter by 4½ in. wide. Transmission is through a worm and wheel, giving a single reduction between the engine crankshaft and the driving wheels. Worm and wheel are enclosed in an oil-tight case. The drive wheels are of the disk type, 30 in. in diameter by 4 in. wide. The width of tread can be adjusted. There are two 16 in. caster wheels at the rear. This tractor is 106 in. long over all, and 45 in. high; it weighs 1,000 lbs. and is rated as a 3-5 hp. machine. Its speed can be controlled between limits of 1 and 3 m.p.h., and it is capable of pulling one 10 in. plow. The minimum ground clearance is 10 in., but under the axle the clearance is 12½ in. The operator steers the machine with his feet; he controls its speed with the throttle lever, and all movements of the tool are controlled with one lift lever. It is claimed for the Aro that with a 10 in. plow it will turn a full-width furrow of good depth under all soil conditions, operate disks, harrows or other seed bed tools and do a thorough job of cultivating any wide row crop, being readily adjustable to different row spacings.

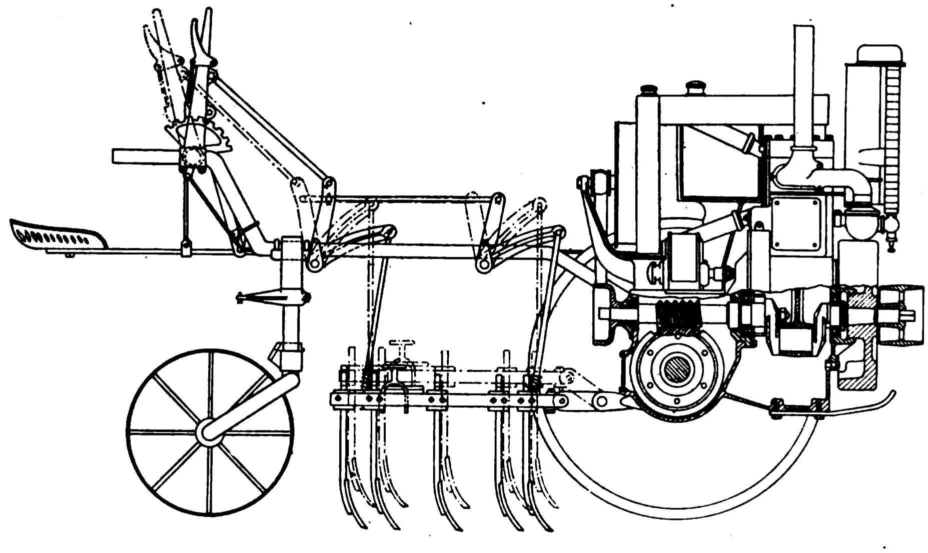
Another garden tractor shown for the first time is the Centaur manufactured by the Central Tractor Co. This has a single cylinder, vertical, air-cooled engine rated at 5 hp. Cooling is effected by means of a blower in the flywheel. Ignition is by a Bosch high tension magneto and lubrication by splash in the enclosed crankcase. The drive is through a pair of bevel and a pair of spurcut gears to a countershaft and thence through an enclosed chain to the driving axle. A differential gear is fitted on the axle, to make steering easy. The driving wheels are 28 in. in diameter by 4 in. in width and are spaced 25 in. center distance. The over-all height is 38 in. and the axle clearance 12 in. For plowing or for use on wet or sandy soil wheel extensions increasing the width of the drive wheel to 8 in. can be applied. The machine is started and stopped by means of a multiple disk clutch and its speed is controllable between the limits of 1½ and 3 m.p.h. There is a belt pulley on an extension of the crankshaft for such work as pumping, grinding and line shaft driving.

The Gromor cultivator was exhibited by the Frank Held Tractor Co. This machine has a single cylinder, vertical, air-cooled engine with an integral reduction gear of 8 to 1. From the engine shaft there is a chain drive to a countershaft with a reduction of 2 to 1 and then comes a final drive by gears with a reduction of 4½ to 1. This gives a total reduction of 72 to 1 and should make the machine sufficiently powerful to cope with all soil conditions. For cooling the engine, a four-blade open fan is mounted at the side of the cylinder driven by belt. Among the claims made for this cultivator are that it has a low center of gravity and sufficient clearance to make operation easy. Drive wheel, motor supports and bearings are of gray iron, while all other parts are of soft steel, cast steel or manganese bronze.

A number of changes in design have been made in the



Aro, one of the riding garden tractors



Sectional view of Aro tractor

trance into the cylinder. The shape of the combustion chamber has been changed somewhat and the compression raised 10 lb. p. sq. in. Removable valve stem guides and a variable speed governor are now employed. The magneto drive has been improved and the location of the spark plug so changed as to place it in the path of the incoming charge. The piston is now relieved eccentrically instead of all around and the connecting rod bearing is oiled by means of an oil ring catching oil, in addition to the oil it receives from the splash.

A number of improvements have been made in the Beeman garden tractor, the pioneer in its class. The crankpin bearing area has been increased. The clutch mechanism has been redesigned, so that both wheels

Utilitor tractor whereby the power of the engine has been materially increased. The engine has been retimed and the valve lift increased 1-16 in. At the same time the inlet manifold was enlarged so as to give the gases a freer en-

are positively released when the clutch is withdrawn, and the crankcase has been remodeled so as to give more room. There is now an oil reservoir or sump under the camshaft gears.

Fifty-five Per Cent of Pennsylvania Farmers Own Cars

SEVEN out of every hundred farmers in Pennsylvania purchased automobiles during 1920, while at the present time, fifty-five out of every hundred farmers in the State own automobiles, not including farm trucks. These figures are shown in a table prepared by Statistician L. H. Wible, of the Pennsylvania Department of Agriculture.

More than 100,000 farmers in the State own automobiles, many of these owning two and three machines, while there are 14,325 farms in the State upon which motor trucks are in use. Lancaster county easily leads in the number of automobiles on the farms, this county having 7914 cars on its farms on January 1, 1921, while Berks county is second with 3836. Cameron county, with 90 automobiles, has the fewest of any in the State.

The following table shows the number of motor vehicles on the farms, January 1, 1921, based on the 1920 census figures which give Pennsylvania 202,298 farms, as compared with the number of January 1, 1920, which was based on the old census figures which gave Pennsylvania 219,000 farms:

	Automobiles		Motor Trucks	
Counties	1920	1921	1920	1921
Adams	1,576	1,726	58	87
Allegheny	2,991	2,463	440	660
Armstrong	1,234	1,810	97	135
Beaver	1,061	1,358	135	141
Bedford	1,959	2,146	200	360
Berks	3,824	3,836	537	774
Blair	933	894	285	186
Bradford	2,621	2,857	222	259
Bucks	2,890	3,200	360	600
Butler	2,233	2,743	132	241
Cambria	1,242	1,439	261	348
Cameron	66	90	7	9
Carbon	468	475	96	111
Centre	1,565	1,400	50	65
Chester	3,400	3,856	456	575
Clarion	1,696	1,671	110	110
Clearfield	1,202	1,042	45	90
Clinton	533	447	31	42
Columbia	1,527	1,562	322	391
Crawford	2,419	2,934	87	210
Cumberland	1,674	2,025	68	110
Dauphin	1,503	1,636	69	130
Delaware	1,072	1,034	252	420
Elk	537	514	40	70
Erie	2,480	2,742	168	357
Fayette	1,145	1,209	204	254
Forest	99	100	5	5
Franklin	2,550	2,525	105	180
Fulton	598	648	44	97
Greene	1,641	1,647	126	112
Huntington	1,145	1,140	42	90
Indiana	1,561	1,889	48	96
Jefferson	1,108	1,179	25	46
Juniata	848	817	26	39
Lackawanna	677	679	160	276
Lancaster	7,043	7,914	328	385
Lawrence	1,297	1,478	119	112
Lebanon	1,263	1,423	36	80
Lehigh	1,718	1,746	195	225
Luzerne	1,769	1,838	684	945
Lycoming	1,291	1,778	126	132
McKean	621	711	45	50
Mercer	2,023	2,474	204	232
Mifflin	689	665	10	23
Monroe	923	800	96	160
Montgomery	1,911	2,420	324	669
Montour	411	402	50	54
Northampton	1,854	1,707	90	153
Northumberland	1,368	1,553	192	230
Perry	771	884	20	46
Philadelphia	643	355	294	283
Pike	348	346	18	22
Potter	768	690	48	54
Schuylkill	1,501	1,660	432	597
Snyder	830	964	105	141
Somerset	2,163	2,360	150	225
Sullivan	394	376	15	18
Susquehanna	2,035	1,869	189	243
Tioga	2,307	2,078	160	189
Union	786	903	90	80
Venango	894	758	45	67
Warren	902	871	37	46
Washington	2,840	2,913	165	202
Wayne	1,552	1,479	86	128
Westmoreland	2,591	2,964	275	345
Wyoming	844	772	70	108
York	4,399	4,221	239	405
Total	104,850	110,500	10,250	14,325

British Authority Predicts All-Metal Plane in Future

ACCORDING to the *Morning Post* of London, Major-General Seely, Under Secretary of the State for Air, speaking recently at Cambridge at a meeting of the Air League of the British Empire, stated that: "Although great strides have been made in the science of aeronautics much remains to be done, and it is to Cambridge scientists that we must look for great service in this respect. The aeroplanes of the future must be of all-metal. The present method of wood construction is quite wrong where an internal combustion engine is used. Greater safety and greater comfort are needed. We are behind other nations in this respect, and the need is a very urgent one."

Many Subjects Discussed at S. A. E. Tractor Meeting

Entire day given over to professional sessions and dinner during tractor show at Columbus. Plowing and belt speeds, non-freezing solutions, alcohol fuel and tractor tests are among the subjects discussed.

By P. M. Heldt

A ONE-DAY program devoted entirely to tractor subjects was arranged by the S. A. E. in connection with the Columbus Tractor Show. The professional session was held at the Southern Hotel and was followed by a tractor dinner at the Deshler. The first item on the program of the professional meeting was a report by D. L. Arnold on An Investigation of Plowing Speeds. A variety of opinions was expressed during the discussion. One member said that the average farmer liked to travel fast, and the idea of high speed plowing appealed to him. He also said that there is no inherent difficulty in high speed plowing. When an ordinary traction dynamometer record is inspected it is observed that the draft varies constantly between rather wide limits. This fluctuation of the drawbar pull is due to a number of causes, one being imperfect scouring of the plow. It is true that the draft increases with the speed.

Plowing Speeds

Another speaker, coming from Massachusetts, where the ground is decidedly stony, said that he hoped high plowing speeds would not be attempted in his neighborhood. An experience was cited of a tractor which when plowing 4 in. deep would pull a certain number of plows, but when setting the plow deeper one more bottom could be pulled. This was due to wire grass in the soil. When the plow was set for deep plowing it cut below the wire grass.

O. B. Zimmerman said that the plowing speed problem is an intensely serious one. If the draft increases with speed there would be a great waste of energy, and, besides, the increased wear and tear on the machine must be considered. The scientific method of arriving at results which had been followed by Mr. Arnold should be of great value to the country.

John Mainland made a report for the Committee on Pulley Face Widths and Speeds. This consisted chiefly of a report on the work done by this committee during the past year, and as the recommendations of the Committee were adopted by the Standards Committee at the New York meeting, what he said was in the nature of a review of the work accomplished the past year. Mainland said that as an implement man he favored tractor pulleys 2 in. wider than the belt width, instead of only ½ in. wider as recommended, in view of the difficulty of accurate alignment of the tractor with the threshing machine, but realized, that in many cases it is difficult to get such a wide pulley on the tractor. He said that one width of pulley recommended was 4 in., and that this is entirely inadequate for threshing. He was later informed by another member that the 4-in. pulley is not intended for threshing but for such lighter work as feed grinding.

The Tractor Division of the Standards Committee during the past year adopted a recommendation to the effect that all tractors should be equipped with governors, and in this connection Mainland emphasized the importance of the governor in threshing. He said that the cylinder of a grain separator has a peripheral speed of 6,250 ft. per min.—a higher speed than the average flywheel rim, and that in four instances he knew of cylinders driven by tractor engines having no governor had burst due to excessive speed.

A paper on Anti-Freezing Solutions for Tractor Cooling Systems was read by O. B. Zimmerman. The author enumerated the qualities that must be possessed by a good non-freezing liquid. It must be cheap and easily obtainable; it must be non-corrosive and non-electrolytic. The specific heat should be as low as possible and the boiling point should not be too low. Table salt and calcium chloride are out of the question because of their electrolytic effects. Alcohol makes a good non-freezing solution, but owing to the fact that only the alcohol evaporates the operator is usually in the dark as regards the strength of his solution and its degree of safety.

Cooling Systems

Mr. Zimmerman spoke particularly favorably of the use of mineral oils in the cooling system, with which he had had practical experience on automobiles. One objection that has been made against the use of kerosene as a cooling fluid is that it gives off unpleasant odors, but this is of no particular consequence in connection with a tractor. The life of rubber hose in the cooling system, if kerosene is used, is from three months to two years. Some objection has also been raised to the use of kerosene on account of the fire hazard, but there is no record of a case of destruction due to this cause.

Mr. Secor of the Advance-Rumely Co. said that he fully agreed with what Mr. Zimmerman had said. There were some 50,000 Rumely tractors with oil-cooling system in service. The system, he said, is simpler than the conventional water cooling system, and the only attention required is the occasional repacking of the pump. The temperature of the radiator is higher at low loads than with water cooling. A somewhat larger pump is required than with water. The chief advantage of the oil cooling system is that the oil will not freeze. A cooling surface of 8 sq. ft. per b. hp. is allowed on tractors. The oil used is known as Winter black and has an initial boiling point of 550-575 deg. Fahr. The average temperature of the oil leaving the jacket is 175-200

deg. It rarely attains 225 deg. As a rule, the smaller the tractor, the higher the temperature that can be carried. There has been no trouble from jackets and radiators being clogged by the oil, and in general there have been no complaints in connection with the cooling system.

Mr. Arnold said that he had used kerosene in his automobile and had had no trouble with it. One hose lasted two years and another a year and a half. He expressed the view, however, that it could be used only with pump circulation, as a car with thermo-siphon circulation would quickly overheat when the cooling system is filled with kerosene, except perhaps in very cold weather.

Dr. Marshall of the Bureau of Standards spoke briefly on the principles underlying the design of cooling systems as developed at the Bureau particularly in connection with aircraft work.

At the afternoon session, Prof. Sjogren spoke on the tractor tests made at the Nebraska University. He presented a table giving the results of all tests made to date. Records of these tests have been published in AUTOMOTIVE INDUSTRIES. As is well known, quite a few tractors have had to be changed in one way or another before they could pass the tests, and in some cases the tests showed up defects of which the manufacturers' engineers knew nothing. Fan belts gave much trouble, and in some cases larger fans or larger radiators were installed. Sometimes there were indications that the water space around the cylinder head was too small, for the heads would overheat while the temperature of the outlet water was not excessive.

Air Washers

In a few cases heat control devices for the vaporising system were installed. Air cleaners of the dry type were often too small, and reduced the power of the engine unnecessarily. Prof. Sjögren said that air washers often proved ineffective because the farmer did not want to bother refilling them with fresh water and rather than do so took them off entirely.

It is desirable to be able to crank a tractor engine when the belt drive is in use. This is not possible with some designs. It was Prof. Sjogren's impression that ratings are being made on too narrow a margin. He also said that there is considerable diversity in the practice of rating. For instance, of three tractors fitted with the same engine (3⅛ x 4½ in.) one was rated as a 6-12 hp. at 1000 r.p.m., the second as a 5-10 hp. at 1000 r.p.m. and the third as a 6-10 hp. at 1200 r.p.m. Prof. Sjogren explained that in making the brake tests no allowance was made for losses in the belt. Prof. Magruder of Ohio State University thought that this method was open to criticism, as the loss in the belt will vary with the belt tension, and if the belt is crossed there is an additional loss. Prof. Sjogren answered that there is no easy method of making allowance for or determining the belt losses, and as the conditions were the same for all tractors, this was not considered necessary. An analysis of the results showed that two tractors developed less than 50 per cent of their belt horsepower at the draw bar, while the highest proportion of the belt horsepower developed at the drawbar was over 80 per cent. In the reports of the operators and observers it was stated whether the course of trouble was considered to be due to faulty material or faulty engineering, and both were found to be about equally frequent.

In Prof. Sjogren's report it was stated that 42 spark plugs were replaced during the tests, and this point was taken up by A. W. Scarratt, who gave it as his opinion that the fault was not with the plugs but in the design of the engine. He had found that out of 50 makes of spark plugs only three would not give satisfactory service in kerosene-burning engines of the type built by his firm. What is necessary, he said, is a little more attention to the design of the spark plug bosses and their cooling means.

Mr. Zimmerman asked what relation exists between the drawbar pull and the weight of the tractor. It was pointed out that this relation depends on the diameter and width of the wheels and upon the type of lugs used. The weakest link in tractor operations, Zimmerman said, was the hold on the ground. The plow must be designed to give a maximum disturbance of the soil with a minimum energy consumption and the tractor must be the direct opposite. He voiced the opinion that an enormous amount of power is lost between the crankshaft and the drawbar.

Mr. Scarratt read a paper on the Carburetion of Alcohol, which is reproduced almost in full herewith. Prof. Norman of Ohio State University said that he did not expect to see a sufficient shortage of petroleum fuel in this country for many years to come, such as to give a chance to power alcohol.

There are enormous deposits of oil-bearing shales in Colorado which give an oil very similar to Pennsylvania crude, and recently large additional deposits have been discovered in Tennessee. In Germany successful use was made of alcohol-benzol-kerosene mixtures, and it was found that very lean mixtures were required. Mr. Secor said that in his opinion alcohol would not interest the present generation, except insofar as it relieved us of any anxiety as to what would become of our children after the last drop of gasoline has been used up. His firm some time ago received a report of a test with alcohol fuel on an Oil-Pull tractor made for the Esthonian Government. No changes were made in the engine, which operated at 80-85 lb. compression, and the fuel consumption was determined to be 0.735 lb. per hp.-hr.

Replying to a question as to the practicability of working shale oil deposits, Mr. Peck said it had recently been proven that shale containing less than 20 gal. per ton had commercial possibilities. An oil field had recently been discovered near San Antonio, he said, which would supply us with oil for the next 300 years.

General Purpose Tractor

E. A. Johnston, chief tractor engineer of the International Harvester Co., spoke briefly on the subject of tendencies in traction design, and then showed motion pictures of an experimental tractor of which several samples had been built by his company. This is, perhaps, the most nearly universal machine that has ever been built. It is a three-wheeled type and was shown plowing, discing, cultivating, hauling wagons, operating self-binders, corn binders, corn huskers, seeders, a spraying outfit and hay machinery of all kinds.

In the discussion Mr. Johnston was asked how small a farm this outfit would be practical on. He replied that the horse eats the product of 5 acres and that this represents only 60 per cent of his total cost, so that he really costs as much as is obtained for the products from 8 acres. Usually 7 to 10 horses are kept on a 150-acre farm. Power apparatus can be operated at 60 per cent of the cost of horses. One of the advantages of a universal tractor with a set of specially designed implements as shown in the moving pictures is that a very material reduction can be made in the weight and cost of the implements. Some such development as that shown by the pictures, Mr. Johnston said, must be accomplished in order to reach the small farmer.

A representative of an electric lamp concern asked what were the chances of electric lighting coming into

general use on tractors, the same as on automobiles. Mr. Johnston replied that they were slight, so far as could now be seen. Night plowing was about as unsatisfactory as night work in the factory. There is always increased breakage, and the dew interferes to a certain extent with efficient work. The small farm is usually worked by the farmer alone, and he could not possibly work 24 hours a day. On the larger farms the equipment is usually adequate to make night plowing unnecessary. There is a slight demand for electric lighting equipment, but not sufficient to warrant the fitting of such equipment on all tractors.

Mr. Nash said that in California much night plowing is done, and usually by electric light. An outfit, which requires no battery and is suitable for two lights, has been developed by one of the large electrical companies. One of the most successful tractor owners works his tractors 22 hours a day during the season, six days of the week, and spends about one-half of the seventh day going over the machine.

Tractor Dinner Well Attended

The Farm Plow dinner was well attended. Fred Glover acted as toastmaster. The first speaker of the evening was J. B. Davidson, executive councilor of the American Society of Agricultural Engineers. Dr. Davidson quoted a noted Canadian to the effect that there are only three primary vocations, namely, agriculture, homemaking and education. He asked what made for a high standard in agriculture. Some people claimed that it was maintenance of soil fertility. If that was so then agriculture has attained its highest development in Korea, where fertility of the soil has been maintained for forty centuries. However, in Davidson's estimation soil fertility and plant breeding are not key factors in agriculture. There are 8000 fewer farmers in Iowa to-day than there were 10 years ago. The percentage of the agricultural population did not make for a high standard of farming.

He would align himself with that new school of economists who say that what we want is efficient agriculture. This is measured by capacity for production. The health of the people on the farm is a factor. Many of the operations on the farm are mechanical in nature. Thus, for instance, harvesting and carrying the products to market are mechanical operations. Thirty times as much grain is produced now as in 1830. Before the war 9,000,000 people in the United States produced as much grain as 66,000,000 in Europe. An enormous amount of power, aggregating 25,000,000 hp., is used in agriculture, far more, according to statistics quoted by Davidson, than used in the industries.

Engineer in Agriculture

Davidson said that there is a big field for the engineer in agriculture. There are in this country 200 million acres that can be reclaimed by clearing, 80 million acres that can be reclaimed by drainage and 150 million acres that can be reclaimed by irrigation. There is, therefore, no danger of a shortage of arable land. The farmer is thinking of two things just now; one is how to get more for his product, and the other, how to reduce his cost, and in this latter connection at least the engineer could be of great service to him.

The second speaker was L. J. Taber, Master of the Ohio State Grange. He said that the triumph of the century, which has changed barbarism to civilization, has been all the work of the engineer. For thousands of years agriculture was carried on in the same old way, but there has been a mighty change in the last half century. Power and farm machinery are closely interwoven. There is none of the radicalism among Ohio farmers that has made itself evident in other sections, and there would be none unless the financial and manufacturing interests failed to take heed of conditions in the country.

Farmers' Strike Result of Inexorable Conditions

Speaking of deflation brought us face to face with the subject of the so-called farmers' strike. The American farmer purchases 45 per cent of the manufactured articles that are not exported. There has been a 45 per cent decline in the value of farm products in the last six months. The condition referred to is not exactly a strike but simply the working out of inexorable conditions. The farmer cannot do without the things essential to efficient production. The great need to-day is the creation of a better understanding between town and country.

It is necessary to lighten the task of the farmer's wife. The farmer must have sufficient reward to enable him to put electric light into his home, to put in power washers and other labor-saving devices for the home. There can be no permanent prosperity in farm life while marketing problems are being neglected. We must have a proper co-operative movement among farmers, a community organization looking after the sale of farm products and the purchase of farm necessities on a co-operative basis. The farmer wants to become a businessman besides.

The last speaker was W. H. Stackhouse, President of the National Implement and Vehicle Association, who presented a good deal of statistical matter bearing on farm production and on the prices of farm products and other merchandise. Mr. Stackhouse said that in 1820 95 per cent of all the people of this country lived on the farm, whereas the percentage in 1920 was only 49. In 1849 the wheat produced in the United States amounted to 4.3 bushels per capita, while in 1920 it amounted to 9.4 bushels.

Farmers' Purchasing Power

According to Mr. Stackhouse it would be utter folly to deny that the world-wide business depression had not affected the farmer. The farmer's purchasing capacity is not the same to-day that it was a year ago. Within the last few days the Department of Agriculture has published figures showing that the value of all farm products in 1920 was $19,856,000,000, which is about five billion dollars less than in 1919, but it would be taking a wrong view of the matter to say that the farmer has lost this amount. The value of farm crops alone in 1919 amounted to $11,405,000,000. From 1913 to 1920 the cost of farm implements increased 78 per cent; the value of farm products, 112 per cent; the value of labor, 115 per cent, and the value of all other commodities, 144 per cent.

Referring to the reputed pressure on farmers to keep them from buying, Mr. Stackhouse said just because it's raining we need not think that it's never going to shine. The farmer wants the cost of manufactured products reduced, and he can be assured that just as soon as the replacement cost of manufactured articles is reduced the manufacturer will lower his prices. It would be folly for him to follow the suggestion to cut prices at once and shoulder the loss, as that would simply lead to a crop of failures. In concluding Stackhouse referred approvingly to the movement inaugurated by the Government during the war of causing the number of different items of manufacture to be reduced, and to the National Repair Week fathered by the National Implement and Vehicle Association.

The Carburetion of Alcohol

AT the tractor meeting of the S. A. E. held at Columbus on February 10, A. W. Scarratt, engineer of the Minneapolis Steel & Machinery Co., presented a paper on the above subject. Mr. Scarratt's firm is doing considerable business with South America and other foreign countries where petroleum distillates are very expensive. He mentioned Cuba, Brazil, Argentina, Chile, Porto Rico and Venezuela, where the introduction of tractors is hampered by the high cost of kerosene, while alcohol is produced in vast quantities and is comparatively cheap. Quoting Mr. Scarratt:

"Naturally, if American tractors are to succeed in these countries they must be equipped to operate on alcohol in an economical and efficient manner. Many manufacturers will claim that their engines will operate on alcohol, and they will, but in a very inefficient and wasteful manner because they are not primarily designed with a view to using this as a fuel. * * *

"The Minneapolis Steel & Machinery Co. has exported a large number of tractors in the past twelve years, during which time many of them have been required to operate on alcohol. But it is only in the last year that the demand for greater economy and efficiency when using alcohol has been seriously felt. During 1920 we have done some intensive studying and experimental work in the development of an engine which will burn alcohol economically and efficiently. * * *

"Alcohol is difficult to vaporize, hence difficult to start on; it ignites at a considerably higher temperature than gasoline, is only 6/10 as rich in heat units as gasoline by weight and is 15 to 20 per cent heavier by volume. Commercial alcohol contains approximately 10 per cent of water by weight and from 10,000 to 12,000 B.t.u.'s per pound, its specific gravity is from .80 to .84 at 60 deg. Fahr., and its range of distillation temperatures is from 158 deg. Fahr. to 175 deg. Fahr., and it is a vegetable derivative. These physical characteristics are quite different from the common petroleum fuels.

"We knew that higher compression was necessary, but as engine size and design influences operation to a large extent, our first problem was to establish an approximately satisfactory compression pressure from which to start our experiments. Our first trials were with 127 lbs. gage compression at normal operating speed. The next problem was to determine what amount of heat applied to the mixture was desirable and its general effect on economy, output and operation. Here we had a real surprise when we discovered that more heat is needed for good operation on alcohol than is required for using kerosene.

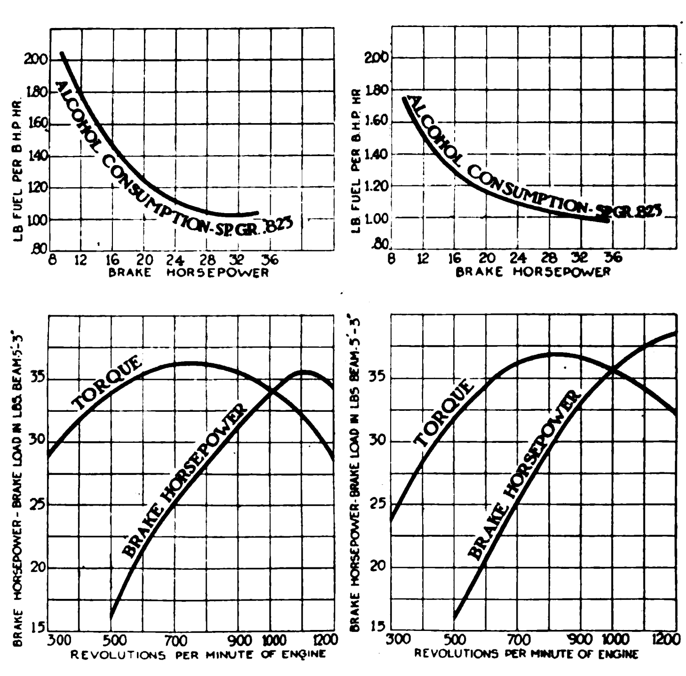
"Our next concern was in regard to the power output, which we found was equal to the power developed when using good kerosene. We then concerned ourselves with the general operation of the engine and finally with the fuel consumption. At first the operation was not good at low engine speeds when under sustained load, and the fuel consumption was higher than we liked, but by perseverance and patience we overcame these obstacles and produced very creditable characteristics with good economy and excellent operation and with two distinct and totally different types of carbureting and manifold systems, one of which was the special Twin City-Holley system worked out by our company and employed on all Twin City tractors at the present time, and the other was the Twin City vaporizer system.

"We felt that if we could obtain the same power with alcohol as with gasoline or kerosene for the same expenditure in B.t.u.'s of fuel, per b.h.p. developed, that we would be doing very well. As a matter of fact, we have exceeded these hopes slightly and actually show a fair increase in thermal efficiency.

"Our experimental work was done on a 4-cylinder 4¼ x 6 in. 16-valve engine. At first no heat was applied to the intake manifold and we were only able to develop 29 b.h.p. at 1000 r.p.m., using 127 lbs. compression, whereas we could easily develop 35 h.p. with kerosene, using 63 lbs. compression. When running with a cold manifold, the temperature of the intake charge dropped to 35 deg. Fahr., frost collected on the manifold and water froze on certain portions of it. It was necessary to choke the carbureter to a considerable extent and very unsatisfactory operation was the result. We then applied heat, with the result that the horsepower increased from 29 to 35 and operation was very much improved, although the engine would not pick up its load at low speeds.

"An intake manifold with glass inserts was used which showed that a large amount of wet, unvaporized fuel was going over to the engine. We then increased the heat still more, by connecting two air heaters for the carbureter intake in series. This dried out the mixture but decreased the horsepower from 35 to 33, although the fuel consumption was decreased considerably, being 1 lb. per b.h.p.-hour. With this set up, the inlet air to the carbureter reached a temperature of 210 deg. Fahr. but after being carbureted the intake gas temperature dropped to 138 deg. Fahr., with an exhaust gas temperature of 215 deg. Fahr. We then decided to drop our compression pressure to 100 lbs., with the result that nearly equal h.p. was developed, the fuel consumption was not increased and the operation was improved at low engine speeds.

"We then tried an intermediate compression, using 110 lbs., which was finally adopted as giving the most satisfactory results. With this compression we had no difficulty in obtaining an output of 35 h.p., which was equal to that developed when using kerosene, and fuel consumption at maximum load remained 1 lb. per



Power curves of Twin City 4¼ x 6 in. four-cylinder tractor engine running on alcohol with two different carbureters

b.h.p.-hour. The alcohol used in this experimental work contained 10,500 B.t.u.'s per pound. An equivalent gasoline consumption by weight would show a fuel consumption of approximately 0.55 lb. per b.h.p.-hour, which is exactly equal to the finest performance which we have obtained on this engine using gasoline and which is decidedly more economical than average engine performance indicates.

"The difficulties of starting are increased somewhat when using alcohol, due to the greater starting effort necessary for cranking the engine and also because air, at ordinary temperatures, does not vaporize the alcohol sufficiently to make a good combustible mixture. Satisfactory starting was accomplished by a redesign of the starting crank coupled with the use of a mixture of alcohol and gasoline, the ratio being four parts alcohol to one of gasoline.

"Following are a few of the important features which we believe necessary for the proper use of this fuel. In our case, 110 lbs. compression proved most satisfactory. Very liberal provision for heating the fuel charge must be made. Use of the entire exhaust heat will be found necessary. The temperature of the ingoing charge of fuel for good carburetion and economical operation should not be less than 100 deg. Fahr. Careful consideration should be given to the design of the intake manifold so as to obtain uniform distribution. At high compressions this is very essential, especially when using alcohol. Gas velocity is important. The intake manifold gas velocity, at full load, should not be less than 9500 ft.p.m. average.

"In our opinion, alcohol is an ideal fuel. It is completely distilled or vaporized at practically a constant temperature. This is a decided advantage and once the engine is properly warmed up, the operation is all that can be desired. There is practically no carbon residue created when using alcohol and the condition of the valves and valve seats, after long periods of heavy run, is surprisingly good.

"We are thankful that it was necessary for us to do this experimental and development work with alcohol. In our opinion the use of alcohol as a fuel, eventually is bound to come in the United States. We believe that the entire automotive industry should get behind this idea and bring it about as quickly as possible so as to provide another source of fuel supply and to bring down the operating costs of all equipment, depending now on hydro-carbon fuels. There are millions of tons of vegetable matter unused in the United States yearly from which alcohol could profitably be manufactured. If the manufacture of alcohol for fuel purposes is demanded by the automotive industry it will head the list of automotive fuels eventually."

AN interesting volume treating of the organization and management of trade associations has been published by the Ronald Press Company. It analyzes in detail the purpose, structure, procedure and value of the trade association and contains a very complete and accurate list of trade associations and their addresses. The book is written by Emmett Hay Taylor.

Safety in Spring Shackles

WRITING in *Engineering* on defective design in motor trucks brought out by war service, F. Strickland remarks that a point affecting the safety of light cars is the arrangement of the spring hanger of the front spring. With the usual arrangement of front springs the axle is attached to the frame only by the front part of the spring. A considerable number of springs broke, and if the fracture was between the axle and the front spring horn there was nothing to hold the axle except the rear shackle.

In the earlier days of motor cars the shackle was in tension, being hung from a bracket as shown in Fig. 1, following carriage practice. Later, however, the shackle was generally put in compression (See Fig. 2) as a bracket is saved and the appearance is neater.

In case the front spring breaks in front of the axle, the construction shown in Fig. 1 is in stable equilibrium while that in Fig. 2 is not. Further, in the first case the motion backwards is limited, while in the second the link may swing back to the position shown in dotted lines. In the latter case the motion of the axle is considerable, and the car frequently gets quite out of control. The result of this, in France, was a number of very serious accidents owing to the cars running off the road at speed. In order to avoid these a short length of belting was fixed under the spring at the spring seat and attached at the front in such a way as to prevent the axle going back in case of the spring breaking. While this belting was the usual method of securing the axle in the service there are neater ways of doing it.

Figs. 3 and 4 show two methods which were tried and found effective. In Fig. 3 two short lengths of angle iron bolted to the shackle formed stops so that in case of the spring breaking the motion of the shackle was limited. This proved effective and was easily adapted to the spring shackles of some cars. It was very cheap and easy to apply, requiring only two pieces of angle iron about 2 in. long, and one bolt for each front spring shackle.

Fig. 4 illustrates another arrangement, which was also very effective and not expensive. In this case a plate about ¼ in. thick is bolted to the frame. This plate has a slot allowing the necessary motion to the shackle, but preventing motion beyond this.

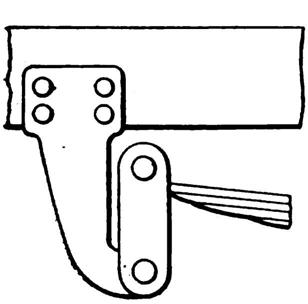


Fig. 1

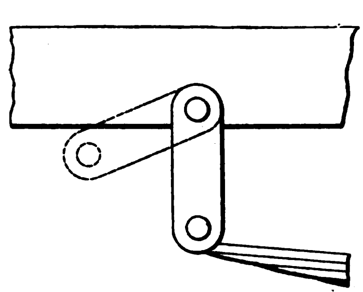


Fig. 2

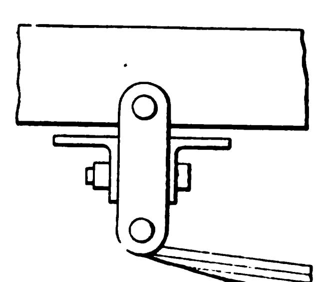


Fig. 3

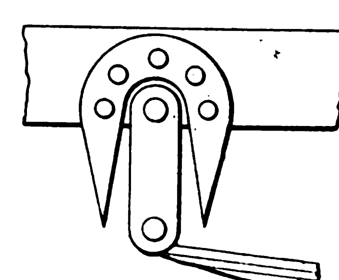


Fig. 4

Means of Materially Increasing Thermal Efficiency

This article, though written with special reference to aircraft engines, contains extremely valuable suggestions applicable to other automotive types, and is worthy of careful study by all who desire to improve the thermal efficiency of these engines. The use of stratified charges and other means for improving efficiency are clearly outlined.

By H. R. Ricardo*

IN presenting this paper the writer aims to indicate certain possible lines of development and research which his investigations and preliminary experiments have shown to be at least worthy of serious consideration. If we review the present state of the art we find the position to be substantially as follows: From a thermodynamic point of view the performance of the modern aero engine has approached so nearly to the ideal obtainable from the cycle on which it operates that there is little scope for improvement. Thermal efficiency or fuel consumption is now the all-important factor, but since the best modern aero engines are actually developing a thermal efficiency within 4 per cent or 5 per cent of the highest obtainable from the cycle on which they operate, it is evident that to gain any further improvement it will be necessary either to depart from, or at least to take considerable liberties with, the accepted cycle, or to modify the composition of the fuel, or both. The cycle on which all present-day aero engines operate is one in which an explosive mixture of fuel and air is drawn into the cylinder compressed to the highest pressure permissible without detonation and ultimate pre-ignition, then ignited at constant volume and expanded until it occupies the same volume as before compression, after which it is released and the cycle is repeated. The theoretical efficiency of this cycle is given by the formula $E = 1 - (1/r)^{\gamma - 1}$. This is known as the air standard efficiency; it assumes that the specific heat is constant at all temperatures, that there is no loss of heat and that there is no dissociation. According to this formula the efficiency is dependent upon r, the expansion ratio. In the ordinary cycle r is also the compression ratio, since compression and expansion happen to be equal, but it must be remembered that it is the expansion and not the compression ratio which governs the efficiency, and that the two need not necessarily be equal.

The most recent investigations on the properties of the working fluid carried out by Mr. Tizard and Mr. Pye and corroborated by the writer's experimental results, show that when due allowance has been made for the losses due to change of specific heat and to dissociation at the temperatures which actually obtain in the cylinder, the true limiting thermal efficiency becomes approximately $E = 1 - (1/r)^{0.295}$. This formula takes no account of the losses due to the direct passage of heat to the cylinder walls during combustion and expansion. It is clearly impossible to arrive at a really universal formula which will take this into account, since the proportion of heat lost must depend upon the form of the combustion chamber, the speed, and, in fact, on the individuality of each engine. In the most perfect case of an engine having a compact and symmetrical combustion chamber and running at a high speed, so that the direct heat loss during combustion and expansion is reduced to the absolute minimum, the highest attainable indicated thermal efficiency is given pretty accurately by the formula $E = 1 - (1/r)^{0.25}$. This allows for the minimum possible heat loss to the jacket walls and may be regarded as the absolute limiting thermal efficiency obtainable under the best possible conditions, assuming:—

(1) Perfect carburation and distribution.

(2) That the compression and expansion ratios are equal.

(3) That the mixture is homogeneous and of the most economical strength.

The following table (Table I) illustrated by the curves in Fig. 1 gives, in column (1) the air-cycle efficiency for a range of compression ratios from 4:1 to 8:1, column (2) Tizard and Pye's ideal efficiency, taking into account losses due to change in specific heat at high temperatures and to dissociation, column (3) the highest attainable indicated thermal efficiency assuming that the combustion chamber is designed to allow of the minimum possible heat loss, that the cylinder is of comparatively large capacity and that the revolutions are not less than 1500 r.p.m. In column (4) are given the actual indicated thermal efficiencies as obtained in a special variable compression engine designed by the writer for research purposes, and in which every known artifice for obtaining the highest possible efficiency and power output has been employed.

TABLE I

Expansion Ratio	Col. 1 $E = 1 - (1/r)^{0.4}$	Col. 2 $E = 1 - (1/r)^{0.295}$	Col. 3 $E = 1 - (1/r)^{0.25}$	Col. 4 Observed Results Variable Compression Engine
4.0	0.4256	0.336	0.296	0.277
4.5	0.4521	0.359	0.314	0.297
5.0	0.4747	0.378	0.332	0.316
5.5	0.4944	0.396	0.348	0.332
6.0	0.5116	0.411	0.361	0.346
6.5	0.5270	0.424	0.375	0.360
7.0	0.5398	0.437	0.386	0.372
7.5	0.5534	0.449	0.396	0.383
8.0	0.5647	0.460	0.406	....

The difference between columns 3 and 4 indicates the scope left for improvement—it is very narrow. So long as the recognized cycle is adhered to, in its entirety, the importance of raising the compression and, therefore, the ex-

*From a paper read before the Royal Aeronautical Society of Great Britain, Dec. 1920.

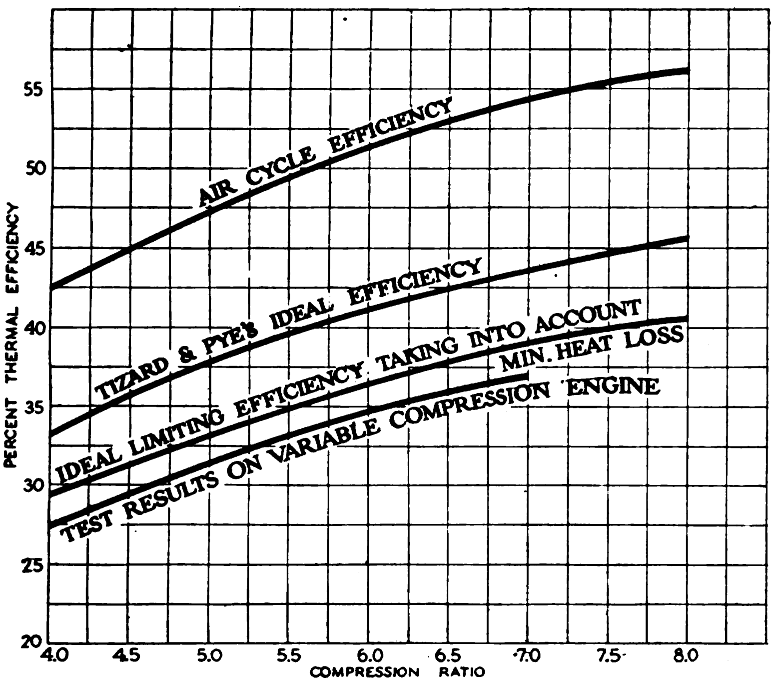


Fig. 1—Curves showing efficiencies with varying compression ratio

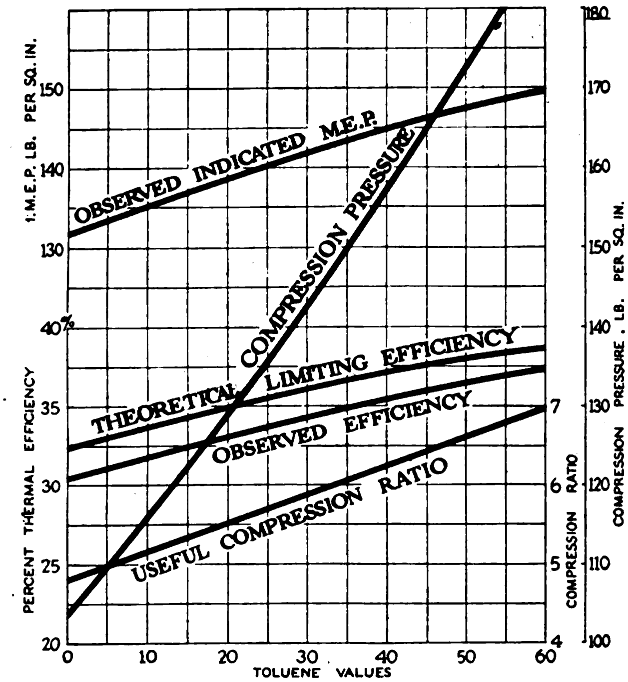


Fig. 2—Curves showing toluene values, compression ratio, efficiencies and observed I. M. E. P.

pansion is obvious. Now when working with all fuels belonging to the general group known as gasoline the compression pressure which can be employed is limited by the tendency of the fuel to detonate and ultimately to preignite. The explanation of the phenomena of detonation appears to be as follows:—When the mixture is ignited from any one point, the flame at first spreads by the normal process of flame propagation aided by turbulence and in doing so compresses before it the unburnt portion of the charge; unless the latter can get rid of its heat with sufficient rapidity, it is liable to be compressed to a temperature exceeding its self-ignition temperature, with the result that it ignites spontaneously throughout its whole bulk and an explosion wave is set up which strikes the walls of the cylinder with hammer-like blows, giving rise to the familiar noise known as "pinking." This explosion wave further compresses the portion of the charge first ignited, thus still further raising its temperature, and with it the temperature of the igniter points or any other partially insulated object in the neighborhood from which ignition first started, to so high a temperature as ultimately to cause pre-ignition and loss of power. Pre-ignition, which is the ultimate limiting factor controlling the compression, never occurs under normal conditions with gasoline, except as a result of persistent detonation. If detonation be prevented, a much higher compression can at once be used without any risk of pre-ignition, and a very decided gain both in power and efficiency obtained thereby.

There can be little doubt that detonation depends primarily upon the normal rate of burning of the fuel, and this in turn depends upon the pressure, and, to a less extent, upon the temperature at the time of ignition. If means be adopted either for slowing down the normal rate of burning or raising the self-ignition temperature of the fuel, or both, detonation can be kept in control and a much higher compression ratio can be used. Either or both of these methods are available. With the exception of ether, acetylene and hydrogen, fuels composed of light paraffin fractions have been proved to be the worst offenders as regards detonation—they are chain compounds and therefore chemically unstable, their ignition point is low, and their normal rate of burning very rapid. On the other hand, fuels belonging to the aromatic group, such as benzol, toluene and xylene are ring compounds of greater chemical stability and high ignition temperature, they cannot be made to detonate even with compression ratios as high as 7.5:1.

It has been known for a long time that by adding benzol to paraffin petrols the tendency to detonate could be greatly reduced, but recent experiments at the writer's laboratory have shown that of these three members of the aromatic group, benzol is the least effective and toluene the most, while xylene occupies a position midway between the two. On account of their relatively low heat value per pound, it is naturally desirable to employ as small a proportion of aromatics as possible. Of the three aromatics mentioned, benzol has also the highest specific gravity and the lowest heat value per pound. It is, therefore, from every point of view the least efficient of the three. Experiments on the variable compression engine have shown that the compression pressure can be raised in direct proportion to the aromatic content of the fuel. A light paraffin freed from aromatics and consisting mainly of fractions of the paraffin series, but conforming in every respect to the Air Ministry's specification for aircraft spirit, detonates under normal conditions as to temperature, etc., and with the most efficient mixture strength and ignition timing, at a compression ratio of 4.85:1 (the degree of compression at which detonation starts being very sharply defined). By adding 20 per cent of toluene the compression can be raised from 4.85:1 to 5.57:1, the gain in efficiency on actual test is found to be from 31.1 per cent to 33.5 per cent, and in mean effective pressure from 131.8 lb. per square inch to 140 lb. per square inch. Now the addition of 20 per cent toluene adds less than 2 per cent to the weight of the fuel per unit of heat and permits of an increase in efficiency of 7 per cent. The net gain is, therefore, very considerable. Finding toluene the most efficient medium for preventing detonation, it was decided to express the tendency of fuels to detonate in terms of their toluene value.

Starting with a light paraffin gasoline, freed from aromatics, the relation between toluene value and the highest compression ratio which could usefully be employed was

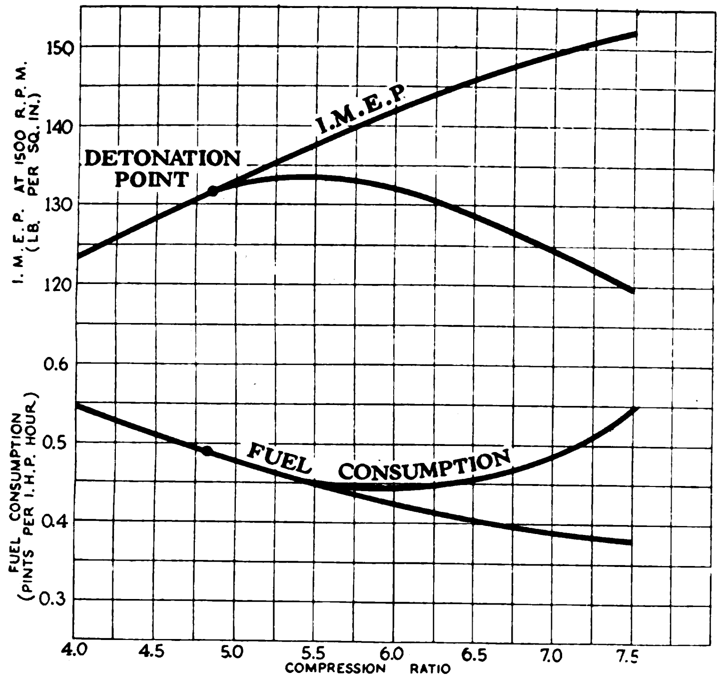


Fig. 3—Curves showing fuel consumption and I. M. E. P. with cooled exhaust gas

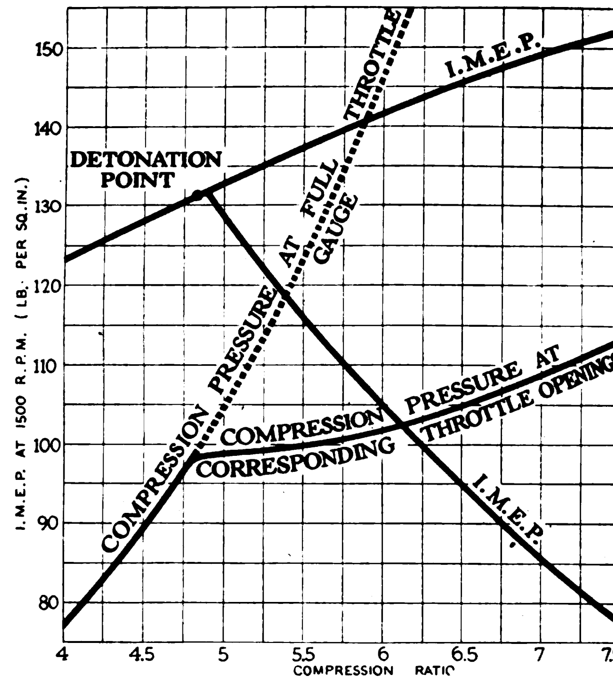


Fig. 4—Curves showing I. M. E. P. and compression pressure with varying compression and throttling

found to be as shown in the table, and the curves in Fig. 2.

Toluene Value	Compression Ratio	Ind. Mean Pressure as Found by Experiment	Ind. Thermal Efficiency as Found by Experiment	Limiting Ind. Efficiency
0	4.85:1	132.5	0.311	0.327
10	5.20:1	135.4	0.323	0.338
20	5.57:1	138.7	0.335	0.350
30	5.94:1	142.0	0.347	0.361
40	6.32:1	144.9	0.355	0.371
50	6.67:1	147.5	0.365	0.380
60	7.05:1	150.0	0.373	0.388

Toluene Value

Toluene	+	100
Benzine	+	66
Xylene	+	83
Ethyl-alcohol, 99 per cent	+	166
Acetone	+	75
Cyclohexane	+	30
Carbon bisulphide	+	10
Methyl mercaptan	+	5 to 10
Ether	—	60

Later investigations showed that toluene was not the most efficient dope, and that, in fact, it could not compare with alcohol, though this fuel is not likely to be of much value for aircraft on account of its low heat value per pound. The preceding table gives the toluene values of a number of different fuels.

From this table it will be seen that the fuel known as hectar, and consisting of 50 per cent benzol and 50 per cent cyclohexane, which the Americans have found so successful, therefore has a toluene value of 48, and could be used with a compression ration of 6.6:1.

It is well to emphasize the fact that of all the known volatile hydro-carbon fuels the total internal energy (taking into account the heat of combustion on the one hand and the change in specific volume on the other) is substantially the same, that is to say, when completely evaporated and used at the same compression ratio, all fuels, irrespective of their heating value, will give the same thermal efficiency and the same power to within about 2 per cent. The only exception is alcohol and the other members of its group; these, under normal conditions, give a slightly higher power because the increase of specific volume after combustion is very considerable, and also in practice owing to their higher latent heat they are seldom completely evaporated, with the result that a considerable amount of evaporation takes place in the cylinder during the suction stroke, thus both increasing the weight of charge and reducing the compression temperature. Popular theories that benzol or mixtures of benzol and gasoline give higher power at the same compression than pure gasoline, owe their origin to the fact that most engines have already too high a compression for efficient use with pure gasoline, with the result that a late ignition setting and often an over-rich mixture also must be used. The addition of benzol in such a case permits of the use of full ignition advance and the most efficient mixture strength, and so gives rise to this very prevalent impression. Actually the total internal energy of, and therefore the power output available from, benzol is very slightly less than gasoline.

Apart from varying the composition of the fuel, which is not always practicable, a somewhat similar increase in compression and therefore in efficiency can be obtained by the addition of inert gases which serve merely to delay the normal rate of burning. Experiments with pure aromatic-free gasoline of 0 toluene value showed that the safe compression ratio could be raised from 4.85 to 1 up to 7.5:1 by the addition of cooled exhaust gas. Fig. 3 shows the relation between mean pressure, thermal efficiency and compression ratio, when just sufficient exhaust gas was admitted in each case to check detonation. The upper part of the I.M.E.P. curve and lower part of fuel consumption curve show results obtained with a fuel of high toluene value and of the same total internal energy. The divergence between the two mean pressure curves indicates approximately the proportion of inert gas added. It will be observed that the compression ratio can be raised at once from 4.85:1 to over 6:1 without any reduction in power whatever, and with a very substantial gain in efficiency; thus it is possible to improve the economy of an engine by as much as 6 per cent without affecting its horsepower one way or the other, by the mere addition of exhaust gas, costing nothing, and adding nothing to the weight of the engine.

To appreciate the possibilities of the use of exhaust gas in this manner, let us suppose that we have a fuel of 0 toluene value. With such a fuel the highest compression ratio we can use if the engine is to be capable of running "wide open" at ground level, and with an economical setting, is only 4.85:1, corresponding to a limiting thermal efficiency of 32.7 per cent. By the addition of cooled exhaust gas a compression ratio of say 7:1 giving a limiting thermal efficiency of 38.6 per cent could be used and still permit of the engine being run wide open on the ground with perfect safety, and developing even at ground level very nearly the same power as the lower compression engine. As the machine ascended the quantity of exhaust gas would be reduced until at about 12,000 ft. it could be cut off altogether. It will be seen that, in this manner, not only can a high compression engine be made to operate safely on the ground with any fuel, but that the control of exhaust gas can be made to afford a very efficient altitude compensator. By way of comparison, tests were run with varying compressions and with a fuel of 0 toluene value in order to ascertain the relation between mean pressure, compression pressure, and compression ratio when detonation is prevented by throttling. The results obtained are shown in Fig. 4, and require no particular explanation. It is interesting to note, however, that detonation became apparent at very nearly the same compression pressure in all cases. By way of comparison it will be noted that with this fuel the throttled engine with 7:1 compression ratio can develop only 57 per cent of its full power on the ground while the exhaust controlled engine can develop 84 per cent.

Safety Fuels.—A good deal of interest has been shown lately in the question of employing fuels of high flashpoint to avoid fire risks. So far as the writer is aware, kerosene only has as yet been seriously considered. There are two possible methods of dealing with this fuel: (1) by vaporizing it and so using it in a normal type of engine; (2) by injecting it into the cylinder as a liquid, either during the suction stroke or at the end of compression. With regard to the first method, commercial kerosene consists almost entirely of heavy fractions of the paraffin series. These are all chain compounds, and their chemical stability decreases with increase in molecular weight. From the point of view of detonation, therefore, kerosene is one of the most troublesome fuels in existence. Further, in order to vaporize a reasonable proportion of it, it is necessary to raise its initial temperature to certainly not less than 140 deg. Fahr. This means a reduction in the weight of charge of at least 20 per cent as compared with gasoline, and a corresponding reduction in mean pressure. Further owing to its chemical instability on the one hand and the high compression temperature resulting from pre-heating, the limiting compression is reduced to about 4.2:1, corresponding to a limiting thermal efficiency of only 30.2 per cent and a limiting indicated mean pressure of only about 115 lb. per square inch, or say; 100 lb. per square inch brake pressure. Again, no means have yet been discovered of preventing the heavier fractions condensing on the cylinder walls and passing down into the crank-case, where they soon prove destructive to the bearings, etc. So serious has this trouble proved in the cast of stationary kerosene engines that so far the only kerosene engines of normal type which have given consistently satisfactory results over long periods are those in which the working parts are open and each bearing is lubricated individually. Although detonation can be kept in check and a comparatively high compression ratio employed with the help of the addition of exhaust gas, yet the low-power output, the condensation trouble, and the low efficiency are such serious drawbacks as, in the writer's opinion, to put kerosene out of court as a fuel for existing types of aero engines. The alternative method of injecting the fuel is not much more hopeful so long as it is applied to the existing type of engine. If the fuel is injected on the suction stroke one avoids the loss due to pre-heating, and can, therefore, use a higher compression and obtain considerably higher power, but the condensation trouble becomes more serious than ever, while the problem of measuring and pumping small quantities of fuel and maintaining correct proportions between the fuel and air at all loads and speeds is no easy one.

Lastly, if the fuel be admitted at the end of compression and ignited on entry by means of a hot plate or other igniter, the very formidable difficulty of so pulverizing and distributing the fuel that each particle can find at once the necessary air for complete combustion has got to be tackled; it is one which is very familiar to the author from bitter experience with Diesel and semi-Diesel engines. There is, however, another way of dealing with the high flashpoint fuel problem which, in the writer's opinion, is the most hopeful at the moment. Many natural kerosenes contain a considerable proportion of heavy aromatic hydrocarbons having the same characteristics as regards flashpoint as the kerosene of which they form part. These aromatics burn with a smoky flame, and are therefore very objectionable when the fuel is used as an illuminant. Recently steps have been taken to isolate and remove these heavy aromatics, and at the present time they are being removed at the rate of several thousand tons per month. Their use as a safety fuel for aircraft engines is worthy of careful consideration. Owing to their almost complete immunity from detonation they can be used with a very high compression ratio, even after preheating in a vaporizer. Experiments made with these aromatic extracts show that with an inlet temperature of 140 deg. Fahr. it is still possible to use a compression ratio as high as 6:1, and even 6.5:1, with the result that the efficiency is very high and the power output equal to or very nearly equal to that obtained with ordinary gasoline of low toluene value. Direct comparative tests carried out with kerosene and samples of these aromatic extracts gave the following results:—Kerosene, sp. gr. 0.812; I.M.E.P., 111.0; fuel pt. per 1 h.p. hour, 0.595; aromatic extracts, sp. gr. 0.884; I.M.E.P., 125.5; fuel pt. per 1 h.p. hour, 0.42. In both cases exactly the same vaporizer temperature was used, the only difference being in the compression ratio employed. The results obtained are, in the writer's opinion, sufficiently encouraging to justify further investigation. The difficulty of condensation still remains, but this appears to be less serious than with kerosene, since the freedom from any tendency to detonate permits of more pre-heating, while it is open to question whether the heavy aromatic condensate is as destructive to lubrication as the kerosene.

Influence of Mixture Strength.—Because of the losses to dissociation, change of specific heat and direct heat losses, the limiting efficiency obtainable under the best conceivable conditions is only about 70 per cent of the air cycle. Now each of these sources of loss is a direct function of the maximum temperature, which in turn is dependent upon the mixture strength. When the mixture is so proportioned that the whole of the available oxygen is just combined, the maximum temperature rises to approximately 4500 deg. Fahr., and the mixture strength is then approximately 47 ft.-lb. per cubic inch. As the mixture is weakened the maximum temperature is, of course, reduced, at first only very slightly, but so long as a homogeneous mixture is employed it is not possible to reduce the mixture to below about 40 ft.-lb. per cubic inch, without serious loss of efficiency due to incomplete combustion, owing to the limited range of burning of all volatile hydrocarbon fuels.

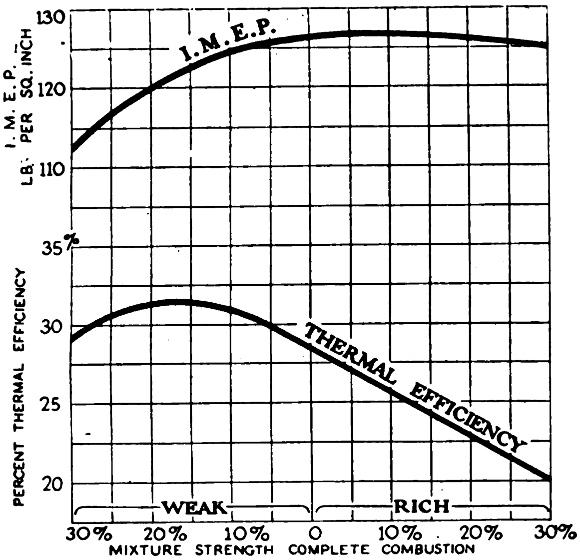


Fig. 5—Curves showing I. M. E. P. and thermal efficiency with varying mixture strength, compression ratio 6:1. Fuel, benzol

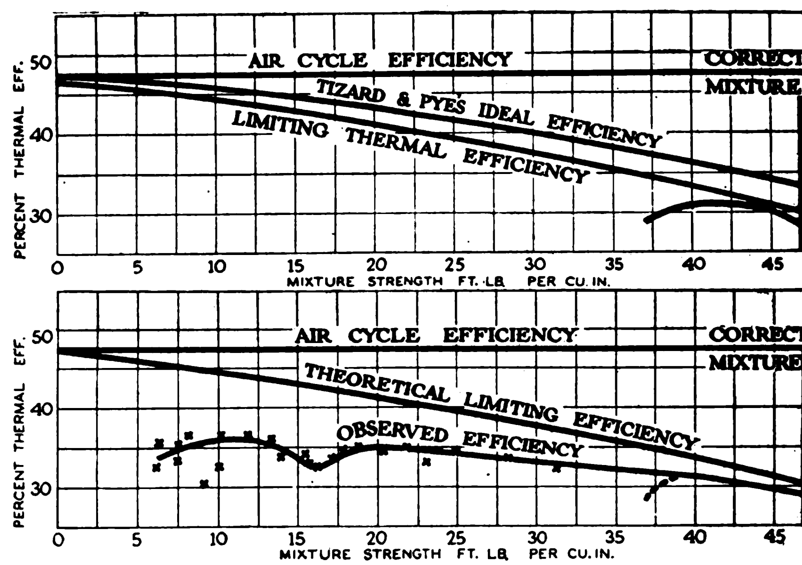


Fig. 6 (Upper)—Curves showing air standard efficiency, actual and theoretical, down to the point of no heat supply. Compression 5:1

Fig. 7 (Lower)—Curves showing efficiencies and mixture strength for bulb engine

The writer has carried out a very large number of tests on about 40 different fuels in order to ascertain the relation between mixture strength, power and economy. Except for insignificant variations, the characteristic efficiency and power obtained by gradually weakening the mixture is the same for all fuels and at all compressions, excepting alcohol, which on account of its greater latent heat and its large increase in specific volume gives increasing power as the mixture is enriched for a long period after the point of complete combustion has been passed.

The curve (Fig. 5) shows the relation between thermal efficiency and mixture strength expressed in terms of mean pressure. The example shown is taken with benzol at a compression ratio of 6:1 and, with but infinitesimal variations, it may be taken as applying to any fuel except alcohol. It will be observed that maximum efficiency is obtained when the mixture strength is such that the mean effective pressure is about 3 per cent below the maximum. Any further weakening of the mixture results merely in loss of efficiency due to incomplete combustion.

Now were it possible to control the power output by mixture strength alone, and still obtain complete combustion, it is clear that the maximum temperature would then be proportioned to the load and would diminish as the load is reduced. As the temperature diminished so also would the losses due to dissociation, change of specific heat, and direct heat loss diminish until at the point of no load and, therefore, of no heat supply, they would disappear entirely and the limiting efficiency would be virtually coincident with the air cycle. The accompanying curve (Fig. 6) shows how, under these conditions, the limiting thermal efficiency would vary with the load. In this diagram the horizontal line denotes the air-cycle efficiency, which, since it takes no account of heat losses, etc., is constant for all loads, the sloping line denotes the theoretical limiting efficiency over the range from no load to full load, the third line represents the limiting efficiency with minimum heat losses, and the fourth the actual test results obtained over the range of mixture strength available with a homogeneous charge. While it is not possible to weaken the mixture strength so long as the charge is homogeneous, it is possible to do so by means of stratification, that is to say, by supplying the cylinder with a relatively small charge of combustible mixture and admitting separately a large charge of air, keeping the two separate until after ignition. To do this it is necessary to reconcile two conflicting conditions—the two portions of the charge must be prevented from mixing till after ignition, and at the same time there must be sufficient turbulence in the combustible charge to insure rapid combustion. These two conditions are not irreconcilable, and the writer has succeeded experimentally on two engines in obtaining the whole range from dead light to full load by controlling the fuel alone. **Under these circumstances not only is the efficiency on reduced loads far higher than could be obtained by any other means, but the heat loss is so low that a water-cooled engine can be run at reduced loads for any length of time without cooling water.**

The accompanying curve (Fig. 7) shows the efficiency actually obtained in one experimental engine with a compression ratio of only 5:1. **It will be observed that it rises to no less than 37 per cent at about one-third full load corresponding to a fuel consumption of just under**

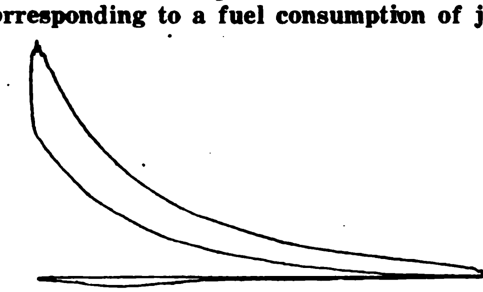


Fig. 8—Indicator card from experimental engine using excess air

0.36 pint of benzol per indicated horsepower-hour. It will be seen that the curve of efficiency actually obtained follows the theoretical curve with a reasonable degree of approximation. In Fig. 8 is shown a typical indicator diagram taken from one of the two engines with a Hopkinson optical indicator. **It should be noted that when working on this system distribution troubles disappear.** In any ordinary multi-cylinder engine it is necessary so to proportion the mixture that the weakest cylinder receives a charge of a certain minimum strength to insure regular running; this means that other cylinders are receiving a slightly richer charge than is absolutely

necessary and their efficiency is therefore reduced. On the other hand, when working with a stratified charge, the power output of each cylinder is dependent solely upon the quality of fuel admitted to it, so that any cylinder which receives a richer mixture than others will develop correspondingly more power, and the economy will always be at a maximum, that is assuming, of course, that the mixture strength is at all times below that required to consume the whole of the oxygen. Again, from the point of view of altitude compensation nothing could be simpler, for (so long as the oxygen in the cylinder is not all consumed) constant power can be maintained over any reasonable range of density by merely supplying a constant fuel feed, e.g., by gravity, or if a carbureter is used in its crudest form, the variation in power with altitude will correspond with the natural characteristic of the carbureter and will, therefore, vary as the square root of the density.

With a view to gaining further practical experience with this system, one of the two gas engines supplying power to the writer's laboratory was, about nine months ago, converted to run with stratified charge and control on the fuel alone. Since that date it has run continuously under violently fluctuating loads and has developed no trouble of any kind. It is running in parallel with another engine identical in every respect but working on the ordinary cycle. **In the case of the latter engine it is necessary to remove the cylinder head every two months for decarbonizing and grinding in the exhaust valve, while the cylinder of the engine working on the stratified charge has only been opened once, when it was found to be practically clean, while the exhaust valve appeared to keep almost as cool as the inlet valve in the other engine.** As regards governing and regularity of running there is nothing to choose between the two engines, each of which can develop a maximum of 24 brake horsepower at 750 r.p.m. Although the above experiments suggest that the system has been developed to a practical stage, the writer feels that this is hardly yet the case, and that considerably more research is required before it can be considered wholly satisfactory. In the writer's opinion **the potentialities of working with a stratified charge cannot be over-estimated. It opens up the possibility of obtaining far higher efficiencies than are obtainable by any other known means, and what is perhaps equally important, it reduces the temperature of the cycle and with it all the troubles due to high temperatures which directly or indirectly are the root cause of most mechanical failures.** Since the rate of heat flow to the cylinder walls varies roughly as the cube of temperature, and the power output practically directly as the temperature, **it follows that quite a small reduction in power will reduce the heat losses to an extent that must render air-cooling quite a simple problem.**

The possibilities of working with a short compression and long expansion stroke deserve careful consideration. In effect this can be accomplished by the simple expedient of closing the inlet valve late, so that compression does not start until well up the compression stroke; this method has both direct and indirect advantages. The direct advantages are that while the compression pressure is controlled by the nature of the fuel, the expansion ratio can be extended to any degree and very high efficiencies can be obtained, though, of course, at the expense of the power developed per unit of cylinder volume. For example, suppose that a fuel of 0 toluene value is used, then while the compression ratio is limited to 4.85:1 on the ground, the expansion ratio may be say 8:1. The limiting efficiency for 4.85:1 expansion is 32.7 per cent, and for 8:1, 40.6 per cent, the power output under these conditions will therefore be 4.85/8 or 60

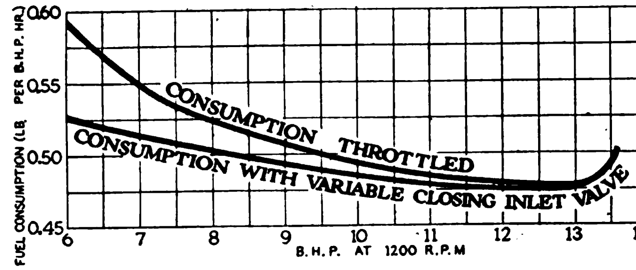


Fig. 9—Curves showing comparative fuel consumption when throttled and with late closing inlet valve

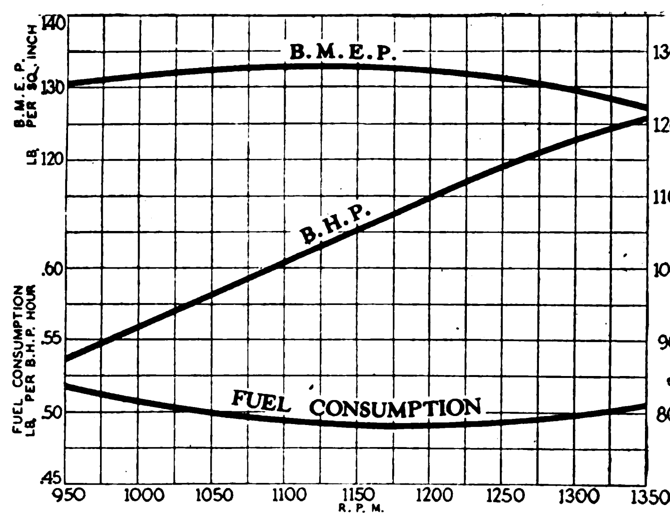


Fig. 10—Curve showing performance of 100 hp. single cylinder engine

per cent of that obtainable with an 8:1 compression, assuming that such a compression could be employed, or 73 per cent of that obtainable if both compression and expansion ratios were 4.85:1. By varying the time of closing of the inlet valve the compression could be increased as the machine ascended, until at about 15,000 ft. the full compression could be used and full power developed. Thus the indicated thermal efficiency could be maintained at a maximum and the power nearly constant over this range of altitude.

The indirect advantages are:

(1) That with such a valve setting the engine has a rising torque curve which is a desirable characteristic.

(2) In the event of one cylinder dropping out and the speed falling in consequence, the compression in the remaining cylinders is reduced, and the shocks due to the irregular turning moment are also reduced. When controlled by throttling, the reverse is the case; if one cylinder drops out the others, owing to the drop in speed, take in a heavier charge, resulting in severe shocks and increased liability to detonation and pre-ignition.

(3) When working with a late-closing inlet valve the whole charge enters the cylinder and a portion is rejected. The rejected portion, which returns to the manifold, has picked up a considerable amount of heat from the inlet valves, cylinder walls and residual exhaust gases, some of which heat it imparts to the inlet manifold with the result that, as the load is reduced, so is the temperature of the manifold increased, which is a desirable characteristic.

Some years ago the writer carried out a series of experiments with a variable inlet cam fitted to a small engine having an expansion ratio of 5.95:1. A number of very careful comparative power and consumption tests were made, the power output of the engine being controlled in the one case by varying the time of closing of the inlet valve, and in the other by using a normal valve

setting and throttling the charge. The results obtained in these experiments are shown in Fig. 9, from which it will be observed that the gain in efficiency in the former case, though perhaps not so large, is none the less quite appreciable. It should be noted that in these experiments the same expansion ratio was used in both cases, so that the advantage due to prolonged expansion was not obtained, and the gain in economy recorded is that due to indirect advantages alone.

Designing for Best Performance at Given Density

In aircraft engines when one is working over a large range of atmospheric density the question always arises —at what density the engine shall be designed to give its best performance or at least to develop its full power. Until comparatively recently all engines were so designed that they could develop their full power at ground level, without pre-ignition, without overheating, and without overstressing the parts. During the war, however, it became evident that this was unnecessary and undesirable, and manufacturers were urged to design their engines on the assumption that they would not be opened wide below 10,000 ft. So far as the writer is aware, no manufacturers actually produced such an engine. It is, however, interesting to consider what might be done in this direction. We will begin with the assumption that modern aviation spirit has a toluene value of 10, which is about the average value of American aviation spirit. At 10,000 ft. the air density is 0.72, and at this density a compression ratio of 7.0:1 could be used with such a fuel, giving a theoretical limiting thermal efficiency of 38.8 per cent and a theoretical limiting mean pressure of approximately 165 lb. per square inch reckoned at ground level or 119 lb. per square inch at 10,000 ft. Under these conditions let us now consider what power the engine could develop at ground level, keeping just free from detonation. If controlled by throttling the maximum indicated mean pressure would be approximately 95 lb. per square inch. If controlled by varying the time of closing of the inlet valve it would be considerably higher, because for various reasons the efficiency obtainable under these conditions is greater and would be very nearly in the ratio of $5.25:7.0 \times 165$ (5.25 being the limiting ground level compression ratio for a fuel of toluene value 10) or say about 122 lb. per square inch. If controlled by the addition of cooled exhaust gas the mean effective pressure, as shown previously, would be very nearly equal to the full available M. E. P. with a compression ratio of 5.25:1 or 140 lb. per square inch.

In all cases let us assume that the mechanical losses of the engine are equivalent to an M. E. P. of 15 lb. (a fair average figure). Then the theoretical limiting brake mean pressure in the three cases would be:

(1) 80 lb. per square inch.
(2) 107 lb. per square inch.
(3) 115 lb. per square inch, while at 10,000 ft. the brake M. E. P. will be 104 lb. in all cases.

Use of Exhaust Gas to Enable Higher Compression

In all three cases the explosion pressure would be substantially the same, and little or no higher than at 10,000 ft.—that is about 450 lb. to 500 lb. per square inch. In the latter case it will probably be actually lower, because the principal effect of the exhaust gas is to slow down the rate of burning and so round off the peak of the diagram. Assuming that the propeller torque varies as the square of the speed and directly as the density, then, if the engine is designed to run wide open at 10,000 ft. at 1500 r.p.m., its maximum speeds at ground level will be approximately 1100 r.p.m., 1270 r.p.m. and 1320 r.p.m., respectively. In the former case such an engine would probably fail to leave the ground.

From these considerations it seems clear that the principle of designing a very high compression engine for use at high altitudes and throttling it on or near the ground is not the right one Of the three methods considered, the use of exhaust products appears to be the most hopeful as a means of permitting a very high compression engine to operate satisfactory at low altitudes, and still have sufficient power to get rapidly off the ground. The alternative method of dealing with the problem of varying atmospheric pressure is to maintain artificially ground level density in the cylinder at high altitudes by supercharging. From the point of view of engine weight there can be no doubt that this method scores heavily, for, although the strength and weight of many of the parts may be proportional to the density in the cylinder, there still remains a very considerable number whose weight is altogether independent of the pressure in the cylinder, so that the weight of the engine, as a whole, can only vary as the density plus a very large constant.

There are at least two possible ways of dealing with the supercharging problem, one by merely forcing more fuel and air into the cylinder by means of a pump or blower and the other by employing a supercharge of pure air in a stratified form. Some four years ago the writer carried out a very extensive series of tests on this latter system, and obtained most encouraging results on two experimental engines, but had to break off these experiments and concentrate all his attention on engines for tanks. The results obtained were, however, so encouraging that further tests should be made. Apart from the obvious increase in power at high altitudes this system of supercharging provides a perfect and automatic compensation of mixture strength for altitude, and gives a considerable increase in economy, the consumption falling from 0.49 lb. per brake horsepower-hour when running normally to 0.455 lb. when supercharging.

Limiting Size of Cylinder.—Designers of aircraft engines have, in the writer's opinion, shown quite unnecessary timidity in regard to the power output obtainable from individual cylinders. So far as the writer is aware no one has yet had the courage to construct an aero engine with cylinders developing more than 50 hp. each. Some two and a half years ago, as a result of experience with large cylinders on tank engines, the writer was requested by the Air Board to design an engine for aircraft to develop 100 hp. per cylinder. A complete design was prepared, and after much delay a single cylinder unit was built at Farnborough having a bore of 204 mm. and a stroke of 280 mm. This unit has been running on and off for over a year. Apart from a failure of the valve gear at first which has never been quite explained, it has given very little trouble and no trouble at all which can be attributed to its large size. In view of the fact that its compression ratio is only 4.84:1, the results obtained are rather extraordinary and constitute, the writer believes, quite a record for so low a compression. From the accompanying curves, Fig. 10, it will be observed that this single-cylinder unit develops 120 brake horsepower when running at 1350 r.p.m. with a consumption of only 0.493 lb. per brake horsepower-hour at its normal speed of 1250 r.p.m., corresponding to an indicated thermal efficiency of 31.2 per cent, or within 4 per cent of the limiting value for this compression and an indicated mean pressure of 150 lb. per square inch. These results will, the writer hopes, help to dispose of the myth that very large cylinders can only operate with relatively low mean pressures and at a low efficiency.

Time Study Work Requires High Grade Men

A prominent industrial engineer points out that the time study man is the connecting link between the management and the working force; that he reflects the policies and attitude of the employer. He believes that the time study man is important in the adjustment of industrial relationships.

By William Baum

LOOKING into the future of shop and factory methods, William Baum, industrial engineer for a large textile concern in Milwaukee, and consultant for a number of Milwaukee industries, says that co-operation in time studies and organization methods between employer and employee, even to the extent of sharing the expense, will be found necessary. Both sides must see that time study is highly ethical, and is for the purpose of determining the time required to perform an operation which will be fair and just to employee and employer.

Mr. Baum's views, as expressed recently before the Society of Industrial Engineers of America hinge on the importance of training of time study men at this time in the light of future conditions in the labor and production situation, and are in substance as follows:

"The importance of standardization and scientific wage systems based upon time and motion studies is well understood by progressive industrial managers, who begin to reap the great benefit derived from the introduction of scientific management systems. Wherever such systems have been installed by responsible and competent engineers they have resulted in greater production, lower unit costs and higher wages.

"The men charged with the important task of making time studies must be qualified to make an analysis of manual, mental or machine processes into the smallest elements; to eliminate waste of time, energy, tools and health; to establish proper allowances for fatigue and unavoidable delays, and to determine the one best way of operation and process. It can be readily seen that the skillful handling of the stop watch is not the only factor which enters into the training of time study men.

"Their training should be as broad as possible. In many years of training of time study men I have found that the graduate mechanical, electrical or chemical engineer makes the best time study man, especially if he has had some shop practice. The college man has the advantage that his mind has been trained to take accurate observations in the physical and chemical laboratory. It is this foundation of thinking and working scientifically which enables him to learn and master the intricacies of industrial time study work in a comparatively short time.

If engineering students in our colleges could be given an opportunity to attend courses and laboratories on time studies, using proper text books, they would be amply prepared to take up the work in the industries. Herrick's Class Book would be proper.

"As the matter now stands, most successful industrial engineers train their own forces, not according to hard and fast rules, but by letting them 'go through the mill.'

"The training of time study men is not only a matter of teaching the technique of the art. In practice the time study man is the connecting link between the management and the working force. He reflects voluntarily or involuntarily the policies and the attitude of the employer which reacts in one or the other way upon the man in the shop. If the time study man has a broad conception of his position, he will have the desire to be a servant to both his employer and the employee. After all, the object of taking time study is a highly ethical one—to determine the time which is required to perform an operation and which is considered fair and just to employees and employer.

"Most labor disputes hinge on wage questions and can be reduced to a minimum only if the basis for setting the rates is correct, represents the truth and is indorsed by the one who works and the one for whom the work is done. In fact, the time may not be far off when the industrial engineer and his time study assistants will be the true servants to both management and working force, and as such be paid in equal proportions by both parties. The garment workers in Cleveland have already set an example.

"There is no group of workers or a self-respecting union which could afford to reject or resent time studies if such work is done in absolute fairness to the men as well as to the company. Naturally, when the time-study engineer is the personal emissary of the manager, suspicion arises among the workers, who see in the time-study man only a driver, an intruding observer of their work. Let the time-study man be the unbiased friend to both workers and management, employed and paid for by both, and the results will be most satisfactory from a production view as well as industrial relationship.

"The success or failure of any scientific wage system will depend not only upon the characteristics of any system to fit existing conditions but also upon the skill and particularly upon the personality of the time-study man. In his mind must be instilled the highest principles of professional ethics, integrity and honesty. If he is earnestly interested in the welfare of the workers, understands human nature and is willing to stand for the truth under all circumstances, he will secure the trust and confidence of all men and women who see in him their friend and adviser."

THE automobile carries, at some stage, practically all of the products of the steel mills and tons of freight carried by the railroads.

Edge Act Corporation Proposes to Finance Foreign Trade

The attention of manufacturers interested in export development is directed to a statement of the proposed Export Trade Financing Corporation, which is inviting purchase of stock. This banking institution proposes to finance America's trade abroad.

AN interesting and important development in the export field is that of the opening of the stock subscription books of the Foreign Trade Financing Corp. The proposal to organize this corporation is based on the Edge Act, an amendment to the Federal Reserve Act. This amendment is practically authority for American banking interests to extend their financing to foreign countries when necessary to aid American trade. The Edge Act is complemental to the Webb Act. Under the Webb Act several manufacturers could form a sales company and this company could act as sales agent abroad for lines so closely related that they would be considered competitive in this country.

The Edge Act does not authorize selling companies but applies similarly to the banking feature. This corporation will not sell, nor will it supplant abroad the branches of American banks. It will rather serve as a Federal Reserve Bank for the foreign deals of the banks and selling companies. It will aid rather than supplant the branch banks.

This company was tentatively formed at the annual meeting of the American Bankers' Association at Washington last October. The next step was taken at Chicago Dec. 10 and 11, last year, when the heads of many national trade societies met at the call of the president of the American Bankers' Association. At that meeting it was decided to invite W. P. G. Harding, Governor of the Federal Reserve Bank, to become head of this corporation. The importance of this proposed organization can be judged by the fact that Mr. Harding has accepted this invitation.

The Foreign Trade Financing Corp. proposes to raise $100,000,000 by selling stock. With this stock sale return as a beginning, deals will be extended by the sale of debentures, based upon loans made to finance foreign trade. The sale of these debentures will supply capital, it is said, to the extent of $1,100,000,000 total, if that amount is required.

It is announced that the capital of the corporation will be used to aid the industries that subscribe for it. In other words, if the automotive industry subscribes heavily to this stock, it will be used for automotive loans in proportion, if it is needed.

This corporation is not merely a friendly aid society. It will make a profit on its deals. Banks, manufacturers and individuals are invited to subscribe for stock. Its object, however, is to be helpful in distributing the overproduction of raw materials in America to countries where the raw material is required, and to finance the manufacture of this raw material into finished products. The Committee on Organization of the Corporation includes many bankers and leaders in national trade organizations. J. G. Culbertson, John J. Raskob and Roy D. Chapin of the automotive industries are members. Communications regarding the purchase of stock should be addressed to Committee on Organization, 66 Broadway, New York.

British Body Work

THE Wellington (New Zealand) correspondent of the London *Times*, after noting a large increase of value in the motor imports of the Colony during the first eight months of 1920—the value of this increase being about $5,700,000—mentions that a belated delivery of cars was then taking place, and that *the percentage of British and European cars and cycles is very small.* He adds the *important remark that the American cars are of the class which the market requires*, and that some recent *arrivals of British cars had been a disappointment as regards the bodywork.* Apparently he means this criticism to apply to British cars of the type intended to compete with the American models which have the largest sale.

He eulogizes British trucks, which he thinks cannot be ousted by rivals, and notes that there is a growing market for trucks, especially among farmers, dairymen, etc.

Merchandising Abroad

DURING recent months many American business men have visited Europe and upon their return each one has told of his impressions. Very often these impressions have had to do largely with the political and international aspects of the situation "over there," and, while interesting to a certain extent, have not given much food for thought in connection with the immediate practical activities of other American manufacturers.

Like others who have gone abroad since the armistice was signed, E. V. Hennecke, of the Motometer Co., Inc., who recently returned from several months in England and France, was impressed with the economic significance of certain aspects of the political situation. He gained also, however, some interesting and definite impressions as regards business and merchandising methods, which have a rather direct bearing upon some of the foreign trade problems now confronting other automotive manufacturers.

One factor not sufficiently recognized usually by American manufacturers in attempting to merchandise their product in England, is the difference between our system of distribution and the system commonly used in Britain. In the case of automobile accessories, for instance, it is common over here to market through a jobber and then through a dealer. In England, however, the manufacturer usually sells direct to the dealers or the jobber sells directly to the consumer. In other words, one distribution unit is eliminated. This is made pos-

sible chiefly by the smaller area over which distribution takes place and partly by long established custom.

Merchandising organization, moreover, has not been carried to so great a degree of refinement as in this country, although British and French manufacturers are rapidly improving in this respect. Many of them are molding their advertising catalogues and their merchandising efforts along the lines generally used in this country, and they may be expected to equal us in this respect before many years have passed.

On the other hand, Hennecke found, merchandising cannot be conducted on the rapid, aggressive manner that is common in America. Things just don't move that fast in England and French business. Many American manufacturers have expended a great deal of useless money in trying to merchandise in these countries exactly as they have successfully done at home. They have expected too rapid results, and as a result have often obtained few results at all.

The American manufacturer needs a very thorough knowledge of the customs and methods used in England or France if he is to attempt to conduct his own merchandising campaign. In many cases he will do better to get a native Englishman to conduct his entire selling campaign for him—making certain, of course, that he has chosen a competent and efficient representative. This is often good policy for several other reasons.

In England, for instance, Hennecke found that the trade-mark "Made in U. S. A." is almost a certain bar to the sale of a product at the present time. This is true, he says, even in regard to consumer sales. The unfavorable rate of exchange is, of course, one reason for this condition, but there is also a strong prejudice against American goods because America bids fair to take away from the British their former economic domination. It is surprising to note the pride taken by the average Englishman in the trade superiority of his country.

When the American product is manufactured in England, however, much of this prejudice is dissipated, since the Englishman then feels more favorable toward it since English labor is being used in making it and taxes on the profits are paid to help support the English government.

In France, however, the situation appears to be different. There is a great love for America and the trade mark "Made in U. S. A." is a help to the sale of goods despite the extremely unfavorable rate of exchange.

There are often local peculiarities which have a very definite bearing upon the sale of an American article in foreign countries, and the American manufacturer who attempts to merchandise without a thorough understanding of local conditions is very likely to fail in his efforts without ever being able to understand the real causes for his lack of success. Hennecke cited an example of this in connection with the product of his own company, the motometer.

He found that in England there are two very powerful automobile clubs, the R. A. C. and the A. A. A., both of which use a special insignia placed on the top of the radiator cap. This insignia is not only ornamental, but entitles members to certain desirable privileges while touring, and is considered by members of these societies as a very essential part of their motor equipment. Obviously, this fact creates an increased sales resistance for the motometer and constitutes one of the factors which must be overcome in merchandising.

This instance is cited simply as an example of the kind of local condition which is likely to make merchandising difficult for any specific product in a particular case. It emphasizes the need for a close analysis of markets before the investment of capital in selling effort.

Speaking of general conditions in the automotive industry in England and France, Hennecke stated that he found things very dull in practically every instance. Many of the English plants were entirely shut down, while those in operation were proceeding on greatly curtailed schedule. Optimism prevailed throughout the trade, however, and an early return to normal is expected.

The accessories business in these countries is not developed to nearly so high a degree as in America, and there is an excellent opportunity for American manufacturers in this line of automotive equipment.

Hennecke got one very vivid impression during his stay in France. It was the apparent determination of the French people to get to work and repair the damage done by the war. Everyone there, he said, seemed to be filled with a spirit of industry and there seemed to be a strong individual, as well as general, effort to get to work and stay at work. There appeared to be less industrial unrest in France than in England.

A Britisher's Opinion

AMERICAN engineers might well be interested in this comment by A. J. Hancock, works manager of the Vauxhall Motors, a well-known British plant. This comment was made after a visit to America, which included a number of factories. The comment follows:

"As a result of my visit I am not despondent over England's future," said Mr. Hancock. "What I have seen simply means that the English must work just a shade harder in industry, and that people of our working class need to lend themselves to the arts of quantity production in a manner they are now disinclined to adopt.

"It is a revelation to see able-bodied workmen in America doing repetition work so fast and with such apparent interest. They do it much faster than the English worker who uses the same appliances. We must change this in England in order to hold our place against American competition in the world markets. American enterprise rides to a big gain or a big fall. American capitalists take bigger risks. For instance, the heads of a firm will say: 'Let us lay down a million more feet of floor space' as readily as English business men would say: 'Let us lay down a thousand feet.' I am of opinion that America has lost the sense of the ideal in its successful search for quantity production.

"The better classes of American motor cars lack the simplicity of design and the taste in finish that characterize the English product. If we were to take over the manufacture of some of the best-known trans-Atlantic motor cars we would simplify the design and do away with many parts. For instance, Vauxhall cars, at the present rate of exchange, are priced in the neighborhood of $4,000. Compared with American cars in this price category they will do all United States products will do, at less expense, with less complication; and they are a perfectly turned out job. Many American cars of the better class are too heavy, and are extravagant in the use of fuel.

"I am perplexed over the fuel situation. In our country the high cost of gasoline compels economy. Motor design of the future must turn toward more economical motors. If every motor car—every Ford car, even—was to have its fuel consumption reduced 10 per cent the price of gasoline would drop 50 per cent. Automotive engineers will solve the problem. A fuel consumption of between 30 and 40 miles to the gallon is not improbable for the middle size touring car of the future."

Exports of Automobiles and Tires for November, 1920

COUNTRIES	—Commercial—				—Passenger—				Parts	—Tires—			All other
	Complete Cars		Chassis		Complete Cars		Chassis			Inner	Casings	Solid	
Europe:													
Austria	...	$......	...	$......	...	$......	...	$......	$76	$......	$......	$......	$......
Azores and Madeira Islands	...	......	...	......	6	6,000	...	......	170	......	......	......	......
Belgium	1	5,764	...	......	89	157,284	...	......	17,606	83,433	14,884	......	......
Bulgaria	...	......	...	......	...	......	...	......	116	1,525	449	......	......
Czechoslovakia	...	......	...	......	...	......	...	......	......	......	......	......	......
Denmark	...	......	...	......	38	63,378	...	......	450,483	16,893	120	......	......
Finland	15	20,983	5	13,405	7	9,320	...	......	744	13,768	650	......	2,371
France	1	1,500	..	......	60	101,121	...	......	578,861	171,414	2,261	......	18,200
Germany	...	......	...	......	4	5,400	...	......	......	17,212	6,532	......	20
Gibraltar	...	......	...	......	2	3,478	...	......	1,488	......	......	......	......
Greece	5	10,384	2	3,730	79	106,203	...	......	15,366	12,250	916	372	......
Hungary	...	......	...	......	...	......	...	......	......	......	......	......	......
Iceland and Faroe Islands	...	......	...	......	...	......	...	......	1,773	......	......	......	......
Italy	...	......	...	......	34	38,260	...	......	10,344	148,784	21,785	......	2,902
Malta, Gozo, and Cyprus Islands	...	......	...	......	4	4,948	...	......	......	895	80	......	......
Netherlands	46	40,952	2	3,885	364	400,098	...	......	19,655	104,520	19,463	......	40
Norway	41	125,126	4	8,760	159	254,594	...	......	51,241	77,563	4,923	2,191	1,171
Poland and Danzig	...	......	...	......	16	22,480	...	......	5,218	9,362	1,530	......	......
Portugal	...	......	...	......	7	13,018	...	......	15,359	8,102	6,000	213	26
Roumania	...	......	...	......	102	58,903	...	......	10,337	19,805	4,657	4,867	......
Russia in Europe	...	......	...	......	...	......	...	......	216	......	......	......	......
Spain	49	63,358	3	5,315	414	648,789	9	13,411	593,511	100,815	7,243	......	305
Sweden	39	71,260	28	45,933	317	423,239	11	11,690	65,422	22,855	8,109	900	4,879
Switzerland	...	......	...	......	177	226,648	...	......	11,596	12,960	499	......	......
Turkey in Europe	22	17,826	...	......	150	152,612	...	......	15,861	11,766	6,566	......	......
England	100	161,754	58	133,358	547	655,689	33	39,060	2,169,162	249,591	42,116	......	298
Scotland	...	......	...	......	2	2,900	...	......	17,949	4,829	1,679	......	......
Ireland	...	......	...	......	78	38,272	...	......	3,724	......	......	......	......
Yugoslavia, Albania, etc.	...	......	...	......	...	......	...	......	......	5,456	......	......	......
North and South America:													
Bermuda	...	......	...	......	...	......	...	......	......	......	72	......	......
British Honduras	1	1,595	...	......	1	545	...	......	1,841	115	......	......	......
Canada	39	78,474	10	23,845	119	196,210	1	993	589,229	171,767	18,076	6,811	3,406
Costa Rica	4	4,738	1	3,016	7	13,161	...	......	3,536	593	......	1,680	4
Guatemala	2	5,000	5	10,901	11	17,230	...	......	6,588	2,779	114	......	371
Honduras	3	3,295	1	1,919	4	7,076	...	......	5,323	611	62	......	......
Nicaragua	2	4,300	...	......	6	7,879	...	......	4,862	......	38	297	505
P name	8	7,702	...	......	37	48,460	...	......	16,903	5,435	2,418	2,191	422
Salvador	1	3,810	1	3,996	8	15,750	...	......	10,242	10,413	1,378	4,500	443
Greenland	...	......	...	......	...	......	...	......	......	......	......	......	......
Mexico	136	214,332	22	53,342	658	540,444	5	2,500	116,517	204,487	41,997	10,887	......
Miquelon, Langley, etc.	...	......	...	......	...	......	...	......	......	......	......	......	......
Newfoundland and Labrador	2	11,398	...	......	...	......	2	1,900	898	......	......	253	750
Barbados	9	11,510	2	1,596	23	20,204	...	......	3,230	2,366	214	......	67
Jamaica	20	29,175	...	......	48	46,740	...	......	26,840	4,257	1,010	2,349	507
Trinidad and Tobago	2	7,000	42	29,835	38	29,983	...	......	25,894	1,749	504	1,061	......
Other British West Indies	3	1,465	1	528	21	21,880	...	......	2,963	1,212	132	......	1,232
Cuba	176	556,803	90	350,011	724	924,742	1	2,200	367,407	312,614	33,867	97,292	5,023
Virgin Islands of U. S.	...	......	...	......	10	8,609	...	......	2,019	2,934	331	......	21
Dutch West Indies	..	......	...	......	3	1,484	...	......	792	2,305	207	......	......
French West Indies	...	......	...	......	24	24,869	...	......	8,674	2,219	234	1,305	595
Haiti	...	......	...	......	1	500	...	......	5,146	7,857	918	......	76
Dominican Republic	15	22,229	...	......	43	53,163	...	......	32,217	22,948	2,751	1,307	142
Argentina	7	18,384	20	81,977	469	653,260	5	11,280	1,052,802	406,823	63,925	2,475	380
Bolivia	1	2,500	2	4,687	3	11,650	...	......	1,603	1,952	......	388	......
Brazil	85	57,055	15	43,533	582	737,908	12	27,036	563,357	99,976	17,312	3,502	320
Chile	25	26,985	10	29,849	34	53,414	2	10,000	60,394	12,341	2,327	2,383	415
Colombia	39	30,632	21	40,739	73	130,349	3	7,617	38,196	18,419	3,043	300	205
Ecuador	7	21,136	3	6,750	18	29,916	...	......	9,888	8,120	1,322	......	59
Falkland Islands	...	......	...	......	...	......	...	......	......	......	......	......	......
British Guiana	2	5,115	6	2,920	15	10,245	1	433	2,252	2,705	466	370	......
Dutch Guiana	...	......	1	1,261	1	536	...	......	631	1,905	350	......	......
French Guiana	...	......	...	......	...	......	...	......	14	......	......	......	......
Paraguay	...	......	...	......	...	......	...	......	175	932	......	......	......
Peru	122	65,569	10	5,100	150	122,056	7	4,867	57,161	23,036	2,995	2,429	......
Uruguay	35	18,282	...	......	355	390,417	24	12,130	98,953	49,367	4,617	284	......
Venezuela	...	......	1	1,494	93	96,313	1	1,713	18,511	26,602	1,955	215	101
Asia and Far East:													
Aden	2	7,188	...	......	11	10,301	...	......	3,042	125	......	......	......
China	6	19,056	4	14,415	148	207,589	13	23,752	54,286	28,356	20,244	50	99
Kwantung, leased territory	...	......	...	......	...	......	...	......	6,165	......	......	......	......
Chosen	...	......	...	......	...	......	...	......	961	......	......	......	......
British India	101	210,479	38	102,271	692	977,184	4	5,457	136,535	58,001	8,227	16,730	1,135
Straits Settlements	66	127,459	16	20,833	154	222,157	2	1,624	74,019	83,316	8,150	1,948	......
Other British East Indies	16	31,290	4	12,566	35	47,633	...	......	13,295	4,095	611	......	......
Dutch East Indies	136	377,349	89	245,187	806	1,127,665	38	115,413	210,911	216,857	7,384	57,703	3,469
French Indo China	15	11,245	4	4,428	96	103,032	...	......	2,228	......	......	......	......
Hongkong	...	......	3	9,372	15	31,124	...	......	4,573	341	54	1,905	......
Japan	2	7,496	32	71,811	51	102,199	10	11,848	58,842	17,815	1,671	5,876	682
Persia	...	......	...	......	...	......	...	......	3,124	......	......	......	......
Siam	...	......	...	......	18	19,601	...	......	1,898	879	......	261	......
Turkey in Asia	1	2,532	...	......	88	91,958	...	......	11,418	1,585	273	98	722
Australia	15	33,070	45	64,026	201	270,581	650	680,106	168,318	113,197	55,268	5,500	1,210
New Zealand	30	77,633	25	54,490	666	864,158	61	80,023	112,603	117,661	7,982	19,825	......
Other British Oceania	...	......	...	......	...	......	...	......	1,466	1,848	210	573	......
French Oceania	1	1,350	...	......	2	1,600	...	......	704	......	97	697	14
Other Oceania	...	......	...	......	1	975	...	......	2,089	975	......	372	......
Philippine Islands	78	147,272	46	84,325	410	621,471	6	32,500	138,696	134,339	25,159	20,474	25,152
Africa:													
Belgian Kongo	...	......	...	......	...	......	...	......	57	......	......	......	......
British West Africa	77	107,847	19	30,983	42	61,913	2	4,488	27,098	43,559	7,595	632	73
British South Africa	4	5,538	4	9,327	501	623,535	2	3,163	214,132	76,256	11,201	......	358
British East Africa	4	7,816	...	......	102	108,399	...	......	2,452	20,916	3,666	......	......
Canary Islands	2	6,456	...	......	8	9,373	...	......	3,698	1,258	13	800	......
French Africa	2	2,170	...	......	52	57,300	...	......	15,655	904	200	2,000	350
Liberia	...	......	...	......	...	......	...	......	100	......	......	......	......
Morocco	...	......	...	......	43	53,345	...	......	6,419	5,835	......	......	......
Portuguese Africa	6	6,604	...	......	28	32,842	...	......	604	......	......	......	......
Egypt	6	4,425	...	......	176	153,170	...	......	13,891	12,373	117	......	......
Non-contiguous Territories:													
Hawaii	...	......	...	......	...	......	...	......	......	107,866	......	......	1,390
Porto Rico	...	......	...	......	...	......	...	......	......	166,757	......	......	1,988
Total	1,635	$2,921,666	695	$1,635,719	10,581	$13,406,552	905	$1,105,204	$8,480,615	$3,717,751	$511,219	$286,266	$81,898

Transmission Brakes

Editor AUTOMOTIVE INDUSTRIES: Viewed from the standpoint of those who live or drive in mountainous sections, the transmission brake should be the emergency brake. If *both* brakes operated on the shaft, with the service brake arranged as the less powerful one, it would be better than the two wheel brakes on many present cars and fully as safe as the latter.

The transmission brake distributes the retarding effort more equally than is possible with wheel brakes under varying load—and loads are rarely constant. But where there are long descents, the heat from constant application of the shaft service brakes frequently sets fire to the floor boards. Hence, for driving in hilly country the transmission brake is better when actuated by the hand lever.

There is no good reason why wheel brakes could not be of as high a grade of design as other parts of a car or why the external brakes could not be partially enclosed at little expense. The transmission brake has undoubtedly received more attention from its position and general environment, being a part of the unit power plant in many cases and directly related to other members which are better made and run truer than wheel parts.

So long as we tolerate that mechanical misfit—the Hotchkiss drive—so long shall we have shaft brakes. Of course, there are and have been Hotchkiss drive cars of an otherwise high grade that were fitted with wheel brakes only. The writer has yet to see one of these cars that you could be sure of holding if you had to stop when ascending a steep hill; if the brakes were adjusted for good service in a forward direction, you could push them to the floor board without stopping the car from rolling backwards. The same is true if the adjustment is made with a full load and the brakes are put to the test with but a fraction of this. This becomes a serious matter where there are frequent or long hills with grades of seven per cent or more—particularly if the traffic is heavy. Under such circumstances, the shaft brake is one's only salvation. DONALD A. HAMPSON.

Urging Wood Conservation

Immediately on reading the editorial on "Wood Conservation" in the issue of AUTOMOTIVE INDUSTRIES of Jan. 6 Cornelius T. Myers addressed the following letter to the members of congress to whom he feels entitled to express his views. We commend this course of action to other engineers and to manufacturers.

Hon. Earnest R. Ackerman,

I wish to write you in behalf of an appropriation of $400,000 which the Forest Products Laboratory at Madison is seeking in order to carry on its work the coming year.

I am personally acquainted with some of the work which has been done and some of the proposed program, and can say that it is not only theoretically constructive, but has been of great practical value to the wood working industry.

I appreciate and am in accord with the efforts of Congress to decrease governmental expenses to the minimum for the next few years, but would greatly deplore any economy with respect to so important a function as is being performed by the Forest Products Laboratory, which is, as you know, a branch of the Forest Service of the Department of Agriculture.

The value of the products of the wood working and using industries aggregates about ten billion dollars annually and these industries employ as many men as any other single industry in this country. It is conservatively estimated that the commercial application of the research work already done by the Forest Products Laboratory is saving the country thirty million dollars annually. To do other than appropriate money to continue so vital a work would be equivalent to letting your furnace fire go out in order to reduce the coal bill.

I can speak personally for the work of the Forest Products Laboratory and its very capable staff, and trust that you will give your personal attention to this item, both in committee and on the floor of Congress.

Rahway, N. J. CORNELIUS T. MYERS.

Action on Patent Bills Urgent

Editor AUTOMOTIVE INDUSTRIES:

For more than a generation there has been a constant petitioning of Congress to enact a law that would permit the Patent Office to use the money earned by it to promote the interests of patents. The patrons of the patent office are entitled to this service, as they pay for it. The refusal to permit this has caused to be returned to the United States Government more than $8,000,000 as profit. The men of long experience who worked so hard to make the Patent Office a success are gone—starved out. Men who can pass the required examinations will not take the places open at the salaries attached. The work is increasing 20 per cent a year since the war and the ablest men in the Patent Office are leaving it at the rate of 2 per cent a month. Our Patent Office is a wreck!

Erroneous and invalid patents are rushed through in an attempt to keep up with the work. These later clog the courts and cost the people much money. Assignments are a year behind the record clerks. One hundred and twenty thousand patents await action! Buyers of patents cannot ascertain titles. Copies of patents cannot be obtained because the records are lost or out of print.

And all because Congress does not authorize the money to hire enough men and pay enough to get them.

For a year the Nolan bill, H.R. 11,984, has been dragging along. Another 25 per cent of the best men have gone while it dragged. It has passed both Houses of Congress with some amendments and now has been passed by the Conference Committee and reported back to both Houses. A vote is expected in the House during the closing days of Congress. Every manufacturer, engineer and production man should urge its passage. Failure to pass this bill will lose another year and cost untold millions that the new business lodged in the Patent Office should and can bring. This is important to you. CHAS. E. DURYEA.

Since this letter was written the Nolan Bill has been passed by the House of Representatives, but has not yet been brought up by the Senate.

Mutual Benefit Should Be Major Thought in Dealer Contract

What is written here is not startling in any degree. There is not anything new in the faultfinding with the manufacturer-dealer contract in the automotive industry. It is merely a part of the growing pains. Next—what is the importance of the dealer in the trade?

By Clyde Jennings

THE recent announcement that a committee of the National Automobile Chamber of Commerce will meet with a committee of the National Automobile Dealers Association and discuss the relations of dealer and manufacturer is certainly reassuring. It is not to be supposed that this committee will draw a model contract and that instantly the present defects will be remedied by all manufacturers and distributors adopting a standard of dealing.

This will not be the result, nor can it be the result. The members of the two committees will not have the power to bind all of their members to a certain contract, nor would this be desirable. These committeemen, however, can have a considerable power for good. The contract which is the connecting link between the dealer and his source of supply of merchandise has been the subject of much criticism and of, perhaps, more misunderstanding. Both dealers and manufacturers' salesmanagers are human and their relations have been and will be subject to the misunderstandings that constantly arise in human organizations. It will be within the power of the men serving on this committee to point out some of the injustice suffered by their fellows and then carry the other side's story back to their membership. Such a move will undoubtedly serve a good end. Usually the terms of a contract become a subject of a dispute after both parties are angry and in no fit humor for proper consideration of a business proposition.

It is not the intention of this article to assert that all contracts are bad, nor that all are good. Indeed, the existing contracts appear to be on both sides of the fence. It is, perhaps, more important to regulate the spirit that carries out the contract than to regulate the contract itself. In this phase of the situation, the joint committee undoubtedly can have a very marked influence for a better understanding. The representatives of the two great national bodies should have the nerve to speak out to their fellow membership if their conferences develop marked evils.

This article is not going to present for your consideration a model contract. We do not believe there is such a thing, nor that any one contract will serve the needs of all manufacturers. Rather it is hoped to offer some remarks on contracts in general. These will apply to all contracts, just as they will to manufacturer-dealer contracts. Before attempting to write this article, I had an audience with a man who has been dealing with contracts in a large way for a number of years. He is not a lawyer, in fact does not pretend to know anything of law terms or of the technical effect of contracts. He says that these things are detail, in which he has no interest. He cares not so much for the exact wording of a contract as for the spirit of the contract. After leaving this man I held in mind a number of contract epigrams, and perhaps his views can best be expressed in this form. So here are some of his remarks.

A contract must be good to both parties. It must be fair.

A perfectly written contract is illegal if it is unjust and will be abrogated when brought into court.

Our contracts do not work so much on law as on justice and the man who brings a contract into court to enforce its terms must come with clean hands.

A contract to live must take into consideration a proper profit for both parties and must be so carried out regardless of the letter of the contract.

Business is not selfish; it is co-operative. No business can thrive on the losses of those connected with that business.

Honesty is the best policy. That saying has lived too long to be doubted. It is based on policy, or practice, and not on a moral foundation. Honesty is not and cannot be the mere living in keeping with a writing, but honesty must take into consideration the surroundings.

Of course this man had something more to say out of the wisdom that he has gathered in his long years in big business. It has been a part of his experience to take over several businesses that were in rather bad position. He has found it necessary, under these circumstances, to cancel many contracts. His belief in the native honesty of the average man has been greatly strengthened by these experiences. He did not notify the holders of these contracts of the cancellation, but he called them in to discuss the contract. He pointed out wherein these contracts were selfish, how they put an impossible handicap on the business and other things that we all know creep into contracts. Invariably he has found the man willing, in the end, to cancel his own contract. Often it required time for the man to think it over. Usually the holder of a selfish contract stiffened with opposition when the suggestion was made, and then realized his unfair position. He also realized that the success of the business was more important, even as regards himself, than his individual prosperity for a short period.

Let it be said here that the writer holds no brief for the manufacturer or the dealer in this contract discussion. It is quite well established that the dealer has suffered in many instances. Also it is established be-

yond question that the manufacturer has been the victim of the sharp practice dealer. The fault is not on one side. There are manufacturers who have not had a serious disagreement with a dealer in 15 years of merchandising. The dealers who have quit this service have left with good feeling. There are dealers who have sold for the same factory for 20 years and who assert that the factory management is entirely fair and reasonable; while other dealers have quit this same factory in a rage and later spread bad reports about the dealer relationships.

Recently a now prosperous New England dealer told of 19 years of service in the sale of a single car. Thrice during that period the ownership of the sales agency changed. Once because the dealer thought he did not get a square deal. Another time because the factory was not satisfied. The third time was when this employee bought into the sales agency, which he now controls. He says that during this period he has held steadfastly to the opinion that the factory sales department was entirely just in intent, and it was only necessary to properly present any particular incident to get justice. At the same time it has been the writer's experience to hear factory men speak of dealers as "foolish children" and in worse sounding terms. These are merely suggestions to indicate that no one rule will cure all ills.

Now for a moment we will return to the man of big business and his epigrams. Consider the first:

A contract must be good to both parties. It must be fair.

A recent communication tells of a factory making a contract that never had a chance. The factory was oversold at the time the contract was made. No effort was under way to increase production. This man required the profits on 100 cars a season to justify his establishment. He was promised 400. He received less than 50. Was that contract "good for both parties?" Turn it around. Is it "good for both parties" if a man enters into a contract to sell 100 cars a season, then buys one himself, sells one each to half a dozen relatives and then lays down on his job? Manufacturers will tell you of experiences of this kind.

New circumstances always will arise that are foreign to any clauses in the contract. No one ever imagined that in the winter of 1919 there would be hundreds of cars stored in the manufacturing district that could not be delivered before the buying wave exhausted itself. Some manufacturers realized the importance of this position when it developed, and, although it was foreign to the contract, assisted dealers in financing these cars. Some manufacturers did not. We ask you: Was it fair to hold the dealer to the letter of a contract when entirely unexpected circumstances arose?

Another of the epigrams:

A perfectly written contract is illegal if it is unjust and will be abrogated when brought into court.

The man of business illustrated this point in this way. During the war scarcity of raw materials he was forced by a very large company to sign a contract for $2,000,000 worth of material necessary to his business in order to obtain delivery. No price was named. The seller was to make the price at the time of delivery. "This was unfair," said my informant, "but I signed under duress. At once we began to lay plans for our own source of raw material. We are now in a safe position. When the market began to fall I cancelled this contract, because it was 'unfair.' I was willing to go into court. But the other party to this contract knew that it was unfair and was entirely unwilling to carry it into court, although the document probably was a model from a legal point of view."

Our courts do not work so much on law as on justice, and the man who brings a contract into court to enforce its terms must come with clean hands.

We hear much of law decisions that are based solely on the technicalities of the law. But the very fact that we hear so much of these few cases is an argument that court procedure—in the main—is based on justice. There are thousands of court decisions handed down daily. We hear little of the 999, but we do hear of the 1000th, which is the exception. Routine is not news. We would not read a newspaper that told only of the routine of life of the day laborer, or the busy, singing housewife in her house dress. We want to read of the man who is arrested, of the woman in gay clothing. Law decisions are no exception in news.

A contract to live must take into consideration a proper profit for both parties and must be so carried out regardless of the letter of the contract.

Comment on this would appear to be superfluous. Dealer franchises must always be based on production. The size of the town, the dealer expense, the opposition and other things must enter into the composition of a contract.

What good can it do a factory to have a large dealer list if the men whose names are on this list are standing in the financial soup line of their respective towns? The local customer judges the company by its dealer representation, not by the factory that he never saw.

Business is not selfish; it is co-operative.

The comment here is the same as just offered. The dealer who is not making money is not an asset to a factory. If it is the factory's fault, extra means must be taken to keep him satisfied. If it is the dealer's fault, eliminate him. Remember Roosevelt's utterance: "Speak softly, but carry a big stick." But if the contract is badly made, the factory cannot make a big stick out of it.

Honesty is the best policy.

All of us have seen so many organizations fail which were built on trickery and false pretense that we always wonder why men continue to "put it over."

A contract is necessary as a business memorandum. It should be just that. It should be a business agreement which can be shown to the banker to enable the dealer to obtain proper loans. His tenure as a dealer should be sensibly defined. If there is a penalty clause for one party, there should be a penalty clause for the other. It must be a mutual agreement to guide certain transactions, which gives to both parties an opportunity to be honest and prosperous. Then there should be the proper spirit behind it.

AN interesting motion picture, tracing the development of the gasoline engine and means of transportation, has been produced by the Cole Motor Co. The film has been named "The Porcelain Lamp" and had its premier showing at the Strand Theater during Show Week in New York.

The film pictures in dramatic manner the discovery of gasoline, the various modes of transportation from the time man had only his legs as a means of conveyance, the stages of development of the gasoline engine, and the development of the modern automobile. An interesting story is woven about that part of the picture which concerns the discovery of gasoline, and in the story a porcelain lamp plays an important part.

Workmen Feel Just Like the Rest of Us As Regards Wage Cuts

It is not surprising that the worker is putting up a fight against wage reductions. The history of the long division between labor and capital bears strongly on the matter, as does the amount and type of information available to the average worker. No man receives a cut in his earnings without raising some kick about it and determining to replace it.

By Harry Tipper

A LETTER which has been received this week affords us an opportunity to deal again with a matter that has formed the subject of several of these articles. This letter states:

> "The fact that labor is walking out immediately when they think they have the manufacturer in their power because of returning business is certainly striking a blow at any spirit of co-operation that might have been engendered in the heart of the manufacturers by the fact that they were compelled against their wishes to cut their wages. Without any bias and looking at the matter in a calm, unprejudiced way, manufacturers certainly made every effort to maintain wages. These were cut only as a last resort and the workmen certainly ought to know it. The fact that this is not appreciated by labor generally, as shown by the current strikes, in spite of the fact that thousands of people are out of employment, has greatly disappointed the employers and manufacturers here."

This statement indicates the lack of appreciation by the manufacturers as to the consequences of the long division of capital and labor, as these statements are ordinarily used. It was pointed out in these articles some time ago that the workers are not inclined to be any fairer in their approach to the labor question than the employers. In fact, with their ignorance of many of the factors entering into the situation, the kind of information they have and their desire for larger comfort they can be expected to retain any advantage they have gained as long as possible and combat any reduction in that advantage.

We have pointed out in these articles from time to time that the removal of suspicion of long standing is not to be accomplished in a few months or a few days, and that the difficulties in the way of agreement between employers and employees cannot be wiped out by a few efforts and a gesture or two.

The manufacturer is very apt to assume—because he knows his prices are being reduced at a more rapid pace than his costs—the worker should be equally well informed and accept the situation with as much resignation. The worker, however, is not equally well informed, what opinion he has does not agree with the manufacturer's information at all. A significant example of this difference was shown in the hearing before the Labor Board some time ago when the four brotherhoods brought up the question of wages.

Mr. Lauck, the attorney for these brotherhoods, brought in a brief which was very ably worded and thoroughly arranged. It purported to show that, while wages had increased approximately 100 per cent on the average, industrial returns had increased from 3 to 500 per cent on the capital. This brief was worked out so thoroughly that very few manufacturers would be possessed of sufficient information to refute the arguments and statistics contained therein. Mr. Lauck is a very prominent figure in labor circles. His arguments have been used and reused in the publications reaching labor and in the union meetings.

This is only one instance of the kind of information which the worker is securing in respect of the relation between wages and profits and between wages and cost. The information which has been given to the workers on this matter has been worked out more ably and carefully than any information from other sources and certainly it has been of far greater interest to them than any information supplied by their employers.

But this is not the most important reason for the attitude of the worker under present conditions. The fluctuations in wages are very much more personal to the worker in their appeal to his comforts and discomforts than the fluctuations of profit to the owners of industry and the executive.

One of the men in labor circles who has been a constant advocate of the retention of the present wage schedule by workers, mentioned a manufacturing concern the other day in connection with some disagreements. I said to this man, "How do you expect to get anywhere with your plans? That concern is almost down and out." He said, "Maybe it is, but I notice that the heads of the concern still own two or three automobiles and they still have their summer cottages and town houses, and they are still able to live in about the same comfort they did previously. They are still maintaining their executive organization in about the same way. The concern may be down and out, they are not. Why should the workers in the factory have to cut out some of the few comforts they have acquired and be the only ones to suffer in that way." To the worker this is a very strong argument. He lives from week to week, when his wages are good he secures a little extra comfort and he is not in the least likely to let that extra comfort slip without some struggle to retain it.

No man receives a cut in his earnings without raising some kick about it, and no man who studies the matter can expect his working forces to accept a

cut because business is bad, as long as there is the slightest chance to hold it.

No man who is in any position of responsibility in industry will accept a cut in his earnings without the idea that he will replace that cut as soon as business improves. The worker who is expecting a reduction in his pay to-day is expecting it on the basis that just as soon as business improves he will replace it if he can.

Any man who will study his own personal reactions will know that he cannot expect any other man to do what he finds it impossible to do, reduce earnings without complaint and without a distinct determination to get them back whenever it is possible. Any other contention or idea is absurd, and the idea expressed in this letter that manufacturers feel co-operation has received a body blow because of this reaction of the workers is equally absurd. This attitude as a matter of fact is in line with our general attitude on all matters which lie outside our personal relations.

We are very much more interested about the injustices of the other man toward us than we are about our own weakness in the same respect. It jars us pretty hard to be treated badly by some one else, while at the same time we are ready to excuse our own defects of the same kind. The worker is no different from anybody else, in that he desires to seize as much advantage as he can and retain it as long as he can. If he loses anything, he will try to get it back.

There is only one qualification to this statement and that is where he has become convinced of the squareness and understanding of the employer by long association, so that he is willing to play the game with him, believing that he will get back what is fair as business improves.

There are several isolated instances in industry where the workers have accepted a reduction and one or two where the workers have suggested a reduction. There are several instances where the workers have accepted a three-day week in order to keep all the workers employed to some extent. These instances occur because in those establishments the long association has been of such a character as to convince the workers they can expect a square deal and it is worth while for them to play the game all the way through.

The average worker does not believe that the manufacturer is suffering to any extent which need concern him. The newspapers he reads do not agree upon this, most of them discuss the reduction of wages as though it were the arbitrary decision of the manufacturer and had little or no relation to the cost.

Able men from union ranks and other interested organizations have written much which tends to prove in his mind that manufacturers have always received more profit than the worker and he is not inclined to waste any sympathy on the manufacturer over the troubles of the owners of industry. Neither is he in the least inclined to forego any advantage he has gained in wages unless he is obliged to, and then only under the impression that he will secure it again when business improves.

On the other hand, the manufacturer is frequently improperly informed as to the relation between the labor costs and the selling price in his own business, and is inclined to demand a reduction in wages because of the reduction in the selling price without any further analysis of the matter.

The manufacturer who desires to establish the same efficiency in his human relations which he expects in the development of his mechanical equipment, must be prepared to lead in fairness and square dealing just as he is prepared to lead in mechanical knowledge for the development of the other side.

Investment in time and experimentation to secure the right relations, can be no less than the investments in time and experiment demanded for mechanical improvement. He should know that this investment is much greater, and that a part of the study and development means the understanding of the worker better than the worker understands himself.

No man who understands the worker would expect him to accept a cut without kicking about it and without a desire to overcome it, and no man can expect the worker to believe, where he has no knowledge, or to drop his suspicions and play the game to his own disadvantage where he is ignorant of the effect which it will have.

Preparing for More Motor Vehicles in Tennessee

[From Department of Highways, Nashville, Tenn.]

THE Tennessee Highway Department is constructing highways both on the State aid and Federal aid plans. Aside from these highways, all the counties are constructing highways with funds derived from automobile license fees, county wheel taxes or county bond issues. It is impossible to secure any authoritative data on funds expended by the counties.

The following is a summary of State aid work under construction and in various stages of completion:

Type	Miles	Estimated Cost
Grading only	33.86	$139,194.26
Macadam	16.00	29,401.08
Chert	8.4	80,531.25
Concrete	2.5	130,200.20
Bridges	....	34,539.23
Total	60.76	$413,866.02

The 1921 Federal aid program consists of 271.75 miles of highways surfaced with the various types and having an estimated cost of $8,575,900, and bridges estimated at a cost of $370,000.

The following is a summary of Federal aid work under construction:

Type	Miles	Estimated Cost
Grading	20.47	$73,837.10
Macadam	84.68	1,430,064.87
Chert	30.45	470,312.49
Bituminous macadam	160.43	2,852,366.47
Rock asphalt	46.57	1,465,639.19
Bituminous concrete	7.43	261,639.19
Concrete	26.52	1,006,308.60
Bridges	....	32,467.21
Total	376.55	$7,753,541.27

Force account work on a day labor basis is being done on three macadam projects aggregating 16.77 miles.

One concrete highway project, 10.14 miles in length, is being constructed by county forces, under supervision of engineers of the State Highway Department, at fixed unit prices, making it essentially a contract job with the county as the contractor.

The remainder of the work is being done on a contract basis.

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Export Selling

NOW and then, it is possible to show graphically some of the merchandising efforts attempted in export selling. The following translated paragraph from a letter written by an automotive dealer in Mexico is one of such cases:

"I am well satisfied with the catalogues and the correspondence I have been getting and only deplore that practically everything is in English."

This dealer, who speaks no English and who lives in a smaller city where it is not so easy to obtain English translations as it might be in Mexico City, Vera Cruz or Tampico, had requested catalogues and service information from American automotive manufacturers, particularly on cars and tractors.

The result, as shown by the letter, is especially disheartening in view of the present efforts being made by American manufacturers to distribute their lines through that country. An opportunity has existed in Mexico during recent months for automotive expansion that should have called forth at least the best efforts of every manufacturer who is sincerely desirous of building up and holding a large foreign business. But to realize on an opportunity such as this, should call forth the proper preparation by manufacturers and exporters.

Taxes! Taxes!!

SENATOR HARDING will be inaugurated President a week from Friday.

He is expected to call an extraordinary session of Congress to convene March 14.

Less than a month after the session convenes the House Ways and Means Committee will open its hearings on the question of Federal taxation.

Unless its present temper is radically changed, the congressional leaders will insist upon additional taxes on passenger-carrying automobiles on the ground that they are luxuries. The taxes proposed are unfair and almost confiscatory in their nature.

In addition to a prospective increase in Federal taxes it is almost certain many of the State Legislatures will enact laws which will impose additional tax burdens on an industry already overloaded.

The automotive industry is the second greatest in the United States. Its potential influence in Congress and in State Legislatures is tremendous. It should seek no favors, but it should object to being made the football of politics and taxation.

The only way heavily increased taxes can be averted is by concerted action on the part of the industry as a whole. If it makes the right kind of fight at least a part of these unfair taxes can be avoided.

Legislators, state and national, cannot be influenced unless a cannon, rather than a shot gun, is trained on them. They will take the easiest way, which is to tax automobiles—if the various branches of the industry begin shooting all over the lot instead of trying to hit the bull's eye.

With less than two months in which to map out a definite program and act, no steps have been taken to formulate a platform upon which every organization interested in automotive vehicles can stand.

Unless all organizations which are a part of the industry get together and act together, they will wake up some fine morning to find a few more taxes have been piled on their shoulders.

Legislation, state and national, never was more important to the industry than this year. The Motor Vehicle Conference Committee, through state committees, is watching state legislatures. The National Automobile Chamber of Commerce is on watch at Washington, but it is not exerting all its great influence to act in harmony with other organizations.

The directors of the Motor and Accessory Manufacturers' Association, at a meeting here Friday, decided to table the tax question because of the pressure of more important business. Their next meeting will be held late in March. Hearings on taxes will begin a fortnight after that date.

The industry is making no definite effort to prevent the flooding of the country with American made automotive equipment and supplies bought for a song in foreign countries.

The industry is making no definite effort to prevent the War Department from dumping scores of thousands of automotive vehicles of all kinds on the market.

If every member of every automotive organization was to send a telegram of protest to the legislators who represent him, legislators would at least know that the sender would hold him accountable for classing motor transportation as a luxury and taxing it accordingly.

Isn't it time for the automotive industry to prove it can work in harmony to prevent unfair, unjust and discriminatory legislative action?

If half the things planned are done to it, the recovery of the industry will be retarded for many months—perhaps years.

Parts Business in the Motorcycle Industry

ACCORDING to our British correspondent, British car manufacturers consider it rather beneath their dignity to use stock parts, and consequently there is no such thing as an assembled car manufacturer in Great Britain. In the British motorcycle industry, however, a large percentage of the manufacturers use stock parts or units such as engine or gearset, even some of the larger makers finding it economical to purchase these parts rather than manufacture their own. As a result many small makers who could not survive at all without the parts manufacturer are able to do a good business.

In this country quite the reverse condition obtains. A considerable proportion of our car builders do not fabricate any of the major units which make up the vehicle, but simply assemble the units which a specialty manufacturer, with large output, is able to sell them at a price which enables competition with even the large producer whose business is sufficiently large to enable him to build all or most of the component car units to advantage. The same is true in the truck and tractor fields, but strange to say is not true in the motorcycle industry. There seems to be no inherent reason why a motorcycle parts business could not be built up if proper initiative and thoroughgoing methods are applied. It is at least a possibility which is worthy of study by manufacturers who are seeking an opening in the automotive field.

Excess Profit or Surtaxes

A FINANCIAL man recently declared that it was not the repeal of the excess profits tax that was needed, but the repeal of the surtaxes on incomes.

He said that the great need of to-day is for more money with which to conduct business. This money in the past, said the financier, came from persons with large fortunes, who were constantly seeking new fields of profitable investment. Since the war closed, these persons have been engaged in transferring their investments to tax free securities. As rapidly as possible persons of large income had been selling the ordinary sort of securities. It has been the job of salesmen of securities to find new capital to absorb these securities. This new capital has been found in the investor with a comparatively small income, but the new investor's power of absorption is not equal to carrying such a heavy load as is now offered to him. Already this investor has a large capital in Government bonds and is increasing daily his investment in industrial securities of the highest types, but the investor of large income is shedding too rapidly for him. So anxious is he to avoid the surtax that industry is handicapped in its effort to secure capital.

It is surprising how many of the common people one finds who believe that a limit on company profits is a pretty good thing. The average person probably has an exaggerated idea of how much profit companies make, and they are not much educated by the annual statements of these companies. Usually these tell nothing to the public. When the casual reader sees in these reports a careful restraint in the way of saying anything about excess profit taxes, he suspects that the taxes were so large as to need concealment.

Anyway, the excess profit taxes probably will not be much of a bother for a few months, so why not get rid of the surtaxes?

Using Higher Compressions

THOSE interested in bettering the thermal efficiency of automotive engines should study the article by Mr. Ricardo in this issue.

For several years past there has been a tendency toward lower compression ratios which some think were forced upon us by the inclusion of less and less volatile elements in the average fuel available. This is, of course, a tendency toward lower efficiency, hence it is refreshing to hear a word now and then about the use of higher compression and higher expansion ratios—even higher than were used when fuel that didn't produce a knock was available in abundance.

Perhaps the easiest way to adapt the engine to the fuel was to lower the compression, but it is evident that it was not the only way and certainly a very poor way from the standpoint of economy. Diluents which prevent excessive pressures and temperatures have been tried with varying degrees of success, depending upon their nature and proportion. Some say that diluents, such as benzol, which in themselves possess fuel value will never see very extensive use because they are not available in sufficient quantity. Inert gas such as exhaust products can be used to advantage in some cases as Mr. Ricardo shows. But perhaps the most promising diluent, at least within certain limits, is pure air, especially when used under part load conditions in such a way as to maintain high compression and thus avoid throttling. To do this requires some but not extensive alterations in the conventional type of automotive engine (as we propose to show in articles soon to appear in AUTOMOTIVE INDUSTRIES). The problems involved are not completely solved, but do not seem by any means insuperable, and the advantages are of such great significance as to make the effort at solution well worth while.

Army Starts Sale of Surplus Cars

Unserviceable Stock First to Be Cleared

Twenty-nine Thousand Vehicles Booked for Auction—Deny Undisclosed Supplies

WASHINGTON, Feb. 18—Orders have been issued to all departments of the United States Army to dispose of surplus automotive equipment which it is officially estimated will amount to approximately 29,000 unserviceable vehicles. The sales campaign which was inaugurated at Camp Holabird, Baltimore, this week, will be nation-wide though the vehicles will be concentrated at four camps now under the supervision of the Motor Transport Corps of the Army. Unofficial though apparently authentic information to the effect that general orders calling for the disposal of all vehicular equipment, retaining only 30,000 vehicles in this country, insular possessions and in Europe, was denied at the War Department today.

This unheralded movement on the part of the Army has resulted in protests to Congress and the Secretary of War from automobile dealers associations and chambers of commerce. The War Department has taken little cognizance of the protests from business men and, it is said, will continue its program of selling 29,000 automobiles, trucks, motorcycles, tractors and bicycles.

Practically all this material is now unserviceable, the War Department advised AUTOMOTIVE INDUSTRIES to-day, and because of the large sums required to put the stock in service, they point out that it will have little effect on regular dealers and will boom business for garages and dealers selling accessories. Dealers, however, contend that the net result of this flood of vehicles will be disastrous because prospects for new machines will take advantage of ridiculously low prices accepted by the Army and take a chance on a small repair bill.

Censor Inquiry Results

AUTOMOTIVE INDUSTRIES was informed to-day that the inquiry undertaken by the Inspector-General under orders from the Secretary of War brought out some startling facts. It is claimed that two unlisted warehouses were discovered near Newport News which contained several hundred uncrated automobiles, trucks and ambulance bodies, which had been stored with a view to easy loading when needed in France. These machines are deteriorating rapidly owing to climatic changes but it is averred that the majority of this lot is ready for service after slight repairs. Officials of the Motor Transport Corps refused to confirm this statement.

Recent attacks in Congress directed at the War Department for the misuse of automobiles purchased for war purposes has resulted in establishment of a censorship. This information was obtained from authoritative sources, however. The Inspector General's survey was caused by the introduction of numerous bills in the Senate and House directing the War Department to turn over all surplus automotive equipment to the highway departments.

The story is current and officially confirmed that special orders were issued recently to departmental commanders to prepare charts based on the reduction in the size of the Army as authorized by recent legislation. These charts were to cover the amount of automotive equipment and other vehicles considered absolutely essential to the maintenance and transportation of the troops in each Army post throughout the world. Army officials deny, however, reports that the analysis of the charts received here indicated that there would be from 200,000 to 300,000 vehicles of all types, motor and horse-drawn, which would be offered for sale as surplus.

The Transportation Division of the Army informed AUTOMOTIVE INDUSTRIES that approximately 103,000 automotive vehicles were in France during the years of the war and about the same number bought and in service in this country. They pointed out that thousands of vehicles were rendered useless in service and a large part of the remainder sold abroad rather than disrupt American markets.

Under existing legislation, the War Department has been disposing of automobiles, trucks and tractors by transfer to the Postoffice Department, the Bureau of Public Roads and the Public Health Service.

Army Reduction Makes Surplus

Tentative measures pending in Congress would require the sale of 10,000 trucks, 1000 automobiles, and 2000 tractors. The reduction in the Army brought about a natural surplus without the stimulation of legislation. The War Department claims that all Government agencies have first choice of surplus automotive equipment before it is offered for sale at auction. The Bureau of Public Roads asserts that the War Department has frequently declined to transfer equipment needed for highway construction on the ground that no surplus was available.

Congressman Anthony of Kansas had ideas of his own and declared that the highways could not absorb additional equipment and imposed a provision in the Army appropriation bill to compel the sale of not less than 10,000 trucks

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Baltimore Buyers Pay $40 to $2,400

2100 Light Delivery Cars, Trucks and Ambulances Sold in First Allotment

BALTIMORE, Feb. 21—Despite a protest by the Baltimore Automobile Trade Association to the Government asking that the sale of used motor vehicles in large quantities be discontinued in Baltimore, officials of the Government sold last week 2100 motor cars of all kinds and in various conditions.

No touring cars were offered, the models being light delivery cars, trucks and ambulances. A crowd that ran into thousands was on hand throughout the sale and the machines were sold at a very rapid rate. For a time the average was about two a minute.

Inspection of the cars by buyers was limited to a look under the hood and a moving of brakes and gears and any other exterior inspection possible, but no cars were permitted to be tested as far as operation was concerned.

Government officials stated the cars were serviceable, but did not come up to the specifications demanded by the Government. All the machines that left Camp Holabird, the Government camp a few miles from the city, were towed away.

The cars being sold here are used motor vehicles gathered from the various motor camps of the United States. They are being sold under the authority of the Quartermaster-General's office and officials of the Motor Transport Corps directed the sale. Buyers came from all over the country. It is estimated that the first day's sales totaled $200,000.

On the second day some of the big trucks brought as high as $2,400. The lowest price was $40.

Purchases Range to $20,000

Interests said to represent the General Motors Corp. and the Backus Motor Co. of East Orange, N. J., are reported to have purchased about $20,000 worth of cars each.

Brigadier-General A. E. Williams, assistant to the Quartermaster-General, attended the sale and was accompanied by Colonel F. H. Pope, chief of the Motor Transport Corps, and Lieutenant-Colonel W. N. Haskell, assistant director of sales.

Practically none of the cars leave the grounds under their own power. About 300 freight cars of the B. & O. and Pennsylvania Railroad now are parked just outside the grounds ready to receive the cars for out-of-town shipment.

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Production Grows as Sales Expand

Paige Sets Schedule of 1,500 for March

Reports Orders for 800 Cars on Books—Packard Sales Show Increase

DETROIT, Feb. 18—Optimism engendered by enthusiasm at the national shows and which was discounted to some extent by more conservative manufacturers, who attributed it solely to stimulation of the exhibitions, has cropped out anew this week as the result of actual sales recorded and orders to parts manufacturers. A sharp upward trend is noticeable.

While the improvement, in the minds of many, is attributable in great measure to weather conditions, which naturally have a tendency to hurry the spring demand, others insist that it presages a return to real business and predict a steady improvement that by mid-summer will find the industry in pre-war normal condition. Outstanding evidence is the attitude of the Paige-Detroit Motor Car Co., which now is on a schedule of 40 cars a day, operating four days a week with the plant's entire force of approximately 3000 men. According to Paige officials there are 800 actual orders on the books, and a production schedule of 1500 cars for March has been outlined.

Paige dealers throughout the country, according to factory officials, report an inclination on the part of the public everywhere to assume a buying attitude, and while actual orders have shown no great spurt, there is every indication, dealers say, that brisk spring business will begin during March and increase steadily.

Packard Ready to Expand

The same optimistic report was given out by officials of the Packard Motor Car Co. In fact, it was said at the Packard plant that the average for the present week was far in excess of that for the same week last year in point of actual orders. The Packard plant is operating with only about 1000 employees and building approximately 25 per cent of the normal schedule. Packard officials say if sales continue to increase in the next few weeks as they have in the last two, the factory force and output will have to be materially increased.

Fred Glover, general manager of the Timken Roller Bearing Co., expressed himself gratified with the signs of improvement. His company, Glover said, had received orders in much better volume for February, while the great improvement in orders for March clearly indicated that the return to normal would soon be under way vigorously.

GOODYEAR SCHEDULE INCREASED TO 60,000

AKRON, Feb. 22—The Goodyear Tire & Rubber Co. to-day went on a production basis of 60,000 tires weekly increasing from 38,000 and increasing the operating time from four eight hour days each week to five eight hour days a week, with no additional men being put on. This is the first substantial increase in production announced by any Akron rubber company and is the first increase by Goodyear since the beginning of refinancing negotiations. The company at its peak last summer, was making 33,000 tires daily in the Akron plant. Goodyear's announcement, coupled with a shipment of 30,000 tires to Henry Ford by the Goodrich company indicates a steady upward trend in the tire industry.

Continental Motors Adds 1,000 to Force

NEW YORK, Feb. 21—Business of the Continental Motors Corp. is increasing, according to an optimistic statement on the business outlook made by G. W. Yeoman, vice-president and treasurer of the company, in response to a request for information made by Sidney S. Meyers, general counsel of the Motor and Accessory Manufacturers' Association. After pointing out the impetus given by the New York and Chicago shows, Yeoman said that nearly 1000 men have been added to the force employed in the Detroit plant to get out this month's demands and that orders for delivery for March will be from 30 to 40 per cent greater than February.

"If anyone tells you this is only a little spurt and that the demand will decrease, tell them they are crazy," said Yeoman. "Sixty to 90 days from now the automobile business, through the possibilities of liquidating large stocks of inventory, should be in a very advantageous position to again establish itself on a cash basis. The sale of trucks has not yet started in any volume, although we have orders on hand from about 60 per cent of our customers for shipment the latter part of February and for the months of March and April.

Necessary as Foodstuffs

"Our entire organization is of the firm belief that the automobile and truck industry is built on a strong foundation and that its products are as necessary to the upbuilding of this country as the raising of foodstuffs and other so-called staple articles."

Kalamazoo Plants Increase Operations

Definite Increase in Business Experienced Since Shows—See Complete Recovery

KALAMAZOO, MICH., Feb. 21—"Just as it has in times past, the automobile industry will lead business in this country back to prosperity" said Christian Girl, president of the C. G. Spring Company, during a discussion of the outlook for business in the near future.

"Distribution is still the weakest link in the chain of American industry" added Girl. "It is the close affiliation of the automobile with the problems of distribution and the need of motor cars and trucks to solve these problems that will tend to a steady revival of the automobile business. This revival will not be an over-night affair like the recent suspension. It will come gradually.

"We have suffered from a hard fever. While we no longer have the fever, we are weaker than when the fever raged. It will take time to convalesce, but recovery is certain. I look for over 50 per cent production this year and normal business in 1922."

The C. G. Spring Co. is already feeling the effects of the coming better times. Inquiries are common and many substantial orders are being booked. The working force will be increased steadily as business requires. This also applies to other Kalamazoo manufacturers allied with the automobile industry. The recent depression is gradually disappearing and is being succeeded by a feeling of optimism.

"We are now running about 60 per cent of our capacity" said J. D. Bobb, president of the Limousine Body Co. "I look for a substantial increase in business by spring.

Substantial Orders Received

"The outlook is flattering" said F. P. D'Arcy, president of the D'Arcy Spring Co. "During the past few days we have received several substantial orders and the inquiries at hand indicate there will be plenty to do later on. Our plant is now operating on about 33 per cent capacity, but the number of employees will be steadily increased. The fact that we intend to reorganize and recapitalize indicates that we are looking for a larger business in the future than in the past."

James I. Handley, president and general manager of the Handley-Knight Co., reports orders on the companies books for over $250,000, all to be filled by April.

"Conditions have improved greatly

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St. Louis Estimates 750 Sales at Show

Total Business Done Is Expected to Exceed $1,000,000—Attendance Mark Highest

ST. LOUIS, Feb. 18—From the viewpoints of attendance, merchandising, sales and the procuring of prospect lists, the fourteenth annual automobile and accessory show, held in this city last week, was without question the most successful of all St. Louis exhibitions, according to Robert E. Lee, president of the St. Louis Automobile Manufacturers and Dealers Association, and manager of the show.

Every exhibitor reported sales daily, almost from the time the doors were opened. An incomplete analysis of the business consummated during the week make a total of approximately 750 cars sold. Considering $1,500 as an average price, the total will surpass the million dollar mark. This represents an increase of a minimum of 10 per cent over the sales negotiated during the 1920 exhibition, according to Lee.

The total attendance, including the record breaking crowd of 22,000 on the opening night, amount to a 20 per cent increase over last year's show and reached 105,000. This is the greatest number of persons ever attending a St. Louis automobile display. "An outstanding feature of the show is the fact that exhibitors obtained prospect lists much larger than those recorded during previous shows," said Lee. "This proves that the public is again in the buying mood and the fear of continued business depression is allayed."

Because of the unusual interest which the public showed during the exhibits last week, the dealers are predicting that during the spring months there will be a shortage of cars. On Feb. 1 the St. Louis association in making its monthly canvass of the number of unsold motor cars in the city, found that the stock was far below that which the dealers usually carry at this time of the year.

Stock Accounting Asked in New Templar Suit

COLUMBUS, Feb. 19—N. P. Clyburn, former prosecutor of Ross County, now a resident of Washington, has brought suit in the Franklin County Courts asking for a receiver for the Templar Motors Co. of Cleveland. Included in the action is a complaint against M. F. Bramely, president of the Templar Co., and W. O. Cooper, head of the W. O. Cooper Co., the stock selling agents, for an accounting on the allegation that the two named persons received $2,500,000 or thereabouts for the sale of stock illegally. Former Attorney General F. S. Monnett of Columbus is plaintiffs' attorney.

B. Pittman, formerly sales manager, who is now in the brokerage business in Columbus, brought a similar suit against the corporation and officers, but it was dismissed. Several indictments have been returned against Pittman, one of which is for the embezzlement of $200 and another for circulating a circular tending to reduce the value of stock. This is the result of a circular issued telling of the alleged illegal financial transactions of the company. The annual stockholders' meeting of the Templar Co. is scheduled for March 1.

Sales Sentiment Grows Throughout Country

WASHINGTON, Feb. 21—Business conditions will improve from now on, says Archer Wall Douglas, chairman of the Committee of Statistics and Standards of the Chamber of Commerce of the United States, in his monthly review of business issued to-day.

"The most convincing evidence that we are on the high road to recovery," Mr. Douglas said, "is found in the universal report, brought by traveling salesmen from every section of the country, of steadily growing sentiment that business will be better in the spring—not a sudden return to prosperity, which is neither likely nor desirable, but a slow and natural working out of those processes of liquidation which are now in full operation."

Gasoline Prices Drop Six Cents in Mid-West

NEW YORK, Feb. 21—Gasoline prices have been reduced from 1 to 6 cents a gallon in the principal cities east of the Rocky Mountains, but no reductions have been made as yet on the Pacific Coast. Reductions of 3 cents have been made throughout the eastern territory and of 4 cents in the middle west. In the midcontinent and southwest territory prices have declined in some cities as much as 6 cents a gallon from the peak of 1920. The lowest price is in Kansas City where it is 21 cents a gallon, with St. Louis second at 22.5 cents. Chicago and Houston, Tex., are tied for third place at 23 cents. The price is highest at Butte, Mont., where it is 31 cents.

DISCUSS TRUCK PARTS SERVICE

CHICAGO, Feb. 24—A committee of the Motor Truck Manufacturers Association consisting of O. Armleder of the O. Armleder Co., M. Cook of the Service Motor Truck Co., and J. W. Stevenson of the Indiana Truck Corp., will meet with representatives of units and parts makers at the Hotel La Salle here to-day to discuss with them the subject of establishing their own distributing and service stations. This meeting was scheduled for Detroit on Feb. 18 but was postponed.

COLUMBIANA RECEIVER ASKED

EAST LIVERPOOL, OHIO, Feb. 21—A petition has been filed at Lisbon asking for the appointment of a receiver for the Columbiana Rubber & Tire Co.

Medium Priced Cars Lead New York Sales

General Improvement Noted in All Classes—Dumping Slows Truck Sales

NEW YORK, Feb. 21—More motor cars were sold in New York during the past week than in any similar period in several months. The upward trend of the market is not confined to any particular car, or class of cars. The return to buying has been general and for the first time in many weeks there is a distinct demand for cars that is evidencing itself in many ways.

The largest sales increase was made in the medium price class. Three dealers in this class reported sales for the first 18 days of February to be 33⅓ per cent above the same period in 1920. While several of the others did not approach this mark, all had experienced increased business.

There also was an appreciable increase in the demand for the higher priced cars. Most of the "quality class" dealers reported business increases that were distinctly satisfactory.

In this class, as well as in the medium priced car class, there was a marked increase in the demand for open cars. Early spring delivery orders in open models in the higher priced cars were particularly noticeable.

While there is no marked improvement in the truck market, there is evidence of an early upward trend of the extremely low sales record. The truck dealers are watching closely the effects of the sale here of some of the A. E. F. equipment in the past few days. It is felt that the natural spring demand for trucks may be somewhat diluted this year if these trucks are dumped on the market.

There has been little appreciable demand for used cars, although the market is slightly better. Some of the dealers have had inquiries for used cars for export to Belgium and a few lower European countries.

AUTOCAR ADDS TWO DIRECTORS

PHILADELPHIA, Feb. 21—The board of directors of the Autocar Co., Ardmore, Pa., has been increased from seven to nine by the addition to the board of J. Howard Reber and Roscoe T. Anthony. The other directors were re-elected and they in turn re-elected the old officers. David S. Ludlum is president of the company.

EVERED SOLD TO TWIN PORTS

SUPERIOR, WIS., Feb. 21—The Twin Ports Steel & Tractor Co., which was incorporated recently with $250,000 capital, has taken over the entire business and works of the Evered Foundry & Machine Works here. It will continue the manufacture of gas tractors, hoisting engines and power winches, but will also take on jobbing orders for pattern, casting and machine work.

Trucks Find Place At Machinery Shows

Manufacturers Encouraged by Roads Exhibit Results, to Take Mine Show Space

CHICAGO, Feb. 19—Although manufacturers have not been disposed to stage a separate truck show in this city, they are at the same time taking advantage of every opportunity to put their product before the public through the medium of other shows into which a display of motor trucks fits well. This was shown in their use of the Good Roads Show.

A still truck show, it has been felt, lacks the magnetic power that a show in motion has, and the manufacturers saw in working machinery, such as that used in road building, this desired touch. Thousands of road builders attended the good roads show and while their interest did not center in the trucks when they came, nevertheless they could not help but see them once they were there.

Now comes another show, the mining machinery show, which is to be held in Chicago some time in the fall and possibly on the Government pier. Manufacturers appealed to the good roads builders with their exhibits of last week; in the fall they will send forth their message to the mine operator and show him, just as they showed the road builder, how essential the motor truck is in his line of business. The approaching mining show will be a show in motion, just as the good roads exhibit was, and the truck manufacturer will make capital of it.

Wisconsin Factories Resume on Large Scale

MILWAUKEE, Feb. 21—Passenger car manufacturers in Milwaukee and Wisconsin are steadily increasing working forces in order to handle current orders for immediate and near-future delivery. In Milwaukee, the four-cylinder division of Nash Motors Co., Kenosha, which was down for several weeks, is employing more than 400 men. The Milwaukee assembling plant of Ford has resumed work and is rapidly reaching its normal schedule of 115 cars a day. Manufacturers of automotive materials, parts and equipment likewise find conditions more encouraging and are making gradual increase in working forces and output. A considerable number of men have been notified to report for work March 1 and 15, and in the meantime a few men are being taken back every day.

SIEMON SELECTS ROCHESTER

ROCHESTER, Feb. 21—Assurances that the Siemon Tractor Corp. will establish its plant in Rochester have been given to the industrial development committee of the Chamber of Commerce here. Negotiations have been in progress for the past few weeks between the chamber and the officers of the company which has been in existence for three years. An extensive investigation of the tractor, the cost of manufacture, the probable market for it and the financial situation in which the company finds itself, all has been investigated.

J. C. Siemon, president of the corporation, is a business man well-known in Canada and Buffalo. A number of prominent Rochesterians have interested themselves financially in this company. President Siemon announces, however, that additional capital will be needed to establish the plant in Rochester. He is looking for quarters for a site at the present time.

Briscoe Schedules 12,000 for 1921 Production

DETROIT, Feb. 18—Waring Sherwood, advertising manager of Briscoe Motors at Jackson, in reply to rumors that the plant was about to shut down, has authorized the statement that Briscoe is rapidly getting to normal production, and expects to reach that point by April 1.

"Our plant has not been shut down at all," said Sherwood. "We have never at any time had less than 500 men working, and we have put on 40 additional men. We are building from 15 to 20 cars a day, and plan to increase our force and output steadily until by April 1 we expect to be turning out 50 cars a day. We have outlined a schedule of 12,000 Briscoes for 1921, and have every reason to believe we will carry out that schedule.

"There is every indication of good spring and summer business, and our actual sales before, during and since the National shows, convince us that the automobile business rapidly is on the upgrade. Everything points to splendid business throughout the year."

TOOL APPLIANCE ORDERS GROW

PHILADELPHIA, Feb. 18—A marked increase in orders is recorded for the first half of February by the Standard Shop Equipment Co., manufacturers of set-up appliances for machine tools. This company does considerable business with automobile manufacturers, so that the increase furnishes another indication that business has started on the upgrade. There is no reason to believe this increase has been temporary.

AUTO-LITE ADDS 200 MEN

TOLEDO, Feb. 21—The Electric Auto-Lite Corp., a subsidiary of the Willys Corp., has called back to work nearly 200 former employees, making about 400 now employed out of a normal 3000. While the outlook for the future business remains uncertain, it is more encouraging than it has been.

BROCKWAY STARTS FULL FORCE

CORTLAND. N. Y., Feb. 21—The Brockway Motor Truck Co. has resumed operations with its full force of 200 employees. Preparations are being made for the enlargement of the plant.

Willys-Overland Bankers Organize

Protective Committee Formed Because of Close Association With Willys Corporation

NEW YORK, Feb. 23—Bank creditors of the Willys-Overland Co., Inc., have formed a committee headed by Ralph Van Vechten of the Continental and Commercial Bank of Chicago to protect their interests. The committee includes John Sherwin of Cleveland, Joseph Wayne, Jr., of Philadelphia, and several representatives of New York banks and banking houses.

The committee was formed because of the close relations existing between the Willys-Overland Co. and the Willys Corp. The affairs of the Willys Corp. have been taken over by a bankers' committee which is working in harmony with another committee representing merchandise and construction creditors.

The banks interested in the Willys-Overland Co. are by no means identical with those which have made heavy loans to the Willys Corp., and the Chase National of New York, which is probably the largest bank creditor of the corporation, is not represented on the other committee. It is understood, however, that the two committees do not conflict in any sense and that they will co-operate so far as possible for the good of the two companies.

The affairs of Willys-Overland are not involved directly with those of the Willys Corp., although 27 per cent of its common stock is owned by the corporation. It is understood that no refinancing is contemplated for Willys-Overland in the immediate future nor has any merchandise creditors' committee been formed up to this time.

Large blocks of the first and second preferred stock of the Willys Corp. have been deposited with protective committees which have been formed, and preliminary conferences already have been held with the bankers' committee.

KELSEY WHEEL PLANT STARTS

MEMPHIS, TENN., Feb. 21—Following an inactive period, the Kelsey Wheel Co., large manufacturers of wheels and automobile bodies, began a general resumption this week with 100 employees at work. Ten per cent capacity runs were started and from week to week a return to normal standards will be accomplished. The company employs about 800 men under normal conditions.

ALLEN RESUMES ON NEW ORDERS

COLUMBUS, Feb. 21—The receivers for the Allen Motor Co. have opened the Columbus factory, which was closed down recently for inventory, with about 100 men employed. Orders for a large shipment of cars were received recently and mail orders are coming in. The plant is being operated on about a 50 per cent basis.

Tariff Rule Hurts Cars at Paris Show

American Place Selection Follows British, Italian and Belgian —German Cars Barred

PARIS, Feb. 1—Regulations for the Paris automobile show, to be held in the Grand Palais from Oct. 5 to 16 next, provide for twelve classes covering the entire automotive industry, with the exception of aviation. On the main floor, which will be reserved to automobile exhibits, stands of 40, 60 and 80 square metres will be provided, with prices varying from 120 to 500 francs per metre, according to position. The rental of the best and biggest stands will, therefore, be 40,000 francs, and the smallest stand on the ground floor will cost 4800 francs. The above prices comprise electric lighting and all decoration.

Manufacturers belonging to Allied nations are admitted on the same terms as French firms, providing they have taken part in three previous Paris shows and on condition that their pre-war import duties were not higher than 15 per cent ad valorem. Under this rule American firms do not have the same choice as British, Belgian and Italian manufacturers. Special positions will be reserved for American firms, and for manufacturers belonging to nations who were neutral during the war. Late enemy nations will not be admitted.

The Paris show is handled by a committee composed of delegates from the leading French automobile trade associations, with Henry Cézanne as general manager. The balance remaining after all expenses have been paid will be disposed of as follows: Thirty per cent to be given to organizations existing for the benefit of the French automobile industry, and 70 per cent to be returned to exhibitors in proportion to the rental they have paid for their stands. Price of admission to the show will be 10 francs on the opening day and on Fridays, and 3 francs on all other days.

Requests for space should be sent to the offices of the organizing committee, 51 Rue Pergolese, Paris, not later than June 1, 1921. The drawing of lots for positions will take place from Aug. 1, but applications received after June 1 will only be considered after other requirements have been met. Exhibitors in the Paris show must undertake not to take part in any exhibition, race, or competition not approved by the National Automobile Federation.

Swiss Railroads Seek Truck Line Regulation

NEW YORK, Feb. 21—Dispatches from Switzerland say that the use of motor trucks for transporting goods in that country has become so extensive that the Swiss state railways have requested the government to take legal measures to prevent private firms from competing with them. Not only has passenger traffic on state railways been cut down by the use of private motor cars, but freight traffic has also been seriously affected by motor vans. Every time freight rates are raised more persons avoid use of the railways and the truck service has become a formidable rival for the transportation of goods, especially as they can provide door to door delivery.

One motor truck company proposes to establish a service between Italian and French ports and Switzerland, thus taking goods coming from the United States direct to Swiss warehouses on motor vans.

Receiver Is Appointed for American-British

NEW YORK, Feb. 21—George C. Van-Tuyl, Jr., has been appointed by Federal Judge Knox as receiver for the American & British Mfg. Corp., New York, in a suit brought by the American & British Securities Co., a creditor, for $37,516. The petitioning creditor is a Delaware corporation. Its claims are for money loaned, but it also holds 23,265 shares of the preferred stock of the manufacturing corporation and 31,277 shares of the common. The bond of the receiver has been fixed at $20,000.

The petition alleges that the defendant company is financially embarrassed, although it is considered solvent. It is stated that in the summer of 1919 the American & British Mfg. Co. entered into a contract to construct automobiles on a quantity basis and that in order to complete the contract it had to sublet certain parts of it. After making its agreements, a strike broke out in the plant of one of the sub-contractors, and because of this labor trouble, the business of the manufacturing company was put back for nearly a year, but it continued to manufacture other parts, and in so doing used up all its funds, which amounted to more than $1,000,000. This is stated to be the cause of the present trouble. Plants of the company are at Bridgeport, Conn., and Providence.

COMMITTEE TO DIRECT PREMIER

INDIANAPOLIS, Feb. 21—The board of directors of the Premier Motor Corp. has appointed a special committee to direct the affairs of the company because of the death of Dr. L. S. Skelton, president. This committee is headed by I. F. Schaefer and includes Newton P. Hutchinson, A. Follansbee, J. D. Sutherland, the Fletcher American National Bank and the George W. Goethals Co. The Goethals company has been retained to make a complete study of the Premier situation.

MERCEDES SOON TO ARRIVE

CHICAGO, Feb. 18—The new 6-cylinder Mercedes car is expected to arrive in this country in the next thirty days. It will sell for $10,500, chassis complete, and will be handled in the Chicago territory by the Mercedes Agency, 30 North Michigan Boulevard.

British May Change Yearly Show Plan

Annual Olympic Exhibit Loses Favor With Manufacturers— Not Justified by Trade

LONDON, Jan. 27—(*Special Correspondence*)—The statement which has been rife to the effect that the next Olympia car show is to be held *in September*, is at best premature, and most probably quite impossible of being realized. It would be nearer to the truth to state that a movement finds increasing favor *in the trade to forego the yearly show*, but it is not so *certain whether the view inclines to a more or less total abandoning of the show or to holding it in alternate* years, as in Paris.

Considering that cars are becoming stereotyped in design, that standardization bids fair to reduce varieties of types and makes, and, above all, that *the show is a tax on the industry*, it is not surprising that the matter of abandoning an annual show is becoming prominent in the trade.

Last year's show is reported to have yielded a normal year's profit despite much higher administrative and other costs. Nevertheless it was not justified by the trade it brought, so that on this account and others, it is not surprising that the movement against, at least a yearly show, is gaining support.

Dealers as a body, especially the leading ones, are averse from a yearly show. They say that they can do all their business locally, and that the show period tends to disturb normal business. Manufacturers who dissent from the yearly show ideal say that its purpose so far as it is a means of financing the trade society can be accomplished by a levy on members, varying with their turnover and output or some other reasonable means of assessment.

DUDLO EXTENDS PLANT SITE

FORT WAYNE, IND., Feb. 19—The Dudlo Co., which in normal times employs about 1000 men, has announced the purchase of six acres of ground adjoining its present plant upon which additional buildings will soon be erected. The company makes insulated wire for automobiles and other automotive products. Its principal customer is the Ford company. At the present time the plant's departments which work on Ford material are shut down.

DUPLEX OFFICERS ELECTED

BEAVER DAM, WIS., Feb. 21—At the annual meeting of the Duplex Storage Battery Co. of Beaver Dam, Wis., a $1,000,000 corporation manufacturing storage batteries, the following officers were elected: President, John W. Deniger; vice-president, John V. Zweck; secretary and general manager, Peter M. Kettenhofen; treasurer, M. A. Jacobs. The directorate was increased to two members.

S. T. D. Enter 3 Cars For Indianapolis

Sunbeams and Talbot-Darracq to Be Driven by Boillot, Resta and Thomas

PARIS, Feb. 5—(*Special Correspondence*)— The European representative of the Indianapolis Motor Speedway Co. has received the official entries of one Talbot-Darracq and two Sunbeam cars for the next 500-mile race on the Hoosier track. André Boillot has been selected to drive the Talbot-Darracq, and Dario Resta and René Thomas will be at the wheel of the two Sunbeams. All three men have had previous experience at Indianapolis; Thomas and Resta each having finished first and second in previous races. Until this year André Boillot was a member of the Peugeot team.

The Talbot-Darracq and the Sunbeam cars form part of the Franco-British syndicate known as the S. T. D., comprising Sunbeam, Talbot and Darracq. There is one experimental department, under the control of Louis Coatalen, for the three firms, and the racing cars are consequently all of one design. The Sunbeams, however, have been built at Wolverhampton, England, while the Talbot-Darracq are being produced at the Darracq factory, near Paris. For the first time eight cylinder ahead engines are being built, the bore and stroke being 65 by 112 mm., which brings the piston displacement just inside the 3-litre limit.

Louis Coatalen, who will accompany his team, states that the cars will be rushed back to France immediately after the Indianapolis race in order to take part in the French Grand Prix at Le Mans, on July 24. In the French classic the S. T. D. combination will have seven mounts, as follows: two Sunbeams, drivers André Boillet and René Thomas; three Talbot Darracq, drivers Zobrowski, Seagreave and H. J. Cooper, and two Talbots to be handled by K. Lee Guinness and D. Resta.

Moto-Meter Establishes European Production

NEW YORK, Feb. 21—Arrangements for the establishing of branch factories of the Moto-Meter Co., Inc., of Long Island City, in England and France, have been made by President George H. Townsend and E. V. Hennecke, the sales manager, who recently returned from abroad. The Benjamin Electric Co., Ltd., of Tottenham, London, will have charge of the manufacture in England, and the French factory will be conducted at 50 Avenue de la Grand Armee, Paris, by F. Represseau et Cie. Both factories already are in operation.

A Canadian factory will be operated at Hamilton, Ont., under the direction and supervision of the home office. S. E. Ryder will be in active charge.

Money Need Hurts British Industry

Austin Would Defeat American Competition With Increased Capital—Trade Has Bad Name

LONDON, Jan. 27 (*Special Correspondence*)—Sir Herbert Austin, M.P., head of the Austin Motor Co., at a meeting this week of Austin stockholders held that the British industry *is under capitalized for current and future needs. He said if it had* $125,000,000 *it could build cars just as cheaply as Ford, and that competition in the future with British cars would be less from America and more with European countries.*

He admitted that the motor trade had "a bad name" among city interests, but could see no justification for the fact. He referred also to what he considered the unfair competition the British makers have to face in foreign countries and in British colonies, and stated that *there were thousands of foreign cars at foreign and colonial ports awaiting disposal by auction.* Despite all these difficulties, he stated that some British firms were selling treble more cars than at the corresponding period before the war.

The position, said Austin, is that the industry wants more capital; the city investors think that it has had more than enough. It is for the public to decide. In other words, *it is a matter of restoring public confidence in the industry's prospects which, unfortunately, have been badly shaken by the failure of the trade to justify the post-war hope for its recovery.*

France Makes Changes in Regulations Governing Fuel Consumption Tests to Be Held at Le Mans

PARIS, Feb. 5 (*Special Correspondence*)—There will be a repetition of the French fuel consumption tests of last fall on May 14 and 15 next, when more scietific measures will be adopted than were possible for the initial test. The event will be held on the closed course at Le Mans, selected for the French Grand Prix race. It is 10½ miles round, and practically level. A distance of about 150 miles will have to be covered, but by reason of the shortness of the course it will be possible to maintain accurate control over the competitors.

This year's event will be open to stock cars only, cyclecars and motorcycles being excluded. Fuel will be given out to the competitors the day before the competition, and the cars will all be kept in a closed park until the time for starting. They will then be pushed to the starting line, and as the amount of fuel is calculated according to piston displacement and weight, the winner will be the one covering the greatest distance.

Among the changes are a minimum speed for each individual lap, and a speed competition on the day following the fuel trials, without any change being made on the carbureter adjustment. Last year all the competitors adjusted their carbureters for speed after the fuel trials. Any kind of fuel can be used.

Six classes are provided for, beginning with machines of 61 maximum cu. in. piston displacement and increasing to a class of more than 275 cu. in. The following table shows the minimum weight for each class, the minimum speed to be maintained, and the allowance of fuel, in American gallons, per 62 miles. Corrections will be made on this amount according to increases in weght and in piston displacement.

Class	Piston displacement cubic inches	Minimum weight pounds	Minimum speed miles per hour	Fuel allowance, Gallons, per 62 miles
1	61	1212	15.5	1.32
2	85	1873	19.8	1.58
3	122	2535	22.3	1.90
4	183	3086	24.8	2.19
5	275	3527	28	2.51
6	Above 275	3857	31	2.91

PATENT OFFICE BILL FAVORED

WASHINGTON, Feb. 18—The House this week accepted the conference report on the Nolan bill providing for increases in the force and salaries in the Patent Office and for other purposes. The section imposed by the Senate vesting authority with the Federal Trade Commission to accept assignment of patents made by government employees except employees of the Patent Office, was accepted by the conferees and the house. The commission will have power to administer government patents and the right to say who shall have commercial rights, where the inventor surrenders his patent and rights thereto to the government.

AUTHORIZE AIRCRAFT PAYMENTS

WASHINGTON, Feb. 19—Manufacturers of aircraft now engaged in fulfilling Government contracts entered into prior to June 30, 1920, will be paid provided the recommendations contained in the report of the House appropriations committee are approved. The fortification bill as reported out carried a provision authorizing the expenditure of $688,277.60, the sum requested by the Secretary of War. The majority of these contracts are only partly completed and the manufacturers advised the War Department that an extension was required.

Big Tractor Demand Foreseen in South

Diversification of Crops as Outlined Creates Wide Need for Power Equipment

ATLANTA, Feb. 19—That the widespread program of crop diversification that is to be followed in the South this year will serve to materially increase the demand for tractors and power farming machinery, and that the effect of this program will be lasting so far as the future development and prosperity of the power farming industry is concerned in the South, is the opinion expressed by the various branch managers of the manufacturers, most of whom maintain Southern headquarters in Atlanta.

There is little or no doubt but that the South will greatly reduce its cotton acreage this year. This abandoned acreage will be devoted to food and feed crops, and with thousands of Southern farms following this program a broad market is thus created for power machinery, principally tractors. Very few of those farmers who have been devoting their time to cotton for a number of years, and who will this year abandon most of their cotton acreage and diversify their crops, are equipped with modern power machinery.

Agricultural experts of the various State departments contend that diversification, to be practiced with any degree of real success, almost necessitates the use of modern power equipment on the farm, and especially the use of one or more tractors for plowing and cultivating purposes, and a host of other duties that this machine is capable of performing. Without such equipment, it is pointed out, the shortage of farm labor will serve to greatly reduce the agricultural production, as compared with production which could be obtained under the modern and scientific methods of power farming.

States Urge Motorization

For that reason the State agricultural departments of the various Southern States are endeavoring to convince as many farmers as possible that power farming will solve the problem of greater production, enable them to get back on their feet and enjoy their full share of the prosperity. The whole idea is to get as many Southern farmers as possible to using tractors and power machinery before the 1921 spring planting season is at hand.

In the opinion of distributors in Atlanta who cover the whole Southeastern field, right now is the time for the tractor and implement dealers to go after the business. A cotton acreage reduction of from 33-1/3 to 50 per cent is an assured fact, and as the farmer is fully aware that his production will be materially lessened unless he does operate his farm along more scientific lines, he is open for conviction. Experiences of some dealers the past few weeks, who are out after the business, has proven this to be a fact.

The Southern farmers have had this power farming idea drilled into them for the past three years until thousands of them are now "convinced." Power machinery is not so vitally important to cotton production, but it is vitally important to other crops, and the farmers who will practice diversification this year know it.

United States Tractor Adds $300,000 Capital

MENASHA, WIS., Feb. 18—The U. S. Tractor & Machinery Co., at its annual meeting decided to increase the capital stock from $500,000 to $800,000 to accommodate the development of the business. During the year the manufacturing area has been increased from 7500 to 25,000 sq. ft. All of the facilities have been in production steadily, and since Feb. 1, some departments are operating overtime, and night shifts are in prospect. Branches have been established at Kansas City, Minneapolis, Springfield, Ill., and New York City.

W. O. Otis has been appointed sales manager to fill the vacancy caused by the resignation of E. J. Perkins. The tractor line has been increased from one to three models, and the line of governor pulleys from one size to six. Officers were re-elected as follows: President, J. G. Sailer; first vice-president, Christian Walters; second vice-president, George J. Mayer; treasurer, Dr. A. B. Jensen; secretary and assistant treasurer, G. D. Harris; assistant secretary, G. E. Lewis.

TO MAKE TRACTOR IN MEMPHIS

MEMPHIS, TENN., Feb. 21—The Ideal Tractor-Cultivator Co., organized under the laws of Delaware with an authorized capital of $1,000,000 will manufacture a newly patented farm tractor at Memphis. The new firm will be located at the plant of the North Memphis Machine Works on the Belt line. The machine works will continue as before this line being added. J. P. Stanton will continue as manager of the plant. R. L. Tolston of Memphis is the inventor of the tractor. Officers of the company are Robert F. Carr, president of the Union Motor Car Co., president; vice-presidents, W. J. Meyer, Memphis; S. B. Street, Columbus, Miss.; R. F. Moorehouse, Springfield, Mo. R N. Phillips, of Memphis is secretary and treasurer.

STOUGHTON APPROACHES NORMAL

STOUGHTON, WIS., Feb. 21—As the result of orders taken at the various shows held so far this year, the motor truck division of the Stoughton Wagon Co., is increasing its force and probably will be employing a normal force by March 1. Other departments, which manufacture farm wagons, manure spreaders and similar equipment, are still running at a relatively small part of capacity, but new orders are being received in an encouraging volume.

Tractor Study Shows $4.21 Cost an Acre

Depreciation Shown High in New York State Analysis—Average Life Six Years

ITHACA, N. Y., Feb. 21—From studies of the cost of tractor operation made on eighty-seven New York State farms for the year 1919, the State College of Agriculture finds that the average cost of operation of a tractor without an operator was $1.16 an hour. The average cost of a tractor operator was 50 cents an hour and the average cost of the two-bottom plow was 36 cents an hour, making the average tractor cost operator and plow $2.02 an hour. The average rate of plowing on these farms was 4.8 acres in ten hours of work, making the average cost of tractor plowing $4.21 an acre. With present fuel prices, this cost would be slightly increased, and varies as fuel costs advance or decrease.

The average annual cost of tractor operation on these farms was $600 for tractor and operation. The largest single item of cost was depreciation, which amounted to $187.25, while the average life of the tractors amounted to six years. Other costs in order of importance were: Tractor operation, $166.63; fuel, $137.38; repairs, $44.25; interest, $39.72; chore and other work on tractor by farm labor, $38.94; lubricants, $37.58; other costs, $8.25.

The average number of hours worked by these tractors annually was 425, of which 321 hours were drawbar work and 104 hours belt work. This number of hours may be compared with the average number of hours worked by a horse on New York farms, about 900 to 1000 hours annually, or about three hours for each working day. The smaller number of hours worked by a tractor is due partly to the fact that the tractor completes the heavy work in a shorter space of time, and partly to the fact that it is less adaptable than horses. Many kinds of horse work cannot be done with advantage by the tractor, but most of the heavy work can. There is a growing tendency to apply the tractor to new tasks as operating experience increases.

Working Hour Range Wide

The number of hours worked by tractors on different farms ranged from 47 to 1277 for the year. Those farmers, who were able to keep their tractors busy at profitable work were able to reduce considerable the tractor cost. On nine farms on which tractors were used an average of 1001 hours each for the year, the average cost without the operator was 85 cents an hour, while on 31 farms on which tractors were worked an average of only 203 hours for the year, the average cost an hour was $1.72 for the tractor without the operator. Including the cost of operation and plow the respective hour cost would be $1.71 and $2.58, and the respective costs of plowing an acre $3.56 and $5.38.

Ford Predicts 70,000 March Output

Dismisses Stories of Financial Need

Now Employing 15,800 Men in Alternating Shifts—Car Surplus Nearly Liquidated

DETROIT, Feb. 23—In an interview to-day with a representative of AUTOMOTIVE INDUSTRIES, Henry Ford declared that 15,800 men now are working in the Highland Park plant. Production ranges around 2200 cars daily. Finished cars, together with engines and parts for the assembly branches, constitute the Highland Park output.

Ford said the company had 95,000 cars in the hands of dealers when the plant closed just before Christmas and 30,000 more under construction at branches. The 30,000 were finished in January while the Highland Park plant was closed. Retail sales aggregating 57,000 cars in January liquidated the 30,000 in the assembly branches and 27,000 of the 95,000 in the hands of dealers.

Retail sales the first half of February were 42,000 and total production 35,000. If this ratio of sales continues, approximately 50,000 of the surplus will have been liquidated this month. Ford said the March dealer requirements would be 70,000 and the plant would build 3100 daily in March.

Uninterrupted operation and increases in the working force, as well as an output in conformity with demand, will depend entirely on steel prices, Ford said. The River Rouge plant has not been closed at any time and approximately 1000 men have been employed there continuously. The force was increased today to 2600 manning the blast furnaces, building tractors, and doing other work. The production schedule for tractors now is 100 daily.

Ford dismissed questions regarding financing by saying, "The best indication of our position is the fact we are going to build 70,000 cars in March and we could not buy materials and meet payrolls without money."

Future of Industry Assured

Ford is highly optimistic and has full confidence in the future of the industry as well as its continued improvement. He said the rotating system of employment would be continued until the main factory is again in normal production. All men who are to be retained permanently will be given an opportunity to get part time work. No wage reductions on specific jobs will be made, Ford said, and there will be no reduction in the minimum wage.

E. C. Kanzler, brother-in-law of Edsel Ford, apparently is functioning at the Highland Park plant as production manager and Charles E. Sorensen as general manager. It is understood the policy of the company in future will be to abolish titles and that six or seven men will handle the work. They will specialize along certain lines but without titles.

NEWS BULLETINS

WASHINGTON, Feb. 24—Recommendations of the War Department for the disposal of surplus automobile equipment were adopted by the Senate committee on military affairs in reporting the army appropriation bill to the Senate to-day. The item, if passed without amendment, would to a large extent block efforts of Congressman Anthony of Kansas to dump army automobile equipment on the open market. The Senate bill specified that the total transfers and sales during the first six months of the present calendar year must not aggregate in excess of 10,000 motor trucks and 2000 passenger carrying automobiles.

The House bill, which carried the Anthony provision, required the sale and not transfer of motor vehicles. Brigadier General Lord told the Senators this week "the House committee put that word 'sell' in there with malice aforethought so that the money would go into the treasury" and Senator Lenroot, of Wisconsin, agreed with him. Under the proposed legislation now before the Senate all points of law are met because under existing law the War Department must give other Federal departments a choice of trucks.

NEW YORK, Feb. 24—A. B. Jones, formerly vice-president of the B. F. Goodrich Co., has been elected president of the Kelly-Springfield Tire Co. He will succeed F. A. Seaman who was acting temporarily as president. Seaman was elected a vice-president of the company.

CHICAGO, Feb. 24—The Stewart-Warner Speedometer Corp. has acquired the speedometer business and certain assets of the Van Sicklen Speedometer Co. of Elgin. The purchase did not include the capital stock which will retain its corporate entity. The Van Sicklen Co. is controlled by John N. Willys interests and has a new factory at Newark, N. J., which never was occupied.

NEW YORK, Feb. 24—An air mail plane which left San Francisco Tuesday arrived in New York yesterday afternoon. The mail was on the way only 33 hours and 20 minutes and the flying time was 25 hours and 53 minutes for the 2666 miles covered. The feat was made a success by a daring night flight from Cheyenne to Chicago through heavy storms. The flight was characterized as "a most momentous step in civic aviation."

Trucks Clear Snow in New York Storm

Motor Equipment Keeps Streets Open to Traffic in Season's First Test

NEW YORK, Feb. 23—Modern snow fighting equipment and a comprehensive plan of campaign enabled the Street Cleaning Department of New York to score a comparatively easy victory over the first heavy snow fall of the winter. The main arteries of traffic had been cleared by Monday night of the 13 in. which fell Saturday night and Sunday. More miles of streets had been cleared to-day than two weeks after the big storm last winter when the fall was not so deep. Four factors made the campaign a success. They were:

First—The equipment, consisting of 150 tractors, 350 trucks, over 600 push plows, about 150 four-wheel pull plows, 1800 department carts and about 850 contractors' vehicles which went to work very nearly on schedule time.

Second—The plan, begun last July, of training as many men as possible in four different schools in driving and handling this equipment made efficient work possible. By December these four schools had trained 649 men as drivers, so that all passed their licensing tests and became licensed chauffeurs.

Third—The entire city was divided into small zones, the equipment distributed in these zones, and every man assigned to his zone. At the same time each police station had a list of the snow fighting men living on the beats in that precinct, and the police were instructed to 'phone the police station the moment snow began to fall and get a list of these men.

Fourth—The street railway lines have about 3,000,000 sq. yd. of surface from which they were required to remove the snow altogether, not merely push it from the tracks. By agreement, the lines were given a full street, from houseline to houseline, approximating this area, which they were to clean entirely and which they did clean. In return, they were allowed to clear the tracks with sweepers and the city took care of the snow thus cleared.

Mishaps Prove Slight

There were only two hitches. Some of the push plows were installed on the heavy tractors without a bracing bar with which they were supposed to be fitted. As a result, five of these plows were put out of commission by the heavy tractors and one by one of the lighter tractors. The other mishap was on Sunday when gasoline supplies gave out for a time.

Goodyear Canvasses for Support of Plan

Officials Assigned to Visit Stockholders to Enlist Support in Financing Move

AKRON, Feb. 21—Many officials of the Goodyear Tire & Rubber Co. have been dispatched to all points of the compass to visit stockholders of the company and explain the proposed refinancing which will involve $85,000,000, so as to have enough favorable proxy votes of stockholders to insure ratification of the plan at the special stockholders' meeting called for March 4.

Stockholders' proxies are not coming as fast as had been anticipated, it is said. Officials of the company in sending notices to stockholders urged them to appreciate the necessity of extreme promptness in returning signed and voted proxies. The slow returns from these notices is said to have prompted the company in sending many of its men on the road, to visit stockholders and gain their signatures to proxies for the March 4 meeting.

Stockholders are asked to vote on several important matters vitally affected by the proposed refinancing, and upon the ratification of which it is said the definite consummation of negotiations hinges. Unless the plan is accepted by both stockholders and merchandise creditors it is recognized that the only alternative is a receivership.

It is admitted openly in Akron that the whole future of Goodyear depends upon approval of the financing plan by stockholders. The Goodyear company is so big, the ramifications of its interests are so far-reaching, and its place in the American industrial structure is so prominent, that anything looking to its failure would amount to nearly a calamity. Two months ago stockholders agreed to a plan of issuing $50,000,000 first mortgage bonds, but it having been found that other securities must be issued in order to completely satisfy the situation, additional consents must be secured to the new plans involving $85,000,000. The failure of Goodyear would amount to a business disaster which would be so far-reaching as to affect many other lines of industry.

Hesitate On Added Burden

It is also stated that stockholders having already approved the $50,000,000 refinancing plan, feel considerable hesitancy about giving new consent to added encumbrance of the company's property and inventories without first having it explained to them exactly why such additional financing is necessary.

Since the issuance of the annual statement of Oct. 31, 1920, the company's indebtedness, including contingent liabilities, has increased nearly $66,000,000, largely by reason of delivery of raw materials contracted for at high prices, and also by reason of further depreciation of materials delivered and covered by contracts for future deliveries. In December it was estimated that the company's deficit was $24,400,000, and that at the present time the additional estimated depreciation of materials contracted for but not yet delivered is $18,247,000.

The statement on present debt and capitalization shows a bank debt of $44,981,500. This includes $18,825,000 as a special secured loan negotiated last November, $13,594,000 including other obligations secured by rubber used in current operations, and $12,202,500 of unsecured notes and other commercial paper. Other secured notes payable are listed at $467,830, and bills receivable discounted by the company are listed at $1,970,000.

Merchandise Debt $11,305,104

The merchandise debt is listed at $11,305,104. Taxes will amount to $4,387,026, preferred stock subscriptions of employees to be refunded of $318,701, and miscellaneous indebtedness of $413,573. With other contingent estimated obligations of $2,120,556, the company's total indebtedness so listed is placed at $65,964,290.

Present commitments for future deliveries of merchandise on which specifications and prices have been fixed total $54,959,503. This sum includes $7,200,740 on rubber, $5,664,000 on cotton, $41,879,763 on fabric, and $215,000 on other materials. In addition the company estimates its depreciation of materials covered by commitments, not heretofore written off, of $18,247,000.

The approximate capitalization is $65,000,000 of 7 per cent preferred stock and $61,000,000 of common stock.

Bankers Extend Loan

NEW YORK, Feb. 23—The loan of $18,825,000 which was made to the Goodyear Tire & Rubber Co. several months ago by a banking syndicate headed by Goldman, Sachs & Co. and which matured Feb. 15, has been extended for 30 days with an option on a further extension of 60 days.

NEW CASTLE RECEIVER NAMED

NEW CASTLE, PA., Feb. 18—E. W. Beadel, local manufacturer, has been appointed receiver for the New Castle Rubber Co., in a meeting of creditors this week. The company failed during the recent financial reorganization of the Goodyear Tire & Rubber Co., although not an allied property. A quantity of Goodyear stock was listed as a large portion of its assets. F. A. Seiberling was not individually interested in the company, but it is understood that his son had a prominent part in the organization of it.

FILE NEW FORT WAYNE SUIT

FORT WAYNE, IND., Feb. 19—Another suit on account and for the appointment of a receiver has just been filed against the Fort Wayne Tire & Rubber Co. The complainant is the Quaker City Rubber Co. The demand in the complaint is $35,000, making a total of $136,000 demanded from the company in four suits.

Kalamazoo Plants Increase Operations

Fuller Finds Healthy Tone to Business—Barley Looks to Good Sales Year

(*Continued from page* 475)

since the shows in New York and Chicago" said Handley. "We have made numerous favorable distributing connections and look for a steady increase in our business. Our new car is well received wherever shown and I predict a ready market for all we can make this year."

Frank D. Fuller, president of Fuller & Sons Mfg. Co., reported that business is quiet, but enjoys a more healthy tone than anytime within the past three months.

"We are equipped to do a large volume of business" said Fuller. "That is shown by the fact that during the first nine months of 1920 we were able to produce three million dollars worth of truck transmissions. We are operating on part time schedule at this time, but are planning to steadily increase our working force."

The Barley Motor Car Co., makers of the "Roamer," enjoyed their best year during 1920 and are now preparing for a good run this season. It is expected to nearly equal the 1920 production. The car is meeting with added favor year by year.

The Dort body plant is now ready for a large production when the demands require it. The equipment throughout is high class and the two big structures have been laid out so as to provide the greatest efficiency in operation. A small force of men is now employed and Will Henderson, manager, believes that many more hands will be required in the near future.

While it is particularly quiet in the truck and tractor lines, both the Kalamazoo Motors Corp. and the Reed Foundry & Machine Co., makers respectively of the "Kalamazoo" truck and the "Reed" tractor, look forward to an early revival in trade.

TO EXTEND FORT WAYNE PLANT

FORT WAYNE, IND., Feb. 19—The General Electric Co. has purchased sixty acres of ground for the expansion of its local plant, which during normal business conditions employs about 6000 men. The local plant makes a large quantity of electrical equipment for automotive concerns.

WESTERBURG RECEIVER NAMED

NEW YORK, Feb. 23—J. N. Warren has been appointed temporary receiver for C. H. Westerburg & Co. of this city. He is serving without compensation in an attempt to bring about an agreement among the creditors which will forestall attempts to have the company declared bankrupt. The assets of the company virtually balance the liabilities.

Army Starts Sale of Surplus Cars

Anthony Bill Faces Probable Defeat in Senate—Legislation May Be Delayed

(*Continued from page* 474)

and 1000 automobiles. His move has been met with proposed bills requiring the transfer to the Bureau of Public Roads and subsequently the sale to State highway departments at a nominal sum.

It is understood here that Senators will block the Anthony amendment when the Army bill is called up, and substitute a proviso authorizing transfers. According to Senate leaders, there is a chance that President Wilson will veto the Army appropriation measure because it contains certain features objectionable to him. In that event, it would appear that the bill must go over until the extraordinary session of the Sixty-seventh Congress which will be called in March or early in April. The Army will have sold a large share of the equipment and the Anthony amendment rendered useless.

It is likely that the next sales of surplus equipment will be held at Camp Jessup near Atlanta, a concentration camp for the Motor Transport Corps; El Paso, and San Antonio, Texas for equipment held on the border, Jeffersonville, Ind., for equipment owned in the Middle West, San Francisco for machines held in the West. The Motor Transport Corps also has depots at Columbus, O., New Cumberland, Penn., Perth Amboy, N. J., Schenectady, N. Y., and Norfolk, Va. They have not yet determined where the next sale will be conducted.

It is customary to allow bidders to inspect the equipment for three days prior to sale and then bid according to auction lot numbers listed in the official catalogue. Inasmuch as machines are not ready for operating under their own power, the successful bidders are urged to make preparations for immediate removal as the liability is assumed immediately after the sale. The sales are conducted by professional auctioneers. Judging from the prices obtained at the Baltimore sale, the auctions throughout the country will net the Government several millions.

SEEK REPEAL OF PUMP RULING

MILWAUKEE, Feb. 21—An appeal by manufacturers of certain types of gasoline pump equipment from the ruling made a year ago by the Industrial Commission of Wisconsin, prohibiting the use of visible tank pumps, is under consideration. It is said there is small hope for a repeal of the order. Manufacturers of visible tanks claim it is to the best public interest that the visible type be permitted, so the consumer may be able to determine for himself if he is getting the amount of gasoline he pays for. The opposition, headed by Frank R. Daniel, chief inspector of the Wisconsin Fire Inspection Bureau, contends that the number of filling station fires has been increasing; that in other States serious fires and catastrophes occurred from the use of visible tanks and electrically driven pumps, and that there have been cases where the rays of the sun caused losses by ignition from the focusing of the rays through the glass tanks.

General Motors Assets Increase $156,100,479

NEW YORK, Feb. 21—Estimated consolidated balance sheet of the General Motors Corp. and subsidiaries as of Dec. 31, 1920, compares as follows:

ASSETS

	1920	1919
Real estate plant eq.	$248,000,000	$153,803,642
Misc. Inv.	63,000,000	53,398,491
Cash	49,278,000	48,231,200
Lib. bds., etc.	....	213,219
Sight drifts	11,000,000	....
Nts. & accts. rec., etc.	37,661,000	37,694,267
Mkt. Secur.	....	989,448
Inventories	166,000,000	128,696,652
Def. exp.	5,090,000	3,301,713
Goodwill pat., etc.	22,724,000	20,323,889
Total	$602,753,000	$446,652,521

LIABILITIES

	1920	1919
Db. 6% stk.	$56,368,100	$68,339,300
Db. 7% stk.	25,153,500	....
Pfd. stock	16,183,400	16,957,000
Com. stock	356,300	153,411,000
Com. stock	205,170,550	....
Pur. money bonds	1,443,000	150,000
Pur. money notes	9,840,000	....
Bonus stock awarded	....	7,848,570
Sub. stock & capital	1,788,000	1,585,344
Accts. pay	25,794,000	37,846,813
Notes pay	72,225,000	28,652,318
Taxes, payrolls etc.	12,000,000	11,521,771
Pf. divs. due	1,025,000	829,882
Res. for dep.	35,742,000	....
Res. for tax, etc.	4,500,000	36,262,473
Res. for empl. bonus	1,080,000	....
Res. for cont.	6,552,970	4,546,653
Surplus	127,531,180	78,641,897
Total	$602,753,000	$446,652,521

Baltimore Buyers Pay $40 to $2400

(*Continued from page* 474)

John C. O'Brien, general manager of the Baltimore Automobile Trade Association, said the association's members protested to the Government because of the injustice of bringing machines from all over the country to be sold in this city. This, the dealers believe, would have a serious effect on future business here. They sought to have the Government sell the cars at the various Motor Transport Camps instead of bringing them to Baltimore.

FULLER REELECTS OFFICERS

KALAMAZOO, MICH., Feb. 21—Fuller & Sons Mfg. Co. report the result of their annual election as follows: President, Frank D. Fuller; vice-president, L. C. Fuller; secretary, Walter P. Fuller; treasurer, W. E. Upjohn. The above and S. N. Bickerstaff constitute the board of directors.

Metropolitan S. A .E. Visits Cooper Union

Laboratory Equipment and Testing Machines Discussed—Frame Design Merits Considered

NEW YORK, Feb. 18—The regular monthly meeting of the Metropolitan Section of the Society of Automotive Engineers was held last night in the Cooper Union Laboratories. Members of the section were given an opportunity to inspect the laboratory equipment, much of which was in operation. An automobile engine fitted with pressure indicating devices was run on the dynamometer stand. Two O'Kill pressure indicators were used to determine the maximum compression and explosion pressures and a Hospitalier manograph was arranged to project an indicator card on a screen provided for the purpose. The relative merits and utility of the two devices were later discussed.

In the strength of materials testing laboratory tension, torsion and fatigue testing machines were seen in operation, two of these being arranged to draw autographic records of the tests.

The paper of the evening was by Ethelbert Favery, who conducts the course in motor vehicle engineering at Cooper Institute. His talk dealt with a method of analyzing the stresses in automobile frames due to loading and road shocks, and included the development of a stress and shear diagram. The discussion which followed indicated that there is much interest in the matter of frame design.

Most of those who spoke appeared to favor rigid as against flexible or semi-flexible types. Three point suspension of the frame on the axles and of the engine in the frame, was favored by some speakers as tending to reduce distortion. One speaker stated that the tendency in passenger car design is toward deeper sections and stiffer construction in general.

Both the meeting and the dinner which preceded it were well attended.

COST MARK BILL OPPOSED

NEW YORK, Feb. 23—The Rubber Association of America has urged its members to oppose vigorously a bill introduced in the Minnesota legislature which would require the marking of merchandise with the manufacturer's cost, price at which it was sold to him, name and address of its distributor and the retail price of the article.

RESUME FORT WAYNE BUILDING

FORT WAYNE, IND., Feb. 19—The Greater Fort Wayne Development Co., which is putting up the homes to house the workers who will be employed at the new International Harvester plant here, is going right ahead with its work. It is expected that work on the Harvester plant will be resumed within a couple of months.

Decline Road Action Under Present Plan

Congress Asserts Highway Funds Now Being Wasted—Will Demand Results

WASHINGTON, Feb. 18—Efforts to force a continuation of Federal aid appropriations for highways by a rider on the Postoffice appropriation bill were defeated in the Senate to-day and assurances given that the proposed plan for a national system of highways as advocated by the automotive industry and organized automobile owners would be considered at the extraordinary session of the next Congress. Senator Thomas, Democrat, of Colorado, supported Senator Townsend, Republican, of Michigan, and chairman of the Senate committee on Postoffices and Roads, in opposing the amendment of Senator Swanson of Virginia. The Colorado Senator's threat to filibuster indefinitely against the proposed amendment served its purpose and the Senate rejected the Federal aid proposition.

Senator Swanson sought to persuade the Senate to accept his amendment which was the Federal aid bill passed in the House last week. He contended that 43 State legislatures would adjourn in March without knowing what the Federal Government was going to do in connection with road improvement. The Bureau of Roads data showing that on December 31, 1920, $149,683,107 was either under actual construction or completed leaving $117,066,893 on that date available for new contracts was submitted to the Senate.

During the debate on the amendment, Senator Townsend advised the Senate that the committee on postoffices and roads would undoubtedly report on the national highway system measure and other road measures now pending in committee. He expects that action will be taken by Congress before July 1. He pointed out that it was necessary to devise a scheme to get results for money spent on roads instead of wasting it under present method of distribution.

ARMY AIRCRAFT BILL OFFERED

WASHINGTON, Feb. 19—Senator New of Indiana has introduced a joint resolution which would authorize the Air Service of the Army to conduct extensive investigations as to the need of new designs in aircraft engines and other equipment used in aerial offense against seacraft. The legislation directs that obsolete warships should be turned over to determine the effects of missiles dropped from aircraft. Airplane builders expect that the tests will lead to more extensive use of bombers.

AEROMARINE TO OPEN SCHOOL

NEW YORK, Feb. 21—The Aeromarine Engineering & Sales Co. will open a training school for aviators this spring at Raritan Bay, Keyport, N. J., according to C. F. Redden, president of the company. It will be operated in connection with the sale of surplus navy flying boats recently taken over by the Aeromarine company. Students at the Aeromarine school will receive instruction in both land and water flying, giving particular attention to straight flying and navigation necessary in operating passenger carrying machines. They also will be taught practical airplane construction.

Price Guarantee Merits to Be Ruled on Singly

WASHINGTON, Feb. 18—Economic readjustment has forced the Federal Trade Commission to adopt an open attitude in regard to guarantees against price declines in business. It was announced this week that the Commission would consider the merits of the practice in specific cases rather than consider the subject in a general way.

The Commission finds that so many complaints have been received about the practice of manufacturers guaranteeing commodities in the hands of wholesalers against decline in price, that an inquiry showed the impossibility of dealing with the matter in its broad aspects. The Commission will consider the legality of each case and its effect on business.

Truck Limit Ruling Restrained by Court

YOUNGSTOWN, OHIO, Feb. 18—Scoring a partial victory against the Mahoning County commissioners in a fight to prevent restriction of heavy duty truck operations, attorneys for the Youngstown Automobile Dealers Association have obtained from the Appellate Court a temporary restraining order, preventing the commissioners from enforcing their bridge weight limitations. Judge Cooper in Common Pleas Court this week dissolved a temporary injunction which he had granted three weeks ago. In raising the bar, Judge Cooper issued a decision supporting the rights of the county commissioners to limit the bridge weight capacities, but based this ruling on his interpretation of statutes that this action could be taken only to safeguard life and property, and that such action could be effective only for a "reasonable time" in which to carry out repairs and reconstruction.

UNION RETAINS OFFICERS

BAY CITY, MICH., Feb. 18—No changes were made in the officers or directors of the Union Motor Truck Co., which met at its annual meeting a few days ago. During the past year earnings were such as to enable the company to pay charges and dividends on its preferred stock and to leave a surplus over all liabilities. The company bought more than $270,000 worth of materials from Bay City merchants and paid out more than $250,000 in wages. Production has been cut down, but there has been no complete shut down.

Little Car Claims Asserted Falsities

Six or Seven Cars Made All Different Is Testified—Blacksmith Made Parts

DALLAS, TEX., Feb. 19—Blacksmiths made a great many of the important parts of the first automobiles assembled at the plant of the Little Motor Car Co., according to testimony given in Federal Court here at the trial of W. S. Livezey, president of the concern, and other officers and promoters charged with using the mails to defraud.

The company was thrown into the hands of a receiver and the arrest of Livezey and others followed more than a year ago, after thousands of persons had subscribed to stock in it at $1 and $2 a share.

C. E. Peters, consulting engineer of Cleveland, who came to Dallas early in 1920 to superintend the assembling of the first cars, said he found many important parts had been made by a Dallas blacksmith. These included spring pads and spring clips, the steering wheel link and one of two brake drums. Of the two brake drums, he said, one was a Ford part and the other was a home-made affair, and neither was suitable for the brake design called for. The stability, workmanship and construction of the first cars, he said, were very crude.

"There were six or seven cars on the floor," he declared, "and no two of them were alike."

The officers of the concern, he said, took little interest in the work and never consulted him or advised with him. One of them, he said, put a wooden frame on one car and spent the rest of his time painting his own touring car which he had recently purchased.

In advertisements it was claimed that $1,000,000 worth of material was on the ground. This statement, employees have testified, was utterly false. Other claims in a letter to a prospective purchaser were that the company had so many orders it could not find time to answer mere inquiries.

FISHER UNIT NEAR COMPLETION

CLEVELAND, Feb. 21—The mammoth body building plant of the Fisher Ohio Co. is nearing completion and is expected to be in operation on March 1. The plant, which is one of the largest industrial units in the State and is said to be the last word in construction for automobile body building, is equipped to do a business of $20,000,000 a year. The Detroit company will provide the new company with that much business.

The Fisher corporation guarantees the 8 per cent dividend on the Fisher Co. from April, 1920, until July 1, 1922, the first payment of which was made Jan. 1. After that time it is expected that the Ohio company will be able to keep up its dividends on its preferred stock.

INDUSTRIAL NOTES

Stout Engineering Laboratories, Detroit, in which the new Stout batwing monoplane is being produced, are being moved this week to a large building on Beaubien Street. The factory now has $500,000 worth of orders booked, according to officials, and all of these are scheduled for delivery this year.

United States Motor Truck Co. has established a distribution connection in Kansas City. The new company is affiliated with the St. Louis sales company and the Marion County Motor Co. of Centralia, Ill.

American Motor Body Co., which owns the Wadsworth Mfg. Co. of Detroit, is now working 500 men on an old order for Ford Sedan bodies. It has employed 150 men in the finishing room since it reopened, Feb. 1. It normally employs 3500.

Miller Rubber Co. has removed its New York export branch to 121-125 Duane Street, where it will have larger office and storage facilities. The export headquarters will remain in Akron.

Van Briggle Officials Are Indicted for Fraud

INDIANAPOLIS, Feb. 21—Lilburn H. Van Briggle, president of the Van Briggle Motor Device Co., has been arrested on a charge of using the mails in a scheme to defraud, as a result of an indictment returned last Monday to Judge Anderson by the Federal grand jury. He was released on bond of $10,000 and will be arraigned in Federal Court March 7. Henry S. Rominger, treasurer, and Charles A. Taylor, sales manager, also were indicted and arrested on similar charges.

The defendants are charged with making false representations as to the financial condition of the company, which manufactures Van Briggle carbureters and shock absorbers for Ford automobiles, to prospective purchasers of the capital stock of the company. Van Briggle is accused of having purchased large blocks of stock in his company and then selling it to third parties at a high price, representing that it was treasury stock. It is also alleged that he failed to pay for the stock so taken by him.

Charge Fraud in Sale of Victor Truck Stock

BENTON HARBOR, MICH., Feb. 19—E. E. Edgar and John S. Watt of Harvey, Ill., have filed suit alleging misrepresentation and fraud against the Victor Truck Co. of St. Joseph, Mich. The suit is said to be the outcome of the failure of the Baroda Commercial Bank a short time ago. One of the principal defendants is A. E. Rick, president of the defunct bank, from whom a full accounting is asked by the plaintiffs.

The petition asks the appointment of a receiver and a full accounting from F. D. Allis and C. C. Van Wagoner, officials of the truck company.

The petition recites that Van Wagoner by dubious methods induced the plaintiffs to invest heavily in stock in the company. Edgar and Watt, according to the petition, were to be distributors in Wisconsin, Illinois and Minnesota, and they allege they deposited $500 for parts and supplies and bought two trucks for $3,200 on the statement of Van Wagoner that the St. Joseph Co. was financially sound and producing trucks in marketable quantities. These statements, the plaintiffs allege, were untrue.

Petitioners also allege Van Wagoner approached them in January of this year and persuaded them to buy 200 shares or two-thirds of the common stock of the company owned by G. A. Fitch of St. Joseph for $10,000. Half of the money was paid in cash January 8 and a 60-day note was given.

Kelly-Springfield Tire Shows $7,721,901 Profit

NEW YORK, N. Y., Feb. 23—Gross profits of $7,721,901 the second largest in the history of the company, are shown in the annual report of the Kelly-Springfield Tire Co. for 1920. Net profits were $3,430,914, also the second largest ever reported, although unusually large deductions were made leaving a balance of only $1,959,293 before providing for taxes, compared with $2,853,571 for 1919. The deductions in 1920 amounted to $2,076,152 which included $500,000 for fluctuations in inventory valuations as well as for losses on Liberty bonds and deduction of fixed and miscellaneous charges.

After payment of preferred dividends but before allowance for taxes, the amount available for common stock was $1,296,255 or approximately $4 a share on $8,061,000 worth of common stock outstanding Dec. 31 as compared with 50 per cent on $5,361,978 common in 1919.

President Frederick A. Seaman stated that the company had no supplies or contracts for raw materials at former high prices and is in a position to take advantage of low levels for future requirements. The first nine months of 1920 showed marked improvement over the same period in 1919 but there was a marked falling off in business for the last quarter. Completion of the new plant at Cumberland, Md., has been delayed but it is expected to be opened during March.

FORD PATENT SUIT FILED

BOSTON, Feb. 18—A bill in equity was filed in the Federal District Court here by William B. Moses of Watertown against the Ford Motor Car Co. of Detroit, and Laline & Partridge, Inc., 1255 Boylston Street, charging an infringement of patent rights in certain improvements in starting, generating and lighting apparatus, and seeks temporary and permanent injunction restraining the joint defendants from causing to be made or sold or offered for sale Ford motor cars containing an infringement on his invention.

METAL MARKETS

THE nearer we come to the end of the padding that war inflation has wrapped around iron and steel prices the more obvious becomes the irremovable character of that part of the swollen levels which is due to high freight rates. It costs to-day upward of $10 for freight to assemble the iron ore, limestone, fuel, etc., necessary to produce a ton of pig iron. In 1897 and 1898 pig iron sold for less money per ton to the consumer than it costs the blast furnace in freight to-day for the raw material to produce a ton. Until the Interstate Commerce Commission applies the pruning knife to freight rates, there is no possibility of a recession to pre-war prices, even though every other cost ingredient may have been pared to what it was before the war. With reports current that a round tonnage said to approximate 25,000 tons has been taken off the market by speculative interests at a price below $25 for basic, the question presents itself whether the pig iron market can go any lower considering that, deducting the $10 freight on raw material, the blast furnace that sold this tonnage will receive less than $15 for raw material, labor and overhead. Noteworthy also is the character of this transaction, the buyers being speculators who will hold the iron for an advance and the sellers steel producers who do not need it because of the idleness of most of their steel making capacity. In other words, large financial interests believe that, until freight rates are reduced, the pig iron market can not go lower. From the point of view of the automotive foundry buyer, the differentials quoted on foundry and malleable over basic prices are still somewhat askew. To understand clearly the situation in the steel market which newspaper reporters seek to exploit in the only way such material can be turned into "first page stuff," i. e., a battle royal between the Corporation and the Independents, it must be borne in mind that the Corporation, in the very nature of its organism, can not alter its price and operating policies as frequently and swiftly as the smaller interests. It is now shipping steel at somewhat higher prices than those quoted in the open, "independent" market to many consumers to whom it sold much more steel at the same prices last year, while the "independents" were then asking considerably higher levels.

Pig Iron—Middle West automotive foundries have been bidding $26 @ $27 for foundry and malleable, valley basis, producers being apparently disposed to consider negotiations with such bids as a basis and countering with offers of $1 to $2 higher. The situation has narrowed down to a case of haggling over price in each individual transaction.

Steel—Somewhat better inquiry is noted for cold-rolled strip steel from automotive sources. Cold-finished steel bars are sought at concessions which many makers are unable to grant because they depend for their hot bars on the Corporation. Pittsburgh reports state that the Ford Motor Co. and other Detroit passenger car builders are issuing more shipping instructions for sheets.

Aluminum—While some odd lots of foreign 98 to 99 per cent metal are offered at 24c., the general "outside" quotation is 25c., with demand light.

Lead—The chief interest has reduced its official quotation to 4.50c., New York and East St. Louis. The "outside" market is 4.25c., East St. Louis.

FINANCIAL NOTES

Savage Arms Co. reports total earnings for 1920 as $117,000, equal to $1.35 a share on the $7,748,000 of common capital stock outstanding. In 1919 the company earned $2,032,000, which was equal to $19.28 a share. After the payment of common dividends, including the extra payments declared during the year, the deficit for 1920 amounted to $631,000. In 1919 a surplus of $643,000 was reported.

Saxon Motor Car Corp. shows a gain in assets as of Dec. 31 over April 1, 1920, of $484,675. This is represented principally in inventories which increased from $747,493 to $1,770,036, and deferred charges, and machinery, trucks and equipment. Cash decreased from $1,091,151 to $62,561. A decrease in surplus is shown from $4,402,816 to $4,286,700.

Curran Motor Products Co., Detroit, has been organized with a capital of $100,000 to market automobile accessories, chiefly the inventions of Dr. E. T. Curran. Dr. Curran is president; W. N. Nahikian, vice-president; P. M. MacKay, secretary-treasurer, and P. T. Quinn, sales manager.

Dunlop's Ltd. the British tire company which is the parent of the Dunlop American company, proposes to issue debentures amounting to 3,000,000 pounds Sterling at 98 with interest at 8 per cent.. They will run for 20 years with annual drawings for retirement at 105.

Curtiss Aeroplane & Motor Corp. reports a net loss for 1920 of $1,756,582, which includes full depreciation on plant, securities owned, patents receivable and inventories, as well as cost of cancellation of contracts for material. It is declared no new financing is necessary.

Davis Steam Motors, Inc., Detroit, with a capital of $100,000 in shares of $10 par value, has been organized to market a steam engine for use in both passenger cars and trucks. The incorporators are Merrill Davis, E. M. Bliss, F. D. Siebert and A. B. Eggert.

American Bosch-Magneto Co. has reduced disbursements on its capital stock from $2.50 to $1.25 a share. This places the stock on a $5 annual dividend basis as compared with the previous rate of $10.

L. V. Fletcher & Co., New York, manufacturers of carbureters, has filed a petition in bankruptcy, with liabilties of $39,968 and assets of $14,369.

Ajax Rubber Reports $177,920 Loss in Year

NEW YORK, Feb. 21—The report of the Ajax Rubber Co. for the year ended Dec. 31 last, shows a loss of $177,920 after depreciation charges. This compares with a net profit of $2,201,267 for 1919. The balance sheet shows inventories of $7,408,968; notes and accounts receivable of $3,959,947; cash, $301,990, and deferred charges of $336,205. The total assets are $18,376,854. The liabilities include $6,145,000 in notes payable, and $528,292 in accounts payable.

Horace DeLisser, chairman of the board, says in a report to stockholders that the company is in a favorable position because of the comparatively small and evenly balanced inventory as well as because of the small amount of commitments placed for future deliveries of raw materials. At the end of the fiscal year this amounted to only $220,000 for rubber and $1,767,000 for fabric. De Lisser adds that in practically the first year of the company's efforts toward an export business, there were shipments of more than 1,100,000 Ajax tires and tubes to 60 foreign countries.

Apex Seeks Extension; Reorganization Planned

YPSILANTI, MICH., Feb. 23—Creditors of the Apex Motor Corp. have been asked to grant an extension of time for approximately a year to permit thorough reorganization of the company on a basis of reduced overhead and economical operation. The directors have accepted the resignation of O. W. Heinz as president and general manager and elected H. T. Hanover in his place. George P. Listman of Seattle has been elected a director.

A statement sent out by the company states that its financial condition was serious at the time the change of management was made, but that the United Finance Co., the largest creditor, with a claim of approximately $500,000, has agreed to an extension of 30 days to learn the views of other creditors and prepare a financial statement. If the other creditors will agree to an extension, the finance company will advance sufficient funds to get back into production to fill the orders on hand. The agreement with the finance company provides that all future business must be on a C. O. D. basis.

The directors have repudiated a refinancing arrangement entered into by Heinz with C. B. Haffenberg. This arrangement would have provided for the sale of stock and the directors would not permit this action in view of the company's financial condition.

Federal Truck Report Shows $806,812 Surplus

DETROIT, Feb. 17—Federal Motor Truck Co. reports total sales of $10,628,742.09 and profits of $745,878.66 for the year ended Dec. 31. Liabilities aggregating $4,525,340.50 include:

Notes and Accounts Payable	$ 352,734.39
Dealers' Deposits	31,843.93
Land Contract	335,360.00
U. S. Government Claim	359,091.87
Reserves for Depreciation, etc.	577,649.72
Capital Stock	2,000,000.00
Surplus	806,812.76
Assets include:	
Cash	$ 163,293.11
Notes Receivable and Acceptances	68,040.11
Accounts Receivable	160,770.88
Securities	192,505.26
Plant Accounts	1,383,248.90
Merchandise Inventory	2,497,398.25
Prepaid Expense	60,083.99

AJAX SEEKS PLANT SITE

BOSTON, Feb. 21—The plant location of the Ajax Motors Corp., Boston's only motor vehicle builder, has not yet been definitely determined. Pending the construction of its own plant, its products are being assembled at the Tracy plant in Rutherford, N. J.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Feb. 24—The local loan market again eased toward the latter part of the week. Call money ruled at 7 per cent with a range of 6 per cent to 7 per cent as against a range of 7 per cent to 8 per cent the week before. A feature of the week was the reappearance of an "outside" market, where call money could be had at 6 per cent. There was little trading in time money, the supply of which was light until the latter part of the week. Sixty and ninety day paper was quoted at 6½ per cent to 7 per cent, and the longer maturities at 6½ to 6¾ per cent. Corresponding rates for the previous week had been 7 per cent and 7¾ per cent respectively.

Although the excess reserves of the New York Associated Banks declined $7,625,180, the loans and deposits continued to decline. Loans at $5,001,150,000 marked a decline of $20,216,000 from the previous week. Net time deposits declined $11,725,000 and net demand deposits decreased nominally.

The week-end statement of the New York Federal Reserve Bank showed a greatly improved reserve position for the local Bank. Gold reserves increased $25,499,000. Total bills on hand decreased $40,966,000 and total earning assets declined $43,266,000. Net deposits declined $21,101,000. The ratio of total reserves to Federal Reserve note and net deposit liabilities combined, increased from 39.4 per cent to 41.7 per cent. This ratio is higher than that for any week since last September.

The Federal Reserve Banks as a whole showed the same marked improvement as the New York bank. Gold reserves increased $10,674,000 while Federal Reserve notes in circulation declined $12,972,000. Federal Reserve Bank Notes declined $4,747,000. The ratio of gold reserves to Federal Reserve notes in circulation after setting aside 33 per cent against net deposits, increased from 57.6 per cent to 58.5 per cent. Bills discounted and secured by Government war obligations were down $21,495,000 and total bills on hand $50,107,000. Total earning assets decreased $51,923,000 and net deposits $25,535,000.

The stock market last week was dull and irregular with net gains, however, practically offsetting the losses. The bond market was also very quiet and was marked by fewer new issues than have been characteristic of recent weeks.

STORM KING EXTENDS PLANT

HARTFORD, WIS., Feb. 19 — The Storm King Mfg. Co. of Hartford, Wis., manufacturer of patented curtains for Ford and other cars for cold weather equipment, has been obliged to take over larger quarters to accommodate the expansion of its business and provide more adequate facilities. As rapidly as possible the output is being increased to 500 sets of curtains per month.

Men of the Industry

E. P. Chalfant, one of the veterans of the motor vehicle industry, has voluntarily taken an indefinite leave of absence from Automotive Products Corp. of New York, an export house which he organized two and a half years ago as an ally of the American Steel Export Co. He is also president of the Gill Mfg. Co., Chicago, and president of the Gill Piston Ring Corp., New York, and will hereafter devote himself actively to the affairs of these two companies, making his headquarters at the New York branch, 1864 Broadway.

A. D. Williams has assumed charge of sales for "X" Laboratories, manufacturers of "X" Liquid, and will be located with headquarters at their New York office. Williams formerly was associated with the American Chain Co., Bridgeport, Conn.; the F. Hersh Hardware Co., Allentown, Pa., and the last few years has been field manager for the Bethlehem Spark Plug Corp.

E. E. Westman, for the past two and one-half years director of purchases of the Premier Motor Corp. of Indianapolis and for many years connected with various automobile concerns of that city, has severed his connection with Premier to become secretary and treasurer in charge of sales for the Kant Kut Tube Products Co., Indianapolis.

Fred Rufenacht has purchased the plant of the Bucyrus Rubber Co., New Philadelphia, Ohio, and it is thought he will organize a company to operate it as the Crawford Tire & Rubber Co. Rufenacht is a coal operator of New Philadelphia and was an officer and stockholder of the Bucyrus company. Philip H. Heater has been appointed manager.

W. G. Thompson has been elected president of the Thomart Motor Co. of Akron and Kent, Ohio. The company was organized last April and started limited production in December of 1-ton speed trucks. James L. Stewart has been elected vice president and general manager, and B. A. Shriber, secretary and treasurer.

Jack Neely, assistant sales manager of the Barley Motor Car Co. for several years, has resigned his position and will be associated with the Studebaker Motor Car Co. He will be assigned to one of the numerous factory branches of the latter company, assuming his new duties as a branch manager about April 1.

R. S. Jemison, who has been connected with the advertising department of the Miller Rubber Co., has been appointed advertising manager of the Oldfield Tire Co., and has moved his headquarters from Cleveland to Akron. Jemison is widely known throughout the south as a writer on sporting topics.

Joseph E. Burns has succeeded R. G. Ewell as sales and advertising manager of the Allen Motor Co., Columbus. He was formerly territorial representative for the company and previous to that had been connected with the educational bureau of the Cole Motor Car Co.

F. S. Warren, for the last five years sales manager of the Booth Felt Co., Inc., New York, and previous to that for two years New York representative of the Advance Felt & Cutting Co., Chicago, has gone into business for himself in New York.

C. R. Miller has resigned as general manager of the Allen Motor Co., Columbus. He was formerly works manager at Willys-Overland and general manager of Miami Cyclex & Mfg. Co. His plans for the future are not announced.

Fred Wellman, for two years advertising manager of the National Motor Car & Vehicle Corp., has resigned his position to join the National Motor Sales Co. of Chicago, distributors of National cars, in the capacity of sales manager.

Ewart C. Hugh, formerly European traveling representative of the All American Truck Co., Chicago, has formed the Hugh Co., Buffalo, which will manufacture metal products for the automotive industry.

G. R. Harris has resigned as secretary-treasurer of the Troy Wagon Works Co., Troy, Ohio. W. J. Murray has been appointed general manager and H. H. Tamplin new secretary-treasurer.

Victor Greiff, E. E., who joined the American Bosch Magneto Corp. a year ago to install a research laboratory, has completed the work and returned to his home in New York City.

George J. Blanton, who for the past four years has been connected with the engineering sales department of Chain Belt Co., Milwaukee, has been made New York district manager.

Stephen A. Douglas has been appointed general sales manager of the William R. Johnston Mfg. Co., Chicago, manufacturers of automobile equipment.

Frank B. Willis has been appointed sales manager of the Duplex Truck Co., Lansing. He was formerly sales manager of the Kelly-Springfield Truck Co.

W. T. Norton, Jr., chief engineer of the Motor Transport, has resigned, and at the present time has made no definite connections.

Frederick T. Frazer has been elected a member of the board of directors of the Byron G. Moon Co., Inc.

Water A. Wood has been elected president of the New York Automobile Dealers Ass'n.

HARTMAN TO LEAVE FORD

DETROIT, Feb. 21—Hubert E. Hartman, assistant secretary and general attorney for the Ford Motor Co., has announced his resignation, effective March 15. He gave as his reason a desire to enter business for himself, adding that he expected to continue to handle some of the company's affairs. Hartman has been with Ford seven years.

HANDLEY RE-ELECTED PRESIDENT

KALAMAZOO, MICH., Feb. 21—The annual meeting of the Handley-Knight company resulted in the election of the following officers and directors: President and General Manager, James I. Handley; vice-presidents, W. E. Upjohn and C. S. Campbell; secretary-treasurer, Walter L. Otis; directors, the above and C. A. Blaney, Kalamazoo; J. S. Woodward, Battle Creek, and Walter Stewart and Martin V. Kelley, Toledo.

STANDARD AERO BANKRUPT

PHILADELPHIA, Feb. 21 — The United States Circuit Court of Appeals has affirmed an order of the District Court of New Jersey declaring the Standard Aero Corp. of New York a bankrupt. The proceedings were on petition of Charles H. Leonard of Elizabeth, N. J., a creditor. The plant of the corporation at Plainfield is located on ground leased from Leonard, who sued in the New Jersey court and obtained a judgment for $9,000.

The Aero corporation built airplanes for the United States and received payments of approximately $5,000,000. Its business ended with the armistice and its relations with the Government were ended by the further payment of about $1,000,000. This sum was disbursed and nothing was left except a bank balance of less than $400.

Wilson Appointment Rests With Chrysler

NEW YORK, Feb. 23—When asked today whether or not he had been invited to accept the general management of the Maxwell-Chalmers combination, W. R. Wilson, who is one of the vice-presidents of the Irving National Bank of this city, referred inquiries to Walter P. Chrysler, chairman of the management committee, which will make the appointment. He intimated the subject had been taken up with him, but added that he could not say whether the appointment would come to him. Chrysler has declined to make any statement.

Wilson, who is about 35 years old, is better known as a financier than as a production man, although he has had considerable experience in the automotive industry. He was associated with the Studebaker Corp. until the formation of the Dodge Bros. Motor Car Co. He assisted the Dodge brothers in perfecting their organization and remained with them five years in a confidential capacity.

DETROIT S. A. E. TO MEET

DETROIT, Feb. 21—The Detroit Section of the Society of Automotive Engineers will hold its February meeting Feb. 25 at the Detroit Board of Commerce. O. C. Barry, research engineer of the Hupp Motor Car Co., and formerly professor of automotive engineering at Purdue University, will speak on the fuel problem in terms of miles per gallon.

PATENTEE SUES G. M. C.

BOSTON, Feb. 18—Rollin Abell of Milton, Mass., has entered suit in the Suffolk Superior Court for $600,000 against the General Motors Corp. of New York for alleged repudiation by the defendant of an agreement to use a valve mechanism in connection with automobile engines, for which the plaintiff was to be paid not less than $50,000 a year.

N. A. C. C. MEETING MARCH 3

NEW YORK, Feb. 21—A general meeting of the members of the National Automobile Chamber of Commerce will be held Thursday, March 3. The passenger car manufacturers will meet in the morning and the truck manufacturers in the afternoon. The directors of the Chamber will meet Wednesday morning, March 2, and the truck committee that afternoon.

Calendar

SHOWS

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Atlanta, Annual Automobile Show, Atlanta Automobile Dealers' Ass'n, Auditorium, Virgil Shepard, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 5-12—Atlantic City, Annual Automobile Show, Automobile Trade Association of Atlantic City, Million Dollar Pier, A. H. Generatzky, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 7-12—Nashville, Annual Automobile Show, Nashville Automobile Trade Ass'n, Page Bldg.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

Mar. 14-19—Washington, Annual Automobile Show, Washington Automobile Dealers' Ass'n, Rudolph Jose, Chmn.

Mar. 19-26—Detroit, Annual Automobile Show, Detroit Automobile Dealers' Ass'n, Morgan-Wright Building.

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April—Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

CONVENTIONS

May 4-7—Cleveland, National Foreign Trade Council.

Oct. 12-14, 1921—Chicago, Twenty-Eighth Annual, Convention National Implement & Vehicle Ass'n.

RACES

July 24—Grand Prix, Le Mans.

S. A. E. MEETINGS

Boston section—March 18.

Buffalo section—April 19—Paper on "Carbureter Performance," by F. C. Mock.

Dayton section—May 3.

Detroit section—March 25—Discussion of "The Relation Between the Industry and the Department of Engineering Research of the University of Michigan," by Prof. E. A. White.

Metropolitan section—March 10—Paper on "Brakes," by H. G. Farwell.

Metropolitan section—April 14—Paper on "Low Grade Fuel Carburetion," by A. H. Beach.

Midwest section—March 11—Discussion of storage batteries.

Minneapolis section—March 2—Discussion of good roads and equipment.

Minneapolis section—April 6—Discussion of repair equipment.

Washington section—March 18—Highway and Highway Transport Trading.

Washington section—April 1—Aeronautical Engineering Session.

Mexico to Construct Main Roads System

NEW YORK, Feb. 19—Approximately 22,000 kilometers of highways are included in the road improvement project of the Mexican government. This statement is made in a letter just received here from Salvador Medina, executive official of the Mexican Department of Roads and Public Works. Under the project the road work will be administered through regional groups, each of which will have a technical administrative center. Senor Medina describes the project as follows:

"This bureau has decided upon a project for the improvement of the leading roads of the Republic—a project covering the upkeep of all public roads during the present year, there also existing the plan of carrying out this work in all the States of the Republic, in accordance with a technical outline already approved. In the said project, roads are enumerated according to regional groups, which in due time will constitute actual zones of permanent attention, each one having a technical-administrative center.

"The center of each zone shall be Mexico City, Tampico, Queretaro, Guadalajara, Morelia, Iguala, Oaxaca, Tuxtla Gutierrez, Campeche, San Luis Potosi, Zacatecas, Chihuahua, Hermosillo, Ensenada and La Paz. The total extension of the roads covered by these zones is 22,000 kilometers."

LOWERS RATE ON STEEL PARTS

WASHINGTON, Feb. 18—An order was issued by the Interstate Commerce Commission this week requiring carriers to establish a rate of $1.125 on the pressed steel side members of truck frames, no higher than rates on structural steel channels. The order followed a decision by the commission in the case brought by the Moreland Motor Truck Co. against the C. M. & St. P. Railroad, in which it was found that the rate of $2.2115 per cwt. on pressed steel side members of truck frames, in carloads from Milwaukee to Los Angeles, was unreasonable.

Maxwell Contract Suit Moved to U. S. Court

TOLEDO, Feb. 19—The suit in which the Toledo Bridge & Crane Co. asks for a judgment of $34,901.79 from the Maxwell Motor Co., alleged to be due for breach of contract, was remanded from the common pleas court of Lucas county to the Federal court for the Northern District of Ohio, Western Division.

The Toledo company alleges that it had a contract for 40,000 oil pans at $2.50 each and that the contract was cancelled before completed.

The case brought a legal battle in the common pleas court but will be settled in the district court which is at the present time heavily loaded with business. The case will probably not be heard for several weeks.

CARRPLANE COMPANY FORMED

ATLANTA, Feb. 19—The first airplane manufacturing company in the South is to be located at Jellico, Tenn., the Southern Carrplane Mfg. Co., having been organized there with $250,000 capital. The plane to be manufactured will be known as the Carrplane. It was designed by Capt. Walter J. Carr, formerly an army aviator. L. E. Woody is president and general manager of the company; W. I. Jones is secretary and treasurer.

Safety Regulations Reduce Car Accidents

NEW YORK, Feb. 18—More playgrounds, more safety education in the schools, uniform traffic rules, and regulations against overloading are among the measures which the National Automobile Chamber of Commerce will advocate with increased vigor during the coming year as part of its program to reduce the number of accidents incidental to the operation of motor vehicles. In urging these causes, the chamber plans to assist organizations already active along these lines rather than to stimulate independent campaigns.

Official figures show a decline in the ratio of fatalities to the number of cars in operation. Automobile deaths per car were 0.0025 in 1914, and these were reduced to 0.0013 in 1919.

ALABAMA AIR CLUB FORMED

ATLANTA, Feb. 19—The Alabama Aeronautical Society, affiliated with the Aero Club of America, has been organized at Birmingham, Ala. Lieut. Commander C. W. Tindal, formerly of the United States Navy, was the organizer. It will be conducted along the same lines as the New York State Flying Club and the Missouri Aeronautical Society.

TO STAGE FAIR IN JAVA

NEW YORK, Feb. 19—An automobile and tractor exhibition will be held at Bandoeng, Java, Sept. 19 to Oct. 9, 1921, in connection with the Second Netherlands East Indies Fair, which will be international in character and which offers to manufacturers an opportunity for exhibiting their products in the highly lucrative markets of the East Indies.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XLIV NEW YORK—THURSDAY, MARCH 3, 1921 No. 9

Plan to Center Automotive Research in S. A. E. Committee

New activity will be initiated and directed by this committee and carried forward by a research department organized as a part of Society's office staff. Important to collect and publish existing data.

By Herbert Chase

PLANS for putting into effect the research activities which it was recently announced that the Society of Automotive Engineers Research Committee had been authorized by the Council to undertake are developing and bid fair to assume the importance predicted for them. It has naturally proved impossible as yet to formulate details of the new activity, but it is understood that the work will be handled in much the same way that the S. A. E. Standard Committee work is handled. There will be an office organization with a Research Manager whose duties will include the collection of data and its preparation for publication. One of the Research Manager's duties will be to learn the view of the Research Committee, and where decisions are made to see that they are put into effect and followed through to a conclusion.

It is not proposed that the Research Committee as a whole, or such divisions thereof as shall be formed, will undertake the actual conduct of research, or finance its conduct in selected laboratories, but rather that it will arrange for such research as may be considered desirable, through co-operation with industrial laboratories as well as with laboratories of government bureaus, universities, etc.

Every effort will be made to correlate the work of various laboratories to prevent unnecessary duplication and to so arrange the work undertaken as to bring about solution of the most pressing problems of the automotive industry. The S. A. E. will thus act as a sort of clearing house for research work. It is expected also that much existing research data will be accumulated for reference and comparison, in fact, some members of the committee regard the collection and dissemination of existing data as the first and most important activity of the committee.

It is not to be expected, of course, that any one manufacturer's problems will be investigated by the committee, except in so far as such investigation will be of general benefit, but whenever the results of individual researches are made available to the committee these will in turn be made available to others in the industry who may be interested.

The committee as at present constituted is as follows: Henry M. Crane, Chairman. Harry L. Horning, E. A. Johnston, C. F. Kettering, J. G. Vincent, Herbert W. Alden, Dr. H. C. Dickinson, T. C. Menges, Joseph Van Blerck and Prof. O. C. Berry.

This committee will be added to from time to time as need requires and will no doubt be segregated into divisions, as is the case with the Standards Committee, should this prove desirable.

There are quite natural differences in viewpoint among members of the committee as to ways in

which the work to be undertaken can be made most useful, as to how it can best be carried forward and as to what subjects are of greatest importance. It is quite generally agreed, however, that research pertaining to fuel and its utilization is of paramount and most general importance.

One member of the committee takes the view that research gathered by the committee should be confined to very definite commercial ends—to the solution of problems of immediate and pressing importance to the industry. But the same member fully recognizes the need for digesting and publishing information now available. He indicated that some large industrial laboratories have already expressed willingness to co-operate with the committee, not only in making available information now in hand or in progress of collection, but by prosecuting for the general good of the industry lines of research laid down by the committee.

In some instances, more especially in the case of university students research where the investigators are frequently lacking in experience, it will doubtless prove desirable to have the same line of work undertaken in two or more laboratories in order that a check may be had.

One member of the committee is drafting for discussion a set of rules of procedure to govern activities of the committee. When patents are involved it will, of course, be necessary to proceed with caution in order not to favor any commercial interest. This matter will require careful handling.

It has been pointed out, quite properly, that a close relationship necessarily exists between standardization and research work. It is frequently necessary to carry through certain research work before a satisfactory standard can be formulated.

Coker F. Clarkson, General Manager of the S. A. E., believes that the decision to undertake the work with which the Research Committee is charged is of as great significance and importance to the Society as was the decision, arrived at many years ago, to undertake standardization work. The latter work required the establishment of a standards department in the S. A. E. staff and it is expected that a similar department will be built up to handle the detail prosecution of the research program. The Research Committee will formulate policies and lay out the program of work to be undertaken, but will necessarily have to depend largely upon the Research Department to carry the work forward. It has been agreed that the Society shall, at least for the first year, undertake work on its own resources, that is without seeking outside funds for the purpose. It seems quite likely, however, that as the work progresses and becomes of greater value to the automotive industry as a whole, the industry will participate in supporting it financially as it has the standardization work of the Society.

Some members of the committee feel that the automotive industry in common with most other industries, lacks appreciation of the value and importance of research fundamentals, and would confine the work of the committee to the determination of facts without attempting to apply the results of research to automotive products. The same persons lay stress upon the educational value of the work, believing that a better knowledge of fundamentals will result in more intelligent application of these fundamentals to the solution of the problems of the industry. If the committee can succeed in demonstrating to all concerned the need of more careful and thoroughgoing research, its hope that the quality of work turned out, especially by industrial laboratories, will reach a higher standard will no doubt be realized.

If various industrial laboratories agree, as is expected, to exchange information through the offices of the committee, it is evident that much duplication will be avoided, and a great deal gained both in time and cash outlay. Even if the committee succeeds in the first year in simply persuading industrial organizations of the advantages to all concerned of releasing data accumulated as a result of research conducted by these organizations its efforts will be well spent. In many cases standards of comparison are lacking, so that results obtained in various laboratories are not comparable. Efforts to bring about the general acceptance of such standards will enable ready comparisons to the benefit of all concerned, hence there is opportunity for fruitful results in work to this end.

There are in this country some eighty engineering schools in which courses in automotive engineering are being given. Most of these have laboratory facilities which can be or already are engaged in automotive research work. There has, however, been little if any effort to organize or correlate this work in such manner as to make it of greatest value either to the industry, which, in many instances, is called upon to donate the engine or other apparatus to be tested, or to the institution whose facilities and personnel are used.

Some universities regarded as leaders in automotive engineering education have already indicated a desire to arrange their programs of research in such manner as to avoid unnecessary duplication and to make their work of the utmost possible value to the automotive industry. They have, in fact, expressed willingness to cooperate in bringing about arrangements whereby a program in which each institution will have a definite prearranged part will be formulated and carried out in conjunction with the committee.

It is believed that the Research Committee of the Society can and will play an important part in formulating such a program and in seeing that it is carried through and the results compiled in a form that will make them of greatest value to all concerned. It has long been apparent that some organization can and should perform this function, and it seems certain that no organization can do it to better advantage than a properly constituted committee of the Society.

Those who are familiar with the work of the S. A. E. during the past few years will recall that the Council of the Society has appointed research committees which served during several recent administrations, and that a report on fuel utilization in present day engines was made at the last summer meeting of the Society by one of these committees. Aside from this little has come from the activities (or lack of activity) of these committees. This has been due in part to the fact that the Society office staff did not include personnel sufficient to carry forward on an effective scale work which could otherwise have been prosecuted. This personnel is now to be added to the staff of the Society, and the results which have long been considered possible of attainment should now be realized. The appropriation of $30,000 by the Council to be used in defraying the cost of maintaining the necessary organization, constitutes in the opinion of many members of the Society one of the most important actions ever taken by the Society. The ultimate good which results will naturally depend in large part upon the research organization built up as well as upon the support and co-operation of Society members and others in the work. If this co-operation is forthcoming as now seems likely, there appears to be little question but that the new activity will give much deserved credit to the Society and those responsible for instituting and prosecuting the research program.

Progress in Highway Educational Problems

President Burton of Michigan University believes that present generation will see highway development equal to railroad development witnessed by older generation and that education in this line is the great need of today. Other prominent speakers at Michigan Highway Conference.

By Clyde Jennings

THE movement for a wider appreciation of education in highways and highway transport gained a long step forward when Dr. Marion L. Burton, president of the University of Michigan, addressing a gathering of highway commissioners and engineers and students of the University, said in effect:

> We want it known that the University of Michigan appreciates the importance of the highway movement. I am not exactly certain in my statistics, but I expect to see between twenty and twenty-five billion dollars expended in highway construction during the next generation. It is my expectation that the generation now coming into manhood will see in its active life a movement in highway construction that will equal the development in railways that the older generation has witnessed. It is my belief that education in this line is one of the great problems of today and we hope that each student of this university shall leave here with an appreciation of this problem.

This statement, coming from the president of a leading western university, cannot but have a marked influence in educational standards. The University of Michigan has been one of the leaders in highway engineering and has been quick to appreciate the need of the complemental education—that in highway transport. Several other western universities have been and are working along the same line, but the eastern universities, in the main, have ignored the topics.

The occasion of this strong statement from Dr. Burton was a mass meeting which was a part of the Seventh Annual Conference on Highway Engineering and Highway Transport at the University of Michigan. Those in attendance at the five-day session were highway leaders of Michigan. On February 23 the members of the Permanent Committee on Highway and Highway Transport Education were guests of the University and of the Conference. The sessions of that day were under direction of Dr. P. P. Claxton, United States Commissioner of Education, and chairman of the committee. During the day the members of this committee explained to the members of the Michigan Conference the objects of their work. It was the second meeting of this sort the committee has held, the previous one being at Pittsburgh last November, when a similar exposition of the work was made to the school teachers of Pennsylvania. It is interesting to know that the meeting out of which this committee was developed was held at Ann Arbor last April.

The explanation of the work of this committee is simple. It is the thought of those responsible for the committee that there is a great need of engineers for the proper development of the highway plans now financed. Also when these highways are developed there will be a need of engineers to properly direct the traffic over them. This committee is encouraging proper schools to enter this field of education.

A highly interesting message of this session was contained in a paper read of Thomas H. MacDonald, chief of the United States Bureau of Roads, who said in effect that a highway in itself is of no value. It lacks the merit of a work of art, or of an article of certain intrinsic value. Its value is entirely in the service it renders to the community. On this theory he maintained that it is the duty of the promoters and builders of highways to measure their building by the traffic needs of the community which the highway is to serve.

The Committee was welcomed to the University of Michigan by Dean Cooley of the College of Engineering. The program included an address on "Highway Social and Economic Welfare," by Dr. Claxton, who insists that the educational and social advantages of highways will well repay their cost. Prof. C. J. Tilden, director of the Permanent Committee, explained the objects of the committee. Roy D. Chapin pictured the future of highway transport. George C. Diehl, Chairman of the Good Roads Board of the American Automobile Association, outlined a course in local geography for secondary schools which, he said, would be a great move toward a better understanding of the highway situation by the citizens of tomorrow. Harriet E. Beard, of the Detroit schools, told of the effective safety work being done there. Col. Mason H. Patrick told of the interest of the army in roads. Prof. Henry E. Riggs compared highways with railroads. Arthur H. Blanchard, professor of highway engineering in the U. of M., outlined effective surveys for highway transport. There was a largely attended dinner in the evening at which Dean Cooley presided and Tom Snyder and A. R. Kroh were speakers.

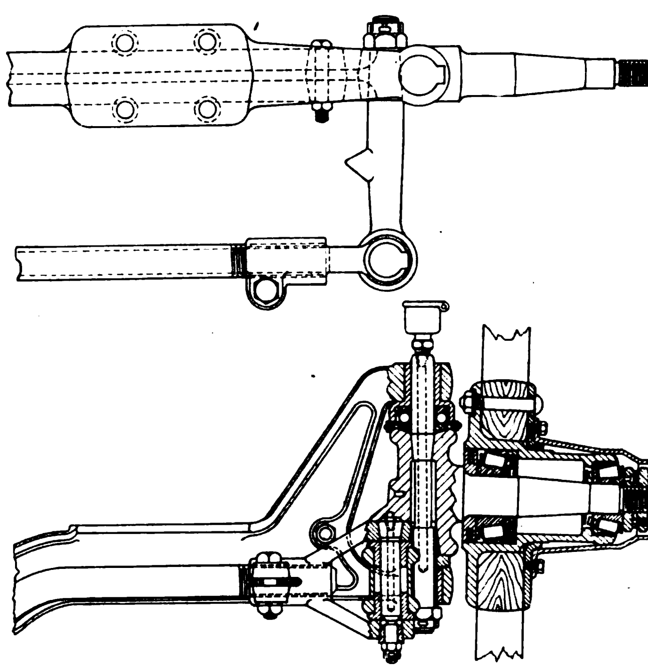
A SERIES of experiments, begun in 1914, but interrupted by the war, has recently been resumed in Brussels on the use of palm oil in internal-combustion motors. A Swedish two-cycle semi-Diesel engine was found which would run successfully on palm oil. According to analysis by Belgian chemists, palm oil is a mixture of palmitate and oleate of glycerine, with some variable quantities of palmitic and oleic acid. It contains about 95 per cent. of fatty acids and appears as a pasty substance of yellowish or salmon color. Its calorific power is estimated at 9,228 calories (Barthelot-Mahler), and it is inflammable at 210° C.

Two New Worm Gear Axles Arranged For Hotchkiss Drive

Housing and spiders are steel castings. Axle shaft, brake cams and some other important parts are of molybdenum steel. Both brakes internal expanding. Special lubricating features on both front and rear types.

By J. Edward Schipper

TWO new worm-drive axles incorporating a number of ingenious features, were shown at the Chicago show. They are the product of the Dunkirk Axle Co. The heavier of the two models are known as R-20 for the rear and F-20 for the front. They are similar in most respects to the smaller models R and F-15. The housing, housing spiders and hubs are made from electric steel castings. The worm and worm wheel are of generous proportions. Reduction ratios of 5.2, 6.25 and 7.75 are standard for model R-20.

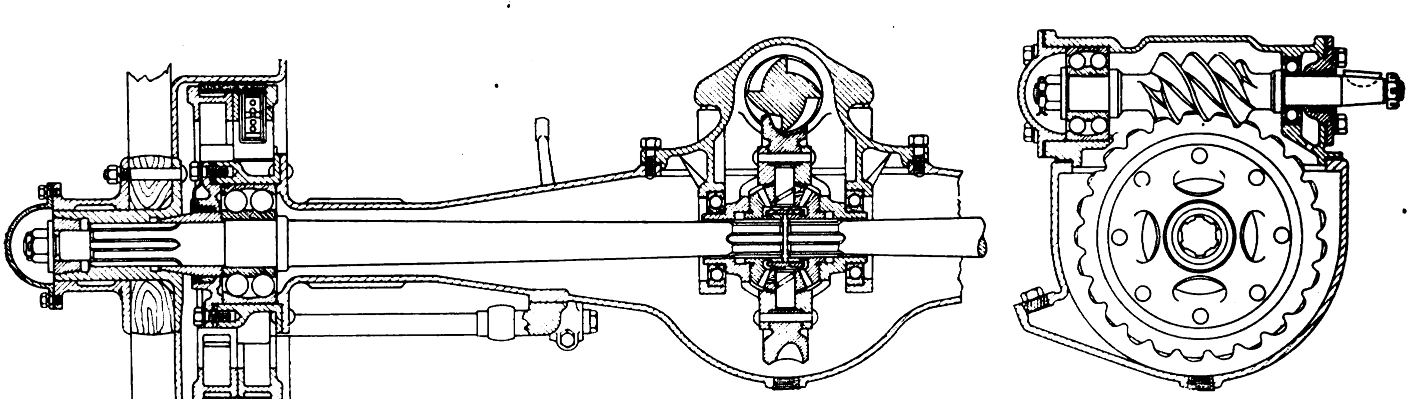


The Dunkirk model F-20 front axle for trucks

The differentials are of the bevel type and the side gears are splined to receive the ends of the axle shaft. The pinion, spider and side gears are all made from alloy steel, hardened and ground, for the bearings and splined fits. No bushings are used. The axle shaft, brake cams, brake supports and other important parts subject to stress are made from electric furnace, chrome molybdenum steel, heat treated and ground to size. Concentricity of the drum is secured by grinding on the inside braking surface and at the same time, grinding the center hole to size. The brakes are dual, internal expanding, of the wrap-up type. Each brake has an expanding and centering member, the lining and brake bands being separate pieces. With this feature it is possible to remove the brake lining rapidly for relining purposes without the use of wrenches, tools, etc., and also without the necessity for removing the entire brake shoe.

The brake levers are forgings from high carbon steel and are splined, giving an adjustment of about 6 deg. On the R-20 the levers are 8½ in. long. The axle is provided only for Hotchkiss drive and the spring pads for 2½ in. springs. A feature of the axle, however, is the provision for adjustment of the center distances by sliding the spring pads along the seat provided for the purpose.

The rear axles are of the semi-floating type and are ball bearings throughout. Oiling of all the moving parts is automatic from the splash within the housing, the wheel bearings are also lubricated from the same source. The brake cams and bearings are lubricated by wick feed and need attention but once a season. Another feature of the axle is the oil retaining packing which allows the entire wheel mounting to run in an oil bath without leakage to the drum. Dunkirk axles are produced in the plant formerly used by the Empire Axle Co. Production is scheduled to start at the rate of 500 sets a month.



Longitudinal and transverse sections of Model R-20 Dunkirk worm-drive truck axle

Rigid Construction and Clean Appearance Features of New Engine

High power output and good fuel economy claimed for engine recently tested in Detroit. Positive lubrication, overhead valves and camshaft, complete enclosure of moving parts, five bearing disk type crankshaft and easily detached accessories are among other interesting features.

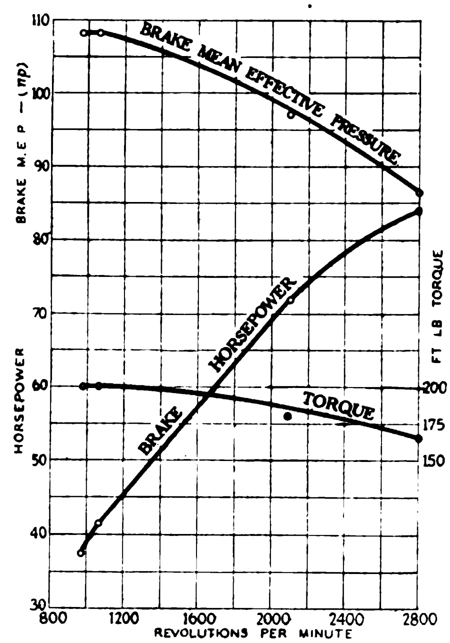
By J. Edward Schipper

AN interesting four-cylinder engine designed by Frank S. Spring and H. L. Elfes, has been under test for the past 2 yr., both on the dynamometer and in a car. Some rather remarkable results are claimed.

The power output from four cylinders of 3⅝ bore by 6¾ in. stroke with a displacement of 278 cu. in. is shown in the accompanying curve. It will be noted that the engine develops 85 B.H.P. at 2800 r.p.m. It weighs 400 lb., including accessories and clutch. The entire powerplant is 33 in. in length. The crankcase is very stiff and heavily ribbed. It supports a 5 bearing crankshaft of the disk type, 2¼ in. in diameter. The design permits the construction of a short engine, and is said to account to some extent for its lack of vibration.

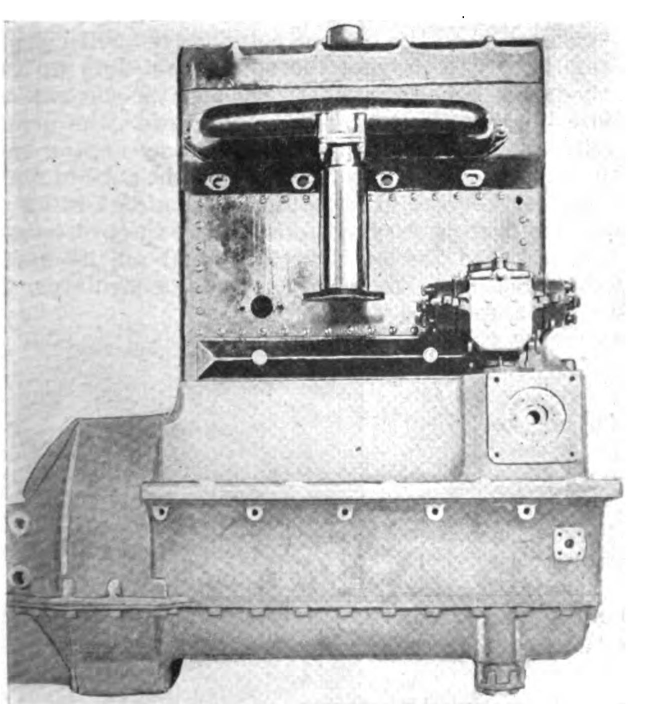
Tests of the engine mounted in a chassis were recently concluded by a large motor car builder in Detroit. The car carried five passengers and weighed 4300 lb. It was driven approximately 400 miles over roads in the vicinity of Detroit, averaging, it is claimed, 24 mi. per gal. In a later run of 1200 miles, with a load several hundred pounds greater than in the test mentioned the designer claims the car averaged 18 m.p.g. The route included the test hills in the vicinity of Pittsburgh and the car was driven wide open whenever conditions permitted.

All bearings are of generous proportions and it is said that their life is more than doubled by the use of the dry sump, in conjunction with high-pressure lubrication delivering a very large volume of cool oil, properly filtered, to all working parts. The latter are completely enclosed, in fact the only exposed moving part is the fan, which is carried on the forward end of the overhead camshaft.

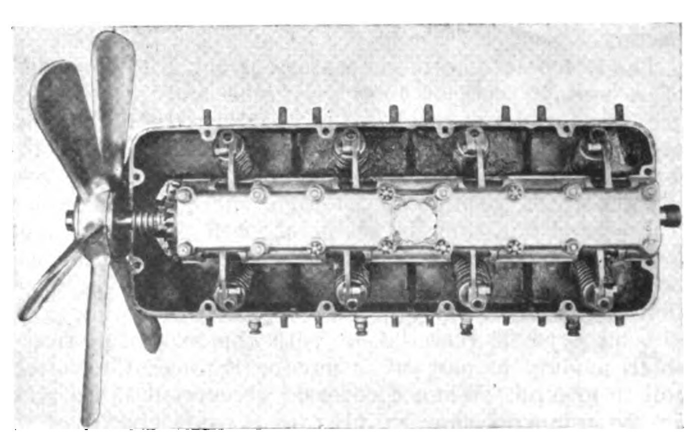


Performance curve of Spring engine

The oil pump is formed by meshing the gear on the lower end of the vertical shaft, which drives the overhead camshaft with the top gear of the short stub shaft driven by the crankshaft. This construction cushions the camshaft drive and helps to silence the valve mechanism. The



Intake side of Spring engine showing clean external appearance



Top view of Spring engine with valve cover removed

stub and vertical shafts are hollow. Oil is lead, through the vertical shaft, to the hollow camshaft and to the tubes upon which the rocker arms are located, oiling all bearings, and returning to the sump through passages cast in the cylinders and crankcase. Oil is led from the stub shaft through suitable passages to all of the main bearings, and thence through holes drilled in the crankshaft to the connecting rod bearings.

The cylinder walls and piston pins are lubricated by the oil thrown off from the connecting rods. A scavenging-pump is located externally on the front end of the oil pan. This pump returns the oil from the sump to the oil tank, which is separate from the engine, as fast as it accumulates. Baffle plates are cast integrally with the upper case to prevent excessive lubrication of the cylinder walls. It is claimed that under the most extreme running conditions, the temperature of the oil in the tank has never exceeded 100 deg. Fahr. Carrying the oil in a tank separate from engine has the advantage that it allows the use of an efficient filter of large area, that is easy to get at and clean.

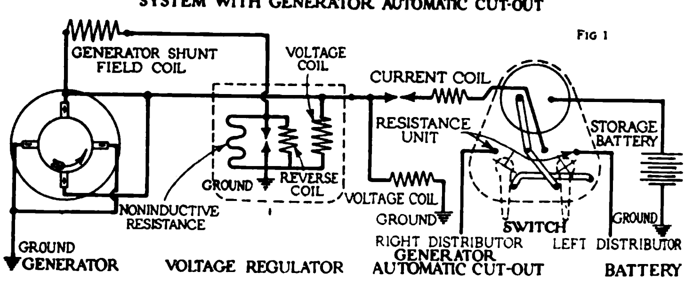
The removal of the top cover of the motor exposes the rocker arms and tappets for inspection and adjustment. The manifolds are external, and are easily removable; in fact, any of the units such as the distributor, generator, pump and starter can be removed by unscrewing not more than four nuts and without disturbing other units.

A Generator Cut-Out for Aircraft Use

A CUT-OUT, designed to be incorporated in the Delco airplane engine ignition system, has been on test at the laboratory of the War Department, Air Service, at McCook Field. The purpose of the cut-out is to break the circuit between the generator and the battery whenever the direction of current flow is reversed, i.e., when current starts to flow from battery through generator. This condition occurs in the Delco system at all generator speeds below approximately 1000 r.p.m., at which speed the generator ceases to charge. Since the battery and the generator are always in circuit in the Delco system except when the switches are shut off, a considerable drain on the battery results from the discharge of current through the non-functioning generator.

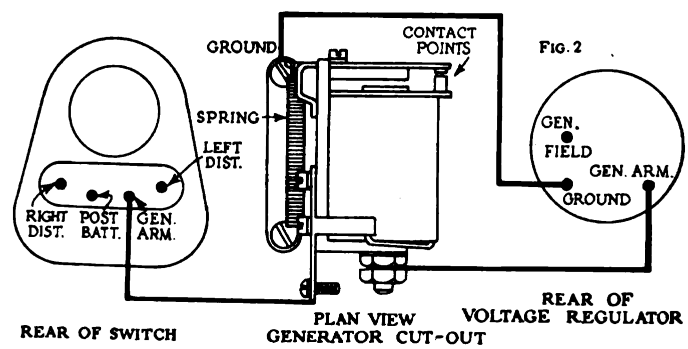
In the standard Delco system, the generator can be cut out at low engine speeds by shutting off one of the two switches in the low tension leads to the two distributor heads. This saves the battery, the capacity of which is limited, but necessitates operation of the engine on only one set of spark plugs at a time when, to prevent fouling, both sets of plugs should be firing. Cutting out the generator, when it is not charging, by means of the device tested, makes it possible to operate on both sets of spark plugs without unnecessarily draining the battery.

CIRCUIT DIAGRAM OF THE DELCO IGNITION SYSTEM WITH GENERATOR AUTOMATIC CUT-OUT



The Delco automatic generator cut-out, Fig. 1, consists of a voltage coil of fine wire, one end of which is grounded, and a current coil of heavier wire, both wound around an iron core. An armature with contact points is provided so that, with sufficient current flow from the generator through the voltage coil, this core will be magnetized and the contact points will close, thus completing the circuit between the generator and the battery. After the closing of the contact points the operation of the electrical equipment is exactly similar to the present type of installation with the exception that a small amount of current is flowing through the voltage coil to ground. When a reversal of current takes place due to stoppage, slow running, or a short circuit of the generator, a reversal of the magnetic flux around the current coil occurs and demagnetizes the iron core. The armature is drawn back by the spring and the contact points are separated, opening the circuit from the battery.

WIRING DIAGRAM OF DELCO AUTOMATIC GENERATOR CUT-OUT



The clearance between the contact points should be about 0.018 in. The voltage required for the closing of the contact points is regulated by the tension of a spring (shown in the wiring diagram, Fig. 2). The tension of this spring should be such as to allow the contact points to close at a potential of eight volts.

If the contact points of the voltage regulator separate before the contact points of the automatic generator cut-out close, then the cut-out points never will close, as the regulator will prevent the voltage building up sufficiently to get enough magnetization of the cut-out core to close the contact points. In other words, the generator will not be put into the circuit at any engine speed if the voltage regulator operates before the cut-out closes.

In the installation of the automatic cut-out in an airplane, it is first necessary to disconnect the present connection between the armature terminal of the switch, and the armature terminal of the voltage regulator. The wiring then required is shown by the wiring diagram, Fig. 2. The cut-out is fastened to any convenient point on the fuselage by the bracket shown in Fig. 3.

The automatic generator cut-out switches the generator into the circuit at about 500 r.p.m., at which speed the ammeter shows a discharge of about 3 amp.

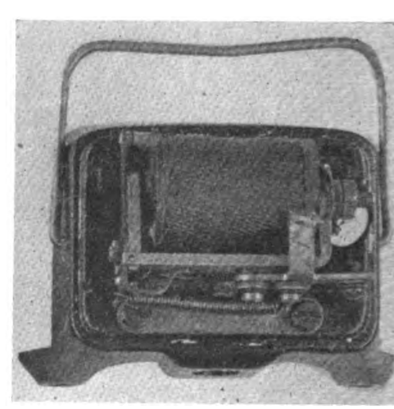


Fig. 3—Assembly view automatic generator cut-out

Passenger Cars Compared on Displacement Per Ton-Foot Basis

Wide variation in practice is shown to exist. Some makers allow nearly double the displacement per ton-foot allowed by others, thus enabling good acceleration and hill climbing ability at a sacrifice in fuel economy.

By P. M. Heldt

ONE of the fundamental factors in passenger car design is the piston displacement on high gear per unit of weight moved a unit distance. This can conveniently be expressed as the cu. in. of piston displacement per ton per foot of travel. In calculating the piston displacement, account is taken only of the displacement during the working stroke and in calculating the ton-feet, both the weight of the car ready for the road and the weight of the passenger load must be considered.

Let W be the weight of the car with load in pounds; d, the wheel diameter in inches; D, the piston displacement of the engine in cubic inches, and r the gear ratio on high gear. Then in one revolution of the rear wheels the car moves ahead

$$\frac{3.1416 \times d}{12} = \frac{d}{3.82} \text{ ft.}$$

The weight of the car and load is

$$\frac{W}{2000} \text{ tons,}$$

hence

$$\frac{W}{2000} \times \frac{d}{3.825} = \frac{W d}{7650} \text{ ton-ft.}$$

While the rear wheels make one turn the engine crankshaft makes r turns, and the total displacement of the pistons during these r turns is $2\, r D$, but as only every fourth stroke is a power stroke the useful displacement is $r\,D/2$. Hence, dividing the displacement by the ton-feet we get

$$\frac{\dfrac{r D}{2}}{\dfrac{W d}{7650}} = \frac{3825\, r D}{W d.}$$

In order to compare the practice followed by various manufacturers in this regard we have collected data on practically all American built passenger cars and tabulated it for convenient reference. To the weight of the car with full supplies ready for the road we have added 150 lb. for each passenger for whom seating capacity is

Name of Car	Cu. In. Displacement per Ton Foot	Piston Displacement Cu. In.	Road Weight with Pass., Lb.	Gear Ratio (on High)	Wheel Dia. In.	No. of Pass.
....	24.6	298.2	4670	3.22	32	4
Monroe	24.7	149.3	3250	4.50	32	5
Norwalk	25.1	192.4	4160	4.50	32	5
Friend Four	25.8	149.3	3180	4.60	32	5
....	26.0	192.4	3490	4.25	32	5
Reo	28.0	239.4	3950	3.87	32	5
Stephens	28.2	224.0	4525	4.90	33	7
Seneca	28.5	138.1	2930	4.75	30	5
Oakland	28.5	177.0	3840	4.50	32	5
Liberty	28.5	230.1	3680	...	32	5
Dorris	28.6	377.0	5106	3.35	33	7
Tulsa	28.8	192.4	3487	4.50	33	5
Lexington	28.8	224.0	4300	4.62	32	7
Essex	28.9	178.9	3448	4.66	32	5
Cadillac	29.0	314.4	5170	4.43	35	7
Saxon	29.0	178.9	3500	4.75	32	5
Cleveland	29.2	190.8	3475	4.45	32	5
Briscoe	29.6	178.9	3115	4.18	31	5
Templar	29.6	196.8	3475	4.40	32	4
Commonw'lth	29.7	192.4	3190	4.25	33	5
Harroun	29.7	174.2	2990	4.00	30	5
Kline Kar	29.8	224.0	3600	4.56	33	5
Marmon	29.9	339.7	4940	3.75	33	7
Nelson	30.2	145.7	2800	4.25	32	4
National	30.2	303.1	4905	4.08	32	7
Daniels	30.3	404.1	5250	3.50	34	6
Skelton	30.7	192.4	3185	4.25	32	5
....	30.7	230.1	3700	4.25	33	5
Noma	30.9	224.0	3850	4.25	32	5
Buick	30.9	241.6	2700	4.08	33	5
Overland	31.0	143.1	2650	4.50	30	5
Rock Falls	31.2	331.4	5660	4.87	35	8
Hatfield	31.2	192.4	3420	4.63	32	5
Hupmobile	31.3	182.5	3390	4.87	32	5
Dixie Flyer	31.4	192.4	3400	4.72	32	5
Allen	31.5	192.4	3375	4.63	32	5
Patterson	31.6	224.0	3690	4.50	33	5
Scripps-Booth	31.7	177.01	3250	4.87	32	5
American	31.8	248.9	4210	4.50	32	5
Roamer	31.9	303.1	4400	3.87	32	5
Elcar	32.0	324.0	3660	4.50	33	5
Oldsmobile	32.0	224.3	3900	4.66	32	5
Porter	32.0	478.4	5310	3.25	35	7
Grant Six	32.1	198.9	3450	4.66	32	5
Globe Four	32.2	178.9	3250	4.90	32	5
Gardner	32.4	192.4	3130	4.41	32	5
....	32.4	414.7	5920	4.28	35	7
Dodge Bros	32.5	212.3	3250	4.16	32	5
Standard	32.6	331.8	4960	4.25	35	7
Winton	32.7	347.9	5196	4.90	35	7
Lorraine	32.8	192.4	3250	4.63	32	5
Westcott	32.8	224.0	3960	5.00	33	5
Apperson	33.2	331.8	4760	4.25	34	7
Auburn	33.2	224.0	3705	4.75	33	5
Hudson	33.2	288.6	4796	4.90	34	7
Holmes	33.3	245.3	4060	4.90	34	7
....	33.3	424.1	6070	4.36	35	7
Moon	33.3	224.0	3750	4.66	32	5
....	33.4	241.0	3760	4.50	33	5
Jordan	33.6	224.0	3725	4.66	32	5
Ferriss	33.6	303.1	4400	4.08	32	6
Mitchell	33.9	248.9	3750	4.41	33	5
Maibohm	34.0	195.6	3100	4.50	32	5
Nash	34.0	248.9	3818	4.50	33	5
Haynes	34.3	288.6	4500	4.77	34	5
....	34.4	524.8	6445	3.87	35	7
Piedmont 6-40	34.5	224.0	3500	4.50	32	5
Ford	34.6	176.7	2360	3.63	30	5
Pilot	34.8	248.9	3850	4.50	32	5
Sayers Six	34.8	224.0	3550	4.75	33	5
Leach	34.9	303.1	2675	4.50	32	5
Case	35.2	303.1	4710	4.87	34	7
Paige G	35.2	248.9	3890	4.75	33	5
Cunningham	35.5	441.7	5550	4.08	35	7
Metz, Master 6	35.5	230.1	3635	4.67	32	5
Lincoln	36.0	357.8	5124	4.45	33	5
Paige L	36.4	331.4	4801	4.55	33	7
King	36.6	282.7	4500	4.87	32	7
Peerless	36.7	331.8	4990	4.90	34	7
Elgin	36.9	218.6	3500	5.10	33	5
Chandler	37.0	288.6	4105	4.40	32	7
Cole	37.0	346.3	4830	4.45	33	7
LaFayette	37.2	348.4	4890	4.50	33	5
Meteor	37.5	340.4	4250	3.92	32	4
McFarlan	38.1	572.5	6100	3.50	33	7
Stevens-Dury	38.8	510.4	5650	3.94	35	7
Crawford	38.9	303.1	4150	4.45	32	5
Brewster	39.4	376.5	4850	4.25	32	5
Bour Davis	40.4	303.1	3910	4.50	33	5
Davis	41.7	224.0	3680	5.90	33	5
Franklin	42.4	261.3	3195	4.33	32	5
Severin	43.6	303.1	3735	4.50	32	5
Piedmont 4-30	47.0	192.4	2200	4.50	32	5

provided. From this total weight, together with the piston displacement, the gear ratio and the wheel size, the displacement per ton-foot was computed.

For more than one-half of all the cars this figure lies between 30 and 35, and the average of all the values is 32.8. A car having a high displacement per ton-ft., all other things being equal, would be able to ascend comparatively steep grades on high gear and would be capable of a high rate of acceleration, but it would consume more fuel per ton-mile than a car in which the displacement per ton-foot was smaller.

On a smooth, level road the resistance to vehicular motion at low speed is about 50 lb. per ton, this including frictional losses in the axle and those in the transmission due to the churning of the lubricant, etc. Therefore, while the vehicle moves one foot the work done in overcoming traction resistance is 50 ft. lb. per ton. The brake mean effective pressure of a gasoline engine under full throttle is about 75 lb. per sq. in. and the work of one cu. in. displacement therefore is

$$\frac{75}{12} = 6.25 \text{ ft. lb.}$$

There is, of course, a slight additional loss in the gearset and the rear axle when these are transmitting load, and, allowing for this loss, we may say that when the engine runs under full throttle, about 5.5 ft. lb. of work is done in propelling the vehicle for each cubic inch piston displacement under gas pressure. As 50 ft-lb. are required per ton-foot of transportation it would require a minimum of

$$\frac{50}{5.5} = 9.1 \text{ cu. in.}$$

piston displacement per ton-foot to propel a car at low speed on a hard, smooth, level surface. What we actually provide is 32.8 cu. in. displacement, from which it follows that the pressure on the piston in regular operation is only about

$$\frac{9.1 \times 100}{32.8} = 27.7 \text{ per cent}$$

of the maximum. The speed of the engine will be less than one-half that at which it gives its maximum output, and as power depends on both pressure and speed, the power developed by the engine when driving at 15 m.p.h., say, is not much more than 10 per cent of the maximum power.

Comparison With Small European Car

It is of interest to compare with the above figure of 32.8 cu. in. per ton-ft., the corresponding figure for a Fiat Model 501, a car evidently designed for economical use of fuel. One of these cars took part in an Australian fuel economy contest, and won first prize in the members' event for cars of 15 hp. or less. This car did a distance of 31.344 miles to the gallon and 36.438 ton miles per gallon, hence it weighed with load 2325 lb. It has a four-cylinder engine of 65 x 110 cu. in. bore and stroke, a gear ratio of 5.1 to 1 and 760 x 90 cu. in. wheels, making the wheel diameter practically 30 in. The piston displacement figures out to 89 cu. in. Hence the cu. in. displacement per ton-ft. is

$$\frac{3825 \times 5.1 \times 89}{2325 \times 30} = 24.9.$$

This is 24 per cent less displacement per ton-foot than that of the average American car.

Nickel Plating Aluminum

We have received several inquiries regarding the subject of nickel plating aluminum. The following item in this connection should therefore prove of interest. —THE EDITOR.

A. Mazuir describes a process of nickel plating which has given him the best of results as regards both adherence of the layer formed and fineness of the deposited metal. This process consists of the following four operations: Decrustation, cleaning of the surface to be nickeled, immersion in a bath of a metallic chloride, nickeling at a high-current density.

The piece of aluminum is lowered for a period of two minutes, while cold, in a bath containing 8 grams of NaO and 30 grams of cyanide of potassium per liter. With this concentration the aluminum is not appreciably attacked; in fact, the effect on the metal is so slight that even threaded and calibrated parts can be handled. The piece is washed in an excess of water and is then energetically brushed with a solution containing 4 parts of water to one part of lime. The surface in this way acquires a brilliantly white appearance without streaks or spots.

The piece is washed and brushed once more to get rid of all traces of lime and is then immersed in an acid bath of some metallic chloride. It has been found that chlorides of manganese and of iron give better results than any other chlorides. Thus with a bath of the following composition—

Hydrochloric acid of 22 deg.	350 cu. cm.
Manganese	2 grams
Water	650 cu. cm.

there was obtained a coating of nickel without spots and very adherent. With a bath of iron chloride containing 3 grams of iron per liter, the results are slightly less satisfactory; the deposit is then a dull white.

During the immersion there is formed on the surface of the piece a metallic coat resulting from a chemical transposition between the iron and the aluminum; fine particles of iron become fixed on the aluminum and thus form an intermediate, very tenacious layer between the aluminum and the nickel.

The immersion in this acid bath lasts two or three minutes. The piece is washed in a low-pressure stream and is then placed in the nickeling bath proper. A bath of the following composition was used:

Simple sulphate of nickel	120 grams
Double sulphate of nickel	50 grams

This bath must show 12 to 13 deg. Baume, and must be completely neutral. The anodes consist of laminated nickel plates. The pressure should vary between 2.5 and 3 volts. In going beyond these limits there is obtained a deposit which does not adhere and which flakes off. The current density should vary between 1 and 1.5 amperes per square decimeter.

The piece is left in the bath for an hour and a half, if it is of average size. It is then washed in boiling water and dried by compressed air. The layer of nickel obtained by this process has a remarkable adherence and an incomparable whiteness and polish. Sheets of aluminum thus nickeled resist the most energetic torsion without peeling off.—*La Technique Moderne.*

Parts and Accessories at the National Tractor Show

Recent developments in air cleaners, traction devices for wheeled tractors and automatic hitches. Rubber tired wheels for road work, line control mechanisms for Fordson tractors and a drawbar pull indicator.

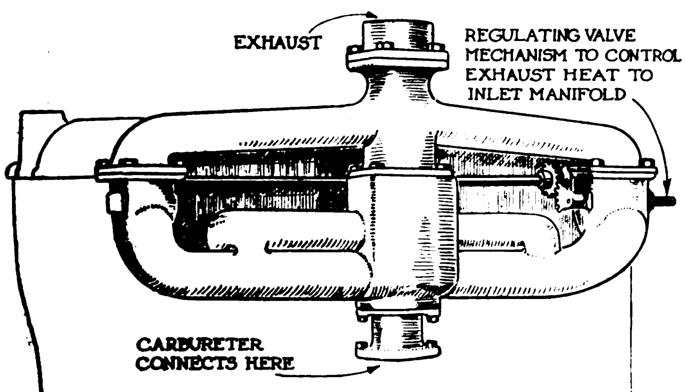
By P. M. Heldt

MOST of the stands around the walls at the tractor show were devoted to parts and accessories, and there was among these exhibits at least as large a percentage of novelties as among the tractors themselves. There were evidences that the heavy fuel problem, the air cleaner problem, the driving lug and other problems of the tractor industry had received due attention during the past year. There were also the usual number of devices intended to improve the Fordson tractor or adapt it to particular uses.

The Climax Engineering Co. exhibited engines with a new type of manifold, known as the K-317 manifold. This is a combined inlet and exhaust manifold in which provisions are made for regulating the amount of heat imparted by the exhaust gases to the incoming fresh charge. Referring to the sketch herewith, the inlet and exhaust manifold are in a single casting, and there is a hot spot or exhaust-heated portion of the inlet passage at the center. There are two outlets from the exhaust manifold, one being through this exhaust jacket and the other from the ends of the straight, horizontal portion of the manifold, through a cast pipe connecting with the outlet from the exhaust jacket at the center. There are damper type valves at the joint of the exhaust manifold with the return pipe, both on the same shaft, which are controlled by means of a pinion and sector mechanism. By closing these damper valves, all of the exhaust gases can be passed through the exhaust jacket, whereas by opening them more or less, almost any desired fraction can be shunted around the jacket.

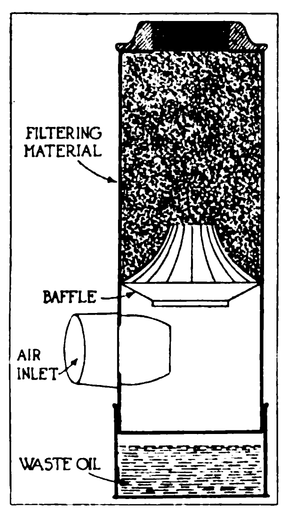
New Air Cleaners

Two new air cleaners were shown, the Pomona Vortox and one manufactured by the United Manufacturing and Distributing Co. The first, illustrated in section herewith, is of the combined centrifugal and filtering type. The air enters through a tangential inlet and is thus given a

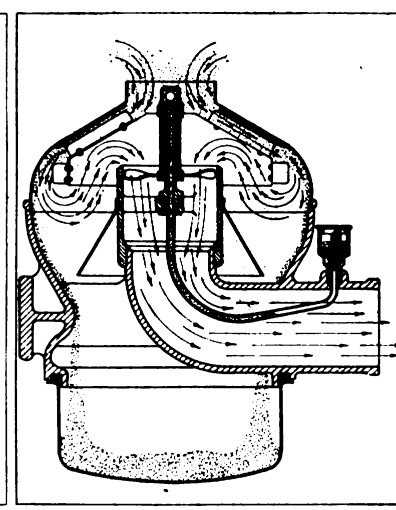


New Climax manifold with control of the exhaust heat

whirling motion, which causes the air to collect close to the outer wall, and as the communicating passage between the lower and upper chambers is at the center of the cylindrical chamber, the dust falls to the bottom, where it is absorbed by stale crankcase oil contained in a removable cup. In the upper part of the cylindrical chamber there is a filter of fibrous material through which the air has to pass on its way to the carburetor, and the passage between the lower and upper parts is of such design that it gives a further centrifugal motion to the air. Thus the air is subjected to two centrifugal cleanings before it is passed into



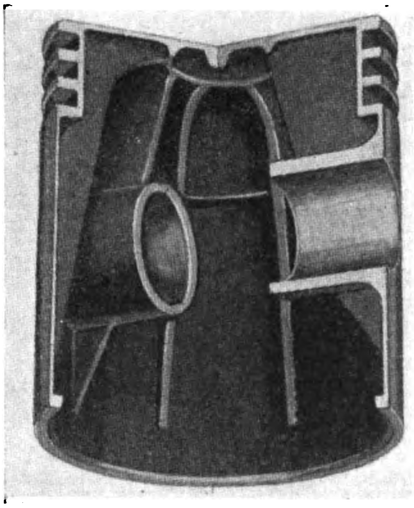
Pomona Vortox air cleaner



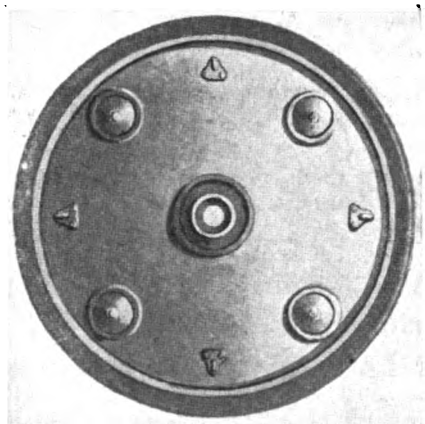
United Mfg. Co. air cleaner

the filter, with the intention of preventing rapid clogging of the filter.

The air cleaner of the United Manufacturing and Distributing Co. is of the dry centrifugal type. As may be seen from the sectional view, the air enters at the top and immediately strikes a rotary baffle which is provided with two sets of fins. The fins give a rotary motion to the air current, throwing the dust against the walls of the chamber. After passing the edge of the baffle the air is compelled to reverse its direction of motion, passing upward and inward to enter the L shaped outlet of the cleaner. The hub of the rotary baffle is mounted centrally in the outlet and carries a driving fan at its lower end, by which the baffle is set in rotation. The dust drops down the walls of the cleaner and collects in a readily removable cup, while the clean air passes out through the side of the cleaner. In the drawing an oil cup with wick feed to the baffle bearing is shown, but this has been replaced by an oil-less bushing in the hub of the baffle.



Clark-Turner light cast iron piston



W. & K. rubber-tired wheels for Fordson tractors

The Clark-Turner pistons, which are cast iron pistons of unusual lightness, were shown by Litter's Motor Machine Shop. These pistons are made with very thin walls and a considerable number of ribs to strengthen the piston and help carry the heat from the head to the skirt. The advantages are those of lighter reciprocating parts. There is less vibration and less strain, owing to the reduction of the inertia forces.

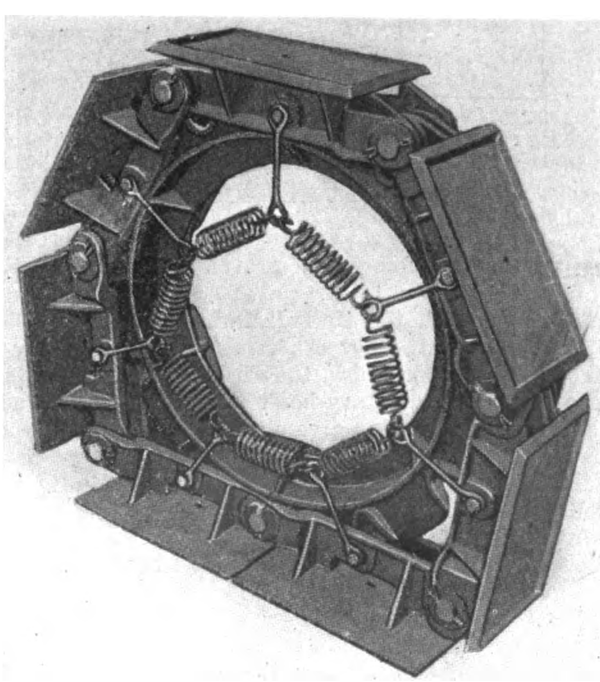
Whitehead & Kales Co. showed rubber-tired wheels for use on Fordson tractors to adapt them for operation on the roads. So equipped the Fordson can be used for hauling loaded trailers on the road, for switching freight cars, for drawing snow plows, etc. The rubber-tired tractor has been found useful by municipalities, factories, contractors, coal and building supply dealers, and road builders. The wheels are made of metal disks, are hollow, and the rear ones can be loaded either with water, sand, cast iron chips, or cement to increase their weight and thus get additional traction. One of the disks is made with four hand holes through which the loading material can be introduced. Each disk is also provided with four hooks for the convenient attachment of anti-skid chains.

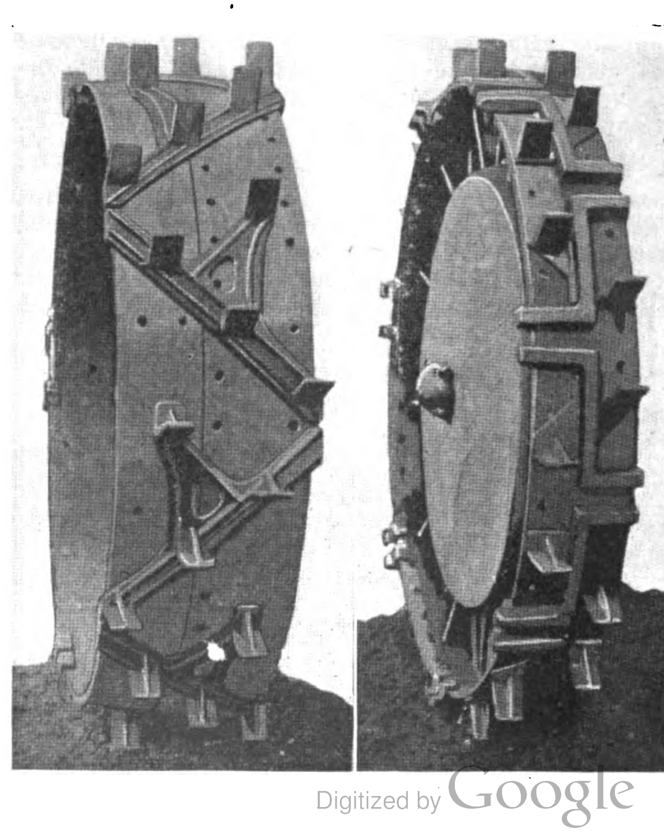
The rear wheels are equipped with 40 x 5 in. S. A. E. standard solid rubber tires, and the front wheels with 24 x 3 in. The wheels and tires are shipped fully assembled, ready to be placed on the tractor.

The Whitehead & Kales Co. has also brought out a new design of tractor wheel which combines lightness with great lateral and radial strength. The rim is made of rolled steel with inwardly turned flanges, but the rim proper, instead of being made flat, is formed with two substantial corrugations. The spokes are arranged so that the two sets cross; at their inner ends they are riveted to steel disks cast into the gray iron hubs, and at their outer ends they are riveted to the rim at the corrugations—not to the flanges. This obviates the weakening of the flanges by rivet holes and adds considerably to the strength of the wheel.

The Miller traction tread is a device which is claimed to give with a wheel tractor some of the advantages of the creeper type. There are seven cast steel shoes, cast integrally with the links of the chain. The links are joined together with hardened, cold rolled steel pins, fitted with rollers, which pass through elongated holes in the ends of the links. These elongated holes allow a reciprocating action to take place between the ends of the links. Upon this reciprocation depends the proper movement of the separate links as they pass over the sprocket. At the center of each link there is an additional pin with roller which takes the thrust from the sprocket teeth.

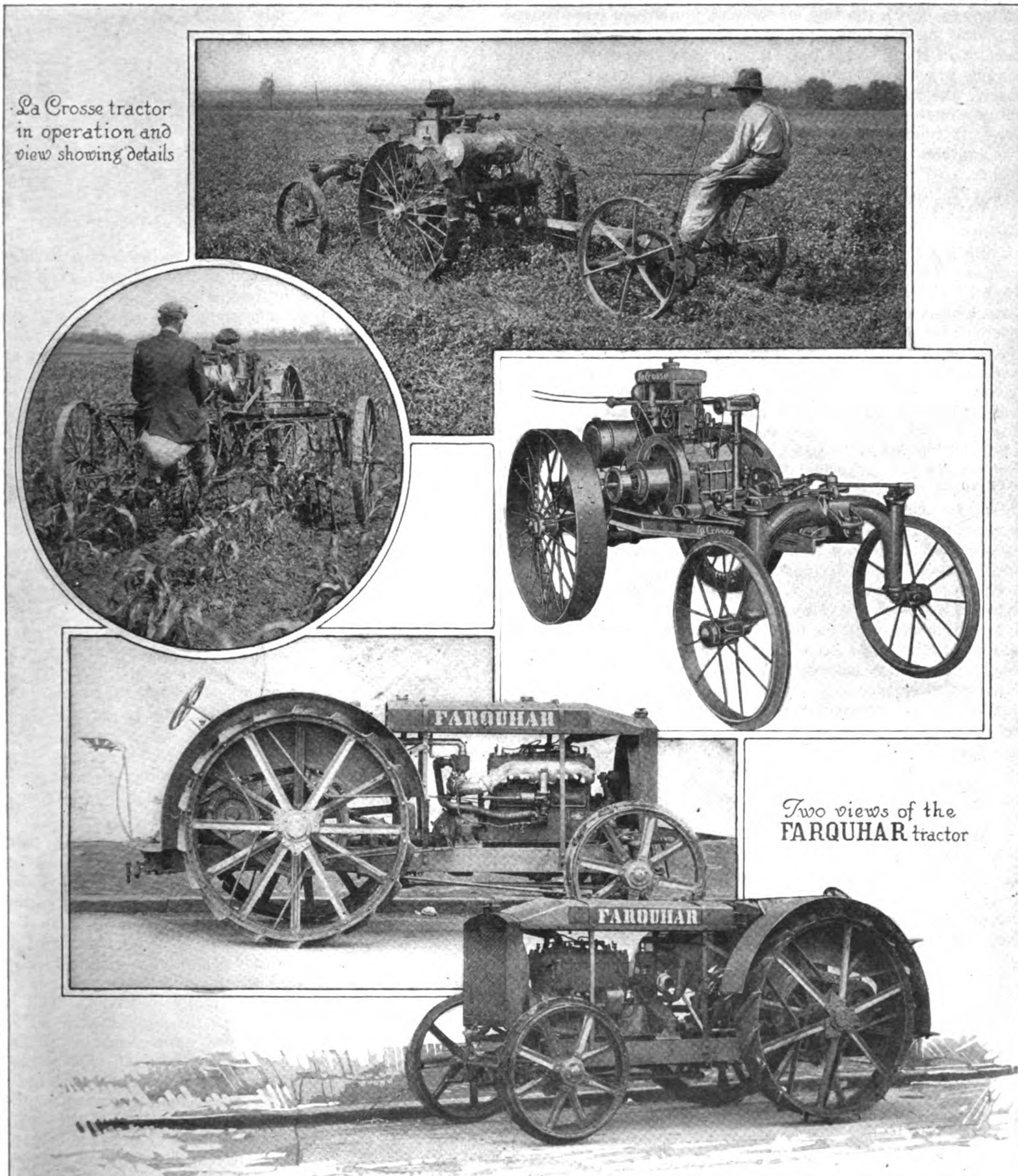
The complete tread unit is mounted on a cast steel sprocket which is secured to the side of the regular tractor wheel. The tread can be removed by removing one pin, stretching the links flat on the ground and rolling the tractor off. The sprocket does not interfere with the operation of the round wheel. This tread is made especially for the leading makes of garden tractor.





Above—Miller traction tread
To the right—Bentz tractor lugs, single-unit and two-unit types

Two New Tractors Exhibited at Recent Show



La Crosse tractor in operation and view showing details

Two views of the FARQUHAR tractor

The above illustration shows the Farquhar 15-25 and the new La Crosse tractor, both of which were shown for the first time at the recent Columbus tractor show. Descriptions of these tractors appeared in our issue of February 24, but the photographs did not reach us in time for insertion in that issue. As will be seen from the illustration, the feature of the La Crosse is the line drive, which makes it possible for the driver to ride on the implement and saves the services of one man when operating grass mowers, self-binders and manure spreaders. An unusual feature of the Farquhar is that it is spring-suspended at both the front and the rear

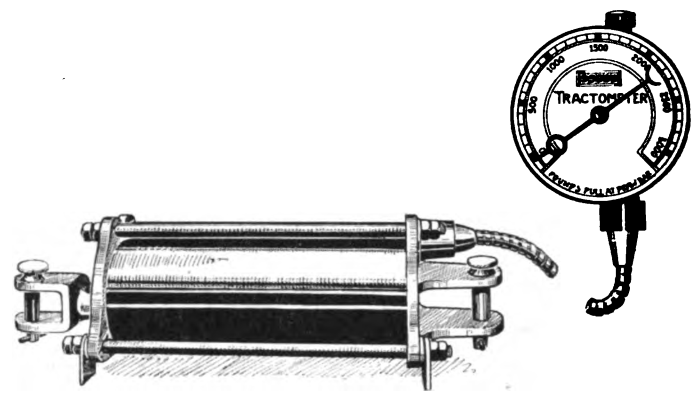
The Bentz tractor lugs were exhibited by the Lebanon Steel Foundry. These lugs embody a quick detachable principle. When applied to the wheel, the lug is placed on the rim and drawn to one side so that the channel of the lug engages with the edge of the rim, and at the same time with the lug previously put on. The next movement puts the lug in its final position, interlocking it securely with the one previously applied, while the other end is ready to receive the next lug. The lug is made in two styles, one being a one-unit type and the other a two-unit type. The two-unit type is suitable for both road and field work. The end lugs are provided with "eyelets" and are bolted together, so that a single bolt suffices for the assembly.

The Taco Calumet tractor hitch is a device which absorbs the shock on both the plow and tractor when plowing in stony soil. It consists of a hitching member comprising a coiled spring which compresses as the draft increases. On tractors on which the clutch pulls out, the hitch is installed to operate a lever when the plow encounters an obstruction, this lever being connected to the clutch lever. Thus the tractor is stopped when a rock is struck, for instance, but the plow is not disconnected. This hitch was designed to do away with the troublesome wooden pin. A similar device, known as the Tractorstop plow hitch, was exhibited by the Meili-Blumberg Co., Inc.

A governor for Fordson tractors was exhibited by the Krebs-Wells Controller Co. This was said to be a true multi-speed controller and to govern the engine at whatever speed it is set to. The governor is mounted at the forward end of the engine and its connection to the throttle is arranged in a neat manner. Similar governors have been made for truck engines since 1914. The Hartley Governor Co. also showed a governor for Fordson tractors.

Among the specialties for Fordson mention should be made of two line control devices and a front hitch.

The Kokomo Electric Co. showed a new magneto for single cylinder engines. This magneto is of the high tension type and is claimed to be dust and moisture-proof. Among the features of construction may be mentioned a laminated armature, mica condenser, platinum or tungsten contact points, windings treated with insulating varnish and taped with oiled silk, hard rubber collector ring and brush holder and Esterline magnets.



Drawbar unit and indicating head of Tractometer

A device designed for measuring the drawbar pull exerted by a tractor in plowing or other drawbar work was exhibited by the Tractometer Co. and is known as the tractometer. It comprises a drawbar unit in the form of a cylinder with cast heads, each with a clevis for connection between the drawbar and the plow or other implement. This drawbar unit incloses the spring which transmits the drawbar pull and the compression of which measures the pull. An overload stop is built into the cylinder and is provided with a cushion for absorbing the jar due to overloads. This unit is furnished with a leather handle for easy handling.

From the drawbar unit a flexible cable extends to the indicating head on which the compression of the spring, and hence the drawbar pull, is indicated. It is claimed that this flexible connection between drawbar and indicating instrument eliminates errors in the readings due to the vibrations of the drawbar. This instrument is very much cheaper than the usual forms of hydraulic traction dynamometer, and it is believed that even tractor owners will purchase the instrument.

A Windshield Designed to Exclude Rain

A WINDSHIELD designed to exclude rain, snow and cold air has recently been devised by W. D. Crowell. This shield consists of two-glass sash and a sun-visor arranged in the manner shown in Fig. 1. When set in the position shown the air stream is deflected upward over the top of the vehicle, and is said to carry with it rain and snow and also to ventilate the enclosure back of the shield by drawing air outward in the manner indicated by the arrows. Gutters placed at the lower edges of the visor and the upper sash carry off to the side any water which runs into them. When in the position shown, the clear opening is about 2 in.

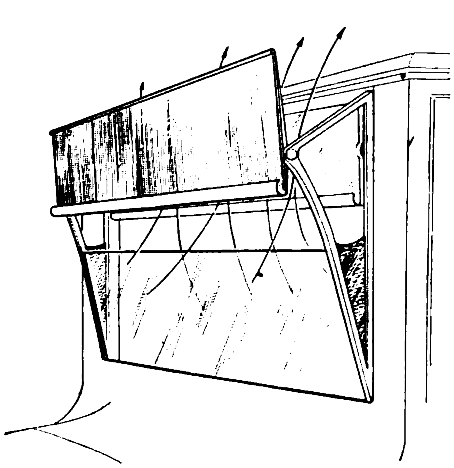


Fig. 1

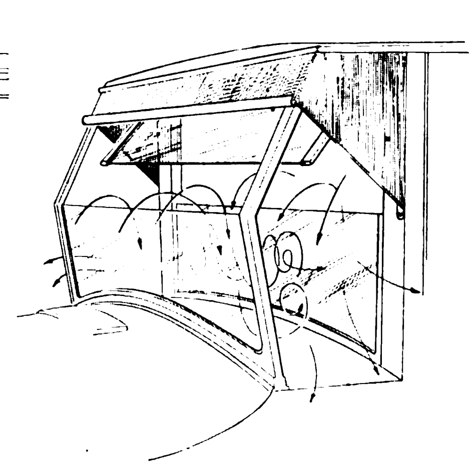


Fig. 2

Another design of windshield, called the down-draft pattern, is shown diagrammatically in Fig. 2. This is composed of three-glass sash and a sun-visor set, for use in stormy weather, in the position shown. Air carrying snow or rain is said to be deflected in the manner shown by the arrows without entering the space back of the shield. The space between the two lower sash is open at the ends to permit escape of the air which enters it. The two lower sash can be fixed if desired, the upper glass only being pivoted.

Patents to cover both designs shown have been allowed or are pending. The Zenite Metal Co. has been licensed to manufacture under these patents.

Diesel Type of Engine for Motor Vehicle Work

Has two pistons in same cylinder and works on two-stroke cycle. Injection results from explosion in ignition chamber connected with combustion chamber by narrow passage. Separate air compressor not required.

A SINGLE cylinder two-piston engine working on the two-stroke Diesel principle but without an air compressor has been built by the Deutsche Automobil Constructions Gesellschaft. The engine employs the Steinbeker method of fuel injection. According to our German correspondent, the first engine is now undergoing tests. The cylinder has a bore of 130 mm. and a stroke of 160 mm. per piston, making the combined stroke of the two pistons 320 mm. This is equal to a single cylinder engine of 5.12 in. bore and 12.6 in. stroke. The output is said to be 35 h.p. at 850 r.p.m., which corresponds to a brake mean effective pressure of 63 lb. per sq. in. The over all length is only 37⅜ in. and the weight per horse power 22 lb., which is about the same as that of the average truck engine.

It is obvious that if the ordinary Diesel engine were to be built for automotive purposes the most difficult problem would be the construction of the multi-stage air compressor, which must furnish air pressure up to 1000 lb. per sq. in. This is eliminated in the Steinbeker engine, and a simple injection system substituted therefor. A sectional view of the Steinbeker fuel injection mechanism is shown in the cut. To the cylinder head is secured a small vessel called the ignition chamber, which communicates with the combustion chamber through a central passage called the firing passage. The cylinder is provided with the usual inlet and exhaust valves. One fuel jet delivers into the firing passage and another into the cylinder direct. When applied to a four-stroke engine this injection mechanism operates as follows:

During the first inward stroke of the piston pure air is drawn into the cylinder, and during the following outward stroke it is compressed and some of it enters the ignition chamber, the pressure reaching a value of 450 to 500 lbs. per sq. in. During the end of this stroke fuel is injected into the firing passage and carried along by the rush of air into the ignition chamber. When the outer dead center position is reached the charge in the firing chamber is ignited by contact with the hot walls thereof, and the pressure in the ignition chamber then reaches 1100 to 1400 lbs. per sq. in. As a result a column of flame is projected into the combustion chamber. This carries along the fuel now entering the firing passage, spraying it into the combustion chamber. When the piston has traveled a short distance from the beginning of the power stroke the fuel supply is cut off and thereafter the charge expands until the end of the stroke. During the next outward stroke the piston expels the spent gases through the exhaust valve, which is then open. It will thus be seen that in the Steinbeker engine the pressure created by the partial explosion in the ignition chamber takes the place of the high pressure produced by the air compressor in the ordinary Diesel engine.

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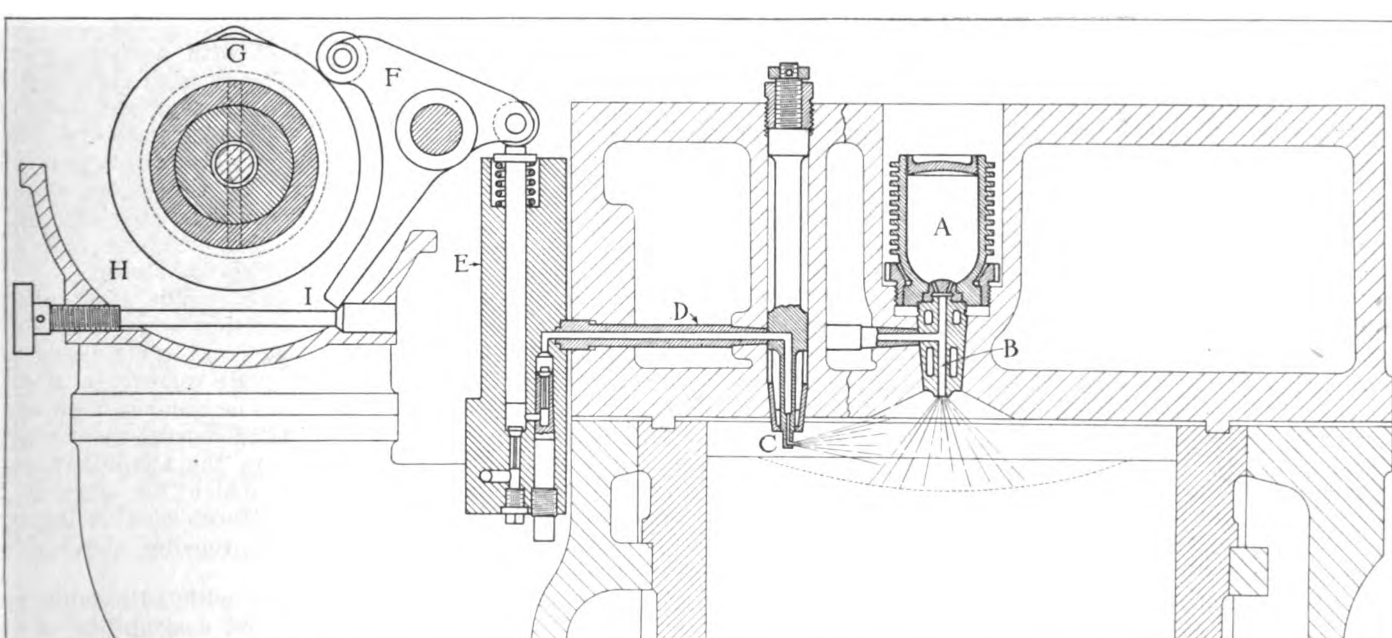


Diagrammatic illustration showing principle of operation of one type of Diesel engine. This principle has been employed in a recently designed automotive engine

Adjustable and Folding Seats Used on Many British Cars

Need for adjustable feature on driver's seat is met by several types of design described in this article. Front seats are also made detachable in some cases thus rendering more accessible parts located under the floorboards. Folding backs facilitate access to rear seats.

By M. W. Bourdon

FOR many years, even prior to the war, there has been evident a growing demand among British motorists for a means of adjusting the front seats so as to afford the most comfortable position for drivers of various leg lengths. This demand is now being met by an increasing number of makers, some content to make the two seats at the front an adjustable unit, others providing separate seats independently adjustable. The latter arrangement does not appear to be necessary to comply with requirements; it makes a more costly job if the degree of comfort afforded by the fixed seat be retained, and so long as the driver be conveniently placed for pedal operation, his companion's position does not matter, within reason.

Austin has quite a good and simple design of unit seat, as shown in Fig. 1, though there are but three definite variations available. The seat is located primarily by notches in the frame engaging with a stud projecting from the floor at each side, and is locked by slotted plates right and left just below the elbow line. The seat bottoms are hinged to tip up as shown, but this feature is only provided to render more accessible certain chassis details beneath the floorboards—the fuel tank, for example, which has its filling spout projecting through the floor under the right-hand seat.

Riley cars also have the unit seat arrangement (Fig. 2), the fore and aft adjustment being locked by a wing nut under each loose cushion, the latter also being secured, as shown, by similar means. The space below the cushions in this case provides accommodation for a few tools, jack handle, tire pump, etc.

Standard cars have separate seats independently adjustable as shown in Fig. 3. T-head screws locate them. Two threaded sockets are provided in the floor so that the range of adjustment afforded by the slot is considerably extended, unnecessarily so, in fact. The back upholstery of these seats is peculiar, for the hinged frame has a broad fabric band laced horizontally around it, while the upholstery is detachable, being held in position by a long inverted pocket which slips over the top of the frame. The Standard is one of the light four-seaters developed in England. The back of the front seat is hinged to enable an unrestricted entrance to the rear when the seats are placed well back to accommodate tall occupants. Here also the box-like base of each seat affords tool space. No springs are used in the back padding, the flexibility of the frame being considered sufficient.

In another light four-seater, the Enfield-Allday, one very wide door is provided at each side, and, to enable front and back passengers to have easy access the separate front seats have hinged backs and bases as shown in Fig. 4. Both seats are located by a cross member secured, as indicated, by means of a slotted tongue and wingnut. This form of seat is obviously applicable also to sedan bodies with single doors, a variation of the Enfield arrangement appearing in the Arrol Johnston sedan (Fig. 5). Here the passenger's seat is non-adjustable fore and aft, though detachable and provided with hinged back and base. The driver's seat differs in having fore and aft adjustment and being located by rails and a pin lifted from or pushed into a floor socket by a forward projecting lever.

Some of these adjustable seats, it will be noticed, are distinctly low in height from floor to top of the cushion. The Albert (Fig. 6) is more so than most, being only 9 in. high at the front. These seats are, in fact, little more than cushions with a folding back attached to them. The baseboard is secured to the floor by cap screws.

None of the examples illustrated are so elaborate in construction or finish as those fitted to high class sedan bodies, for the latter are more in the nature of movable armchairs. Those specimens selected for mention here are applied to cars of quite moderate price (as prices run nowadays) and are standard in the British cars named, which sell at from $3,000 to $4,000 with four or five-seated bodies.

A more elaborate type of seat with anchorage and means of adjustment favored in many high class bodies is that shown in Fig. 7, where each separate seat has metal panelling on a well upholstered framework. The seats run on rails and are located by studs dropping into the central runner and operated by the levers shown. This is a pattern frequently observed on specially built sedan bodies, the covering of the cushions and upholstery being usually Bedford or corded cloth.

Besides the advantage which adjustable seats afford in respect of leg reach, a consideration by no means unimportant is the fact that the front seats being removable, the floorboard can be made removable also to enable the chassis details below to be reached with ease. This fact has been borne in mind in several cases where adjustable seats are fitted, though the advantage concerns mainly those chassis in which the gearset is mounted amidships, and is, therefore, usually located, with the transmission brake and propeller shaft joint, under the front seat.

Users who have had experience with adjustable and removable seats point out the great desirability of the seats, whether they are separate or formed as a unit, fitting closely to the body sides, otherwise the front passengers suffer from additional draughts which are en-

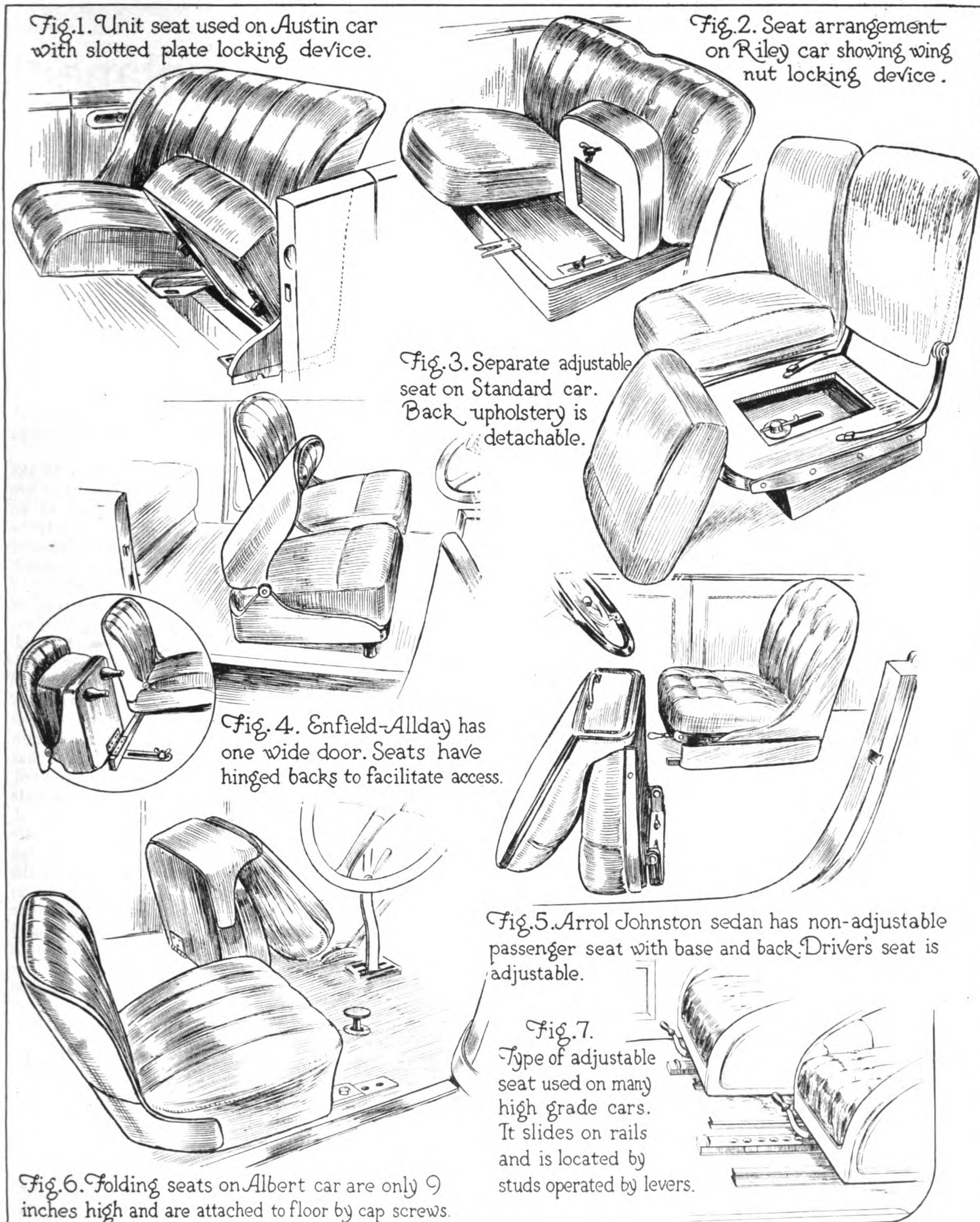


Fig. 1. Unit seat used on Austin car with slotted plate locking device.

Fig. 2. Seat arrangement on Riley car showing wing nut locking device.

Fig. 3. Separate adjustable seat on Standard car. Back upholstery is detachable.

Fig. 4. Enfield-Allday has one wide door. Seats have hinged backs to facilitate access.

Fig. 5. Arrol Johnston sedan has non-adjustable passenger seat with base and back. Driver's seat is adjustable.

Fig. 6. Folding seats on Albert car are only 9 inches high and are attached to floor by cap screws.

Fig. 7. Type of adjustable seat used on many high grade cars. It slides on rails and is located by studs operated by levers.

couraged to swirl around the legs and between the seats and the body.

Another point to be borne in mind is that a closely fitting loose seat, unless it is in some way attached to the sides of the body, is liable to hammer and rattle against the latter when vibration and frame distortion have their natural effects. Hence the Austin arrangement (which, by the way, is not unique), wherein the seat is fastened to the body framing, is not without special merit.

High Thermal Efficiency in Airplane Service

Advantages and disadvantages of two types of mixture control devices are discussed, and test data showing the fuel saving made possible by the use of higher air to gas ratios are given, as are also particulars showing the corresponding effect on the power developed.

By S. W. Sparrow*

DETAILS of design of certain foreign engines, whose high *average* efficiency has received much publicity, are of interest. During an examination of these engines at the Bureau of Standards, an unusual type of air-fuel ratio control suggested itself as a possible source of the high efficiency. Fig. 2 shows this type diagrammatically, while Fig. 1 is typical of a construction common on American engines. In the latter type, the rate of fuel flow is altered to produce the mixture ratio changes. This can be accomplished by restricting the fuel passage or, as shown in the figure, by changing the head producing flow through the agency of a valve in the passage connecting the float chamber with the carbureter throat. Similar results are frequently obtained by a type similar to that shown in Fig. 2, but so proportioned that the mixture ratio change is not accompanied by any appreciable change in the quantity of charge supplied. In contrast, Fig. 2, to typify the foreign construction, is assumed to be so designed that the leaning of the mixture is always accompanied by an increase in the amount of charge supplied. This can be effected by interconnecting the throttle with a device for altering the size of the fuel orifice or, as shown in the figure, by an auxiliary throttle which admits a very lean mixture of pure air. For this auxiliary throttle to be effective, the carbureter throat must offer a considerable restriction to air flow. The important difference between the two types is that in the one shown in Fig. 1, the change in power produced by a mixture change is due almost entirely to the change in power-producing ability of a unit weight of the mixture, while in the other type there is always the additional effect of the quantity change necessary to bring about the change in mixture quality.

Fig. 3 indicates the economy that is possible with the type shown in Fig. 1. The curves shown in full lines are based on tests of an 8-cylinder aviation engine at an altitude of 5000 ft. and a speed of 1600 r.p.m. It will be noted that a decrease in the specific fuel consumption of over 15 per cent is secured when the mixture is leaned, until there is a decrease of 10 horsepower in 150, i.e., 7 per cent. Unquestionably then, so long as this type of control has sufficient range, its proper handling will result in a marked fuel saving. Will it receive such handling? To realize how unlikely this is, it must be remembered that continuing the mixture impoverishment will ultimately result in a blowback in the carbureter, a likely cause of fire. Knowing that safety depends on not reaching this condition and lacking knowledge as to how close to it a given carbureter setting is, the pilot has every incentive to adjust away from, rather than toward, maximum efficiency. Even were it possible to eliminate the fire hazard, the problem would be far from solved. In flight, the only measure of performance ordinarily available is that of power as indicated by the engine speed. In spite of all evidence as to the benefit of the lean mixture from the standpoint of efficiency, such an adjustment, inasmuch as it results in lower power, the only gage of performance available to the pilot, is bound to be unnatural.

*Technical Note No. 39 of the National Advisory Committee for Aeronautics, abbreviated. Based on tests made by the Automotive Power Plant Section, Bureau of Standards.

DIAGRAMATIC ILLUSTRATIONS OF TWO METHODS OF VARYING FUEL TO AIR RATIO.

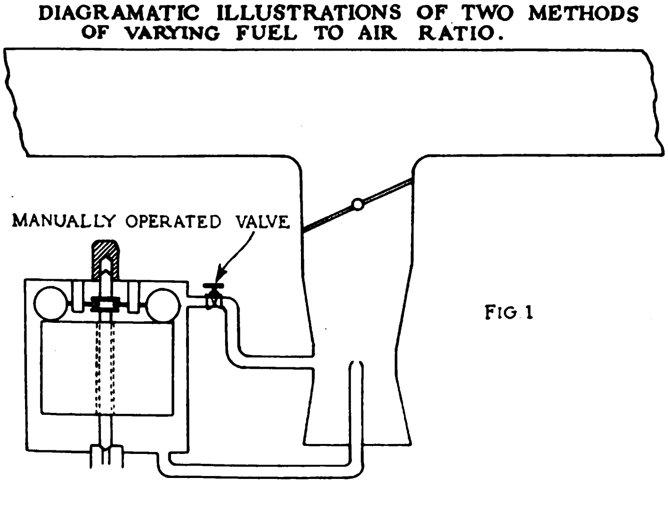


FIG 1

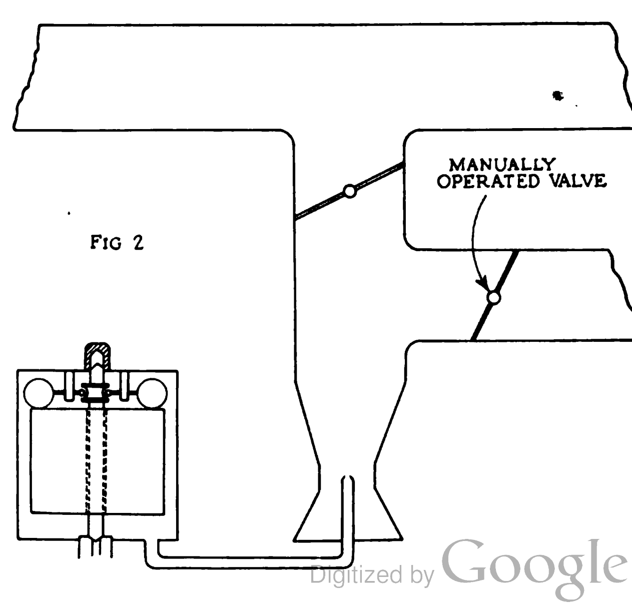
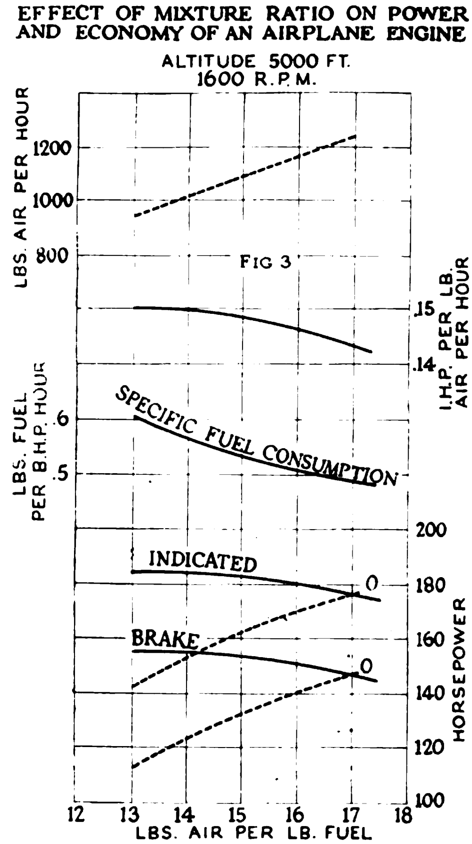


FIG 2

The explanation of the disadvantages of the first type makes clear the merits of the second. With this, as the mixture becomes of poorer quality, the amount supplied is increased. The natural adjustment, that for maximum power, will be the one at which the decrease in quality ceases to be overbalanced by the increase in quantity. If the design is such that this point is always reached before the mixture becomes lean enough to cause a blow-back in the carbureter, there is a considerable safeguard against fire.

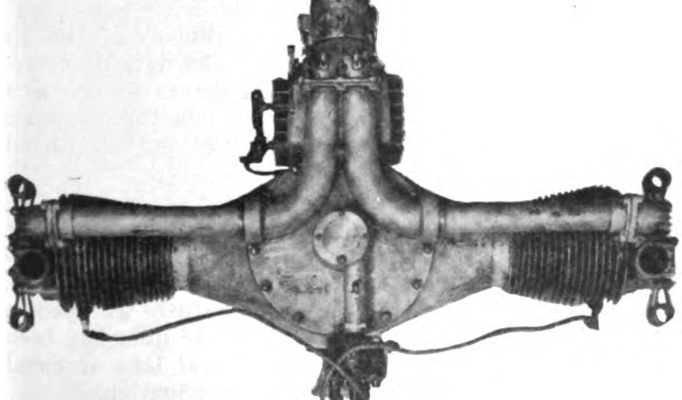
Since this type of control permits the maximum weight of charge to be supplied only when the mixture quality is such as to give a comparatively low power output per unit weight of charge, it is obvious that the greatest engine power will be slightly less than with types which permit the maximum power producing air fuel ratio to be obtained when the maximum weight of charge is supplied. This constitutes the chief limitation of this construction. That the marked advantages of this control appear only at full throttle can scarcely be considered a fault, as most commercial flying can be expected to take place under these conditions. An example of the variation of power that might be expected at different mixture ratios is given by the dotted lines of Fig. 3. Suppose the point O to indicate the desired mixture ratio for operation and hence the point at which the design permits the maximum charge to be supplied. The power at the other throttle positions has been estimated from the weight of air required to give the various mixture ratios and the indicated horsepower developed per pound of air at these mixture ratios as determined from the full line curves.



In the over-dimensioned engine, parts are designed for the stresses of full throttle operation at a certain altitude and the throttle closed so as not to exceed this power at lower altitudes. The mixture ratio control described above forms an admirable safeguard against full throttle operation at these altitudes, inasmuch as, under these conditions, it supplies a mixture too lean for engine operation. Moreover, some of the previously mentioned power loss at full throttle can be offset by an increase in compression ratio. A throttled engine can employ a higher ratio with safety than one operating at full throttle.

A Two-Cylinder Air-Cooled Aircraft Engine

FOR light sport planes the air cooled two-cylinder opposed engine seems to offer advantages. An engine of this type, rated at 40 hp. and weighing 128 lb., is being produced by the Aircraft Repair & Service Co. It has 4 x 6 in. cylinders cast of aluminum, with steel liners. Aluminum pistons with crowned heads are used. These are fitted with two rings at the top and a scraper ring below the piston pin. Large holes are drilled in the piston skirt to reduce its weight. The connecting rods are of H section, one straight and the other forked, hence the crank is of the single throw type and both pistons always move in the same direction. To minimize vibration, counterweights are secured to the crankshaft arms. The cylinder heads are detachable, and the valves, located in the heads, are operated by individual adjustable rocker arms.



A two-cylinder opposed aircraft engine

The lubricating system is of the dry sump type, all excess oil returning to an oil sump which is provided with cooling flanges. Oil is pumped to all bearings by a gear pump, a constant pressure being maintained.

The carburetor is a Zenith and ignition is by a Philbrin battery system. To prevent chilling of the incoming charge by the slip stream, the inlet manifold is located back of the engine. A ball thrust bearing is provided to take up the propeller thrust. The over all length of the engine, inclusive of the propeller hub, is 25½ in.; the width over the rocker arms, 42 in.; the height, 25 in., and the distance between supporting arms, 19 in.

ACCORDING to the present outlook, motor car manufacturers in France will have little business until trade generally is on its way toward recovery. Meanwhile firms are finding it difficult to tide over the crisis. Some are drifting into new fields; one is making machinery for contractors and marine work, another is hoping to secure a Government order for gasoline locomotives.

Automatic Control Employed in Spring Production

Lost motion has been very nearly eliminated in the manufacture of springs by a prominent Detroit company. Automatic recording pyrometers control electrically the thermostat on the gas burners of the furnaces. In other phases of spring production, also, mechanical devices have replaced skilled workmen to a large extent.

By J. Edward Schipper

AUTOMOBILE spring manufacture has been placed on a production basis with automatic control and the opportunity for error through the human equation has been reduced to a minimum by the Detroit Steel Products Co. Recently, the entire plant was overhauled and additions completed which introduce highly advanced methods and far greater efficiency into this branch of manufacture. With the additions, the plant now has a capacity of more than 6,000,000 lb. of springs each month.

All varieties of chassis springs are manufactured, including those for the heaviest motor trucks and trailers, as well as lighter springs for passenger cars, but so flexible is the arrangement of the production equipment that small orders or large tonnages, calling for long runs, can be produced with equal efficiency and economy.

The uninterrupted flow of this large variety of material through the plant has been accomplished by methods and devices so arranged that from the storage bins of raw material to the final inspection there is practically no lost motion. Specially designed equipment, largely the product of the company's engineers, plays a large part in maintaining this unusual output.

The routing of the steel through the plant is, in general, a series of continuous steps in each of the shop units. Interruption of production has been guarded against by the installation of duplicate machines throughout that can be put into service when the emergency arises. So far has this plan been carried that even two costly conveyor tempering furnaces have been installed and held in reserve, ready to be switched into the production line when needed.

The speed of production in this plant is based entirely upon the output of the furnaces. The dimensions and composition of the steel plates regulates the speed at which the furnaces are operated. When thin light plates are passing through the heat chambers, the speed is increased, and when plates of greater thickness and weight are treated, it is decreased. The tonnage of the shop will remain approximately the same, of course, whether large or small plates are being run, since a greater number of small plates will pass through the furnace in a given time.

Spring quality is based upon the heat treatment of steel. The furnaces, which are the latest type of automatically controlled, gas-fired type, were built by the McCann Harrison Co. Gas has replaced oil as a fuel because it causes less oxidization and scaling of the steel as it passes through the furnaces. Moreover, the temperature is much more easily controlled with the gas flame, and there is no carbonizing of the burners as was the case when oil fuel was used.

Automatic recording pyrometers electrically control the thermostats on the gas burners of the furnaces. So accurate are these controls that the heat is held within five degrees of the required temperature. Each of these instruments is locked in a glass case near the furnaces and the thermostatic controls are so guarded that workmen in the shop cannot tamper with them. Each pyrometer furnishes a permanent record of the performance of the furnace which gives the metallurgists and chemists a basis on which to make tests and experiments.

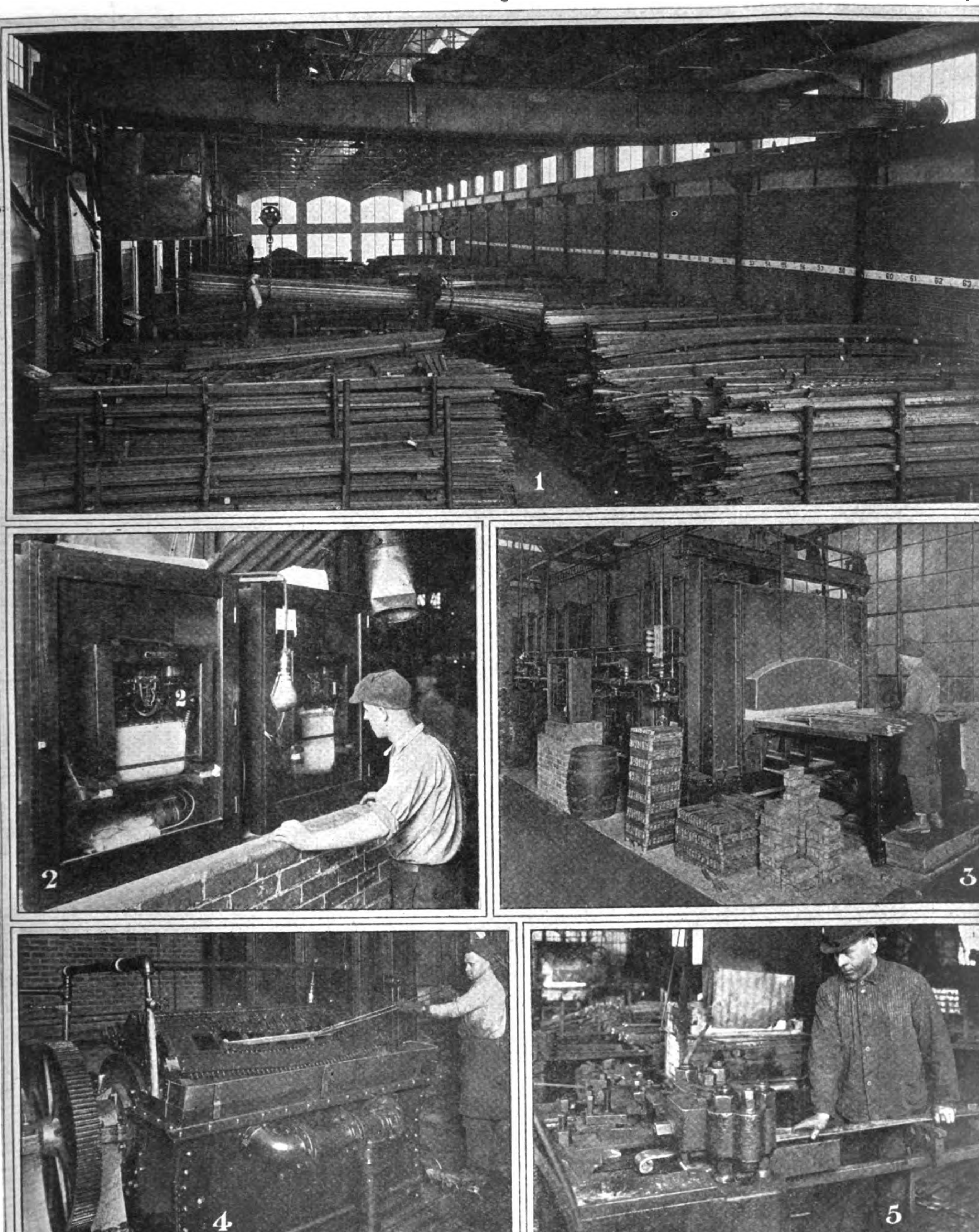
Before the automatic controls were perfected, it was necessary to depend upon the skill and judgment of the individual workman. The temperature at which the furnaces were operated was more or less a matter of guess work. A large corps of skilled operators was necessary to continually make adjustments on the burners in order that an approximately uniform heat might be maintained. To-day, human skill and judgment with their chance of error has been practically done away with, and the experience of the workman has little or nothing to do with the tempering of the steel in this plant.

Every lot of steel, even before it is removed from the railway cars, is subjected to tests by the metallurgists and chemists. Frequently, samples are tested along the production line. The photo microscope is constantly used to reveal the physical structure and character of the metal in the various stages of manufacture.

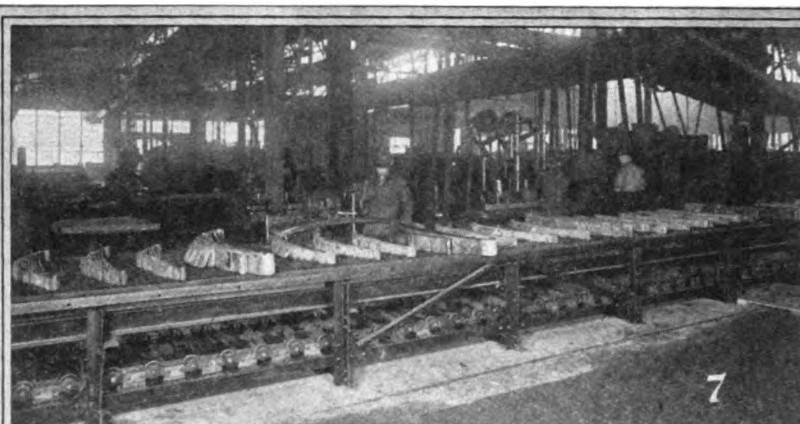
Figures and statistics given out concerning the steel are based entirely upon shop production, and not upon those compiled under ideal conditions by different societies and organizations. This feature is unique in that it tells the absolute facts about the springs. On the short leaf of each spring is stamped the date of manufacture and the key number which refers to the heat treatment. In case of trouble, this enables the engineers and metallurgists to make an accurate and intelligent analysis.

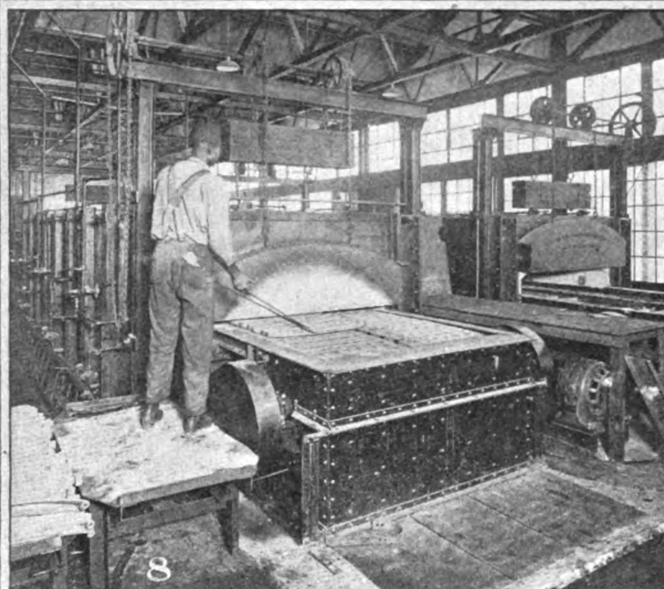
Proceeding with the first step in spring making, the long strips of steel are taken from the storage bins by the traveling crane and deposited directly upon the shearing tables where they are cut to the desired lengths. The varying length of the bars is carefully watched so that there is a minimum of waste. This item has been so closely figured that the present total loss of metal is less than 5 per cent for the entire production.

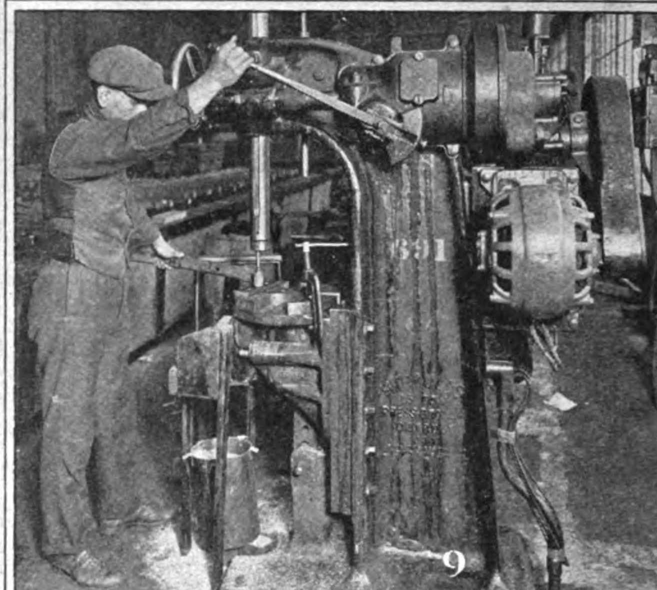
From the shears, the plates from which the main

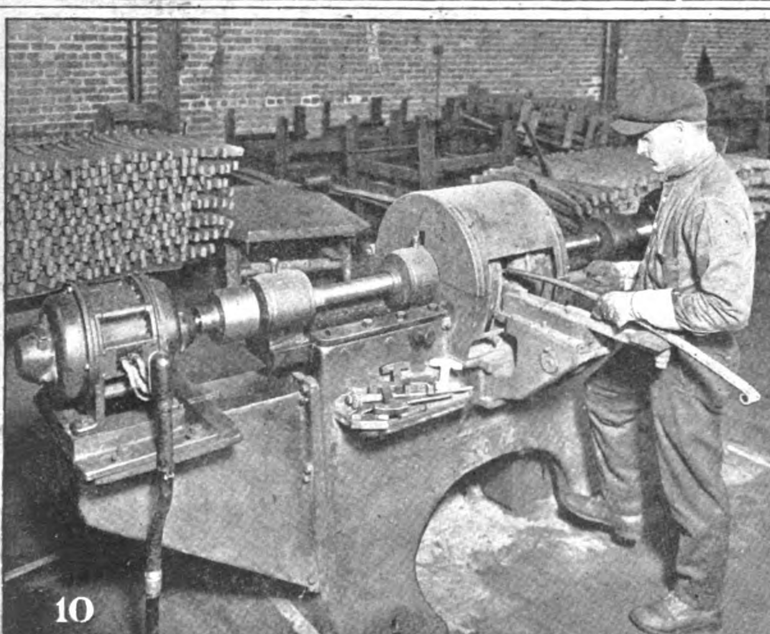


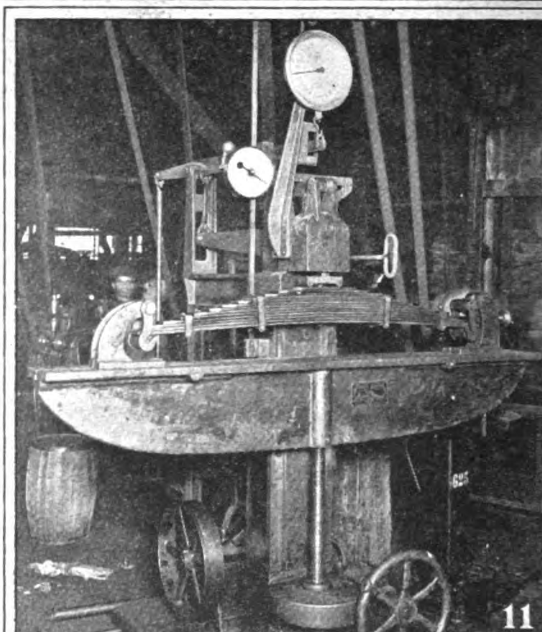
1—*The 20,000 tons of spring steel are carried in storage bins.* 2—*Electric controlling pyrometers are locked in glass cases and guard the constancy of the temperatures of the furnaces.* 3—*The McCann-Harrison walking beam type, gas fired tempering furnace. The output of these tempering furnaces controls the speed of production of the plant.* 4—*This machine, designed by the plant engineers, is new in the spring industry; it forms the camber in the spring leaves and tempers the leaves in an oil bath.* 5—*The McKenzie three-operation eye machine. First, the end of the white-hot plate is "shaved" and bent; second, the loop of the eye is made; third, the entire plate is aligned by means of special gages*











6—Complete sets of spring leaves are placed on the farther end of this conveyor table. When the spring is taken off the table it is ready for shipment. 7—The conveyor assembly table. It will be noted that four distinct types of springs are being assembled at the same time. 8—The "Draw-Fire." This is the McCann-Harrison low temperature furnace where the temper in the leaves is "drawn." 9—Hercules arbor broaching machine that broaches the bushings in the eyes of the main plate of the spring. This machine is of special design to meet the requirements of a single operation. 10—Facing machine which grinds the face of the eyes where they will be attached to the shackle bolts of the motor vehicle. 11—Olsen capacity machine by which the finished spring gets a thorough test

leaves are to be made are carried on small trucks to the forges where the ends are heated before passing through the "three-operation" eye machine. The red hot plates are placed in the machine and first the ends are scarfed and bent; second, the loop of the eyes are formed; third, the entire plate is aligned. This last operation assures the center line of the eyes being at right angles to the center line of the plate and parallel to its flat surface.

During this time, the other spring plates are sent to the punch presses where the ends are cut to the "diamond point" and the center bolt and clip bolt holes are punched. Trimming spring plates to the "diamond point" is rapidly replacing the old tapering process in which the metal was rolled thin at the ends. Engineers throughout the automotive industry favor this change.

The plates are now sent to the automatic gas fired furnaces. These furnaces are the walking beam type. The steel plates are laid on the bed of the furnace, and at regular intervals, three beams which run the entire length of the furnace raise the plates from the tile bed. By a cam mechanism, the beams then move forward a few inches, carrying the plates, and then lower them again to the bed. This process is continuous and every complete movement of the beams advances the entire contents of the furnace. Like all others in the plant, these tempering furnaces are controlled by the automatic pyrometer system, and do not require the attention of skilled operators.

Emerging from the tempering furnace, each glowing plate is immediately placed between the laminated teeth-like jaws of the forming machine. The operator closes the jaws and the plate is bent to the required camber and firmly held. The head of the machine then revolves and the plate is plunged into an oil bath and the temper is set. A moving steel conveyor belt carries the plates from the bath. A pumping system keeps the tempered oil in constant circulation, the hot fluid being piped to a cooling tower and the cool oil returned to the tank.

This machine is the product of the company's designers and embodies the qualities of speed and accuracy. With every complete revolution of the head, the spring is formed, with such precision that scarcely any adjustment is necessary. This is one of the greatest labor saving devices in the plant. Before this machine was perfected, it was necessary to employ a large force of workmen to make adjustments and fit the several plates in the spring. By this new process, the plates are made uniform and interchangeable.

All leaves which have passed through the forming machine are now placed in the low temperature automatic conveyor furnace. Here the temper is "drawn"; that is, the brittleness is taken out of the steel and it acquires the properties of elasticity and toughness. Here again the necessity for human judgment has been eliminated by use of the automatic pyrometer system.

After cooling to atmospheric temperature, the leaves are gathered in sets as they will be assembled and placed on the conveyor assembly table. The entire length of the table, on both sides, is flanked with machines, each operated by a single workman.

First, the bushings are pressed into the eyes of the main leaf by means of an arbor press of special design. This machine is so adjusted that when the bushing is flushed with the flat surface of the eye, the pressure is released. All the plates are rough polished on the bearing surfaces. Farther down the table, the bushings are broached to within one-thousandth of an inch of the specified dimension. The ends of the main leaves are faced in a special grinding machine with parallel wheels which are simultaneously pressed against the sides of the plates.

After this operation has been completed, the rebound clips are riveted to the leaves and the graphite lubricant is applied. The complete set of leaves is now pressed together in the "bolting-up" machine and the center bolt is fastened. The clip bolts are put in place and the nuts are riveted.

So efficient is the assembly plan that as many as five different springs can be assembled on the moving table at the same time. This has been found feasible in view of the elaborate inspection system employed in all stages of assembly.

That the complete spring will "stand up" with a wide margin of safety must be known to an absolute certainty before the spring leaves the shop. Every spring is, therefore, passed through the capacity test machine. Here every spring is placed under a load twice as great as that which it will be required to bear when it goes on duty in the automobile or truck. Every spring must stand this test without showing any excess deflection or permanent "settling." The clips, the bolts, the eyes, in fact, every part of the spring is tested on this machine. Every detail is minutely inspected before it is finally O. K.'d for the customer. The springs are then sent directly to the loading platform where they are weighed and checked for shipment.

Diesel Type of Engine for Motor Vehicle Work

(Continued from page 501)

The ignition chamber is not jacketed but is provided with cooling flanges. In the illustration, E is the auxiliary fuel pump which delivers fuel to the auxiliary jet C through pipe D. It is a simple plunger pump operated by cam G and lever F. Below the camshaft is a small control shaft H with stop I. The main pump, which is not shown, is of the same type and driven in the same manner.

In regular operation the ignition chamber is at a high temperature. The engine is started cold by means of an air bottle which is filled, while the engine is in regular operation, with high pressure air from the engine cylinder. A period of 30 seconds is said to be sufficient for starting, and during this period sufficient fuel flows through the auxiliary jet C for operating the engine under its own power and heating up the ignition chamber. Then operation on the regular cycle begins. The Steinbeker engine is said to be as easily reversible as the regular Diesel engine, a feature which is of importance in marine work.

New English Aircraft Engine

WORD comes from England of a new Napier aircraft engine of over 1,000 hp. It is an X-type engine with 16 cylinders, designed by J. Rowledge, and is said to weigh not very much over 2 lbs. per horsepower. This would seem to indicate that British designers are going in for heavier, more substantial engines, because a specific weight of 2 lbs. per horsepower was very closely approached in the Liberty engine, which is 400 hp.

New Automatic Chucking Lathe Developed at New England Plant

The Hartness automatic chucking lathe is a new tool specially suited for turning up ring gears and similar parts. The tool carriages are mounted on cylindrical bars which slide in bushings at both ends of the frame.

By P. M. Heldt

A NEW tool specially suited for turning up such parts as automobile ring gears has been developed by the Jones & Lamson Machine Co. The objects in view in the design of this machine were to produce a chucking lathe that would eliminate errors from indexing and that would be of great rigidity, so as to permit very accurate work to be turned out and at the same time using high cutting speeds. As an indication of

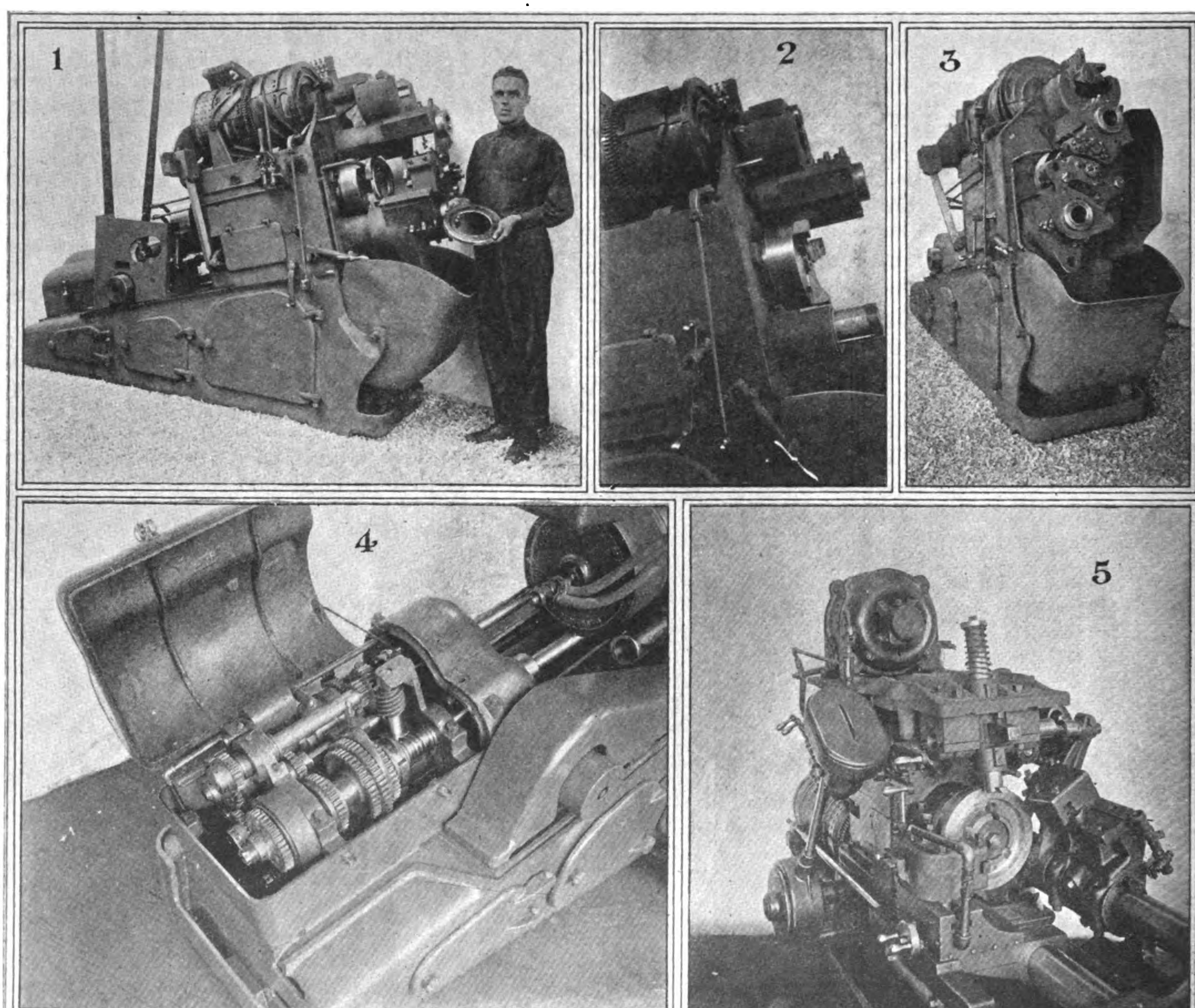


Fig. 1—Hartness automatic chucking lathe. Fig. 2—Showing chuck located between front bearings of tool head bars, so as to avoid overhang. Fig. 3—Front view of Hartness automatic chucking lathe with tool heads in place. Cross feed for facing cuts is obtained by giving an angular motion to lower tool head bar. Fig. 4—Change gears of Hartness lathe. Fig. 5—Second operation on ring gear blank, in Fay automatic lathe with pneumatic fixture

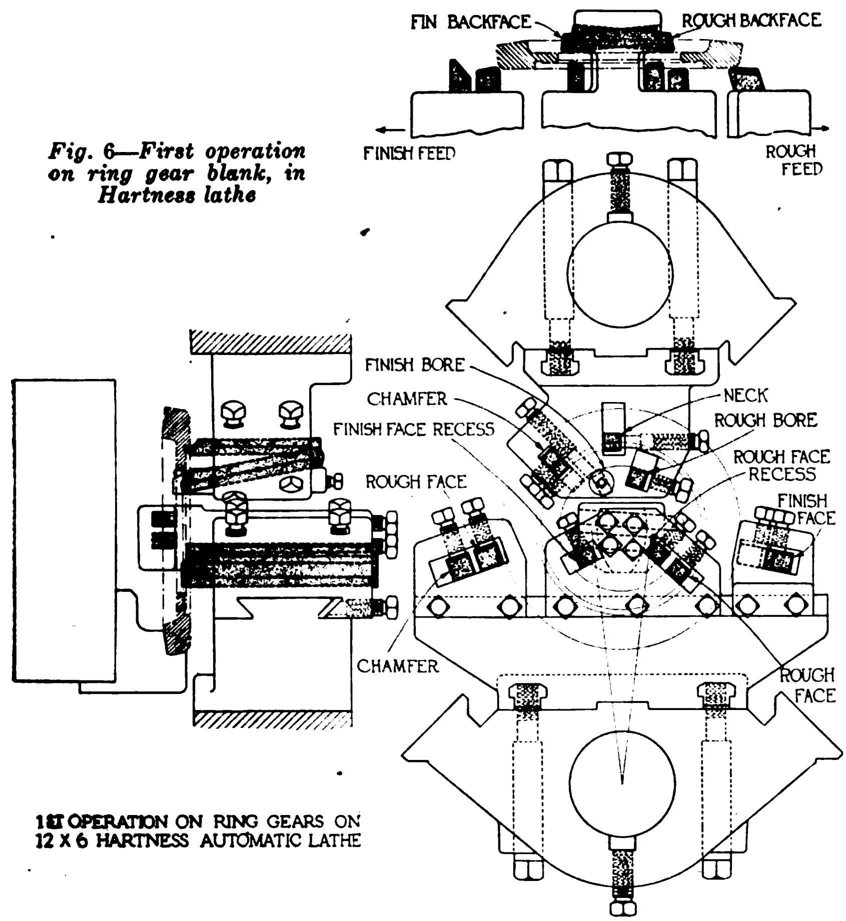


Fig. 6—First operation on ring gear blank, in Hartness lathe

what can be done on this machine in the way of rapid production, it is stated that on cast iron, cutting speeds of 125 ft. p.m. can be maintained on the roughing cut and 175 ft. p.m. on the finishing cut. It is not practicable to give cutting speeds for steel, because the hardness of the steel varies so much with the treatment it receives previous to machining.

The maximum dimensions of work that can be handled in this lathe are 12 in. in diameter and 6 in. in length. Operation of the machine is entirely automatic. All the operator has to do is to chuck and remove the work and to start the lathe after a piece is chucked. The regular equipment provides for eleven changes of speed, from 25 to 135 r.p.m. The feeds for the cutting tools are controlled by cams mounted on a large cam drum. This drum is driven by change gears for the feeding movements and is also driven at high speeds for idle movements. The clutches and gears are located in a separate box at the rear of the machine and are rendered accessible by lifting the cover. The gears are of steel and hardened.

The tool carriages are mounted on large cylindrical bars which slide in bushings at both ends of the frame. The front bearings are in large bosses cast integral with the frame and are directly in line with the cutting strains, thus avoiding overhang. The upper tool carriage bears the tools for boring and turning cuts; it has an axial motion of 7 in. and can also be slightly oscillated so as to bring first the roughing and then the finishing cutters into operation. On the lower tool carriage are the tools for all facing cuts; this too has an axial movement of 7 in. and will face any distance up to 3 5/16 in. when the cutter is on center.

The work spindle is 4½ in. in diameter and has a 3⅝ in. hole; it has the face plate forged integral with it. The machine is adapted for electric motor drive, and when this drive is used, the motor is mounted in the base. Change gears not in use are carried on a door of the base.

Although the lathe is adapted for quite a variety of work in the automotive line, its advantages stand out particularly in connection with the boring and facing of ring gear blanks. The blanks are held in the lathe by means of a three-jaw air chuck. The first operation consists in rough-boring the hole, which is done with a forged tool. As soon as the rough-boring is completed, the finish-boring cut begins, an inserted tool being used for this cut. These two tools are carried by the upper tool-head.

The lower tool-head carries eight tools, four for rough facing, one for chamfering and three for finish facing. Two cutters are used for rough facing the back face of the gear ring, one starting from the outside and the other at the same time from the inside, or from the hold. The third roughing tool roughs out the recess and the fourth the inner face of the ring flange. These four tools therefore rough three surfaces and all of these surfaces are finished on the return motion of the tool-head. As the feed of the tool-head reverses, the spindle speed is automatically increased so as to provide greater cutting speed during the finish cut. The machining time on such ring gears varies from three to six minutes, according to size, amount of stock to be removed and hardness of metal. The ring gear of a popular make of six-cylinder car, which measures 10¾ in. in diameter, can be put through this operation at the rate of twenty per hour.

From the above outline of the operation on the Hartness lathe it will be seen that only the boring and the facing of surfaces perpendicular to the axis are accomplished in this machine. The remaining surfaces, that is, the face and both ends of the toothed portion of the ring, are machined in the Fay automatic lathe, a number of chamfering and rounding cuts being taken at the same time. The ring gear is again held in the lathe by means of an air-operated fixture, this time with the

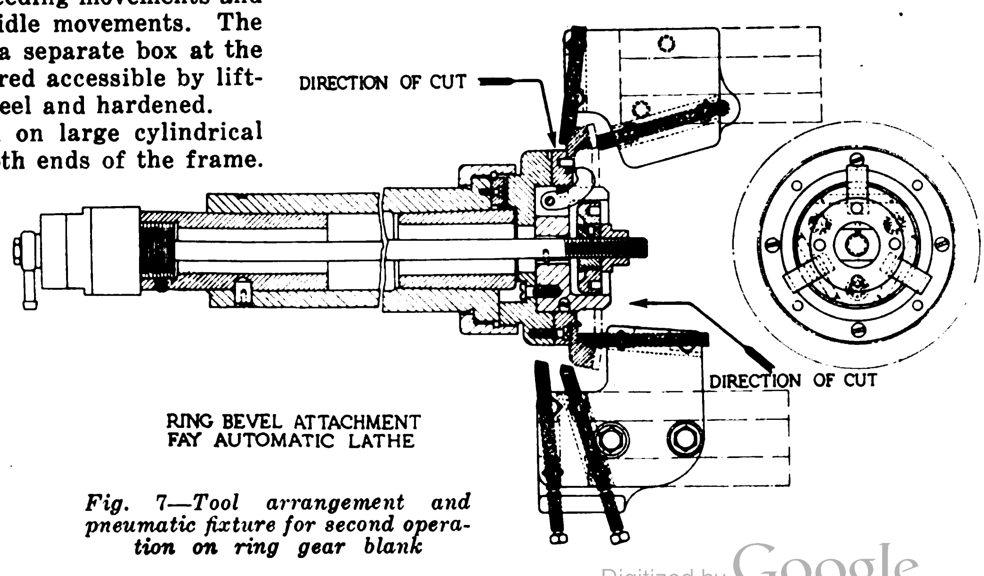


Fig. 7—Tool arrangement and pneumatic fixture for second operation on ring gear blank

toothed side away from the chuck, as shown in the illustration (Fig. 7). It is located either by the bored hole or the counterbore finished in the previous operation, and is held against the back face by pawls or fingers which grip on the surface that was back-faced in the first operation on the Hartness lathe. The work done on the Fay lathe consists in roughing and finishing the outside and the face angle and boring the inner edge of the teeth. The tool arrangement is shown in Fig. 7. One tool roughs the outside and another finishes this surface after the first tool is across. The same carriage which carries these tools also has a tool for boring the inner edge of the teeth; it finishes this surface in one cut from the rough and starts cutting immediately the turning of the outside has been completed. The long face angle is rough-faced by a tool mounted on the back arm and is finish-faced by a tool mounted in the overhead slide (see Fig. 5). The back arm also carries a tool for turning the radius at the back of the gear. Owing to the rigidity of the machine, the degree of accuracy demanded in automobile ring gears is secured even though roughing and finishing cuts are taken at the same time. Taking roughing and finishing cuts simultaneously of course greatly increases the rate of production. All the operations described can be performed in practically the same time it takes for a roughing cut across the long front face, and the largest sizes of automobile ring gears are put through at the rate of 12 to 15 per hour.

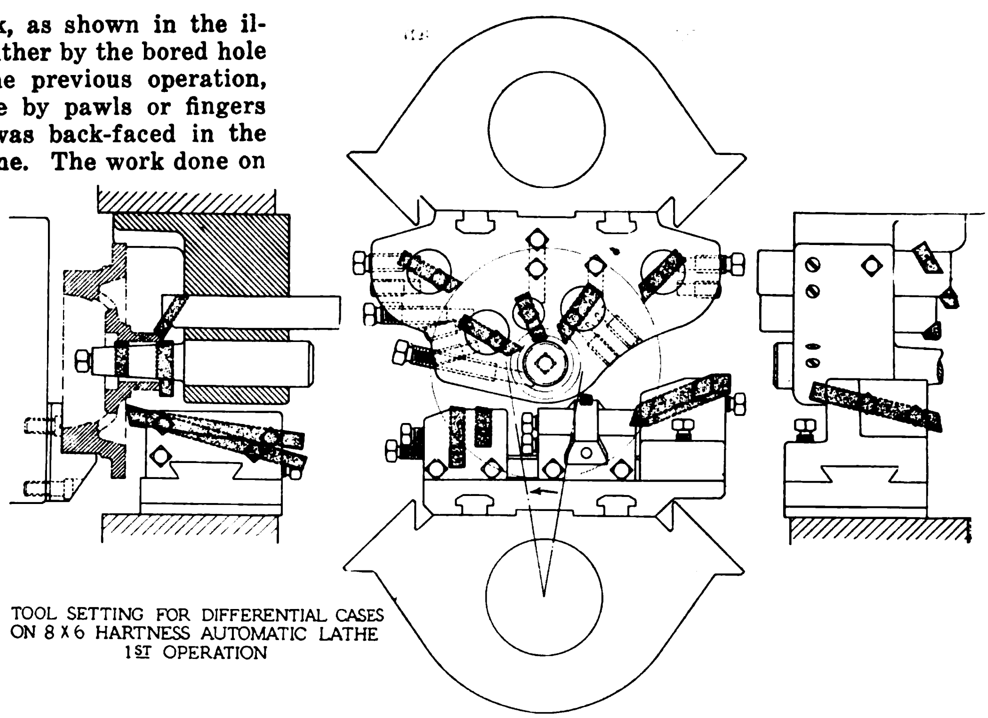
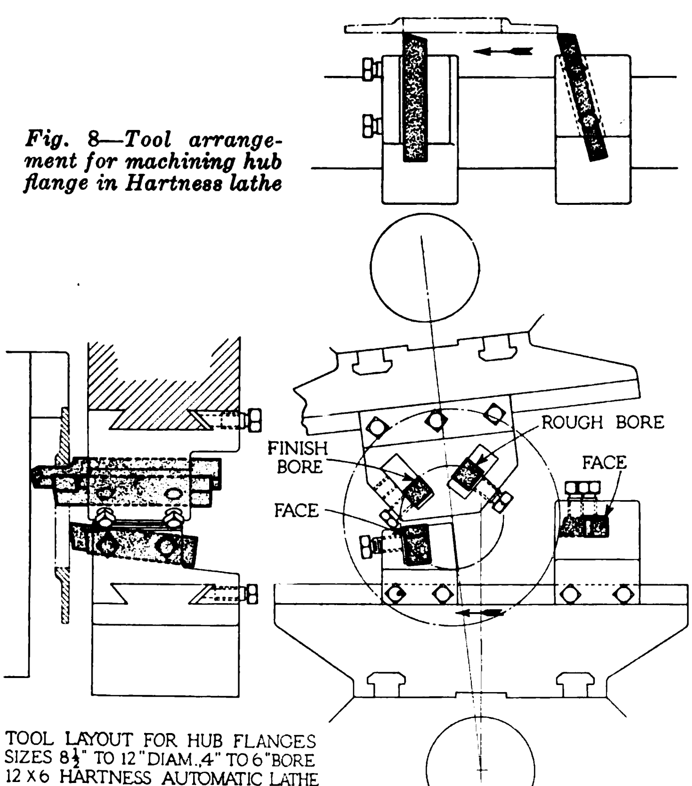


Fig. 9—Tool arrangement for machining outside of differential case in Hartness lathe

Fig. 5 shows one of these ring gears held in position by an air-operated fixture of the type shown in detail in Fig. 7. Hand-operated devices are sometimes used for holding the rings, but are, of course, slower. The advantage of the Fay automatic lathe for this work lies in the fact that in addition to taking all of the cuts at the same time, the machine goes through all its motions automatically, the only work the operator has to do being to put the work into the machine and pulling down the starting lever. One man runs two machines on practically all work, and the idle work of the machine is very slight. The direction of motion of both carriage and back arm is controlled by the proper setting for formers and cams.

Fig. 8—Tool arrangement for machining hub flange in Hartness lathe



Another piece of work in the automotive line that can be done to advantage on the new Hartness automatic lathe is the turning of hub flanges. This is illustrated in Fig. 8. Two tools carried by the upper tool-head rough and finish bore the hole and two tools carried by the lower tool-head face the inner side, starting from the outer and inner edges simultaneously. Roller bearing outer races of large diameter can also be handled in this lathe. The race or ring is held in swivel jaws so that it is gripped at six equi-distant points on its circumference and distortion due to the clamping pressure is held down to a minimum. The upper tool-head carries a taper slide which bores the taper hole. The lower tool-head carries the cutters for facing the front and back faces and for chamfering the corners. In the next operation the piece is held on a taper arbor by air pressure. The upper tool-head first rough-turns the outside and then swings slightly to bring the finishing cutter into position and feeds away from the chuck on the finishing cut. Cutters for rounding both outside corners are carried by the lower tool-head.

Another operation to which the machine is adapted is the machining of differential casings (see Fig. 9). In the first or outside operation the flange is rough and finish-turned, the hub turned (two cuts), the flange faced, the hub faced and the hole bored. How the work is divided between tools carried by the upper and lower tool-head may be seen from the illustration.

The differential gear is a part that does not vary much on different cars, and its housing is ordinarily a difficult part to machine, owing to the many surfaces to be finished. Lay-out here shown makes this a simple operation.

The True Function of an Employees' Lunch Room

It doesn't cost anything to think, and an excellent opportunity for making plans is presented when production does not demand intensive effort for the time being. The real function of the employees' cafeteria is not always determined beforehand. The subject is worth serious consideration.

By Norman G. Shidle

A SUMMER visitor to a rural town became interested in an old rustic who seemed to spend his entire existence sitting on the cracker barrel at the village store. Finally the visitor approached the native one day and asked curiously:

"What do you do here all day long?"

"Well," the old man replied, "mostly I sit and think; sometimes I just sit."

When sales slump off and the intensive drive for production has temporarily become unnecessary, an excellent opportunity is presented to sit and think—and a dangerous opportunity to "just sit." While the present time may not be favorable to the development of new phases of manufacturing efficiency, it is very favorable for considering carefully the lines along which such developments should go, for determining how weak points in the organization may be strengthened and how former mistakes and deficiencies may be corrected.

The function of the factory lunch room or cafeteria, its usefulness and its relative production importance is one factor which may well be considered during these days when there is time to "sit and think."

The employees' lunch room has ancestors a few generations back which often cause its real function to be mistaken. One of those ancestors was the hot coffee and doughnuts which comprised the beginning of "welfare work." This ancestor proved to be a fraud in many cases, acting chiefly as a substitute for fair wages and decent working conditions. Those days, of course, are long since passed. The philanthropic ideals which dominated even the most honestly conceived "welfare work" are no longer being considered with favor.

And the factory cafeteria or lunch room is shaking itself free from the unfortunate association with its "philanthropic" ancestors.

That association is rightly called unfortunate, because the factory lunch room cannot attain its highest effectiveness either from the standpoint of the employer who installs it or of the employee who utilizes it unless conceived and operated on a self-respecting and businesslike basis.

In most modern industrial plants the employees' lunch room has a place. Some of the chief reasons for this are:

1. **Frequently there are not adequate eating accommodations adjacent to the plant. In many cases it would be impossible for the worker to get any lunch unless he carried it from home.**
2. **The luncheon hour should be a period of relaxation, if the man is to start his afternoon's work with renewed interest and energy. This is impossible if he must crowd himself into some small illy-ventilated lunch room, where neither the surroundings nor the atmosphere invite him to remain for a moment longer than is necessary to eat his food as rapidly as possible.**
3. **Nearly all public lunch rooms near to manufacturing plants are of this kind. Clean, inviting lunch rooms will not accept the patronage of men in dirty overalls and greasy clothes. Men do not eat in dirty lunch rooms from preference. Such eating places have a decidedly bad psychological as well as physical effect, the results of which accrue to production in the afternoon.**
4. **The cold lunch is often the only alternative to these public lunch rooms. The ill-effects of constant cold-lunch eating have been so widely and effectively discussed as to need no repetition here.**

Consequently, the employer gains a definite advantage from providing decent eating facilities for his employees. So well-known an authority as Daniel Bloomfield states that "to make such provision even at an immediate financial loss, involves no philanthropy." This is doubtless true, but there is really no reason to operate an employees' lunch room at a loss. While it would not be good policy for the employer to attempt to make his lunch room a source of profit, there is every reason for him to charge a fair price for the food served, so that the lunch room will pay for itself.

The object of the employees' lunch room is not to gain the men's good will by giving them a daily present, it is merely to provide them with the opportunity to buy at a fair price that comfort and nourishment for which they are willing and able to pay. We all like to get things as cheaply as possible, but we are better satisfied when we pay for them at a fair price than when they are given to us by someone for whom we are working.

When the lunch room is operated on a self-supporting basis there is no chance for suspicion to arise on the part of the workman that the employer is giving him something at noon hour and taking away twice as much during working hours. No employer does that to-day, of course, but facts are not necessary to arouse suspicion. Letting the workman pay his way leaves him with a feeling of independence and self-respect—and this feeling is the charm which wards off the ghosts of the cafeteria's ancestors. It is impossible to study human relationships in industry and not come to believing in ghosts; they are often very real.

The lunch room will do more than aid the digestion and physical well-being of the workers. It will, of course, do these things. The production advantages of such aid have been discussed and written about at great length—probably with too much enthusiasm at times. Nevertheless, it is certainly true that better work will come from employees who have an opportunity to eat a decent warm meal at noontime.

But the clean atmosphere and surroundings of a well-equipped cafeteria provide for the manual workmen that relaxation and opportunity for social intercourse which most executives enjoy so much. Office workers usually look to the noon hour as a time for "talking things over," for enjoying the company of their fellow workers and for having a pleasant relaxation from their work. They all eat, it is true, but the psychological features play fully as important a part as the physical appetite. We all know the effect it has on us. The clean, pleasant cafeteria has the same effect upon the manual workmen. Strangely enough, most of his reactions are just like ours.

Having determined that a well-conducted cafeteria is a benefit to all concerned, careful attention should be given to choosing and installing the proper equipment. To accomplish the objects in view, adequate service should be provided at the lowest possible cost—but the service must be adequate.

It is possible by means of a cafeteria system to serve a large number of people in a very short time, and such a system is often desirable in the employees' lunch room. An example of good service in this respect is to be found at the big cafeteria of the Westinghouse Electric Company. Although this installation is much larger than would be necessary in a majority of plants, its operation illustrates the best modern practice and has been adapted elsewhere on a smaller scale.

In this particular case an entire building is devoted to cafeteria purposes, the first floor being divided into separate sections for men and women. The second floor is one large cafeteria for both men and women.

The employees enter the building at the center and proceed up an incline or ramp to the second floor. Thence they go to the section of the cafeteria nearest them. After eating, they depart from the building at either end down other ramps. Thus there is a continuous circulation of employees in and out through different entrances. Some such system as this is desirable in any factory lunch room, as it eliminates crowding and confusion.

A belt conveyor has been installed here upon which the employee places his tray as he goes down the line selecting his food. He picks up his tray and silverware, as in an ordinary cafeteria, but instead of carrying or pushing it, he places it on this moving belt. Thus the tray moves along, the employee following it. This prevents the line being delayed, since all the food is laid out on the plates in advance and it is necessary simply to pick one up and place it on the tray as the tray moves along. This arrangement permits the serving of 34 persons a minute by each service counter.

Since this moving belt idea was an innovation, the employees were just a bit afraid of it at first. To overcome this difficulty, cafeteria attendants were stationed at each end of the line to shut off the belt motor in case a jam should develop. The employees quickly found that if the tray moved along a trifle too fast they could hold it in place on the belt while they were getting what they wanted.

After the employee has finished eating he picks up his tray and carries it to another moving belt by which the tray is carried to an automatic elevator, which in turn takes it to the dishwashing room. This belt conveyor system is one of the chief features of this particular installation. This Westinghouse installation was made by Albert Pick & Company and contains many other details of efficient cafeteria practice in connection with the preparation and serving of food, dishwashing, etc.

The best results in a special instance, however, can be obtained only by providing equipment especially adapted to the needs of the particular plant. The instance cited merely shows the advantages which can be gained from thorough study and planning. Excellent advice along these lines can usually be obtained from the companies which specialize in lunch room equipment and installations, and the manufacturer may as well take advantage of the service which these firms have built up for his benefit.

One phase of employees' restaurant operations that should not be overlooked is that which concerns the serving of food which will be in accord with the religious, as well as the physical attributes of those who are to consume it. The menu should always be so arranged that there will be sufficient variety to give a full meal to every man every day regardless of his religious affiliation. There should never be a day, for instance, when pork is the only meat served, nor should fish of some kind be omitted from the Friday bill-of-fare. In a plant which employs a large number of foreign workers, the menu should be such as to allow for the various fast days or religious observances of the different groups.

In plants where there is any kind of employee association, it is well for a restaurant committee to be appointed from that group.

In smaller plants, a regular lunch room with waitresses and table service has often been found to be effective. In any case, the eating place and its service should embody the following essentials:

1. **Cleanliness.**
2. **Fresh air and good light.**
3. **Rapid service.**
4. **Good food at cost price.**
5. **An orderly method of entering and leaving the eating place.**
6. **As much quiet as is consistent with efficient service.**

Many times the company lunch room is as desirous from the standpoint of office workers and executives as from the standpoint of the workmen in the shop. In such cases, one of two plans may be followed out:

1. A separate space may be provided for this class of employees.
2. Both executives and workers may eat in the same place.

The first plan is the one most generally followed and has much to commend it. In certain other cases, however, the second system is successful. There is much to be said in favor of the latter system, especially from the standpoint of "democracy," but the best results will probably be obtained in any individual case by doing what the executives honestly feel to be the best in that instance.

It should be noted, however, that eating in a clean place alongside of clean people is likely to make the workmen in general more cleanly in their habits. A well-known machine tool plant in New England about a year ago installed a lunch room for its 500 employees. In this lunch room a regular lunch is served at a fixed price, the food being served to the men by waitresses.

Executives and workmen eat at the same table side by

side. Conversation is perfectly natural, the executives simply act as nature prompts them to act, and there is no resulting loss of dignity; nor is there evidenced any of the false enthusiasm or feigned "good-fellowship" which goes with excessive or forced geniality.

In this instance the personal cleanliness of the workers at lunch-hour is very noticeable. Men in very dirty, greasy working clothes come in to lunch with their hands and face thoroughly washed and cleaned. This is true of almost every workman who eats there. Whatever might be the result elsewhere, this condition has come about naturally in this plant, since no effort was made by the management to bring it about.

The president of this company happens to have a very exceptional understanding of human relationships and is one of those perfect gentlemen with whom anyone feels entirely at ease. The executives with whom he has surrounded himself are of the same type. This accounts to a large extent for the success of this "democratic" method of running the lunch room. These men really seem to enjoy eating with the workmen and to be better contented than if they had a separate dining room to themselves.

In many other cases, however, such a plan might be unpleasant for both employees and executives. Nothing is to be gained from attempting to force executives to be what they are not; to eat among workmen as a matter of policy rather than as one of desire. And it must be recognized, of course, that workmen in various plants differ greatly. Moreover, executives often desire to utilize the lunch hour for business conferences, and thus require a segregated eating place.

Whether or not the office employees' lunch room should be segregated from that of the shop employees is one to be decided chiefly in accordance with the feelings of the executives in charge of the plant.

It is not often that the publicity material of a company with goods to sell can be quoted as reliable information about that product. A good summary of the requirements of a successful factory cafeteria, however, is contained in a booklet recently issued by Albert Pick & Co., and comprises an excellent summary to this discussion.

"Whether a cafeteria pays or is run at a loss depends upon its mode of operation. It has to be carefully planned and properly conducted. It is an important business venture which will run away with itself in expense or fall behind in service if it is not well equipped. It is a restaurant and should be conducted on restaurant principles. It should not be entrusted to the tender mercies of novices or theorists. An expert restaurant man or woman should be placed in charge. The food should be purchased in quantities. A careful check-up system should be provided. There should be sufficient variety. Prices should be based on cost. Waste should be eliminated and the most stringent food conservation policies used. * * *

"Whether the factory be great or small a thoroughly thought-out plan can be put into operation in the way that will meet its requirements best."

Let Everybody In

DISCUSSING what he believed to be the ineffectiveness of certain forms of "welfare" work as carried on in his plant, the vice-president of a large New Jersey automotive concern said recently:

"Take, for example, our baseball team. The team is very successful and wins a large percentage of its games. We employ, however, a large number of foreign-born workmen, many of whom scarcely speak English. These men are not at all interested in baseball and never attend the games. They do not understand it and have no enthusiasm for it.

"So it is with many of the other employee activities which we carry on. These foreigners, who comprise a majority of our employees, are entirely out of them."

This executive brings up an important point which is not often recognized in the organization and operation of employees' service work. The tendency is to organize and promote activities which the personnel director is familiar with and which, as Americans, we feel the foreigner ought to take part in.

A particularly good analysis of this special problem is given by Daniel Bloomfield in his recent book, "Labor Maintenance." Bloomfield says in part:

"It is often noticeable that games, like languages, are something that need to be acquired, and the methods of acquiring them have to be planned with intelligence. The teacher of English does not start by ridiculing the mother tongue of the alien who is to be taught. In the recreation room and on the playground the same tact needs to be employed. Plays and exercises traditional with the alien have often been subjected to disheartening ridicule, with the result of driving him away from play activities.

"He gets the burnt-finger attitude. Such disaffection is a loss to the organization and a handicap to right relations. The alien is sensitive about his customs and native mode of self-expression, as we should be in the same situation. Wise recreation leadership will see to it that not only does each member of the organization find a place in the activities going forward, but can do so without loss of self-respect or danger of humiliation."

Better Road Construction

THE need for improved roads and a lower cost of operation is becoming more and more apparent. Railroad congestion, brought about by the necessities of war and government control, with the resulting increased use of motor trucks, has made the highway problem a serious one. While intermittent attempts have been made to establish an efficient highway system in the United States, yet it has not been possible until recently for the automotive engineers to meet with the road experts and work out a definite engineering plan of re-establishment and improvement. Many organizations have been at work during the past year on this important problem. Thousands of experiments have been made by government experts, automotive engineers and road builders. Their investigations have revealed startling facts. Borings to a depth of 10 to 15 ft. below the road surface have shown that many of the roads recently constructed are built on an entirely wrong plan. As one engineer expressed it: "You can't lay a road like a carpet over sand and expect it to last, but if you build it like a bridge, it will." The subsoil several feet below the actual bed of the road has been found to have a very important bearing on the lasting qualities of the highway. Many of the pet theories of experienced road builders have been totally exploded, and new methods which on their face looked fanciful have been found to possess real merit.

Road Construction to Build Up the Exports of Automobiles

This is a discussion of the work which should be done by exporters in furthering highway improvements in Latin-America, South Africa, Australia and China, with comments upon the value of graded dirt roads in these developing territories rather than hard-surfaced construction.

By George E. Quisenberry*

TOO little attention has been given by automotive exporters to the furtherance of road and highway improvement work in the foreign field. This statement is readily proved by even the slightest study of road conditions throughout such great stretches of territory as Latin-America, South Africa, Australia, and China where America must look in great measure for the future absorption of the cars, trucks, tractors and equipment it ships into the export markets.

These territories to-day are awake with the idea of road building as they never have been before. In the last few years, they have bought motor cars by the thousands and this has brought about a consciousness of the need for highway improvement that no other agency could have aroused. But the interest—and only here and there has it yet been fused into the actual construction of many miles of good roads—must be quickened so that future expansion may assure the automobile its rightful place in the transportation systems of these growing and developing countries.

In a word, the automotive exporter must get behind the idea of good roads, he must push their construction and, in large measure, he must supply the impetus and the propaganda necessary to transform thought into action. He can do nothing else that will have such a lasting effect upon the industry he represents and be such a potent factor for its rightful development through the coming years.

Let us look at the situation as it exists to-day, taking Latin-America as the example. This is a territory comparatively sparsely settled and devoted almost entirely to agriculture. Great stretches of the Argentine, Uruguay and Southern Brazil, as well as the inland valley of Chile, present no difficulties to the opening up of serviceable highways. Being agricultural, the problems of road development become analagous to those of the farming districts of our own Middle West.

The Argentine is almost as level as a man's hand over three-quarters of its wide expanse. Land has been cheap and broad national highway routes have been laid out in nearly all of the more prosperous territories. Their width, to one who has been used to the roads of this country or Europe, is well nigh astounding, being 80 to 100 ft. or more. Their development has been left to nature and the huge two-wheeled carts of which the automotive exporters have heard so much. The result has been the natural one that such highways are often impassable and that long distance touring is attended with perplexing difficulties.

Managing Editor, El Automóvil Americano.

The testimony of a recent traveler, representing an American tire maker, who traveled all over the Argentine in an American automobile, is illuminating.

"Good dirt roads for light traffic are not difficult to build here," he says. "It was noticeable on the road from Buenos Aires to Cordoba that wherever there was ditching and even a small amount of grading, there was no trouble in passing. What work was done, however, was done with the pick and shovel. Road machines, which might clear up a dirt road very quickly, have not penetrated to the Argentine. If motor owners and those in the sale of motors and road machinery makers would get together, they could do much to get the work of road making under way."

Road builders agree that the problems of highway building are centered in overcoming water and frost. In other words, drainage and freezing weather. For the Argentine, the latter may be forgotten, as it may for most of those parts of Latin-America which concern the exporter of automotive equipment.

Get rid of the water and the good road has become a reality. Apply this to the Argentine, to Uruguay, to Brazil, to Mexico, to interior Chile, and see what the result will be in future expansion of the motor car.

The proper construction for these countries is that known as the graded dirt road. The roadway is graded above the water, ditched for proper drainage, and crowned so that rain will quickly run off to the sides. This is the same road, easily and quickly built and with slight expense, that carries the great traffic in motor cars through Missouri, Kansas, Nebraska, Illinois, Ohio and the other grain growing states. They are constructed with a small amount of mechanical equipment, present almost no engineering problems and can be maintained with the home-made drag. Furthermore, they are almost year-around roads.

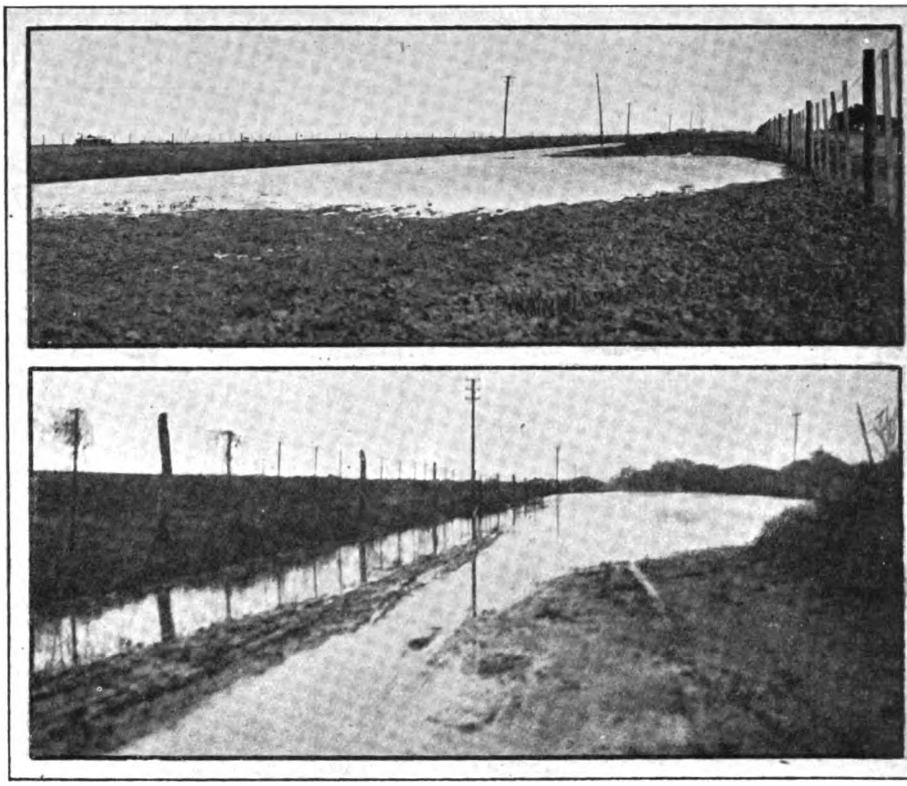
Latin-America is thinking to-day almost entirely of hard-surfacing its roads. This is so despite the high cost and physical difficulties, such, for instance, as in the Argentine where stone is obtained only after long rail or water shipment. In fact, one authority whose insight cannot be doubted declares that the first movement in any road campaign in South America is to overcome the desire for hard-surfaced highways. The graded earth road is much more suitable for a sparsely settled territory where land holdings are generally large and roads of this kind can be obtained in a fraction of the time that would be required to finance and build with macadam or concrete.

The duty of the automotive exporter is to further this propaganda and to aid in every manner possible in put-

ting it across. Passable roads, improved for traffic, must be cut through from town to town and existing roads must be graded and drained so that they will permit passage of cars and light trucks during the greater part of the year. No agency is so well prepared to assist in such campaigns as the automotive exporter and manufacturer. To them should fall a great deal of the preparatory work, just as it has here.

In recent weeks, communications on this subject have been received from Mexico, Peru, Chile, the Argentine and Brazil. Each of these countries is seeking light as to how it may pull itself out of the mud. Automobile and road associations have been formed or are in process of organization to further the work and each is sincerely desirous of getting better highways.

In Chile, the automobile club of Valparaiso is working upon the road between that city and Santiago, the capital, a stretch of some 150 kilometers that, once opened, will be dotted with motor cars speeding between the two chief centers. From Puerto Montt, far to the south in the same country, comes a similar word that improvements are under way. From Lima, Peru, the sentiment is expressed that road work is of prime necessity and elsewhere on the west and the east coast the same may be heard.



Improper drainage has made these Argentine roads almost impassable. To grade them above the water is a task requiring but little mechanical equipment and time

In São Paulo, Brazil, notable work already has been accomplished in getting highways built by co-operative effort. Uruguay has probably a better mileage of good roads than any other country in South America and, in Argentina, success has attended those efforts which have been made to grade up the earth roads and to maintain them either by governmental or co-operative effort of the estanciero owners. Frequent testimony is heard to the effect that many roads in the Argentine require grading or improvement in only a few stretches to make them suitable for many miles of travel.

In Latin-America, as in Australia and South Africa, there are many motor clubs and, in some cities, associations of automobile dealers. They are potent factors in getting road activities under way and, with them, the automotive exporters should work in close union. As an example of what such clubs may do, the Jalisco Automobile Club of Guadalajara, Mexico, might be cited. It has gotten behind several road projects. One of the latest such projects in the Guadalajara district is the road from that city to Colonia Seatle, which was formally opened on Dec. 1, 1920.

Latin-America is close at hand and from it may be gained the road lessons that should be applied in all those developing countries of the world. Conditions are the same in each and the reward for work accomplished will be similar.

This article cannot be completed without a word about China and its future road activities. The Celestial Kingdom, it cannot be doubted, is at the doorway of much building. Of that there is every testimony:

"Just at present, there is more interest being shown in good roads in China than has been manifested in centuries; yet they know little or nothing about it," says a recent letter from Shanghai. "A good roads movement would mean millions to the exporters and they should get behind it."

Coincident with this, is the announcement of the Bureau of Foreign and Domestic Commerce that a road making convention and exhibition of road constructing machinery will be held at Shanghai in May of this year under the auspices of the roads committee of the Pan Pacific Association. Two main roads, the bureau adds, are under contemplation for construction, one from Shanghai to Hangchow, the other Shanghai to Nanking.

THE use of radio communication, both telegraph and telephone, on the military airplane is, perhaps, the latest application of radio science, increasing tenfold the usefulness of the airplane and already influencing the design of military aircraft. The dots and dashes of the Morse code transmitted from the trailing aerial of the airplane carry to the ears of the artillery battery commander the correction for each shot fired, enabling him to group his hits on an invisible target with a degree of accuracy as great as is possible when the target can be seen, or bring to a waiting general news of enemy troop movement observed from the air.

Squadrons of attacking planes can be maneuvered in flight by means of the wireless telephone from the airplane of the squadron commander or from the ground as easily as a company of infantry is handled. By the same means machines engaged in aerial combat and outnumbered may call for assistance.

Bombing planes lost in the fog or darkness are directed unerringly to the home airdrome by the radio direction finder and airplanes without pilots, controlled entirely by radio, are already a reality.

The Air Service of the Army, realizing the importance of this newest phase of radio, has established a school for the training of personnel to install, operate and maintain the radio equipment of airplanes at all the flying fields throughout the country.

Exports of Automobiles and Tires for December, 1920

	COUNTRIES	COMMERCIAL				PASSENGER				Parts	TIRES			All Other Tires
		Complete Cars		Chassis		Complete Cars		Chassis			Casings	Inner	Solid	
	Europe													
1	Austria	3	$1,348			11	$4,627							
2	Azores and Madeira Is.									$1,538	$80	$16		$96
3	Belgium	25	11,240			49	57,418	30	$8,910	14,095	152,937	3,662		156,599
4	Bulgaria	4	9,723			5	2,283			780			$339	339
111	Czechoslovakia													
5	Denmark			2	$6,471	25	40,402			499,385	17,891	1,526		19,417
6	Finland					1	1,600			1,873	17,144	2,052	452	19,648
7	France					21	33,074	6	4,310	196,843	90,488	26,010		116,498
8	Germany	1	3,887			8	15,217			1,442	1,613	211		1,824
9	Gibraltar	1	2,800			10	11,155			2,528				
10	Greece	5	13,425	1	3,966	48	91,411			14,925	24,372	4,125		28,497
112	Hungary													
11	Iceland and Faroe Is.													
12	Italy	1	545	6	2,580	5	8,750			14,255	46,621	9,511		56,132
13	Malta, Gozo and Cyprus Is.					24	33,292			1,183				
14	Netherlands	31	31,301	1	2,000	117	181,472	7	4,935	48,975	140,227	7,296	3,036	150,559
15	Norway	8	19,500	8	18,100	18	26,460			66,384	61,927	6,297	7,628	75,852
113	Poland and Danzig	1	3,635			11	18,009			8,231	3,503	465		3,968
16	Portugal			1	4,243	6	11,722	1	4,250	9,503	7,683	1,390		9,073
17	Roumania	7	5,606	10	7,500	11	13,500			3,505	3,887		847	4,734
18	Russia in Europe	46	25,400			11	7,675			2,180	6,379	2,847		9,226
20	Spain	23	57,172	16	29,876	309	477,346	9	16,080	391,156	168,573	8,629	4,620	181,822
21	Sweden	6	14,311	48	80,666	97	116,722	7	6,431	78,448	31,067	3,340		34,407
22	Switzerland					64	78,396	1	800	13,516	3,944	494		4,438
23	Turkey in Europe	7	3,355			90	71,506			13,673	41,336	812		42,148
24	England	6	7,680	53	86,485	68	123,321	5	4,792	2,685,975	393,203	24,976	36,398	454,577
25	Scotland					3	5,494			1,681	5,950	32		5,982
26	Ireland	1	1,550			2	1,440			715				
114	Yugoslavia, Albania, etc.									70	993	49		1,042
	North and South America													
28	Bermuda									190				
29	British Honduras					3	2,450			1,755	253	7		260
30	Canada	54	104,555	19	44,419	91	168,886	12	24,793	355,230	270,982	79,454	20,941	371,377
31	Costa Rica	2	990			18	20,186			2,467	1,219	220		1,439
32	Guatemala	7	7,355			8	15,834			3,343	1,396	50		1,446
33	Honduras					15	12,504	1	379	4,948	1,547	10		1,557
34	Nicaragua	1	3,426	1	2,540	13	16,703			6,582	1,806	816		2,622
35	Panama	4	1,980			52	65,700			21,496	16,919	1,732	6,560	25,211
36	Salvador	5	20,236	5	19,981	23	35,948			3,185	3,671	6,413	1,918	12,002
37	Greenland													
38	Mexico	164	235,892	24	52,256	565	512,507	1	734	174,372	122,462	20,901	10,511	153,874
39	Miquelon, Langley, etc.													
40	Newfoundland and Lab'dor					1	1,176			1,031	55	7		62
41	Barbados	25	18,580			21	22,332			9,852	2,366	179		2,545
42	Jamaica	18	24,832	2	2,702	47	39,980	1	2,357	32,742	43,484	1,975	269	45,728
43	Trinidad and Tobago	45	46,189	1	1,875	39	51,546	1	2,702	27,875	26,272	1,261	4,952	32,485
44	Other British West Indies	14	8,599			21	18,693			7,385	3,206	116	177	3,499
45	Cuba	42	86,067	18	33,333	231	420,987	6	16,960	176,737	65,661	12,167	37,906	115,734
46	Virgin Islands of U. S.	3	1,810			9	6,600			1,978	869	25		894
47	Dutch West Indies	8	3,602			17	27,034			2,196	2,093	194		2,287
48	French West Indies	11	6,444	1	2,056	20	19,754			9,718	9,594	1,244	4,374	15,212
49	Haiti	1	7,625			21	22,770			7,504	8,065	1,673		9,738
50	Dominican Republic	37	34,674	9	22,726	43	48,793			30,483	17,589	3,542	3,997	25,128
52	Argentina	12	46,875	11	30,753	660	798,044	10	8,576	966,892	222,477	27,039	750	250,266
53	Bolivia	1	2,800							1,432	2,097	31		2,128
54	Brazil	56	32,751	4	7,598	599	691,743	3	6,288	625,154	128,867	5,096	2,928	136,891
55	Chile	97	77,050	6	9,661	101	152,717			50,601	40,668	3,483	178	44,329
56	Colombia	6	2,970	2	4,800	42	72,163	4	2,388	23,873	9,138	1,145		10,283
57	Ecuador	10	5,195			16	32,317			5,043	5,246	329		5,575
58	Falkland Islands													
59	British Guiana	25	12,057	3	8,863	25	18,865			11,296	3,791	226		4,017
60	Dutch Guiana	1	600	2	1,150	1	835			3,316	289			289
61	French Guiana	1	3,061			1	1,000							
62	Paraguay					1	2,500			1,823				
63	Peru	20	35,176			75	131,466			70,602	20,719	4,748	3,365	28,832
64	Uruguay	1	1,200	1	1,426	361	411,848	5	3,220	104,361	88,861	3,411		92,272
65	Venezuela	35	22,822			75	107,708			26,780	10,345	2,635	98	13,078
	Asia and Far East													
66	Aden													
67	China	4	12,048	11	46,619	200	249,686	3	5,287	52,723	32,772	6,379		39,151
71	Kwantung, leased territory					5	7,300			2,500				
72	Chosen									6,307				
73	British India	64	149,184	14	42,602	371	507,833	25	30,725	198,629	61,749	6,054	170	67,973
74	Straits Settlements	14	24,302	39	91,612	56	90,197	3	4,682	100,752	3,338	81	3,327	6,746
75	Other British East Indies			2	3,914	43	67,103			15,469	1,120	343		1,463
76	Dutch East Indies	169	404,062	44	130,024	440	649,057	3	3,923	190,677	36,632	5,090	47,690	89,412
77	French East Indies			8	3,877	24	22,369			9,862			98	96
78	Portuguese East Indies													
79	Hongkong					32	59,593			6,712	8,573	2,336	2,409	13,318
80	Japan	43	63,102	31	68,977	124	160,613	60	71,409	74,110	28,711	596	2,100	31,407
81	Persia									172				
82	Russia in Asia									224				
83	Siam					9	14,658			989				
84	Turkey in Asia	10	39,641			36	38,662	2	600	15,745	2,523	880		3,403
85	Other Asia													
86	Australia	62	102,055	68	93,876	383	505,596	1,178	1,307,734	166,499	88,834	2,489	500	91,823
87	New Zealand	37	94,842	114	251,515	613	788,787	75	95,230	127,598	195,816	9,238	4,875	209,929
88	Other British Oceania	1	800							1,077	200			200
89	French Oceania									1,224	300	16	605	921
90	Other Oceania													
93	Philippine Islands	113	119,120	24	62,265	306	339,395			151,405	182,825	25,535	30,175	238,535
	Africa													
96	Abyssinia													
97	Belgian Kongo									164	1,194	173		1,367
98	British West Africa	79	100,518	5	7,207	58	77,756	9	10,857	82,465	75,243	4,089	334	79,666
99	British South Africa	8	17,938	9	18,168	632	815,139			287,730	159,528	17,671		177,199
100	British East Africa					14	16,086	3	6,612	8,699	9,349	252		9,601
101	Canary Islands	3	8,216			5	5,192			1,179	2,832	53		2,885
102	French Africa	108	57,630	10	6,694	37	23,396	8	3,633	14,006	1,797			1,797
103	Kamerun, etc.	5	2,598	6	8,807	2	2,920	1	785	2,521	5,221	673		5,894
104	Italian Africa													
105	Liberia													
106	Madagascar													
107	Morocco					17	32,578			2,386	640			640
108	Portuguese Africa					27	33,976			246				
109	Spanish Africa													
110	Egypt	5	2,248			90	92,993	1	433	12,347	13,692	651		14,343
	Total	1607	2,266,195	640	1,324,183	7753	9,984,766	1481	1,666,455	8,380,149	3,264,711	366,468	244,527	3,875,709

Unemployment a Vital Problem in Great Britain

Unemployment always constitutes an important phase of the British labor problem. Now it is acute, and must be definitely met if serious consequences are not to ensue. Mr. Tipper explains certain phases of the problem necessary to an understanding of Mr. Northcott's article, following.

By Harry Tipper

NOTHING could better illustrate the difference between the conditions which exist in Great Britain and those obtaining in this country than the approach to the question of employment. The subject is an old one and one of those which has been discussed from all sides a great many times. In this country it has not assumed important dimensions except for very brief periods, whereas in Great Britain unemployment has been a serious problem for many years.

The spectre of starvation has been very close to a considerable percentage of the people at all times in that country, and the fear which is caused by the constant battle with actual hunger is very much more firmly implanted in the rank and file of the workers. Some time before the war outdoor relief, almshouse population and pauperism had reached as high as 26 per cent in some years, and for many years the problem has been a severe one. No one familiar with the industrial conditions in Great Britain in the last twenty-five years could eliminate from his experience the knowledge of the economic conditions of a considerable proportion of the workers in some of the large cities.

One of my friends whose father was a miner in Scotland told me how the family was brought up by the ingenuity of the mother on a wage which never grew larger than $3 per week. It is a good many years since the volume of trade secured by Great Britain has been so continuously equal to the manufacturing capacity that the whole of the working population was permanently employed.

As a consequence, for twenty years at least, before the war, a percentage of the population was out of work at all times and the government relief, charitable work and so forth, were continuously employed in providing at least a measure of food and shelter to these people.

This condition explains a great deal in the following article, which would be without point otherwise. It will serve to illuminate the government unemployment insurance and the demand for greater security against unemployment on the part of labor. It will indicate also the reason for the "ca'canny" attitude of the labor unions in connection with production. It is significant that this Scottish term, originating in the poorest part of Great Britain, has become a part of the terminology wherever trade unions exist. Where a certain percentage of the workers, even the skilled workers, were unable to find permanent employment, it was obvious that they stretched out to the utmost whatever jobs they secured. No man who was constantly in fear of starvation for himself and his family would do otherwise.

This whole problem of unemployment indicates the growth of industrial difficulties in a country where the agricultural occupation has become entirely subsidiary and the manufacturing capacity has grown far beyond the capacity for absorption in the country itself.

This article is interesting from another standpoint. It indicates the considerations involved in a country where the workers are thoroughly organized and the attitude of those workers to the question of profits upon capital and the position of government in relation to industrial affairs.

The bitterness of the workers' struggle for a decent living and a larger amount of comfort in Great Britain has colored the whole development of the trade union and has affected the whole body of public opinion in regard to the national aspect of industrial problems.

This comment is necessary to an understanding of the significance of the following material prepared by our English correspondent, Clarence H. Northcott.

THERE came into my hands recently the house organ of the Dennison Manufacturing Company of Framingham, Mass., in the December issue of which were printed the articles governing the control and use of the Unemployment Fund set up by this firm. No information was available as to the formation and nature of the fund, but the paragraphs printed showed that the firm had in mind both the prevention and relief of unemployment. The committee in charge of the fund was commissioned to "study methods of preventing and relieving unemployment." The chief method cited for preventing unemployment was that of transferring an employee for whom there was no work to another part of the plant where there was work. It was stipulated, further, that the principle of "last to come, first to go" should apply to such transfers or to any "layoffs." The most interesting part of the scheme is the extent of unemployment compensation. While the condition of the fund permits, it is expected that compensation for employees without dependents shall reach 60 per cent of regular rates, and for employees with dependents 80 per cent. To ascertain regular rates, the averate earnings of the previous six weeks will be calculated. While no minimum sums are mentioned, the committee are empowered from time to time to establish such for men and women, with and without dependents respectively,

and to pay these sums whenever they exceed the regular percentage compensation. This compensation is payable for all unemployment in excess of one pay roll day, including holidays per pay week, and two pay roll days excluding holidays, in any four weeks, but will not cover any lay-offs of less than a half day at any time. The rates, however, are subject to reconsideration after payment has been made for six consecutive days.

A noteworthy and rather unique feature of the fund is the provision for compensation to employees transferred or those who have secured work outside the factory. In these cases it seems the desire of the firm that such men and women should receive up to 90 per cent of their regular wage rate with the company. The same provision applies to a man transferred to another department. If, however, such transfer is made, not to avoid unemployment but to retain the services of a valued employee, the compensation is to be debited to the operating expense of the company, not to the unemployment fund.

This pronouncement is of great interest to employers in Great Britain to-day. The wave of depression which passed over Japan and America has reached Europe. In Great Britain unemployment is fairly general, and has touched most trades. Great Britain is so largely an exporting nation that curtailment of buying in such markets as Asia, South America and Europe affects her seriously.

The automobile and engineering trades are feeling the depression acutely. The former was badly hit by the molders' strike at the end of 1919, which interfered greatly with production schedules. In consequence, makers missed last summer's markets. This reacted on the rubber firms.

At the same time cotton, wool and shoes felt the drop in wholesale prices, the restriction of credit by the banks and the thrift of the consumer who refused to buy at the inflated prices ruling. The slump became serious and the year 1920 closed in industrial gloom.

Unemployment has always been a gaunt demon in Great Britain, but this time he wears a savage as well as a hungry face. Men who fought for years in all quarters of the globe and were always well fed and well clothed while they offered their lives to save their country are not going to accept cold, hunger and starvation tamely. The British worker is no Bolshevist, but he is a stubborn fighter for right, and he has accepted the doctrine that industry owes him maintenance in times of unemployment. He has invested his life and well-being in the industry and holds that his ill-requited labor for it in times of its prosperity shall be balanced by a sustenance wage in bad times. If he cannot get this, which he has come to consider his rights, he seems determined to set up a new form of industry. What it may be, whether syndicalism or guild socialism, he is not clear, but he has convinced the employers of Great Britain that he must receive some decent maintenance during unemployment. Their difficulty is twofold.

First, in very few cases have they worked out a program to meet such an emergency. In the second place, they have not allocated any reserves for this purpose when reserves were abundant, and they are afraid that they cannot find any now for the purpose. As one of them put it, the position they are in is like that of a man seeking an insurance upon his house while one corner of it is alight.

The government scheme is of little value. It provides that, in return for certain weekly contributions by employers and workers alike, supplemented by the State, and on fulfillment of certain statutory conditions, men unemployed may receive benefit to the extent of 15s. a week and women 12s. a week. This payment is a mere dole. It is not sufficient to provide food for one individual, without taking account of dependents or of such other necessities as rent and clothing. It is true that most trade unions pay unemployment benefit in return for a small payment from their members. This benefit ranges from 1s. to over 2s. per day, but, as the unions have not large reserves, it cannot be continued for a very long period. The cotton trade unions, who have been paying out since the end of September, have already almost reached the bottom of their treasury. The government benefit, plus that of the unions, is only a small fraction of the normal wage earned. In the industry with which the writer is connected, the minimum time wage for an adult man is 72s. 6d. If unemployed, such a worker would receive only 21s. from state and trade union, that is, about 30 per cent of his regular rate.

An endeavor to find a better scheme that would apply to every industry has been made recently by a group of employers and representatives of labor, who have published their scheme anonymously. The writer, who is acquainted with the employers concerned, can guarantee that they represent big, progressive businesses and bear names known on both sides of the Atlantic. In their discussions they have been assisted by financiers, economists and statisticians, and have consulted freely with all schools of labor.

The opening paragraph of their scheme is one which bears quotation, as showing the economic motive behind such a piece of constructive work:

"The suffering caused by unemployment has been generally recognized, but too little attention has been paid to its reactions on production. Industry moves in a vicious circle. Additional production is necessary if poverty is to be abolished and unemployment relieved. Yet uninformed labor instinctively resists every kind of productive improvement lest it should cause unemployment. Improvements in machinery, in the reorganization of labor with a view to using more effectively skilled grades by means of dilution and in other ways, the introduction of systems of payment by results which have been proved to stimulate production, are all resisted more or less openly, and in every case fear of unemployment is largely responsible for the resistance. It is true that the fear may be largely unjustified, and that 'ca'canny' may accentuate the very evil it is intended to prevent. But such facts are irrelevant. The rank and file of labor believe that improvements bring unemployment and no one has ever succeeded in convincing them that they are wrong. Nor is it any use to argue and make agreements with the leaders of labor; it is the instinctive action of the rank and file that counts. An immense potential increase in the productivity of industry awaits release, and only the complete removal of the menace of unemployment can release it."

As this quotation shows, these employers believe that the future efficiency of British industry depends on giving reasonable security to the worker. They are not satisfied with the government scheme, since the benefits are not sufficient to keep a household together, hence cannot remove "the fear of unemployment or the industrial policy to which this fear gives rise among the workers." Yet, relying on the British preference for governmental action in such matters of social relief, they demand that the State should undertake to deal with this problem on effective and permanent lines, admitting the claim of all adult wage-earners, who are willing and

capable of work, to either suitable employment or adequate maintenance throughout their working lives.

Their proposals are for the creation of a fund which would be sufficient to pay certain benefits. A single person should receive in unemployment compensation 50 per cent of average earnings, with 10 per cent additional for a dependent wife, and 5 per cent for each of not more than three dependent children under 16 years, with a maximum of £5 a week.

Benefits would be payable after three days' unemployment, and should aggregate not more than one week for every six weekly contributions made by the worker, but might extend to 26 weeks. The workers' contribution to this fund is placed at one penny in every 10s. of his wage, that is, a little less than 1 per cent per week. The State is to contribute £4,000,000 and pay the cost of administration, and what more is needed to pay the benefits above sketched, it is suggested, shall be raised by a levy on employers. Their total is estimated on present wage rates at £37,000,000. The promoters calculate that if such a scheme resulted in a 10 per cent increase in production, this would equal 100 millions, or nearly twice the total estimated cost of the scheme. By reason of the psychology of the British worker, such an increase is by no means fantastical. It should be added that the scheme is equally applicable to short time, that is, to work less than the normal working week.

This suggested scheme has been followed promptly by a concrete modification of it in the case of Messrs. Rowntree & Co., cocoa and chocolate manufacturers, who have been pioneers in much social and ameliorative work. Their project went into operation on Jan. 1, 1921, and was drafted in the light of the firm's position, financial and industrial. It applies to all of their workers between the ages of 20 and pension age (65 years) who have been discharged solely through depression of trade, and who, immediately prior to their discharge, had been in the employ of the company continuously for six months. Benefit will take account of length of service, being at the rate of one week for each two months of service up to 2½ years, and one week for each complete year beyond that period. That is, an employee who had been with the company 2½ years would receive benefit from them for the same period as the State grants it.

It is expected by the company that benefits shall total the percentages suggested in the employers' scheme set forth in preceding paragraphs. In addition to the percentages and maximum there set forth, Rowntree & Co. stipulate for a maximum payment of 25s. a week. In these percentage totals are counted the benefits paid by the State and the trade unions. As the largest trade union in their works, which covers in its membership 95 per cent of the unskilled men eligible and 50 per cent of the women, pays 6s. a week, this sum is added to the 15s. paid by the State, and the firm undertakes to pay the residuary cost. Thus, if a single man, without dependents, earning on an average 80s. a week, is discharged through shortage of work, he receives, unless otherwise disqualified, 15s. from the State, 6s. from the trade union and 19s. from Rowntree & Co., bringing his total benefit up to 40s., or 50 per cent of his wage. If the unemployed man is a pieceworker, earning on an average 92s. a week, and has a wife and three dependent children, then in addition to the State and trade union benefits as above, he receives 48s. from Rowntree & Co., making 69s., or 75 per cent of his average earnings, which are calculated on the basis of the preceding quarter.

To meet these obligations, the firm has set aside an initial reserve of £10,000, to which it will add each year from 1921 onward a sum equal to 1 per cent of its wage bill, until the fund reaches £50,000, or 5 per cent of the wage bill, whichever is the greater. Thereafter it will set aside annually such sums, not exceeding 1 per cent of the wage bill, as will keep the fund up to the maximum aimed at.

It is proposed to apply the provisions of this scheme to partial unemployment or short time, but not until 10 per cent of normal full time has been lost by a time worker and 15 per cent by a pieceworker. Time so lost in excess of 10 per cent or 15 per cent respectively will be paid for at a rate proportionate to full unemployment benefit.

It should be added that this scheme was drawn up by the directors of the company and their social and economic advisers, with active assistance from five delegates from the Central Works Council, whose co-operation was requested. The names of those who are about to be dismissed owing to shortage of work are submitted to the shop stewards of each department. In general, men who are bad time keepers or are inefficient are those selected for dismissal, while others are put onto short time. This action is the choice of the workers, who are consequently interested in the right selection of the "slackers." It is true there have been cases where shop stewards have challenged the manager's selection of inefficients, but, on the other hand, when a disgruntled dismissed man voiced his complaint in the local press, two leading shop stewards stoutly defended the firm's action. The fund is to be administered by a committee of nine appointed by the Central Works Council.

To sum up, the two instances of unemployment relief, that of the Dennison Manufacturing Co. and of Rowntree & Co., point the way to a greater humanizing of industry. They take account of the fears and aspirations of the workers, and by removing the incentive to "ca'cannying," offer the prospect of restoring efficiency, interest and initiative.

They remove the burden from the individual and put it onto the Atlantean shoulders of industry. They show an appreciation of the fact that capital, while enjoying the profits, must take the risks of industry. They are an attempt to regularize industry and rob its cyclical movement of boom and panic of much of its terror to the workers, to whom security will furnish a motive for more intelligent and friendly interest in the productive process.

C. H. NORTHCOTT.

AT a recent meeting of the Royal Aeronautical Society of Great Britain, Lord Mountagu of Beaulieu attempted to make a comparison of the cost of transport by air and by other standard methods. He put the cost of road-motor-transport at from 14 to 20 cents per ton-mile (1d = 2c), of motor-bus and charabancs at about 40 cents per ton or 2.5 cents per passenger mile, of railways at 5 cents per ton-mile. The cost of shipping per ton-mile is so low and the ton mileage is so difficult to discover that shipping is treated on the basis of gross tonnage of ship and cargo combined, and varies between 0.076 and 0.144 cents per ton-mile. The cost of passenger traffic per ship-mile varies between 2.22 and 3.6 cents.

For the airplane the author estimates that 88 cents per ton-mile would afford a reasonable profit, and that therefore the airplane can only compete with existing facilities where speed is of great value. The cost of R.34's trip to America is stated to have been $5.64 per ship-mile. The English-to-India trip with a similar ship is $9.94 per mile, including interest on capital and cost of running both ship and the necessary bases. With 15 tons available for useful load, this gives 71 cents per ton-mile.

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EDITORIAL
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What Is Normal?

THERE is much discussion to-day of a return to "normal." Just what this means is difficult to say. Does it mean to a standard of business in 1914, 1917 or some other year? Why not take the peak of the first half of 1920 as normal and seek to bring business to that standard? Why should the American business man of to-day walk backwards?

The writer has heard the subject of "getting back to normal" discussed many times recently and invariably some practical man in the group has asked the question that is so obvious. Only a few days ago a sales manager told of declining to answer a questionnaire that was based on "normal" because he did not know what the compiler of the questionnaire had in mind.

The Chamber of Commerce of the United States has just sent to its members a letter of inquiry seeking information as to how business men are "cutting down their operating expenses." In the questions themselves everything is based on the idea that "normal" is less than was the standard of business a few months ago.

One of these questions is especially interesting. It reads:

"What have you done to reduce your publicity costs to a normal basis?"

Frankly we do not believe there is a business man in this country who can answer that question with an assurance that he is right. Several points of doubt arise on first reading. Here are a few:

What is legitimate publicity?

What is a normal cost of publicity?

Is publicity selling the product, or spending money?

If publicity is sales promotion, should it not increase when business is dull?

It would appear to us that it is quite necessary for the Chamber to effect several definitions before considering the replies to this question.

A National Tractor Show

By David Beecroft

THERE is one best place to hold the national tractor show and that is Chicago.

There is one best time to hold it and that is the week of the Chicago Motor Car Show, or the week following it. The week of the motor car show would be best if ample hotel accommodations can be had in Chicago hotels.

We have seen national tractor shows in Kansas City and Columbus, which have been truly national so far as exhibits and display of tractors and farm power equipment and parts are concerned, but we must stop here.

These shows were not national from the attendance point of view.

The Columbus show this year was anything but national in attendance. The dealers were largely from Ohio and adjacent states. True there were some from distant points but in numbers so small as to be insignificant.

It is impossible to hold a national tractor show dependent upon a farmer attendance. The country is too large for that. Upwards of 75 per cent of the Columbus show attendance was farmers and of these 95 per cent were from Ohio. The Columbus show was just a local show from the attendance viewpoint.

No attempt should be made to stage a national consumer tractor show.

The national tractor show must be for distributors and dealers. Chicago is the logical and geographical center for such a show. To get the distributors the week of the Chicago motor car show is best. That week is best not only for distributors but for parts and accessory manufacturers.

At the recent Columbus show our analysis of exhibitors shows 52 tractor makers, 78 makers of parts or accessories for tractors, and 49 makers of farm equipment to 80 tractors for farm use.

A majority of the parts makers have participated in tractor shows for several years, due to the industry being in the formative state. These same makers supported the national motor car shows in New York City and Chicago in the formative days of the motor car, but many years ago withdrew. To-day they maintain headquarters in hotels in New York City or

Chicago during show weeks and accomplish their end. It is expected that history will repeat itself and they will soon withdraw from tractor shows as active exhibitors. There is little for any of them in consumer or dealer attendance. It is true they add to the magnitude of the exposition, but not so much as many think to the real motif of the exposition.

Were the tractor show held in Chicago during motor car show week, these parts makers could meet the tractor industry just as to-day they meet the car and truck industry. Their expenses would be proportionately reduced and the tractor show would not be robbed of much, if any, of its tangible value.

The Columbus tractor show display housed in seven buildings was a most impressive one. Each tractor exhibitor had ample display space, but it would have been a better show if many parts makers had not been present and their space given to tractor and equipment makers and the exhibitors housed in three instead of seven buildings. The show was too scattered.

The tractor manufacturers are looking for dealers and distributors, and will continue to look for them. The imperative problem of better tractor service will result in a heavy annual change in dealers for some years to come. Many distributors voiced this sentiment at the Columbus show. To meet this situation the national tractor show must for years be a dealer and distributor show. It must be a national show located in a center that has national significance, a national appeal to the 48 states, because the tractor, whether used on a farm or in industry, is and will each year become more truly national in use, in distribution, and consequently in service. Chicago has a national appeal as strong as if not stronger than New York City.

Chicago has exhibit spaces suitable in either the Dexter Park Pavilion in the Union Stock Yards, where the National Live Stock Exposition is held annually, or in the new Municipal Pier on the lake front. The very name of Chicago gives an international appeal, and as we must have export trade and sell to the 100 nations of the world, so we must have our national exposition located in centers of international appeal and character—Chicago will draw immeasurably better than Kansas City, Columbus, Minneapolis, St. Louis, Cincinnati, Cleveland, Detroit, or other smaller cities.

The show should be staged directly by the National Implement and Vehicle Association and not by any local tractor club, just as a score of other national industrial shows are staged by the manufacturers constituting these industries and not by the distributors and brokers merchandising the products. Such a show will not interfere with regional tractor shows.

On Trial

PERSONNEL management is on trial. During times of labor shortage and good profits it flourished in nearly every industrial plant. Huge sums were expended on personnel departments of one kind and another. Strong claims were made in its behalf as a vital factor in production and in modern industrial organization. In many cases these claims were fulfilled; in many others they were not.

The personnel department has before it to-day just as difficult and pressing problems as it had a year ago. The difficulty of the labor situation has temporarily abated, but wrong methods at this time on the part of manufacturers will merely cause them to reap a future whirlwind. The need for effective, intelligent personnel work is great at the present time.

Together with this great need for effective personnel work is present the need for the elimination from all factory organizations of every non-essential activity. Insofar as personnel management recognizes the fundamental natures of the problems presented in regard to human relationships and insofar as it formulates constructive plans for meeting those problems, just so far will it justify its existence and fulfill its very necessary function.

Meyer Bloomfield said recently, "The war gave personnel management a somewhat regrettable impetus; the present depression has helped to weed out many undesirable features, although some good things have gone with them."

Sacrificing Economy for Performance

THE comparison of passenger cars on a basis of displacement per ton-foot which appears on another page of this issue should give food for thought to those responsible for the design of these and other cars, as well as to other engineers who are interested in factors which govern performance and fuel consumption. It is interesting to note that some cars use nearly double the displacement per ton-foot which others employ. The conclusion to be drawn from this comparison is that economy in fuel consumption is regarded by many users as altogether secondary to other performance considerations for it is evident that, other things being equal, the car which has a high displacement per ton-foot will run with a lower percentage of full load than the car with low displacement, and consequently use more fuel per b. hp. than otherwise. Of course, other factors, such as compression ratios and internal friction vary considerably, but it is evident that much is being sacrificed in some cases to get performance—good hill climbing ability and a high rate of acceleration—at the expense of increased fuel consumption.

The foregoing takes account only of operation on high gear. By a proper selection of transmission gears it is possible to vary consumption per ton mile, owing to the better load factor that can be secured, but this may involve more gear changing than the average operator likes. Every engineer has, of course, to make selections which involve compromises depending upon the various factors involved, but it seems unfortunate that so much is sacrificed in fuel economy when there is a real need of better utilization of national fuel resources. It is significant that among the cars showing the lowest displacement per ton-foot are some whose hill climbing and accelerating ability leaves little to be desired.

Steel Prices Main Factor, Ford Says

Prohibitive Costs Alone Can Prevent Full Speed Ahead

Frank Statement of Plans and Prices Are Given in Exclusive Interview

By Roger H. Burlingame

DETROIT, Feb. 25.—Production in the great Ford factory at Highland Park will be fully 75 per cent of capacity by the end of March unless it is made impossible by prohibitive steel prices.

This outstanding fact was disclosed by Henry Ford to-day in an exclusive interview with a representative of the Class Journal publications. The announcement was included in the first detailed statement he has yet made for publication of his factory plans and policies.

Seated by a window in his office with a half dozen Ford executives grouped about the room, Mr. Ford answered questions put to him without reservation, entering into discussion with the interviewer at times as to the advisability of publication, subordinating his opinion in instances to that of his executives and the newspaper man, and throughout the interview, lasting about an hour, never once sought to take the lead or divert the trend of questions.

With his chair tilted back, legs crossed, and his hands clasped behind his head, following a cordial greeting, the most talked of man in the industrial world today adjusted himself in a position of comfort and with patient forbearance and a smile playing about his face continually, listened and replied promptly to questions of minor detail with as much interest as though in conference on world problems.

It was suggested at the outset that the interview was for publication in magazines devoted solely to the upbuilding of the automotive industry rather than for public consumption, and Mr. Ford readily acquiesced in the request that questions vitally affecting the industry might be put to him.

Looks to Normal Output

It was during his reply to a question as to plans for factory operations looking to return to normal production that Mr. Ford sounded the big note when he declared that operations in April and May and for the future were contingent on the price of steel, adding:

"If we have to close again it will be due to the attitude of steel manufacturers."

And right here the man who talks in hundreds of millions showed his grasp of the details of his organization when, in emphasizing his point that steel is the big factor, he approximated the weight of the top, tires, glass and floor-boards for comparison.

The issue was brought up when Edsel Ford suggested that not only steel prices but prices of all materials would have an effect, his father stressing the point that steel was all important and prohibitive prices the real handicap to uninterrupted production.

Frequently throughout the interview Mr. Ford made reference to financiers, referring to them as "money sharks," and there was a note of exultation in his voice when, in answer to the question as to whether he cared to discuss the many reports of financial stress and alleged efforts to float a loan, he said:

Not Building Without Money

"The best answer to that question is employment and production figures just given you and the fact that we are going to build 80,000 cars in March. We must pay for materials and labor and that means a considerable sum."

The many rumors regarding conditions at Highland Park and the reports giving the number of men employed in totals ranging from 5000 to 20,000, were set at rest when Mr. Ford declared that since the reopening of the plant Jan. 31 with approximately 10,000 men, the force had been increased steadily until to-day's total of 15,800 was reached. The force will be increased in conformity with sales and demand, he said, until normal operations again are resumed.

Won't Need as Many Men

It was made plain, however, that the force never would reach the total employed during the peak last year for it has been demonstrated beyond question that the maximum of production requirements can be reached with a materially decreased force due to greater efficiency and more conscientious effort. In this connection Mr. Ford said:

"It is the universal policy and the logical course to minimize operation and production costs and evidence multiplies that by stimulating men to greater effort

(*Continued on page* 531)

HIGHLAND PARK PLANT WILL BE RUNNING 75 PER CENT CAPACITY BY MARCH 31

DETROIT, Feb. 25—These facts about his gigantic business enterprises were disclosed by Henry Ford to-day in an exclusive interview with a representative of the Class Journal publications:

That 15,800 employees were working in the Highland Park plant to-day.

That 2860 cars were produced in Highland Park and branches yesterday.

That 2505 engines were built at Highland Park Wednesday.

That there were 95,000 cars in the hands of dealers and 30,000 in process of construction at the branches when the Highland Park plant closed Dec. 24.

That 57,000 cars were sold during January, liquidating the 30,000 completed in the branches and 27,000 of the dealer stocks.

That retail sales for the first half of February were 42,000.

That total production for February will be 35,000.

That sales, if the ratio continues through February, will approximate 85,000, assuring liquidation of 50,000 more of the dealer stock.

That dealer requirements for March are 70,000, necessitating a production schedule of 3100 daily, within 1100 of the record for daily production.

That working forces and production will be increased steadily until normal production is reached.

That continued operation and increasing production is contingent on steel prices and that if the company is forced to again shut down it will be due solely to prohibitive steel prices.

That there will be no reduction in the wages on specific jobs and no reduction in the minimum scale.

That the Ford Motor Co.'s reply to reports of financial stress is the announcement of steadily increasing working forces and output scheduled to reach close to normal by the end of March.

That the executives now in charge at Highland Park and River Rouge will constitute the permanent official personnel with official titles in most cases eliminated and concerted efforts being directed to development of Ford products and policies.

That 2700 men were employed at River Rouge to-day, 1700 having been added to the 1000 which have been working there without interruption throughout the period of depression.

That a production schedule of 100 tractors daily was started at the Rouge plant to-day, which will be increased as demand requires.

Industry Shows Continued Gains

Chrysler Cheerful on Business Outlook

Declares Willys Plants Ready to Meet Competition—Last of Year Best

TOLEDO, Feb. 28—Walter P. Chrysler, executive vice-president of the Willys-Overland Co., and all the Willys interests, and Charles B. Wilson, vice-president in charge of the plant here, have been in conference this week looking after production plans.

The company has less than 1700 cars in process of manufacture at the present time, indicating that sales have been progressing fairly well since the automobile shows last month. The plan has been to manufacture only on demand of dealers. No definite date has been set for the beginning of a production plan, but it is understood that possibly a small schedule may be put into effect about March 15.

"It's a great deal more difficult to build up a force than to tear one down," said Chrysler. "That's the task we have on hand now and we are going to go forward and build the organization over from top to bottom. There will be all sorts of changes in the next few weeks. Many new men will be coming in and some will be going.

"We have had to eliminate extravagance in the administration of this plant, and we have made some deep cuts. There is competition ahead in the motor car industry."

Chrysler said he had avoided making any forecasts on the industrial conditions of the future because he couldn't make good guesses on affairs so contingent upon many world-wide economic factors.

"We have been through crises in manufacturing before—not quite so bad as this one we have experienced recently—but involving largely the same principles, and we are quite optimistic right now," he declared.

Would Establish Money Value

"The experts have been bringing out figures for us and we have been trying to find out what our dollar will purchase. Some say it will buy about 80 cents worth of what it could have bought before the war. But we don't know. Things are becoming more stabilized every day—we can see that.

"We have a feeling that the last three-quarters of the year will show a pick-up of about 40 per cent in business generally. But that's only a guess." Chrysler would make no comment on the financial arrangements planned for the Willys organizations.

MOSTLY SUNSHINE SEEN FOR TRADE IN MARCH

A weather forecast for the automotive industry for March indicates that while it will be partly cloudy there will be more of sunshine than there has been for several months, and that as spring approaches the "fair and warmer" flag will be displayed with increasing frequency. Here are some of the signs that the clouds are breaking:

Ford is preparing for production on a basis of 75 per cent of capacity by the last of this month.

Production in the various General Motors plants has reached 50 per cent of normal.

Most Detroit manufacturers are adding to their forces and speeding up production to meet increased orders.

Sentiment in the Detroit territory is much more hopeful than it has been for weeks.

Akron tire factories show more signs of life than they have since last spring.

Automotive plants in various parts of the country are resuming production on a small scale and gradually augmenting their forces.

Dealers in most of the industrial districts report steadily mounting sales, and even in farming sections there is increased interest in motor vehicles.

The upward trend includes both passenger cars and trucks.

Peugeot Not to Build Cars in United States

PARIS, Feb. 19—(*Special Correspondence*)—There is no intention of the French Peugeot Co. to build an automobile factory in America. Negotiations have been in hand for several months with American promoters who wish to purchase or construct a factory in the United States where Peugeot automobiles will be built under license. The French company has agreed to sell their license to this group and to supply the necessary technical staff providing American financial backing is secured. According to a statement made by one of the officials of the Peugeot company to an AUTOMOTIVE INDUSTRIES representative, American financial assistance has not yet been secured, and until this is obtained nothing will be done in the matter.

Tire Business Takes Quick Upward Turn

Experiences Greatest Uplift Since Depression Began—Prepare for Ford Orders

AKRON, Feb. 28—The rubber industry in Akron has shown more life during the past ten days, than at any time since the inception of the current business depression. Two recent events of outstanding importance indicate a strong upward trend which augurs well for an early return to conditions in the industry nearly approaching normal.

First of these was announcement by the B. F. Goodrich Co., that 30,000 small size tires had been shipped to the Ford plant in Detroit. This is the largest single shipment of tires made in Akron in eight months.

Second was announcement by Goodyear Tire & Rubber Co. officials of nearly a 100 per cent increase in production, effective the last week of February. The Goodyear increase does not let down the bars for more men just at present, but for those now employed by the company it means longer hours. The increased production ticket calls for 60,000 tires a week and necessitates adding another work day.

Notice that the Ford plants would soon be running full force also has stimulated tire production, and half a dozen Akron companies holding Ford orders, are increasing production so as to be prepared for early shipment.

The Oldfield Tire Co., latest comer to Akron, and of which Barney Oldfield, erstwhile motor speedway champion is president, is laying plans for substantial increases in production this year. The Goodrich Co., while having an ample surplus on hand to accommodate immediate shipments, is contemplating an increase in production in the near future. Miller Rubber is opening up its mechanical goods and rubber sole and heel departments, and Firestone is also showing more signs of life. The Portage Rubber Co. reports as much business booked so far this year, as during all of last year, and expects to increase its volume in 1921 by more than 100 per cent.

CLEVELAND BUSINESS BETTER

CLEVELAND, Feb. 28—The upward trend of business which began with the automobile show continues, although the increase is gradual. There has been decided improvement in sentiment, however, and automotive manufacturers are much encouraged by the outlook. One plant making automobile bodies reports the addition of 350 men to its payroll.

February Deliveries Approximate 1920

Actual Turnover of Business Compares with Year Previous —General Outlook Better

NEW YORK, Feb. 28—So far as cars actually sold and delivered are concerned, this month has developed a normal February sales volume. The demand for cars does not begin to compare with the pressure of a year ago, but the results in actual sales are about equal, because last year the dealers couldn't get the cars they needed on account of the traffic conditions, and this year the reduced factory schedules are barely meeting the demand.

With a few exceptions, and these principally among the higher price cars, the New York retail market has developed a gradually increasing volume of business that is regarded as entirely satisfactory.

One large distributer in the medium price cars, whose product is in the country's ten best sellers and whose contract calls for 6 per cent of the factory output, has found no difficulty in disposing of more than 10 per cent of his factory's output in the past month. This distributer's actual delivery of cars to owners follows a schedule approximately the same as in February last year. At least three other distributers of medium price cars in the New York territory are running ahead of actual deliveries during this period last year.

In the higher price cars there has been a lull of several days, following the tapering off of a fairly good market that developed just previous to the New York show early in January and reached its peak the latter part of January. But even with this condition existing to-day, there is considerable faith in the development of a stronger market as soon as the weather becomes settled. It is pointed out that February usually is a low sales month in this class.

The wholesale passenger car market is becoming somewhat steadier and is showing a healthful, sturdy increase, but a slow one. After experiencing a decidedly improved sales volume early in the month, the used car market is showing signs of sagging again.

The truck market, both wholesale and retail, is still showing the spotty tendencies that have characterized it for several weeks. While there is some general improvement, it has been slight.

SPRINGFIELD PLANTS BUSY

SPRINGFIELD, OHIO, Feb. 28—In a survey just made of industrial conditions in Springfield it was ascertained that the Springfield works of the International Harvester Co., now turning out motor trucks instead of agricultural implements, is operating a force above normal. It is now turning out 30 trucks a day.

The Westcott Motor Car Co. is employing 225 of its normal force of 250 men.

The Kelly-Springfield Motor Truck Co. is pushing ahead with production. Good sized orders are expected soon, it is announced. Reports from dealers show that conditions are encouraging.

The Victor Rubber Co. is turning out 300 cord tires daily. More than 200 out of the regular force of 350 men are now at work in the plant.

Durant Studies West for Assembly Location

SEATTLE, Feb. 26—C. M. Steeves, personal representative of W. C. Durant, formerly president of the General Motors Corp., is completing an exhaustive investigation of manufacturing possibilities on the Pacific Coast and is about to leave for the east to make his report. In automobile circles it is known that Durant and his associates plan the manufacturing on a big scale of an automobile which will sell for less than $1,000 and one of the several manufacturing plants to be built will be located on the Pacific Coast.

Steeves has made a survey of conditions in Los Angeles, San Francisco, Portland and Seattle. Civic organizations here were particularly active in seeing that Steeves did not overlook any of the advantages the city claims for an automobile manufacturing plant.

Steeves would give no intimation as to what his recommendations would be for the location of the proposed Pacific Coast plant.

Body and Glass Plants Increase Operations

TOLEDO, Feb. 28—The Milburn Wagon Co. is now employing 300 men on automobile bodies and Milburn electrics in the plant here, President Frank Suydam declared this week. He said business was increasing and that he expected to be taking on more men each week. The company is working on orders for bodies for the General Motors Corporation.

The Ford Plate Glass Co., which manufactures large quantities of glass for windshields and sedan bodies, opened a portion of its plant at Rossford near here with 600 men today.

HOMAN JOINS C. G. COMPANY

KALAMAZOO, MICH., Feb. 28—The name of the U. S. Auto Bumper Co., Chicago, has been changed to the C. G. Spring Bumper Co. Charles C. Homan, who for many years was purchasing agent at Willys-Overland and later vice-president of Hal Motor, Cleveland, which position he resigned to accept a commission in the Army in France, and who, since his return from abroad, has been connected with the Goodyear Tire & Rubber Co., has accepted the position as manager of the C. G. Spring Bumper Co. with headquarters at the office in Chicago. The company is controlled by Christian Girl.

Mining Communities Work at Full Speed

A. F. of L. Survey Shows Only Scattered Units Aside from Mines Near Normal

NEW YORK, Feb. 27—A survey of industrial and unemployment conditions being conducted by the American Federation of Labor shows conditions to be nearly normal in a few isolated districts despite the almost universal depression.

The places in which business is nearly normal are for the most part mining communities in which production activities seem to be progressing at full speed. The towns which are active because of mining work are Westville, Ill., Carlinville, Ill., Pittston, Pa., and Mahanoy City, Pa. The report from Pittston states that "Coal mines are on full time. The silk business has been dull but is taking on new life."

Four other small communities show normal activity for other reasons. In Oneida, N. Y., there have been several hundred men laid off from the factories but they were out of town men and have gone back to the farms where most of them came from. In Wisconsin Rapids, Wis., a paper mill town, few men are unemployed at the present time. Cloquet, Minn., another town in which a paper company forms the chief industry, reports that the paper company is doing a large amount of repair work on their dam and is also building another dam in the city, so that there is at least temporary employment for everyone.

These small scattered units, however, represent the only really encouraging reports thus far included in the survey. Industrial depression and unemployment is serious in nearly every other unit reported.

TO SELL REYNOLDS ASSETS

MT. CLEMENS, MICH., Feb. 28—Circuit Judge Tucker has signed an order directing Charles J. Reimold, receiver of the Reynolds Motor Truck Co., to sell at the factory in this city on March 14, all the assets of the company. These assets will be disposed of at auction in one parcel. No action has yet been taken by the stockholders who feel that their interests might be better protected if the company were thrown into bankruptcy, and if steps in this direction are not taken at once, the affairs of the corporation will be wound up as speedily as possible.

AMERICAN TIRE PLANT STARTS

YOUNGSTOWN, Feb. 28—Production of tires, tubes and hose was begun this week by the American Tire Corp., Niles, Ohio. This is the first actual operation since the company was incorporated two years ago. The output is expected to be 800 to 1000 tires per day. The company occupies the plant of the Engle Aircraft Co., which dissolved at the close of the war.

Anti-Dumping Bill Held Over in Senate

Manufacturers Support Suggested to Insure Early Action—Would Equalize Prices

WASHINGTON, Feb. 28—Senator Smoot of Utah, one of the most influential members of the Senate, advised AUTOMOTIVE INDUSTRIES to-day that the anti-dumping bill would undoubtedly protect American truck manufacturers and dealers from dumping of surplus army trucks here. The bill is pending on the Senate calendar and has passed the House. It provides for the assessment of special duties as a means to eliminate unfair competition and would operate, he said, to equalize the sales price.

This measure was introduced in the Senate Dec. 10, 1919, at a time when foreign competition became a real menace to American manufacturers. The bill was designed to provide revenue and encourage domestic industries through imposing duties. The Senate Committee on Finance directed Senator Smoot to report the bill April 8, 1920. Through parliamentary tactics, it was not considered in the second or the present session of the Sixty-sixth Congress.

The bill provides that whenever the purchase price of imported merchandise, dutiable or free, of a kind or class produced in this country, shall be less than the market value thereof, a special duty shall be assessed in the amount of the difference between the purchase price and the market value. This proviso, it would appear, would effectively squelch all efforts of English and French merchants to undersell the American dealers in trucks. Senator Smoot stated that this duty was a dumping duty and could be applied on the trucks despite the fact that the present tariff laws allow free entry as "goods returning to point of manufacture."

The act specifies that if there is no such actual market value, but the purchase price of the merchandise is less than American export prices for the same material, the tax shall be assessed on imports. The same applies to imports which are offered for sale in this country at prices less than cost of production for same equipment here.

Provides Penalty For Rebates

Another section of the House bill, as amended by the Senate Committee on Finance, provides a penalty for rebates and concessions which directly or indirectly effect a reduction or diminution of the purchase price or the selling price of the imported merchandise. It is believed that American truck manufacturers and dealers who have felt the effects of foreign competition in having American goods, originally sold to the Army, resold to foreigners and then offered on American markets at less than production cost, will support this measure and urge its immediate consideration at the extraordinary session of the Sixty-seventh Congress.

Senator Thomas, Democrat, of Colorado, who filed a minority report against the bill at the time it was reported out of committee, told AUTOMOTIVE INDUSTRIES that he believed that the bill could be strengthened, if necessary, to cover reimportations under conditions which confront American producers. He appeared interested in the report of the British and French invading domestic markets with rebuilt machines which escaped duty owing to original manufacture here. Senator Thomas would unquestionably press this matter, but his term expires at noon Friday, when the present Congress adjourns.

Palmerton to Manage Foreign Trade Bureau

NEW YORK, March 1—P. L. Palmerton, formerly in the foreign department of the Goodyear Tire & Rubber Co., has been appointed manager of the newly created foreign trade bureau of the Rubber Association of America. He is now organizing the work and expects in the near future to be able to supply members with information on the best means of carrying on trade with foreign countries as well as the best potential markets.

The executive committee of the Rubber Association is giving careful consideration to the subject of the support to be given various good-roads organizations, and it is hoped some program can be worked out upon which the entire automotive industry can unite. Another phase of this work is connected with the efforts of the Motor Vehicle Conference Committee to have enacted uniform state legislation in relation to load schedules, tire carrying capacities, etc.

The Rubber Association also has taken up the question of standardization in the sizes of automobile tires, and its research in this direction has emphasized the need for a technical committee which is to have as its primary purpose the consideration of tire standardization. A committee of five members of the executive committee has been appointed to comprise a technical committee which will consider all standardization projects of the industry.

TO ADJUST MAXWELL CLAIMS

INDIANAPOLIS, March 1—Charles Martindale of Indianapolis has been appointed by Judge Anderson in Federal Court here as master in chancery for the Maxwell Motor Co., Inc., to receive and adjust all claims of creditors against the company within the jurisdiction of Indiana. The action is preliminary to a reorganization of the Maxwell and Chalmers companies, which have been merged.

Appointment of the master was agreed to by the Maxwell company, according to attorneys who filed the petition. A master has been appointed in a similar way in Detroit and action in the District Court at Dayton, Ohio, is also contemplated, the attorneys said.

Oppose Insurance for Confiscation

Companies Find Volstead Law Violators Not Entitled to Protection on Cars

NEW YORK, Feb. 26—"Confiscation insurance" is forbidden to all insurance companies belonging to the National Automobile Underwriters Conference, by a recent decision of that body. As practically all the large stock insurance companies covering automobiles belong to the conference, this action means practically that it will not be possible to get insurance on an automobile against its being confiscated by the Federal government for carrying liquor in violation of the Volstead law.

Insurance underwriters have in general been of the opinion that violators of the Volstead law were not entitled to insurance; and that practically all innocent victims of confiscation already insured against theft would be able to claim indemnity on the ground that the car was stolen. Perhaps the only protection which could be asked of insurance companies was against misuse of the car by a friend.

But the underwriters maintained that if this were to be covered, every enterprising bootlegger would frame his case to correspond, with the result that insurance companies would find themselves betting against a bootlegger's risk of capture.

A recent ruling of a Federal court provides that automobiles "held for trial" may be taken out on bail, that is, for deposit with the court of collateral security. If an owner feels that his car is not likely to be confiscated, that he has an open and shut case, he can, under this ruling, provide care of the car to prevent deterioration.

Oldfield Tire Company Elects New Officers

AKRON, Feb. 25—J. M. Dine, former Firestone official, has been elected vice-president and general manager of the Oldfield Tire Co. Dine has been identified with the rubber industry for fourteen years, both with Goodyear and Firestone. He served as branch manager for both companies in several large American cities.

Other new officers of the company include B. M. Robinson, secretary; H. L. Allsopp, treasurer, and M. E. Moffett, assistant treasurer. R. S. Jemison, of the Miller Rubber Co., has assumed the position of advertising manager.

The Oldfield tire, comparatively a new product on the market, designed by Barney Oldfield, former champion of the motor speedway, won recognition during the 1920 automobile racing season. Mr. Oldfield has just moved central offices of the company to Akron from Cleveland, and announces plans for a material increase in production during current year.

Road Makers to Get 1250 Army Tractors

Senate Turns Down House Action for Dumping—Bill Goes to Conference

WASHINGTON, Feb. 25—Amendment to the Fortification bill, as passed by the Senate to-day after a heated debate, provides for the transfer of 1250 tractors from the War Department to the Department of Agriculture for distribution among State highway departments. The proposal to authorize the sale of 2000 tractors, as passed by the House, was voted down by the Senate. Majority leaders under the management of Senator Wadsworth of New York, chairman of the Military Affairs Committee, championed the efforts of the War Department to retain all tractors, but the will of other Senators, sponsored undoubtedly by demands of highway commissioners for new equipment, prevailed.

During the debate it was brought out that the Chief of Ordnance of the Army estimated that the stock of tractors on hand would serve ordinary requirements for a period of five years. Senator Wadsworth, Lodge and Smoot, Senate majority leaders, directed the attention of the Senate to the fact that every tractor transferred or sold on the open market would require additional appropriations in the next few years. Senator Wadsworth predicted that, for every tractor distributed to highways at this time, there would be requests for new appropriations. It was stated that the army owned 6700 tractors on Dec. 31, 1920, but this was later reduced to 6452, which are retained at present. The Army now has 3109 tractors in service, and the others are in storage at Rock Island Arsenal and at Savannah Proving Ground. According to the information given the chairman, the shelter provided is adequate and constant care is given the equipment.

Would Avoid Obsolescence

Democratic Senators suggested that inasmuch as there had been great improvement in design of tractors, it would be best to dispose of the surplus because of the obsolescence. Chairman Wadsworth stated that the balance of tractors were obligated but not assigned. He contended that the artillery continued to extend the use of the tractor in the transportation of heavy guns, as the average tractor will do as much as six horses and is maintined at lower cost. He said that artillery officers were confident that the use of the tractor would bring about a large saving. There will be another demand for tractors, Senator Wadsworth said, when the reorganization of the National Guard is completed.

The New York Senator asserted that the heavy tractors owned by the Army are not especially adapted to road uses and that no spare parts could be obtained on the open market. He pointed out that many tractor manufacturers who built these machines under specifications prepared by the War Department were not operating. According to information given Senator Kellogg of Minnesota, the War Department has never transferred any modern tractors. The Chairman ridiculed the legislative efforts of highway commissioners whom, he said, were flooding the Senators with telegrams urging the transfer. "It is all velvet for them" Senator Wadsworth said, "they get something for nothing and do not take cognizance of the War Department's future needs." The National Guard has until 1924 to complete the organization of new units and it will require hundreds of tractors for their use. With the authorization for transfer, it would indicate that the Army will be on the market for tractors within a year instead of five as expected. The Senate bill has been sent to conference.

Goodyear to Produce New Airplane Fabric

AKRON, Feb. 26—Wade Van Orman, aeronautical expert of the Goodyear Tire & Rubber Co., has designed and perfected a leak-proof, fire-proof rubber and fabric covering for airplane gasoline tanks, which has been formally accepted by the United States Government, Goodyear officials announce. The new cover will be extensively manufactured for the government, exclusively by Goodyear.

The cover, designed especially for combat and mail planes, consists of a specially vulcanized half-inch thick rubber blanket affixed to a thick layer of several plies of tested cotton fabric. It fits directly over the airplane fuel tank.

Tests conducted by the government at the Goodyear plant in East Akron have proven that when both the covering and fuel tank are punctured by bullets, the rubber and fabric cover automatically closes and completely seals the leaks, preventing leakage of fuel and subsequent explosions in mid-air. The cover will prove particularly effective in use on combat machines, where incendiary bullets are used in aerial engagements, government officials say.

The new cover is admitted by government aeronautical officials, to constitute a material step towards attaining a greater degree of safety than heretofore gained, in airplane transportation.

MAIBOHM ADDS DIRECTORS

SANDUSKY, OHIO, Feb. 28—Three additions were made to the board of directors of the Maibohm Motors Co. at the annual meeting. They are B. C. Kramer of Toledo; George M. Zimmerman, city manager, of Sandusky, and Hal Holtom. Kramer has been elected vice-president and the other officers of the company were re-elected. Reports showed that profits for the year, before taxes and reserves amounted to approximately 12 per cent on the outstanding capital. President Maibohm said there was a gratifying revival of business and that orders were increasing.

New York Modifies Truck License Plan

Abandons Proposed Prohibitive Rates as Impracticable—Will Pay Full Maintenance

ALBANY, Feb. 26—Though the proposed plan of taxing heavy duty motor trucks from the highways of New York has been abandoned as impractical, the State legislature is proceeding with its plan to enact laws which will place the entire burden of road maintenance upon car owners. Under the tax schedule embodied in a bill introduced today fees are boosted from 50 to 100 per cent.

Included in the provisions of the measure are increases in taxes of 25 to 40 cents per horsepower. Trucks of more than three tons weight are assessed double. On a tonnage of from two to three the tax is increased from $15 to $23.50; three to four tons the increase is from $20 to $40. The ten-ton truck will pay $110 and the tax on the 14-ton vehicle will be $140. For every ton in excess of fourteen, the tax will be $20.

The tax on trailers is raised from $5 to $7.50 where the weight is two tons or less, the increase being graduated up to the trailer weighing from ten to 14 tons, on which a tax of $60 is levied.

The tax on omnibuses with a capacity of five persons or less is raised from $15 to $22.50. Where the capacity is more than 30 passengers the tax is increased $67.50 to $101.25.

It is estimated that the new schedules will yield $9,000,000 a year, or $1,000 a mile for the 9,000 miles of State highways. About $6,000,000 was realized from car revenues in 1920. Automobile associations are planning to oppose the new rates unless changes are made in the system of administering highway maintenance.

BENDIX WINS PATENT SUIT

WASHINGTON, Feb. 26—The claims of Vincent Bendix for priority on the invention of an electric starting motor for internal combustion engines have been upheld in the United States Court of Appeals for the District of Columbia on appeals entered by Edward A. Halbleib, Frank Conrad and Joseph Bijur. In making its decision the court ruled that Bendix by reason of reducing his invention to practise before the appellants, established his right to priority.

ARABS BUY MOTOR VEHICLES

LONDON, Feb. 11—(*Special Correspondence*)—Reports are to hand of recent successful tractor trials lasting over 14 days in the Bagdad area of the Middle East. The Fordson was one of the number which showed up well. The Arabs appear to be progressively affected just now and are investing in motor cars, the Sheikhs even going to the cost of re-making suitable roads. The British army of occupation has this result to its credit.

Airplanes to Open Canadian Oil Field

Test As Rival to Steamers and Dog Trains to Come in Spring —Expect Rich Deposits

EDMONTON, ALTA., Feb. 25—The British Dutch Shell interests have purchased considerable holdings near the Fort Norman gusher struck by the Imperial Oil Co. of Canada, Ltd. (Standard Oil.) It is now said that the alleged 1500 bbl. per day output was a gross under-statement of production as the output of the Fort Norman gusher was about 6000 bbl. a day of the finest crude in gasoline content on the continent. However that may be, the Shell people are reported to have twelve outfits ready to move in when transportation is again possible.

The flat statement of the Federal government chief geologists that there is every reason to believe that in the basins of the Athabasca, Peace and Mackenzie rivers will be found the largest deposits of oil in the world coupled with the fact that the greatest oil interests are spending millions on development in the territory promises to result in a stampede north from here and other points, comparable to the Trail of '98, as soon as the snow barrier is broken.

The expected rush to the northern oil country this coming spring and summer has made transportation a big live question in the Canadian Northwest. After long service by dog teams, which hitherto have been sufficient for the purpose, flying machines, new steamers and railway lines are now proposed, for everybody wants to get there in a hurry.

If all the plans work out as now in prospect, there will be in the country between Edmonton and the Mackenzie River oil fields the greatest practical test of commercial aviation that has yet been attempted in Canada. Five distinct flying enterprises are proposed, all of them to be inaugurated, it is announced, this coming season. The Imperial Oil Co. already has two monoplanes on the ground, having flown them from New York under conditions severe enough to give a good hard test of winter flying, and in the early spring it will begin moving its own men and supplies into the north by the air route.

First Enterprise of Kind

This was the first enterprise of the kind, and was decided upon by the Imperial company entirely as a means of doing its own transportation work in the quickest possible time. The planes will fly between Peace River, which will be their base, and Fort Norman, and as far beyond as occasion may require.

The Canada Air Board is also understood to be planning a service into the north for the carriage of Dominion Government geologists, surveyors and scientists, who will be working in different parts of the wilderness country and well beyond the reach of other transportation service. It is claimed that there will be enough of such work to be done to keep an air service well occupied all through the season, and obviously enough it would enable a vastly greater amount of territory to be covered in the summer and autumn months than has ever been possible under the canoe-and-pack system.

F. G. Erickson, the Toronto and New York birdman, has announced his intentions of operating a flying service between Great Slave Lake and Fort Norman on a commercial basis. A Calgary company is already advertising for bookings for a flying boat line that is to begin in the spring between Fort McMurray and the Mackenzie oil fields, following in general the course of the northern waterways. But the most ambitious of all the schemes is that of Capt. E. L. Janney, of the Northern Canada Traders, Ltd., with whom is associated Major C. K. Wollan, of Los Angeles.

Dirigible to Carry 30

A dirigible capable of carrying about thirty passengers will be put on the Edmonton-Mackenzie route, according to Capt. Janney's plans, in March, and after a demonstration flight, on which a party of Canadian and American newspapermen are to be eye-witness guests, a quick service to Fort Norman and back is to be commenced. The fare will be $1500 for the round trip.

It is the expectation of these several flight masters that there will be a rush of oil seekers and sightseers into the north as soon as spring opens and all through the summer. That, indeed, is what everyone is looking for; but the most experienced northerners are hesitating to accept the theory that there will be enough doing in the oil country to warrant a stampede.

The reports of this expected boom have already been greatly overdrawn. It has recently been stated in the east, for instance, that 3000 prospectors are now in Edmonton waiting their time to move on into the north as soon as conditions will permit. Such an army of wealth-hunting waiters has never, of course, been even approximated, and if the plans of the airmen are not based upon better facts than this, their success will be questionable.

Round Trip Cost $1500

The commercial air routes to the north will naturally compete with the already established steamboat routes. As against the $1500 round-trip fare by airship, the steamboats carry for $300 from Fort McMurray to Fort Norman and return. The air route has, of course, a great advantage in point of time, as compared with one month by water. The cost by airship, as thus announced, is about the same as that of the long overland journey by dog-train. For the inexperienced man who undertakes a winter trip into the north, and who wants to go in comfort, two teams of four dogs each will be necessary, with three men, and the cost will run close to $1500 from Edmonton to Fort Norman and back.

Chile Seeks Funds for Highway Work

Plans Expenditure of 20,000,000 Pesos Annually—Bankers Approached on Loan

NEW YORK, Feb. 28—An estimated 20,000,000 pesos will be available yearly in Chile for road construction and improvement under the new highway law of that country. Confirmation of the final approval of this law, which became effective in July of last year, is contained in letters just received by EL AUTOMOVIL AMERICANO, the Spanish automotive magazine of the Class Journal. The normal value of the Chilean gold peso is $0.365, and the paper peso $0.2065.

The revenue estimate was made by F. Pesse Smith, of Puerto Montt, Chile, road director of the Chilean province of Llanquihue, who adds in his letter that this will mean an average investment of 2000 pesos per kilometer of road. The present highways of Chile, of which only a small percentage is in acceptable condition for traffic, total about 30,000 kilometers.

These roads will be improved and maintained under the new law either by permanent or semi-permanent surfacing. The cost of a permanent surface is estimated at 20,000 pesos per kilometer. Furthermore, according to these advices, the government has under consideration a loan of 200,000,000 pesos so that it will be possible to improve a large portion of the highway system in a very short time. New York bankers have been approached on the subject of a Chilean loan and it is probable that it will be one of the Latin-American republics to receive financial consideration.

Director Smith is desirous of obtaining data on road building machinery, etc., his letter stating:

"It is of interest to us to be posted concerning the proper machinery for building highways, rock breakers, concrete making machines, compressing rollers and, generally speaking, all kinds of machinery which is efficient in the economical construction of highways."

WOULD CONTINUE DEFENSE WORK

WASHINGTON, Feb. 28—Organizations interested in the promotion of industrial research and economic movements have been attempting to convince Congress that the Council of National Defense is necessary for national welfare. The Council has several studies relating to automotive enterprise and highway development. This work will be dropped in June unless Congress appropriates a sum sufficient to maintain the present organization. The Council commenced an inventory of automotive resources and is sponsoring a standardization campaign based on their findings in this inquiry as to specifications. At present they have under consideration the encouragement of the use of chassis and other automobile parts which would be easily converted for war purposes.

Sales Tax Opposed by U. S. Chamber

Against Substitution for Excess Profits Levies—Special Tax Favored

WASHINGTON, Feb. 28—Representatives of the automotive industry who have felt that there was little probability of Congress levying additional excise taxes and that there would be a widespread demand throughout the country for some form of sales tax as a substitute for imposts which now are unpopular, will find cold comfort in the report of the committee on taxation of the Chamber of Commerce of the United States, recounting the results of a national referendum on 15 proposals for changes in the present taxation system.

There was an almost unanimous demand among the members of the chamber for a repeal of the excess profits tax but THERE WAS A MAJORITY VOTE AGAINST ANY FORM OF SALES TAX SUGGESTED BOTH AS A SUBSTITUTE FOR AND IN ADDITION TO OTHER FORMS OF TAX. The proposal that excise taxes should be levied "upon some articles of wide use but not of first necessity," partly to take the place of the excess profits tax, was carried by more than a two-thirds vote. The ballot on this question stood: For 1217; against 504.

On the question, "should a sales tax be levied instead of an excise or excess profit tax," the vote was: For 704; against 855. Those who favored a retail sale tax and those who favored a general turnover tax were about evenly divided.

The committee submitting the report opposed the sales tax but put the proposal to a vote because of the wide interest manifested in a levy of this nature. The vote against this tax is significant in view of the strong agitation throughout the country in favor of it.

N. A. C. C. Records Preference

The National Automobile Chamber of Commerce is the only organization connected with the industry which has gone on record formally in favor of a sales tax although the Motor & Accessory Manufacturers Association and the Rubber Association of America are in favor of a sales tax, though not on retail sales as proposed by the N. A. C. C. The proposal of Secretary of the Treasury Houston, that the excise tax on passenger automobiles be doubled is strongly favored by many of the Congressional leaders and members of the United States Chamber of Commerce who voted in favor of such action did so with the understanding that excise taxes levied should be supplemental to those now in effect.

There is a strong sentiment in Congress against any form of sales tax. The professed belief among senators and representatives is that if a 1 per cent tax on sales were authorized, many unscrupulous dealers would use it as a means of bringing in additional profit by adding to their prices several times the amount of the sales tax. This, it is feared, would arouse resentment among the ultimate consumers who always pay the taxes in the last analysis and would result in the loss of votes. Advocates of the sales tax contend on the other hand that consumers would suffer less from the sales tax than they would from any other form of levy.

Government Committee to Standardize Fuels

WASHINGTON, Feb. 25—In accordance with instructions of President Wilson, an Interdepartmental Committee on Standardization of Petroleum Specifications has been organized to supersede the wartime organization, which had for its purpose the purchase of improved motor fuels and lubricants and the conservation of natural resources through more efficient utilization of petroleum products. The activities of this committee have a direct influence on the quality of petroleum products used in the automotive industry inasmuch as Government standards are accepted in the trade.

The President stated that the function of the committee is to prepare and adopt specifications for supply of petroleum and its products to any and all Federal departments and revise such specifications when the need arises giving due consideration to the amounts and qualities of crude petroleum available. Representatives of the Society of Automotive Engineers participated in recent conference when the new specifications were accepted.

Fuel Reserve Stocks Increase in December

WASHINGTON, Feb. 25—Reserve stocks of gasoline continued to increase during December despite extensive use of automobiles permissible with mild weather. Refinery statistics compiled by the Bureau of Mines show that the daily average production for December was 14,980,431 gal., or about 107,000 gal. less per day than in November, but 4,000,000 gal. more than daily average for December, 1919. Stocks advanced 108,000,000 gal. over November.

At the close of the year there were 462,381,837 gal. of gasoline in reserve at refineries. This figure is equivalent to the entire production for the month showing a marked decrease in consumption. Production of lubricating oil increased the reserve by 18,000,000 gal. over the stocks held in November. The 328 refineries operating during December had a daily capacity of 1,714,395 bbl. of crude oil.

HAYES RESUMES OPERATIONS

ST. JOHNS, MICH., Feb. 25—Hayes Wheel Co. will begin operations with a full force Tuesday, building truck wheels. The plant was closed in December and no operations have been attempted since that time.

Mellon Expected to Ease Tax Load

Industry Looks for More Conciliatory Attitude—Congress Misinformed on Conditions

WASHINGTON, March 1—Andrew W. Mellon, Pittsburgh banker and new Secretary of the Treasury, looms as a new and formidable factor in taxation matters relating to the automotive industry. The next Congress will take under advisement his recommendations as to means and methods of raising revenue. Congressional leaders in charge of the fiscal program say that this action does not imply that the Houston program will be discarded. On the contrary the utmost consideration will be accorded the retiring Secretary's proposals because they are founded on an intimate knowledge of the country's fiscal requirements.

Chairman Fordney of the House Ways and Means Committee advised AUTOMOTIVE INDUSTRIES that he was personally opposed to imposing a two cent a gallon tax on gasoline because it was obviously iniquitous. He stated that the intention of Secretary Houston and his tax advisers was undoubtedly based on an attractive theory in specifying that the tax should be levied at the refinery instead of distribution station. The chairman contends that the oil companies would find a way out and transfer the tax to the consumer, particularly the automobile owner.

Mr. Fordney's time has been absorbed so completely in study of tariff legislation that he has devoted little attention to the Houston program. He declared that he would inquire into the effects of an additional excise tax on automobile manufacturers and the proposed horsepower tax at an early date.

Senator Penrose and Senator Smoot, the most influential figures in the Senate Committee on Finance, have not inquired into the Houston plan in detail because of the pressure of other legislative business at the last session and the knowledge that internal revenue legislation would not be considered until the extraordinary session.

Tax Hearings to Come Soon

Senator Townsend of Michigan, who has a deep interest in the welfare of the automobile industry because of its influence on the welfare of his State, told AUTOMOTIVE INDUSTRIES that the Senate would probably take up the taxation problem within a few weeks. He pointed out that it was customary for the House to inaugurate tax legislation and the Senate use its drafts as a guide.

The fact that the new Secretary of the Treasury has an inside knowledge of the financial conditions of the automotive trade, due to his relations as a banker, is expected to influence his recommendations. It is stated that Mr. Mellon knows that the imposition of an

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Ford in Interview Declares Optimism

January Sales Establish Record—Starts Tractor Output—Wage Scale Continues

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and more willingness to give the best that is in them, the volume of labor required for a given task can be reduced greatly. Our office force today practically is what it was under pre-war conditions in 1914."

When it was suggested that production of 2860 cars yesterday with a force of only about 16,000 was extraordinary, Edsel Ford offered the explanation that much of the machining of material had been done prior to the shut-down in December and in consequence production with the minimum force was made possible.

Regarding reports of a car surplus of 125,000 at the time the plant shut down Mr. Ford said there were no finished cars save 95,000 in the hands of dealers and 30,000 in transit and in process of construction at the assembly branches, construction of which was completed during January. During the same month, he said, retail sales were 57,000, materially reducing the surplus which he said rapidly was being liquidated by constantly increasing sales.

Turning to W. A. Ryan, Mr. Ford asked if January sales had not established a record for that month and Ryan replied that no actual comparison had been made but that the total was probably a record.

With the ratio of sales continuing, Mr. Ford said, cars now held by dealers soon would be in the hands of consumers necessarily compelling an increase in output to meet current demand.

The Highland Park plant builds finished cars for Michigan and a part of Ohio and builds all engines and other mechanical parts which are shipped to the branches daily for assembling. The total built in the main plant and branches constitutes the daily output, with the Highland Park plant turning out about 350 cars as its quota.

2700 at River Rouge Plant

Repudiation of the many reports concerning Ford activities is emphasized not only in operations in the Highland Park plant but in the actual reopening today of tractor production at River Rouge where a force of 2,700 is employed, manning the blast furnaces, building tractors and working in various capacities. Although the Rouge plant never had been closed, Mr. Ford said. production of tractors had been stopped pending completion of preparations for resuming manufacture by the new system of pouring iron put into effect today.

Mr. Ford appeared particularly pleased to respond to the question regarding reported cuts in wages among his employees.

"There has been no reduction in the wages for specific jobs," said he, "and there has been no reduction in the minimum wage scale. Many foremen and other employees who had been working at higher wages were given opportunity to accept employment on other work at the prevailing scale for the particular job. The effort to minimize hardships by giving them part-time work even though it required their accepting wages lower than they had been paid on their regular work apparently was appreciated."

In voicing his optimism and full confidence in the future of the automobile industry Mr. Ford said:

Must Bring Back Normality

"The war and the unusual activities connected with it followed by the abnormal conditions accompanying the readjustment period brought about an unusual situation in the matter of labor and production and while everyone was for a time swept along on the tide of extraordinary industrial activity it easily was apparent that return to normal must be brought about by curtailment and readjustment all down the line. January was the breathing spell with the Ford Motor Co., following the period of intensive effort. We are all optimists out here and the figures given you are the best evidence that conditions are improving and that a brighter business outlook is becoming increasingly apparent."

On the question of successors to the men who have left the Ford organization, Mr. Ford suggested it was of little consequence who might look after the various activities of the company so long as the combined effort served to develop and promote its policies and ideals. Waving his hand at the group of executives about him he said:

"These men are all a part of this company. They are all financially interested to the limit allowed by the company under its investment certificate system. Let us eliminate the personal equation. This is not a Henry Ford organization but rather every executive and workman is financially interested in the welfare and future of the company. Why Edsel owns 43 per cent of the stock of the Ford Motor Co."

It was demonstrated plainly throughout the interview that the matter of titles for department heads or executives was of minor consideration and in fact there seemed to be an inclination to eliminate titles in most instances with matters of policy and efforts of all departments to be directed through conferences of all executives.

To Divide Responsibility

Mr. Ford's reply to a question as to who would be delegated with authority to reply for the company to questions that develop was significant.

"All of us," said he with a smile as he indicated the entire group, the inference being that all questions must be put to the executive conference.

Throughout the interview Mr. Ford maintained an air of composure, smiled constantly and never appeared ruffled even when questions regarding the many attacks and rumors were put to him.

GRADUAL INCREASE IN CAR MANUFACTURING BRINGS RELEASE OF HELD-UP PARTS ORDERS

NEW YORK, March 1—Better business is coming in the automotive industry. In fact it already has arrived. The pulse of life is stirring in all its branches. The stimulus of increased sales at retail has worked back at last to the car manufacturers. They are moving cautiously, but they are swinging into production. There has been no big splurge about it and there is no false optimism, but there is no mistaking the tone of the market.

The evidence is unimpeachable. It comes from the parts makers who supply the manufacturers of complete vehicles. They are getting some new business, but better than that, they are receiving an increasing number of "releases" on orders which have been held up since the slump began. These "releases" do not run into huge sums, but they show that the dam has been broken and they are beginning to turn into money some of the materials on hand for months.

Individually these orders are not large, but they bring with them reports of production in plants where there has been none before and of increased output in factories which have been doing some business. Most of them are for delivery this month. Numerous parts plants which have been running at 20 per cent of normal will double their output in the near future as the result of this business.

Collections are no worse than they were, and in some cases they are better. This is true especially of houses which deal directly with automobile dealers, and shows better selling at retail. There are many reports of motor vehicle manufacturers who have been hanging on gamely and whittling down their indebtedness as rapidly as they could work down their inventories and dispose of their products. Frozen credits are being thawed out gradually.

Most of the orders are coming from passenger car manufacturers, but there is some improvement apparent even in the truck field, where business has been virtually dead.

Parts manufacturers are giving earnest consideration to the question of prices. Many of them already have cut the prices of their own products and feel strongly that the prices of motor vehicles must come down before the market can be entirely stabilized.

Buffalo Interests Aid Dunlop Company

Company's Position Here Safeguarded—Will Need New Capital in Spring

LONDON, Feb. 12—(*Special Correspondence*)—The following statement in reference to the American interests of the Dunlop Rubber Co., Ltd., was made by F. Alexander Szarvasy, chairman of the board, at a general meeting of the stockholders today:

"Reference has been made on several occasions in the past to this undertaking, and you were informed that a company called the D. A. Trust had been organized, that £3,000,000 had been subscribed through the Dunlop America Pool, and that the home company had subscribed £1,000,000. The whole of this £4,000,000 was intended to form the Ordinary share capital of the American company, and it was understood, although I am advised that no binding agreement exists to that effect, as terms could not be agreed upon at the time—that the financing of the American company would be independently completed.

"Due, no doubt, to the abnormal financial conditions prevailing in America and in this country during the last quarter of 1920, your board was informed in October last that the proposed financing could not be carried through, and it was then that the problem arose whether it would be better to leave the American company to its fate, write off the £1,000,000 which had been invested, and risk the name of the Dunlop Company falling into disrepute, and at the same time run the further risk of some competitive company in America acquiring the partly built works, together with the name Dunlop, which would have meant competition against the home company, with its own trade mark practically all the world over. Most anxious consideration was given to this subject, and it was decided to remit the sum of £806,000 in order to avert receivership, and to give time for further negotiations.

Directors Visit America

"As I have already mentioned, two of your directors proceeded to America, and as a result of their efforts, arrangements have now been made whereby a bond issue of $6,000,000 has been created, secured on the American company's works and undertaking, the bonds to have a year's currency, to bear interest at 8 per cent per annum. The home company has undertaken to see these bonds funded at the due date. Four million, five hundred thousand dollars of these bonds were subscribed by local interests and local bankers at Buffalo, and $1,500,000 by the principal Ordinary shareholders in the Dunlop America Co., including the home company. With this additional finance the position in America has been safeguarded, but further working capital will be required after the completion and equipment of the mills—possibly to the extent of another six million dollars, or maybe somewhat more.

"The intention is to arrange this finance in America early in the spring by a bond issue of 12 to 14 million dollars, out of which the existing $6,000,000 bonds are to be redeemed and the working capital provided. It is intended that the home company should give its guarantee, if required, as to principal and interest on this bond issue, and it is partly for this reason that the amendments in the memorandum regarding powers of guarantee are being asked for.

"The home company is taking a risk in allying itself so closely with the American enterprise; it has been, however, a question of balancing one risk against another, and it would appear that the lesser of two has been chosen. It is part of the programme to offer to the D. A. Trust shareholders shares in the Dunlop company in exchange for their D. A. Trust shares; then the home company ultimately stands possessed of the whole of the equity in the American company, and thus be justified in giving its guarantee as outlined. If the American business is a success—and I am told that there is no reason why it should not be a very great success—it will be a most important source of revenue to the home company."

SECRETARY OF NAVY LEADER IN INDUSTRY

DETROIT, March 2—Edwin Denby, who will be secretary of the navy in the Harding cabinet, has been connected actively with the automotive industry since 1909 when he joined the Hupp Motor Car Corp. as a director and treasurer. He continued in that capacity until he enlisted in the Marine Corps at America's entry into the war in 1917.

He and Garvin Denby, organized the Denby Motor Truck Co. in 1914 and Edwin became its first president. He was succeeded as president of this company by A. S. More in the summer of 1920, but remained a director and holds the position of vice-president. He was active in the direction of Denby truck affairs, resigning as president to become a candidate for nomination as governor of Michigan.

WEST VIRGINIA BUYS CARS

CHARLESTON, W. VA., Feb. 28—Retail sales of automobiles were stimulated in this city by the automobile show. This section has not been so hard hit as many others by the industrial depression and the outlook is good for the coming year because Charleston's industries are diversified. As a matter of fact, the city is growing more rapidly than it ever has before. The population includes many persons of wealth and there is a good market for high priced cars.

Mellon Expected to Ease Tax Load

Longworth Bill to Sound Sentiment of Manufacturers — Many New Bills Likely

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additional tax bill of $290,000,000, as contemplated by his predecessor, would be disastrous and tend to disturb economic conditions generally.

The Longworth bill, which will be reintroduced at the next session, is the "smoke screen" for the House Committee of Ways and Means, of which Congressman Longworth of Ohio is a ranking member. Chairman Fordney admits that the bill is intended to sound sentiment and obtain a better understanding of the effect such measures would have.

Even the most optimistic legislators admit that the Longworth plan for revising the revenue laws would not yield adequate sums. It is estimated that a levy on corporations, as proposed, at 15 per cent could not yield any sum in excess of $1,200,000,000. The Ways and Means Committee think that higher tariff duties would probably bring about $750,000,000 into the Treasury, though this total is apparently exaggerated considering the reduction in imports when higher rates are imposed.

Chairman Fordney and many other Congressional leaders have indorsed a movement to combine the tariff and internal revenue bills for the purpose of economy. Just what course will be taken in regard to fiscal legislation will be determined by President Harding after conferences with Senate and House leaders. With a changed personnel in the Senate and House, it is likely that many new tax proposals will arise.

One of the outstanding features of an inquiry into private opinions held by legislators as to tax proposals relating to the automotive industry is the misunderstanding that exists as to the real condition of the trade at present. There are many legislators who believe that the automobile industry has grown to such enormous proportions in a relatively short period that it is in a position to bear the brunt of taxation.

Congress Short on Figures

No better evidence of the menace which remains in the unchallenged theories is needed than statements of Senate and House leaders as to suggestions they have received as to revenue legislation. One legislator submitted a proposal to a committee chairman based on information he obtained in a newspaper, but did not verify. He told the chairman that by imposing a national tax of $2 per car, the Government would receive $1,600,000,000, based on a statement which he accepted that there are 800,000,000 motor vehicles in the country. His error was quickly pointed out by mention of the fact that these figures would give every inhabitant of the United States about eight machines.

Miller Dividend Is Carried Over

Charge Off of Merchandise Shrinkage Absorbs Earnings and Causes Deficit

AKRON, March 1—For the first time in its history the Miller Rubber Co. passed a regular preferred dividend today. Action of the company's directors in deferring declaration of the quarterly cumulative 2 per cent dividend on preferred stock due March 1, followed announcement that the company, despite a substantial increase in sales in 1920, had a deficit of $735,016 on Dec. 31, 1920.

Miller sales for 1920 were $32,891,670. This was an increase of approximately $5,775,082, or 21 per cent over sales for the previous year.

In notifying preferred stockholders of deferment of the dividend payment, officials of the company said:

"In closing the books for the year 1920 it has been deemed advisable to give full effect to, and charge off, the entire shrinkage representing the difference between the cost to the company of raw materials on hand and the market value of the same, and also to the reduction in value of in process and finished merchandise on hand, based on lower material, labor and overhead charges, as well as settlements for the cancellation of certain rubber contracts. The shrinkage in inventory on this basis aggregated $3,193,086 and payments made in settlement of contracts amounted to $215,951 for an aggregate of $3,409,037. This action resulted in a net loss for the year of $617,878, the net profit of the company prior to the charging off of the items referred to amounting to $2,791,158. It should also be stated that this profit was practically all earned in the first six months of 1920."

The company on Dec. 31, officials state, was obligated on unfilled purchase contracts for raw materials, the aggregate purchase price of which was $1,500,000 above the market price prevailing on that date. The portion of this which will result in final loss to the company is said to depend on the basis of final adjustment or liquidation of these purchases.

The company has current assets of more than $14,000,000, based on the conservative valuation of the inventory. Of these assets approximately $2,000,000 is in cash on deposit. The total current liabilities are listed at $8,676,000.

Goodyear Stockholders Indicate Preference

AKRON, Feb. 26—Less difficulty is being experienced in gaining the consent of the Goodyear Tire & Rubber Co. stockholders to the company's refinancing program involving $85,000,000, than was encountered in securing ratification of the original plans which involved only $50,000,000, officers of the company have announced. Proxies are coming in slow, however, and may necessitate an eleventh hour postponement of the stockholders meeting now set for March 4.

Inadequate post office facilities at Akron are held responsible by Goodyear officials, for the fact that proxies are coming in slowly. It was found that many of the registered letters containing notices and proxy blanks, issued to Goodyear stockholders, were held at the Akron post office for nearly a week before being distributed for delivery.

Proxies already received, however, indicate a readiness upon the part of stockholders to give the company a vote of confidence by ratifying the refinancing plans, Goodyear officials say.

Templar Opposition Fails to Materialize

CLEVELAND, March 2—N. P. Clyburn, chairman of a minority stockholders' committee, was represented at the meeting of stockholders of Templar Motors Corp. to-day by F. S. Monnett, but, according to President M. F. Bramley, had proxies representing less than 1 per cent of the stockholders.

The board of directors was re-elected with one exception, that being the replacement of A. M. Dean, chief engineer of the company, for Attorney John Orgill. Others elected were W. M. Pattison, W. O. Cooper, D. C. Reed and M. F. Bramley. The organization meeting will take place later.

President Bramley said the company sold 40 cars in October, November and December, 20 in January, and 68 in February, and that orders have been taken for 162 for March and April delivery.

"We have 350 cars finished and 350 in process of construction," Bramley said last night. "We are employing 165 men of a normal number of about 900."

Discontinue J. L. Planes Pending Investigation

WASHINGTON, March 1—Coincident with the House resolution directing the Postmaster General to submit complete information as to the purchase and operation of Junker planes in the air mail service the Post Office Department advised AUTOMOTIVE INDUSTRIES that they had discontinued the use of the J. L. planes until additional tests could be made to determine their mechanical imperfections. It was also stated that the air mail service had employed engineering experts for improving and standardizing the Liberty motors which are now used almost exclusively by the service.

CREDITORS DIRECT PREMIER

INDIANAPOLIS, March 1—A new committee of creditors has virtually taken charge of the affairs of the Premier Motor Corp. This committee is headed by B. L. Craig of the R. M. Collins Co. of St. Louis. The other members are B. H. Miller of the American Foundry Co. of Indiana, and C. B. Reynolds of the B. F. Goodrich Co.

Keystone Tire, Buyer of A. E. F. Surplus

Practically All of Stock of 350,000 Tires Purchased—May Impose Excise Tax

NEW YORK, March 2—Through information released by the Under Secretary for Liquidation of Stocks of the French Government, it is learned that all but 12,800 tires of the 350,000 A. E. F. surplus has been bought by the Keystone Tire & Rubber Co. of this city. Information was declined at the Keystone offices here as to the number which have been already returned to the United States or as to the sizes of the tires.

Of the total of 337,200 tires bought by the Keystone company, about 200,000 are pneumatics and 150,000 solids. They are all of standard makes, and the pneumatics, for the most part, are said to be odd sizes. Information on the number of tires involved in the sale was obtained by the Rubber Association from the American Ambassador in Paris.

It is understood that no excise tax was imposed on these tires at the time of sale to the War Department and that action will now be taken to assess this.

N.A.C.C. Offers $5000 for Essays on Safety

NEW YORK, March 3—Prizes totaling $5000 will be offered by the directors of the National Automobile Chamber of Commerce to school children for the best essays on the prevention of street accidents in which automobiles are involved, as part of a national safety campaign in which the chamber will cooperate with the Playground Association and the National Safety Council. Appropriation of the prize money was made at the directors meeting yesterday.

Reports on car shipments showed an increase of 50 per cent for February over January. February shipments were 33 per cent of February 1920 shipments. Reports received from dealer organizations in 20 sections of the country indicated that February was the best month since September. The outlook for March and April was pronounced better yet. Used cars were reported selling but at sacrifices in price.

WEED CHAIN PATENT UPHELD

WILMINGTON, DEL., March 1—In the suits of the American Chain Co. against the United Auto Stores, Inc., Judge Morris in the U. S. District Court here, entered the final decree Feb. 25 holding Weed patent No. 768495 of the reversible chain grip to be valid and infringed by the grips made by George J. Campbell and sold by the United Auto Stores. It was also held that the infringing grips were finished in a style or dress that so closely imitated the weed grips made by the American Chain Co. as to constitute unfair competition.

Export Shipments Continue to Gain

January Shows Drop in Cars and Trucks but Parts Consignments Increase

WASHINGTON, March 1—Foreign trade in automotive products as a whole showed a marked tendency toward expansion, according to statistics prepared by the Bureau of Foreign and Domestic Commerce on International trade during January. While demand for passenger cars and trucks fell off slightly as compared with January of last year, shipments of automobile parts, not including engines and tires, doubled. There were unmistakable evidences of a stimulated demand for foreign cars on domestic markets, as the record shows that fifty-four automobiles valued at $94,653 were imported during January, 1921, as against thirteen cars and a valuation of $28,694 in the corresponding period last year.

Totals for the seven months ending January, 1921, indicate that the cultivation of foreign markets is quite successful and, that based on the showing for seven months, exports of automobiles and trucks will reach unprecedented proportions by June 30. There has been a curtailment in the demand for automobile and marine engines, but this decrease has been to a large extent offset by substantial increases in exports of stationary and tractor engines. One of the noticeable developments of the foreign trade for January was the heavy demand for American motorcycles.

As to imports and reimportation of automobiles, the official figures show that foreigners are gradually finding a market for their products in this country. For the seven months of the present fiscal year ending January, there were 860 cars valued at $905,093 imported, as against 97 cars with a valuation of $137,636 for the corresponding period in 1920. Imports of automobile parts increased in about the same proportion. The value of these imports for the seven months ending January, 1921, was $860,122, as compared with $286,589. In January, 1920, automobile parts imported were valued at $34,191, while for the same month this year they increased to $93,841.

Creditors Committee to Confer With Apex

YPSILANTI, MICH., March 1—Creditors of the Apex Motor Corp. to the number of 35 have selected a creditors committee to handle the accounts owed by the corporation in behalf of creditors by such agreement as the committee can enter into with officials of the corporation. The committee is headed by John French, president and general manager of the Michigan Stamping Co., Detroit; W. E. Hobell, treasurer of the Franklin Press, Detroit; Andrew Hochstrasser, of the Warman Brass & Aluminum Co., Cincinnati; E. F. Goodwin, cashier First National Bank, Ypsilanti, and M. M. Reed, president Ypsilanti Savings Bank. The five committee men represent the largest amounts owed by the corporation.

The committee was empowered by creditors assembled to act for them in extending further time for the payment of debts, and to act with corporation officials in working out an agreement.

Bethlehem Stockholders Find Position Serious

ALLENTOWN, PA., March 2—Affairs of the Bethlehem Motors Corp. are declared discouraging by the stockholders' committee after an investigation of the affairs of the company. The statement of the committee follows :

"The committee has examined a 'report on examination of account' of Aug. 25, 1920, and this report and information which has been obtained from other sources is most discouraging. Assets taken over by the receiver for the company consist of total assets of $4,396,707, of which $2,685,567 are considered current assets. Total liabilities, all of which are current, are $3,222,544.

"Seriousness of the situation from viewpoint of stockholders is indicated by an analysis of the statement. The corporation's liabilities amounted to $3,322,548, against which is had only $620,963 of readily liquid assets. Value of inventory (which under recent and present condition of automobile industry must be regarded as far from readily liquid) was $2,064,003. Accepting the inventory at that figure and assuming it to be readily liquid, current liabilities exceed current assets by $536,977.

"The committee frankly states that in face of the figures the situation is discouraging, but it is not without hope that if conditions in the industry change for the better and proper management and adequate working capital can be obtained, a reorganization or adjustment can be had which will materially improve the present situation of the stockholders."

Kissel Drops Equipment and Lowers Price $700

HARTFORD, WIS., Mar. 1—by using wood wheels instead of wire wheels, eliminating the bumper, snubbers, clock and some minor articles, the Kissel Motor Car Co., has been able to place the De Luxe touring car minus the De Luxe fittings on the market for $2775 which is $700 under the price of the more elaborately fitted model. All other details remain as before.

BRISCOE TO TAKE INVENTORY

JACKSON, MICH., March 1—Briscoe Motors Corp. will be closed for approximately 10 days for the purpose of taking the annual inventory, Feb. 28 being the closing of the fiscal year. In making the announcement officials took occasion to emphasize that the shut down merely was for inventory purposes and in no sense due to lack of business.

Parts Service Cuts Profits of Dealers

Truck Makers Fear Limiting of Business to Sales—To Confer Further

CHICAGO, Feb. 25—Representatives of the Motor Truck Manufacturers Association and parts and unit makers met at an all-day session at the Hotel La Salle yesterday to discuss the question of service and distributing stations which the manufacturers of parts and units have been establishing throughout the country and which, it is felt, will affect more and more as time goes by the business of the truck dealer.

The discussion brought no tangible results though it indicated that there is very little disposition on the part of the parts and unit makers to relinquish the ground they have already gained or to stop from continuing to establish stations with the ultimate view of twelve hour service. It is expected that they will adopt a program of future procedure in the matter of opening up new territory and will submit it to the truck manufacturers for suggestions.

The invitation for the conference was extended by the truck association and was accepted by a large number of the parts and unit makers who either have already established stations or are contemplating doing so. New phases of the situation are continually cropping out, making a satisfactory solution of the problem equally difficult for both branches of the industry. The difficulties will be settled at conferences.

Individual service and distributing stations for parts and units were started by the makers several years ago, but not until recently has the expansion been so great as to cause the truck manufacturers to take action. Now there is a determined move on the part of the manufacturers to do something that will meet the situation.

Would Combine Stations

There are indications that in cities where one part is being handled by a parts maker distributer, this same distributer will take on the product of some other parts maker, thus doing away with a multiplicity of parts station in any one community. The expansion of such stations necessarily will affect the regular truck station handling service, for where a part can be purchased from a parts station direct service will be done either at that station or at a repair shop nearby in cases where the parts distributer does not handle service.

Such a condition will mean that the truck dealer or distributer service station will find its profits from the service end of the business considerably curtailed unless some arrangement can be effected whereby as complete a stock of parts can be carried as that carried by the parts distributer and that the dealer or distributer of trucks will find his sole business to be in selling trucks.

INDUSTRIAL NOTES

Atlas Wheel Co., Cleveland, is to erect a new factory that will have a maximum capacity of 3000 wheels per day. The present plant of the company has been outgrown. Announcement about the new factory was made at the annual meeting of stockholders. Directors re-elected were: H. P. Arnt, David D. Walker, H. A. Duetemeyer, E. S. Reed, E. E. Ledeger, M. McC. Everhard and E. A. Fischer. Arnt was chosen president, Everhard vice-president and Walker treasurer.

Nash Motors Co. is starting work this week on the construction of another machine shop unit of its new four-cylinder car division works in Milwaukee. The main shops were completed late last fall and the plant is now in operation on a regular schedule. The present work is a continuation of the original plans of the Milwaukee plant project, which will cover about two years of construction work.

Packard Electric Co., manufacturers of Packard transformers and Packard starting, ignition and lighting cable, has moved its New York offices to the Printing Crafts Bldg., Eighth Avenue at Thirty-fourth Street. J. Ed. Erickson, manager for the New York district, is in charge.

Robertshaw Mfg. Co. has moved the sales office of the industrial department from New York to the factory at Youngwood, Pa. W. D. Crouch, sales manager of the industrial department, has been made general sales manager over both the industrial and domestic departments.

General Motors Corp. will change the name of the new Durant Building, Detroit, to the General Motors Building. W. C. Durant has resigned as president and director of the Durant Building Corp. and A. P. Sloan, Jr., has been chosen to succeed him.

Apple Electrical Mfg. Co. has been organized in Dayton, Ohio, with a capital of $500,000 cumulative preferred stock and 5000 shares of common stock of no par value, to manufacture a line of dynamo-electrical machinery.

Consolidated Instrument Co. has been formed with offices in New York, to render service in connection with all types of speed indicating and recording instruments and devices.

Kant Kut Tube Products Co. has been organized in Indianapolis to take over the ignition wire tube department of the E. C. Atkins Co.

Cutler-Hammer Mfg. Co. held a general sales meeting in Milwaukee Feb. 14 to 19, which was attended by all district office managers.

Stewart Mfg. Corp., Chicago, has opened a permanent Cleveland office under the management of E. P. Grismer.

Grant Motor Car Corp. announces that it has discontinued the building of trucks indefinitely.

Calumet Truck Body Corp. will name its new product the Calumet All-Purpose Truck Body.

LIBERTY STARTER RESUMES

DETROIT, Feb. 25—Liberty Starter Co. which makes the majority of starters for Ford cars and which has been closed more than two months, has reopened with a few hundred men and the force will be increased steadily until a maximum of 750 is employed, this total representing about 50 per cent of the normal force. A five day week schedule will prevail at the plant for the present.

"We will ask the men to give us their best efforts and there will be no cut in wage," said President Hartwig. "The five-day week plan will be maintained until increased business justifies a full week."

Stewart-Warner Raises $2,000,000 New Capital

CHICAGO, Feb. 28—The Stewart-Warner Speedometer Corp. has sold to the Central Trust Co. of Illinois $2,000,000 of 8 per cent five year convertible bonds to finance the purchase of the business of the Van Sicklen Speedometer Co., to pay bank loans which amounted to $200,000 on Dec. 3, and to reimburse the treasury of the Stewart-Warner Corp. for improvements made in the last few years from surplus and earnings. The bonds will be convertible into Stewart-Warner stock at $40 a share.

The products of the Van Sicklen Speedometer Co., which is of the air type, will add variety to the Stewart-Warner line which is of the magnetic type. This is the second competitor taken over. The Warner Instrument Co. was acquired in 1912, the consolidation forming the basis for the present corporation.

New Air-Cooled Car for Fall Production

PHILADELPHIA, Feb. 25—The newly organized Fox Motor Car Co., whose president is Ansley H. Fox, head of the A. H. Fox Gun Co., will open its plant at Tabor, next week. The factory has 100,000 feet of floor space and improved machinery and equipment. It is expected that the new car will be placed on the market in the fall. It is planned to produce no less than 2000 cars the first year. The Fox car will be new in design, embodying an air-cooled system. The price of the touring car will be $3500.

Ansley H. Fox maintains an office at Broad and Huntingdon streets. Louis E. Fifer is secretary. The directors are the foregoing and S. M. Germane, Colonel Sheldon Potter, formerly director of Public Works of Philadelphia; Budd G. Nice, Frank H. Schrenk, M. A. Sherritt and Walter J. Rice.

INDEPENDENT TO MAKE TRUCK

YOUNGSTOWN, OHIO, Feb. 28—The Independent Motor Truck Co. announces that it will get into production soon on a 3½-ton vehicle which has passed all tests satisfactorily. The company has been in process of development for three years and now has a capitalization of $1,000,000. A recent combination has given it control of two truck body factories and it is expected other units will be added in the near future. It is understood that a speed wagon to sell around $1500 will be put out in the spring.

METAL MARKETS

IRON and steel prices continue in the twilight zone. Sagacious automotive purchasing agents, however, are not permitting the numerous smoke screens that make for still lower visibility to warp their judgment of market conditions. Newspaper reports "play up" daily price cuts by this or that producer when, in fact, such cuts do not represent new reductions but merely signify that the individual interest named has fallen in line with the price levels previously established by other "independents." Because of its cumulative character this sort of publicity tends to create the impression that the market has declined to much lower levels than it really has, and to enhance the danger of an unnatural rebound in prices. Prices for steel are still more than double what they were in 1914, although 27½ per cent below those prevalent a year ago. There is a disposition among sheet rolling mills in the Youngstown district to make concessions for second quarter deliveries, the general anticipation being that there will be a sharp reduction in the wage schedules of sheet mill workers for the March-April period. After all, however, the market's true test these days is the reception accorded to individual bids and, in what little new business is being placed for automotive consumption, this procedure is being religiously followed. A Middle West buyer offered the other day to take on 1000 tons of malleable iron at $25 a ton. According to latest reports, he has not yet succeeded in securing an acceptance at that level, the producers asking $27, valley. It is quite likely, however, that a compromise offer on the prospective buyer's part of, say $26, would have proved acceptable. The situation with reference to pig iron must be considered apart from the outlook for steel. The former simply can not absorb the enhanced freight rates without showing a sharp bulge over pre-war levels. In the case of finished steel, this increment in costs is spread over a much higher ton price and the unavoidable bulge, expressed in per cent, therefore is more slight.

Pig Iron—What few round tonnage sales are consummated are negotiated at prices that remain undisclosed. The nominal market price, $27, valley, for malleable and No. 2 foundry, applies solely to carload transactions. Steel makers are reported to have sold some "off-grade" basic at $24, valley. The "off-grade" qualification is obviously for the purpose of not hurting the market.

Steel—Slightly improved movement of steel bars to automotive parts manufacturers is reported. Cold-finished bars could be had on fresh orders at as low as 3.25c., although the hot-rolled bar market is still at 2.10c., Pittsburgh, and producers of the cold-rolled figure on a differential of $25 per ton. Cold-rolled strip steel is quoted at around 6c. Reinstatement of parts orders by the Ford Motor Co. is expected to quicken shipping orders on old contracts. Sheet prices are working toward lower levels and 3.85c, for black has been spoken of for representative second quarter deliveries.

Copper—Although tonnages involved are light, a little copper is moving to the automotive brass foundries in the Middle West and Connecticut valley. While producers maintain 13c. as their price, so as not to injure the sale of the $40,000,000 bond issue rcently put on the market, sales in the "outside" market have been as low as 12½c.

Tin—Considerable Chinese tin is coming in, and this grade is more actively offered.

FINANCIAL NOTES

C. M. Hall Lamp Co. shows total assets of $1,539,988.27 in its annual report as of Dec. 31, compared with $1,561,007.83 the previous year. Current assets were $1,007,925.64 and current liabilities $29,994.75, against current assets of $1,037,213.52 and current liabilities of $254,375.26 in 1919. Net working capital was $977,930.89, compared with $782,838.26 the previous year. Fixed assets less depreciation reserve are appraised at $523,867.66. Surplus is $164,612.75 as against $211,251.76. No change was made in reserves for contingencies amounting to $345,380.81.

General Motors Corp. has sent a letter to common stockholders informing them that they will be given an opportunity to purchase sufficient fractional stock warrants to complete one full share of stock or to dispose of their present holdings of fractional stock warrants totaling less than one share in each case. The price paid will be the bid price for General Motors common stock as quoted at the close of business on the New York Stock Exchange the day previous to the one on which the order is received.

U. S. Radiator Corp., in its statement as of Jan. 31, reports the most successful year in the company's history, with gross earnings of $1,321,568.98, compared with $1,113,828 the previous year and $1,227,458 in 1918, the company's best previous year. Operating profits were $1,220,214.68 and total income less interest charges was $1,130,674.65. Net earnings were $927,059.51, after charges of $203,615.14 for depreciation on plant and equipment. This total was approximately $150,000 greater than in 1918.

White Motors Co. shows an operating profit after deducting all administrative expenses, but before providing for depreciation in inventories, amounting to $3,486,704. Reduction of inventories from cost to market values amounted to $1,193,927, leaving an operative profit of $2,292,776. The net profit available for dividends on the capital stock was $2,410,-014. This is equivalent to $4.82 a share. Gross sales for the year were $51,998,122 as compared with $41,667,696 in 1919.

General Aluminum & Brass Mfg. Co. reports for 1920 a surplus of $828,390.17 and net worth of $3,017,340.17. Manufacturing inventories were $1,118,583.66, current liabilities $526,723.80 and net current assets $1,166,-375.88. Plant account depreciation is given as $1,850,864.29, while $72,256.26 is due from employees on stock. Cash on hand is $22,-690.45 with accounts receivable $227,682.22.

American Bosch Magneto Corp. reports net profits for 1920 of $945,700, which is equal to $9.45 a share on the 100,000 shares of capital stock outstanding. In 1919 net profits were $921,963, equal to $9.21 a share, but in that year it was not forced to write off anything for inventory adjustment. Inventories at the close of 1920 were carried at $4,344,727, compared with $2,928,582 at the end of 1919.

Michigan Stamping Co. reports surplus of $316,974.71 with total assets of $4,352,881.49 as of Dec. 31. Total sales are given as $4,804,-142.56 and accounts receivable $664,195.84. Plant account is $1,963,752.94 and merchandise inventory $1,346,619.85. Reserves for depreciation are $290,916.77, and for Federal taxes for 1920 $70,000.

American-La France Fire Engine Co., Inc., and subsidiary companies, report net profits after Federal and Canadian taxes of $597,074, which after allowance for preferred and common stock dividends leaves a surplus of $252,308. With the previous surplus the company now has a total of $1,405,010.

Hood Rubber Co. reports sales for 1920 as $32,867,000, which compares with $25,444,016 in 1919. Tire sales were $8,700,000, against $6,500,000 in 1919. The balance sheet shows an increased surplus of over $1,000,000 after the stock dividend of $2,000,000 is deducted from surplus of Dec. 31, 1919.

Kalamazoo Chain Co. has been taken over by the Hodges Chain Co. of Galesburg, Mich., which has just been organized for $60,000, with $50,000 subscribed and $10,000 left in treasury stock.

Kroyer Motors Co. is offering the $500,000 unsold portion of an original offering of $1,500,000 7 per cent cumulative preferred stock at par ($100) plus a 100 per cent common stock bonus.

Clum Mfg. Co., Milwaukee, has increased its authorized capitalization from $100,000 to $250,000, to accommodate the growth of its business. Valentine Fina is president and general manager.

Autocar Co. has declared a dividend of 1½ per cent payable March 10. In the previous two quarters the company declared quarterly dividends of 2½ per cent.

Kelly-Springfield Tire Co. has declared a quarterly dividend of $1.50 a share on the 6 per cent preferred stock of the company, payable April 1.

Viking Motors Co., Detroit, with a capital of $100,000, has been incorporated to build aircraft motors and accessories.

Portage Rubber Co. stockholders have formed a committee to take care of the $1,500,000 refinancing program.

Pierce-Arrow Motor Car Co. has declared a quarterly dividend of $2 a share on preferred stock, payable April 1.

Watson Products Seeks Funds to Continue Plant

SYRACUSE, N. Y., Feb. 28—Attorneys for Milton Delano, receiver for the Watson Products Corp., have obtained an order to show cause why he should not be authorized to issue $250,-000 worth of receivers certificates in order to continue the business of the company under a schedule prepared by Albert A. Kessler, president of the company, who has been conducting the factory for the receiver. The schedule filed with the court by Kessler shows quick asests of $913,057 including $74,554 in cash and the remainder in inventories. The statement shows that a reduction of one-third from stock prices has been made from the current value of the inventory.

The receivership is a friendly one to permit reorganization of the Watson Products Co. as the Watson Truck Corp. The old company owns 2001 shares of the common stock of the truck corporation. The only assets of the new company consist of the preferred stock of the Dunkirk Axle Corp. which is a reorganization of the Empire Axle Co.

Kessler states that an option already has been given for the sale of this entire block of preferred stock in the axle company and that "if the assets of the Watson Products Corp. should be merged with the assets of the Watson Truck Corp. and a sale should be made under the option, it would create a large amount of working capital for any company succeeding to its business."

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Mar. 3—The money market last week was quiet with a small supply and with light transactions. Call money ruled at 7 per cent with a range of 6 per cent to 7 per cent, the same as the previous week. Time money was unchanged at 6½ per cent to 7 per cent for 60 and 90 day paper and 6½ to 6¾ per cent for the longer maturities.

The week-end statement of the New York Federal Reserve Bank showed a less favorable reserve position. Gold reserves declined $12,512,000, and total cash reserves $13,873,000. Total bills on hand increased $24,452,000 and total earning assets $24,752,000. Federal Reserve Notes in circulation in this district increased $4,392,000, while Federal Reserve Bank Notes decreased $680,000.

For the first time in the current year the reserve ratio of the Federal Reserve Bank as a whole declined. The ratio of gold reserves to Federal Reserve notes in circulation after setting aside 35 per cent against net deposits declined from 58.5 per cent to 58.1 per cent. Gold reserves increased $7,663,000. Federal Reserve notes in circulation increased for the first time this year by $14,262,-000. Federal Reserve Bank notes declined $4,106,000. Total bills on hand increased $35,475,000 and total earning assets $35,227,000. Net deposits increased $26,479,000 and bills discounted secured by Government war obligations increased $13,793,000.

The London money market appears to be in about the same strained condition that the New York market was in December. Short term discounts touched 7¼ per cent, the highest since the November panic of 1890. The official discount rate of the Bank of England, which is ordinarily "on top" of the market, is only 7 per cent. Partly responsible for this money tightness, undoubtedly, is the pressure of income and excess profits taxes which are due by March 31, the end of the fiscal year.

AJAX PASSES DIVIDEND

NEW YORK, Feb. 28—Directors of the Ajax Rubber Co. have decided to pass the quarterly dividend of 1 per cent on the common stock. The dividend was reduced three months ago from $1.50 a share to $1. The action of the directors was influenced by the poor showing made last year. They felt that all the company's resources should be reserved to finance business to meet the demand for tires which it is expected will increase with the approach of spring. They were informed that reports from dealers indicate an earlier resumption of normal operations than had been expected.

Stockholders of the company re-elected the retiring directors with the exception of Harold W. Stimpson, who declined to serve another term. Benjamin Briscoe was elected to the board in his place.

Men of the Industry

G. S. Crane, who has been manager of the Cleveland office of the Cutler-Hammer Mfg. Co., will become manager of controller sales at the main office in Milwaukee. L. B. Timmerman will be in charge of the Cleveland office, and will act in the capacity of assistant to A. G. Pierce, manager of the central district. The Cincinnati office will become a part of the central district with R. I. Maujer as branch manager. E. N. Lightfoot will assume the title of manager of the heating department with headquarters at the New York works.

J. G. Utz, who was associated with Christian Girl in the Perfection Spring Co. and Standard Parts Co. for about ten years, and who, since he resigned from Standard Parts, February last, has devoted a part of his time to the consulting work of the C. G. Spring Co. and the balance of his time to expert spring consulting for automobile manufacturers, has arranged to give up his consulting office and devote all of his time to the C. G. Spring Co. as vice-president.

George C. McMullen, who has represented both the Timken Roller Bearing Co. and the Timken-Detroit Axle Co. in the Pacific Coast territory for the last three years, will in the future devote his entire time to sales engineering in the sole interests of the Timken Roller Bearing Co. He will maintain his offices in Room 450, Monadnock Bldg., San Francisco. McMullen's former assistant, C. H. Brooks, will take care of the business of the Timken-Detroit Axle Co.

J. F. Richman, one of the old guard of the automobile business, has resigned as superintendent and production manager of the Allen Motor Co. of Columbus. Richman has not disclosed his plans for the future, but it is understood that a private enterprise in Columbus will occupy part of his time. Richman has been identified with the automobile industry since the early days of the Olds Motor Works at Lansing, Mich.

E. C. Shaw, director and for many years vice-president of the B. F. Goodrich Co., has been named one of three members of the new state board of administration of Ohio by Governor Harry L. Davis. Shaw has accepted the appointment, but will continue his official identification with Goodrich as a director, in connection with his new duties.

W. W. Clark, export manager of the Hart-Parr Co., has just returned from a four months' business trip through Europe. He found Europe suffering from the same economical troubles as America, but with conditions much worse on account of the unstable exchange which has made trade almost prohibitive.

Frederick P. Nehrbas, connected with the Premier Motor Corp., has resigned, effective March 1. After a short rest, it is his intention to locate along the Great Lakes or in the New England States, where he was intimately known prior to locating in Indianapolis.

C. B. Rose, for the last few months supervisor of the Moline Engine Co. plant, has been appointed general manager and will be formally elected vice-president of the company. Rose will continue his connection with the Moline Plow Co. as consulting engineer.

E. Gruenewald, who has been associated with the R. & V. plants since 1906, is entering the field as consulting engineer, and will continue affiliations with the R. & V. organizations as consulting engineer for both the Moline Engine and the R. & V. Motor.

John S. Ogilvie has resigned as assistant treasurer of the Mutual Tire & Rubber Co. and as treasurer of some of its associated corporations and is now secretary-treasurer of Horn, Severson & Ogilvie, Inc., general insurance brokers, New York.

Homer M. Eichelberger, for the past three years associated with the advertising department of the Franklin Automobile Co.; Syracuse, in charge of production, has resigned, to become advertising manager of the Syracuse Washing Machine Corp.

Albert E. Rosenberg has resigned as vice-president and purchasing agent of the E. G. Mfg. Co. to become a representative for Claussen Tube Works, Hardy Mfg. Co., U. S. Metal Goods Co., Waldenburg Bros. and American Auto Lamp Co.

C. E. Franks has been appointed export manager of S. F. Bowser & Co., Inc., in all export markets outside of Europe. Ralph G. Schulze, former export manager, has been made European managing director.

Harry P. Meredith, former manager of manufacturing of the Curtiss Aeroplane & Motor Co., Buffalo, has been made general works engineer of the Maxwell-Chalmers Motor Co., Detroit.

Frank K. Dolbeer, one of the old timers of the Willys-Overland organization, has resigned as treasurer. The duties of the office will be taken over for the present by J. H. Gherkins.

J. M. Crawford, chief engineer at the Allen Motor Co., has been promoted to manufacturing manager, but will retain charge over all engineering departments.

Mitchell Mackie, sales manager of the Waukesha Motor Co., Waukesha, Mich., has resigned, effective March 1. His plans for the future are not announced.

Robert Rubin has been added to the engineering staff of the Radcliffe Turbine Drive Co., New York, makers of the new turbine drive for motor cars.

Guy C. Core, former advertising manager of the Jackson Motors Corp., Jackson, Mich., has joined the Horsting Co. advertising bureau, Chicago.

W. H. Ellis and C. B. Clarke have been added to the sales force of the Hilo Varnish Corp., Brooklyn.

J. Wesley Bean, formerly secretary-treasurer of the Acme Universal Joint Co., Kalamazoo, has been appointed auditor of the city of Kalamazoo.

C. F. Nelson, of Minneapolis, has accepted the general superintendency of the plant of the Reed Foundry & Machine Co.

C. A. Woodruff, former purchasing agent for the Chalmers Motor Co., the Saxon Motor Car Co. and the Liberty Motor Car Co., has joined Briscoe Motors as director of purchases.

SCHARTOW FORMS NEW COMPANY

MILWAUKEE, Feb. 28—F. E. Schartow, founder and president of the Schartow Mfg. Co., which moved from Racine, to South Milwaukee about a year ago, has disposed of his interests and has organized the Schartow Iron Products Co., which will locate a plant in Racine. It will manufacture a diversified line of automotive equipment, hardware, etc. Work is under way on a foundry and machine shop to be ready about March 21.

The Schartow Mfg. Co. of South Milwaukee, following the retirement of Schartow, has changed its corporate style to the Midland Co. The product, including chains, hardware, harness and saddlery hardware, etc., will continue to be trade-marked "Sharto." The present officers are: President, R. A. Nourse; vice-president, T. E. Ward; secretary and treasurer, C. P. Nourse.

W. M. Anthony Retires as Maxwell Treasurer

DETROIT, March 1—W. M. Anthony, treasurer of the Maxwell-Chalmers organization, has resigned to take effect today. No successor has been appointed, but it is understood Walter P. Chrysler, chairman of the management committee, has selected a man for the post. Anthony, who is 70 years old, has been with Maxwell-Chalmers a long time and his retirement, according to officials, is due to advanced age. It became known today that a general reorganization of the Maxwell-Chalmers personnel is being carried out with the idea that the company's position would be bettered by the induction of new officials into several positions.

The reorganization plan started with the resignation of Roy M. Hood, long-time purchasing agent, who was succeeded by A. C. Downey. The resignation of Ordon Muir, advertising manager, who was succeeded by W. J. Mattimore, and the acquisition of A. E. Barker as sales manager were in accordance with the determination of officials to rejuvenate the organization. An official of the company said many department heads had formed friendships and alliances which precluded giving their best efforts to the organization.

President Ledyard Mitchell said today that the company, at the time of the shutdown last July, had 16,000 Maxwell cars on hand and 5500 Chalmers, of which 10,000 Maxwell and 4000 Chalmers have been sold. President Mitchell said the company is turning out 50 Maxwells and 20 Chalmers daily.

Stearns Earnings Show 10 Per Cent Increase

CLEVELAND, Feb. 28—Profits of the F. B. Stearns Co. for 1920 exceeded those of 1919 by about 10 per cent, stockholders were informed at the annual meeting. Business for January was as good as in the same month of 1920 and the company now is operating at about 95 per cent of normal. The parts business has been entirely satisfactory and the company now makes every part that goes into the Stearns car.

Richard Garlick, treasurer of the Youngstown Sheet & Tube Co., was elected a director to succeed Paul Wick of Youngstown who resigned. The other directors were re-elected.

Calendar

SHOWS

Mar. 5-12—Atlanta, Annual Automobile Show, Atlanta Automobile Dealers' Ass'n, Auditorium, Virgil Shepard, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 5-12—Atlantic City, Annual Automobile Show, Automobile Trade Association of Atlantic City, Million Dollar Pier, A. H. Generatsky, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 7-12—Nashville, Annual Automobile Show, Nashville Automobile Trade Ass'n, Page Bldg.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

Mar. 14-19—Washington, Annual Automobile Show, Washington Automobile Dealers' Ass'n, Rudolph Jose, Chmn.

Mar. 19-26—Detroit, Annual Automobile Show, Detroit Automobile Dealers' Ass'n, Morgan-Wright Building.

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April—Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28, 1921—Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12—London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7—Cleveland, National Foreign Trade Council.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

Oct. 12-14, 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

July 24—Grand Prix, Le Mans.

S. A. E. MEETINGS

Boston section—March 18.

Buffalo section—April 19—Paper on "Carbureter Performance," by F. C. Mock.

Dayton section—May 3.

Detroit section—March 25—Discussion of "The Relation Between the Industry and the Department of Engineering Research of the University of Michigan," by Prof. E. A. White.

Metropolitan section—March 10—Paper on "Brakes," by H. G. Farwell.

Metropolitan section—April 14—Paper on "Low Grade Fuel Carburetion," by A. H. Beach.

Midwest section—March 11—Discussion of storage batteries.

Minneapolis section—April 6—Discussion of repair equipment.

Washington section—March 18—Highway and Highway Transport Trading.

Washington section—April 1—Aeronautical Engineering Session.

Boston S.A.E. Section Visits Rolls-Royce Plant

SPRINGFIELD, MASS., Feb. 25—Over 125 members of the Boston section of the Society of Automotive Engineers and guests met here today for the regular monthly section meeting, which took the form of a visit during the afternoon to the Rolls-Royce factory where several hours were spent, and an evening meeting starting with a dinner and followed by an address on a Comparison of European and American Automotive Practice by Maurice Olley of the Rolls-Royce company. Both the visit and the evening meeting were most successful, many members and guests attending from Boston, Hartford, Syracuse, and other New England cities. President David Beecroft attended.

During the factory visit the party was divided into groups of ten who under a leader were taken through all factory departments and stops made at nearly every stage of manufacture. Every effort was made to let all get any information desired. Factory departments were literally unlocked for the occasion.

At the evening meeting Mr. Olley gave one of the best comparisons of the motor industry in England, France and America that has been heard. The present British design has been largely determined by such factors as cost, competition by motorcycles, roads, climate, limited size of the industry, the spirit of adventure in the Englishman and lack of definite money standards.

The French car has been largely determined by the demand for high speed on the long straight roads, adequate brakes, carburetion intended specially for speed, stiff springs, and without any special claims to quietness. It is uncomfortable to ride in and uncomfortable to operate.

The American car is the most convenient vehicle in the world to operate and to drive and is best able to get any place whether there is a road or not. It is not a speed monster as are the European cars; it is not pleasant to steer; its brakes are deplorable; and its bodies are not comfortable or well made.

Service Men to Hold Convention in Buffalo

NEW YORK, Feb. 25—Plans are rapidly being completed for the semi-annual convention of factory service managers under the auspices of the Service Committee of the National Automobile Chamber of Commerce. It has been definitely decided to hold this next convention in Buffalo and the dates will be May 17, 18 and 19. Among the subjects under consideration for discussion are:

Advantages and disadvantages of the unit replacement system for continuous service.

Service equipment.

Service department organization.

Growth and responsibilities of the service department.

Field organization.

Relation between the engineer and the service department.

Better co-operation between equipment service stations and dealer service stations for the benefit of the owner.

MOLINE ENGINE RESUMES WORK

EAST MOLINE, ILL., March 1—The Moline Engine Co., after two months of idleness, reopened to-day with a force of 60 men. It will be gradually increased, company officials announce. The company produces the poppet valve engine for the R. & V. Knight automobile.

DePalma in Ballot First at Los Angeles

LOS ANGELES, Feb. 28—Driving 50 miles at an average speed of 107.3 miles per hour, Ralph DePalma in a Ballot, on Beverly Hills Speedway, won the opening event of the new championship season this afternoon with Milton, second; Sarles, third, and Murphy, fourth. DePalma established a new 50 mile record for 183 cu. in. cars. Preceding the final race were four sprint matches of 25 miles each. DePalma won the first from a field of nine starters averaging 106 miles per hour; his last lap was better than 111 miles per hour, the fastest the track ever was driven.

Sarles won the second heat averaging 107 miles per hour. Murphy won the third heat averaging 102 miles per hour. Milton won the fourth averaging 104 miles an hour. Winners did not start in succeeding heats. The time was the fastest and the driving the best ever seen here. It was DePalma against the field, all but one of the other drivers using Duesenberg motored cars. The exception was Sarles in a Monroe.

TRUCKS CLEAR MARYLAND ROADS

BALTIMORE, Feb. 25—Maryland's motor fleet of twenty-five trucks equipped with snow plows, opened up every mile of road in the state, after the blizzard of Feb. 21. In the western part of the state the plows had to go through snow fifteen inches deep. The big trucks were kept on a 24-hour shift, chauffeurs working in two shifts. Farmers, dairymen and freight trucking firms that carry on inter-city business were delighted with the work of the new snow fighters.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

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How Can Automotive Production Costs Be Lowered?

This is not the complete answer, but it is one answer by a man who has studied production in most of the large shops of the industry. Interesting discussion of progressive and departmental manufacture.

By George M. Meyncke*

MANY economists, after a profound study of the recent stagnation period, have agreed on a verdict. It is that overproduction is practically impossible—it is merely underconsumption that we suffer from. The Public, they explain, are merely depriving themselves of their wants because of the delays they suffered and the prices they paid in addition to the suffering.

It is true that the Public has been plunged from a feverish urge to stop purchasing because there was not enough goods to go around, to the frigid plea of "Buy Now" campaigns.

It is scant wonder that there is indecision in the minds of the automobile builders as to which is the dream and which the reality, and no doubt we will continue to swing pendulum-like back and forth between the two extremes unless all phases of the automobile industry bend their efforts toward stopping the pendulum somewhere near its perpendicular position.

A local distributor has informed me that several of my neighbors want to buy a car and will do so "when prices come down." These neighbors are obeying to the letter of the law the now extinct solicitation to stop purchasing and they refuse to be excited by the "Buy Now" appeal.

*With the Oesterlein Machine Co.

This is but a concrete example of a problem that is staring all manufacturers in the face. That is, the problem of producing and marketing their products at a price which can be paid by those who are anxious to obtain their products.

Production Costs

On the surface it would seem that the limit has about been reached in the automobile industry from the production end. The industry includes the world's greatest producers. What production problems are left to be solved? How can production costs be lowered?

This can be answered generally in one sentence.

> **The automobile manufacturer is behind the times from the shop equipment standpoint and is not in a position to avail himself of the best the machinery market offers.**

This extreme statement is probably contrary to the common understanding and calls for explanation.

The machine tool industry has confronted and is ready to emerge from an unusual position. Unlike the automobile, its production was encouraged instead of curtailed during the war and thousands of new tools were built and put into service. A machine tool stays in service many years. Tools in use that are thirty years old are not uncommon.

Generally speaking, the same tools built during the war are in use to-day in automobile shops.

However, during and after the war, the machine tool builders have attacked the problem of reselling their old market by the introduction of more productive tools. A concrete example may make this point clear.

There were approximately 2,250,000 passenger cars built in 1920 and in them approximately 11,000,000 connecting rods were used. If these 11,000,000 connecting rods were all made in one shop, a certain one of the essential machining operations would require 132 of the best of machines (on a 2000 working-hour-year basis) made prior to the war, whereas it would be possible to machine them on 45 of the modern machines available to-day.

By actual count in ten large shops and the proportioning of their production to the total yearly production, there were, instead of the theoretical 132 "old style" machines, a total of 786 machines used to get out the 1920 production of this operation or almost six times the number necessary for the theoretical centralized connecting rod shop.

To rework the field for that particular operation on connecting rods, the old machines can be replaced by the new at the ratio of about three to one.

Incidentally, this could be the foundation of argument for the parts manufacturer with very fine specialization of products such as a connecting rod company, with an ambition to supply the entire industry.

When the production ability of some of these new tools is studied, the real scope of their cost lowering value is apparent. They are not confined to any one class of work as is evident from the following.

There is a grinder capable of grinding operations on small hardened parts at the rate of over one million parts per year. There is a milling machine capable of milling parts, such as yokes, at the rate of one million per year. There are drilling machines capable of drilling fairly large holes at the rate of half a million holes per spindle per year.

Specialized Machine Tools

Such machine tools are commonly classified as "specialized tools." There is a fine hair distinction between them and the so-called "special machines" in that the former are the developed product of machine tool builders and the latter are odd machines built for a single fixed purpose.

The general plan followed in specialized machine tools has not been to build the older machines in duplex or triplex and thus multiply the output per machine, but to employ but a single cutting or abrasive tool and make it capable of greater output, or in other words, to design around the actual ability of a single stock removing medium at more or less of a sacrifice of the versatility of the old machines of general application.

When this idea is successfully carried out production increase is obtained with a corresponding decrease in maintenance.

The automobile manufacturers have stimulated and even assisted in the development of much of this new order of production machinery and where they have not actually assisted the automobile manufacturer has furnished the market for the manufacturer who developed his tools unaided.

Some new shops have fortunately been in a position to start with much of this new equipment. As a whole, however, the manufacturers have not seized the opportunity of lower production costs which these new tools make possible. There are both actual and fancied disadvantages that operate against the installation of such machinery.

The automobile industry is much more responsive to improvements than others. They have witnessed such rapid development in their own product that they even anticipate it in other industries. Recently the idea has grown that the curve of progress has reached its peak and will hold a flat for some time. Whether this is true of the automobile itself or not, the writer is not in a position to say. On the question of production machinery, he believes that the high point is yet to come. Witness the new production machinery that has been announced since the war and which is augmented almost weekly as new ideas are perfected.

There are frequently fixed ideas in the minds of production engineers as to the ultimate possibilities in production and these ideas are set too near the limits of past practice.

Progressive Manufacture

Perhaps the greatest actual handicap to new machinery is the almost universal use of progressive manufacture. The mere idea that progressive manufacture shows symptoms of inadequacy is received with consternation by its advocates.

Progressive manufacture, from the machining standpoint, consists of the grouping of all machines required to make, say a universal joint, in a universal joint department, in charge of a foreman responsible for each machining operation necessary to complete the joint.

When one or more machines are required for milling or drilling as many joints per day as the schedule requires, this system is excellent. Suppose, for example, that the schedule calls for production at the rate of 200 universal joints per day and one milling machine and one drill are capable of that output. Each operator is kept busy at his particular machine and there is no accumulation of parts. Now suppose this equipment is replaced with a milling machine capable of producing at the rate of 140 universal joints per hour or 1120 per day.

This means that in less than two hours the output of the department is completed as far as that operation is concerned. The more capable machine is idle three-fourths of the time and a possible saving of production costs is not obtained.

Another job, say the steering knuckle, could be run on these machines when the universal joint output is completed. But this is impractical, because steering knuckles are made in the steering knuckle department under a steering knuckle foreman, who is indifferent to the worries of the universal joint foreman.

Departmental Manufacture

Progressive manufacture displaced departmental manufacture. With this system all chucking lathe work was done in the chucking department under a chucking lathe foreman, and all drilling in the drill department under a drill department foreman.

There are some classes of work, such as automatic screw machine, and frequently grinding, that, because of the skill and close supervision required, have always been handled departmentally.

In reality the introduction of specialized machinery is merely putting other machining operations at par with such classes of work that have previously been inapplicable to progressive manufacture.

To realize on the lower production costs offered by such machinery progressive and departmental manufacture is subject to review and revision from a cost per piece basis.

Foremen will never agree to combine. There is a fear of self-elimination. During the recent rush for production, such a change in system was impossible. To-day it is a cost reducing problem for the management as a whole.

Production Department Investments

Production engineers are not hired primarily to search for investments. In defense let it be said that they are not supervised from the "interest on our money" basis. They think and talk output limits and are ever increasing schedule from the equipment at their command.

In figuring a possible savings on equipment, their minds run in the single channel of saving operators' wages. They do not count the cost of supervision, floor space, upkeep, power, belts or motors and the endless little things that the auditors know as items of overhead that indirectly affect the cost of the finished product.

In considering the replacement of present equipment with more modern equipment, it may result in worthy gains for the auditor to sit in with the equipment committee having an eye for the production department investments so often discussed at such committees.

Unless the producer of comparatively small quantity can utilize more productive equipment, the gap between his costs and the large quantity producers will widen, a fact that reacts against his reaching the desired quantity goal.

Some shops maintain what are called "Flying Squadrons." These consist of capable men who are plugged in at whichever department lags behind the schedule and requires their assistance. Instead of continuing with slow equipment, the small shop can enlarge upon the "flying squadron" idea and progress their men to the equipment on which they can produce to greater advantage.

There is also a tendency to keep one machine constantly on a certain job. There is a point at which the potential possibilities of production become so great that changing from job to job on a single machine results in a lower cost per piece.

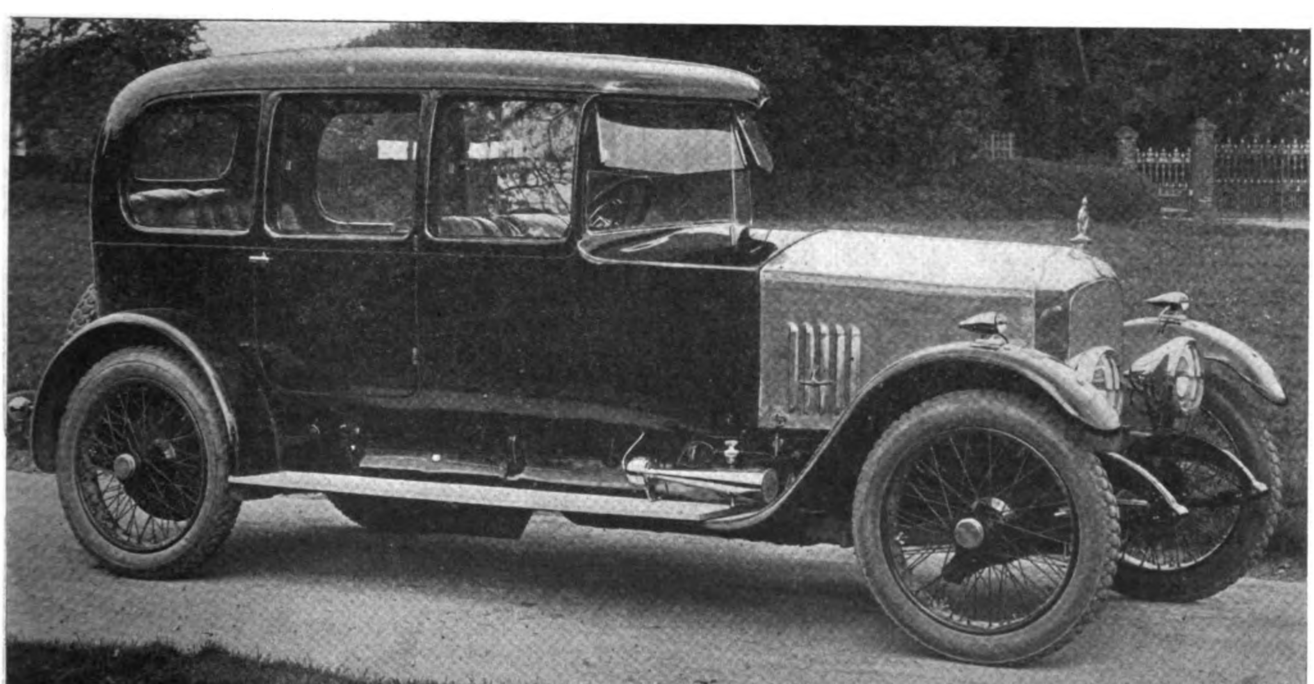
Making use of more productive machinery in the low quantity shop is more of a problem of tool and fixture design and of the training of operators than in the high quantity shop.

The grouping of similar parts and standardizing on fixtures makes possible the utilization of high production machinery, but also necessitates the training of more men to change equipment and to set up machines.

There is opportunity for the combined efforts of the engineering and production departments in a study of parts from the standpoint of material and processes of manufacture. Parts from sheet metal, for example, can now be made cheaper in some cases if castings or forgings are used in connection with the latest developments in machining methods. The relation between the number of operators and the cost of machining differs as improvements in handling operators are developed.

Standardization Work in Belgium

THE Association Belge de Standardisation was formed in April, 1919, in order to study the question of standardization from the commercial and technical points of view in all branches of industry. It consists of important technical and industrial associations in Belgium. A general committee has been chosen to direct the activities of the association, to examine any proposals presented and to keep in touch with similar organizations in foreign countries, in order that the members of the association may profit from results obtained elsewhere, or may, if required, assist in the establishment of international standardization. In each case where the committee decides to attempt standardization, it will appoint a "Technical Committee" of experts, who will report and if necessary consult individual producers and consumers.



A good example of British coach work. Interior drive limousine body on the 25-hp. Vauxhall chassis recently described in AUTOMOTIVE INDUSTRIES

Five Models Included in New Line of G. M. C. Trucks

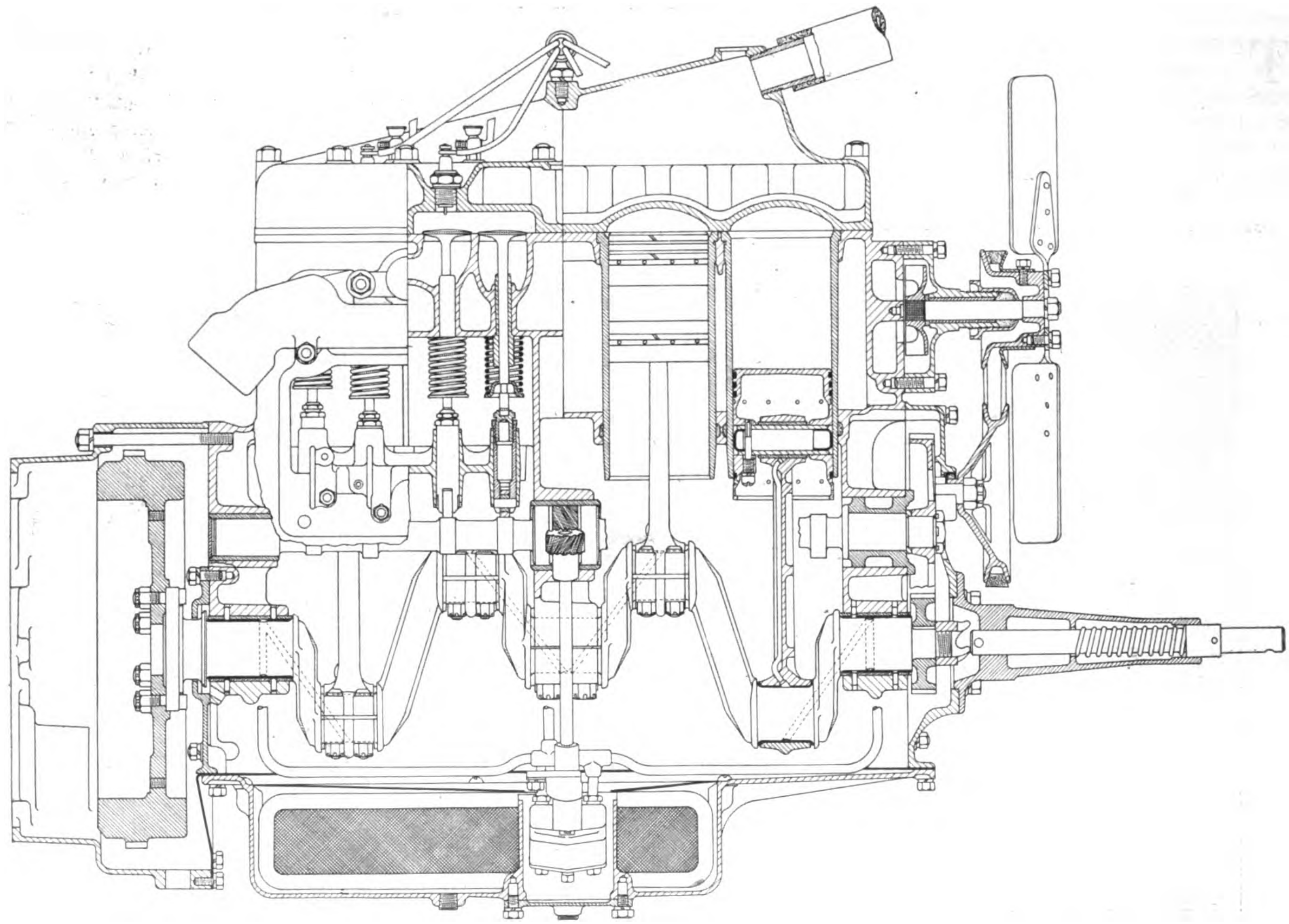
Three larger sizes are equipped with seven-speed transmission, having two sets of constant mesh gears. Will manufacture own engine in three sizes, all of similar design, and all equipped with removable sleeves. New trucks will be faster and more powerful than former models.

By J. Edward Schipper

THE General Motors Truck Co. is just beginning production on a new line of trucks which represents a development of the line previously marketed. The new line is made up of five models. Three engines, all of similar design and all products of the new General Motors truck engine plant located in Detroit, are used in these trucks, the smallest engine being used in both the ¾ and 1-ton, the largest in both the 3½ and 5-ton sizes, and the intermediate size in the 2-ton only.

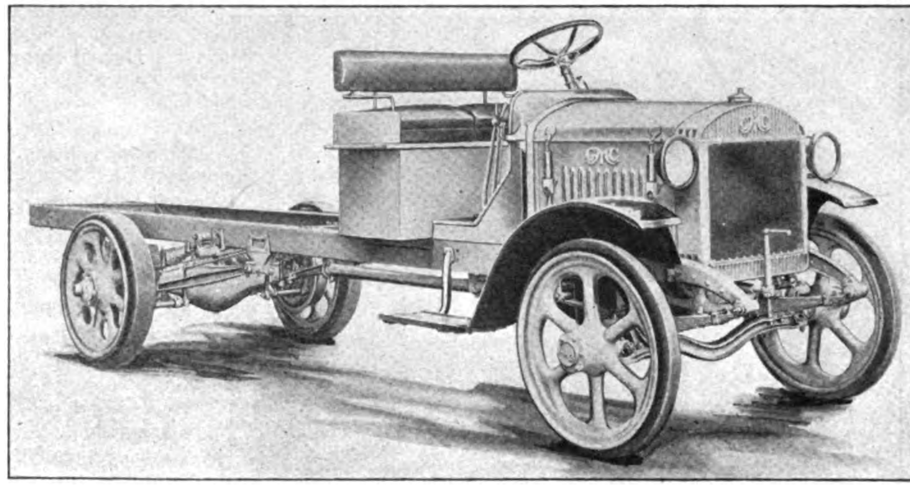
The trucks are designed with an idea of furnishing uninterrupted transportation and incorporate a great many features of interest from the maintenance side. The new engine may be said to have been designed with a view to keeping maintenance cost as low as possible and reducing to a minimum the period of tie-up when repairs become necessary. As compared with the old line of G. M. C. trucks, the new line is faster and more powerful. Heretofore, the design has been laid out with the principal idea of supplying sufficient power for all circumstances. However, with present road and transportation conditions the factor of speed is as important as that of power.

By improvements in the design of the engine, considerably more power, or rather more torque, has been se-



Longitudinal section of G. M. C. engine. Note removable sleeves, large water spaces and arrangement of water pump on fan spindle

cured, although the cubic displacement remains about the same as in the older model engines. The engines run at higher speeds, and this, in connection with a specially designed gearbox, with an additional countershaft reduction, provides twice the number of available gear ratios and, consequently, widens the range of performance and gives a flexibility to the vehicle not approached in the old models.

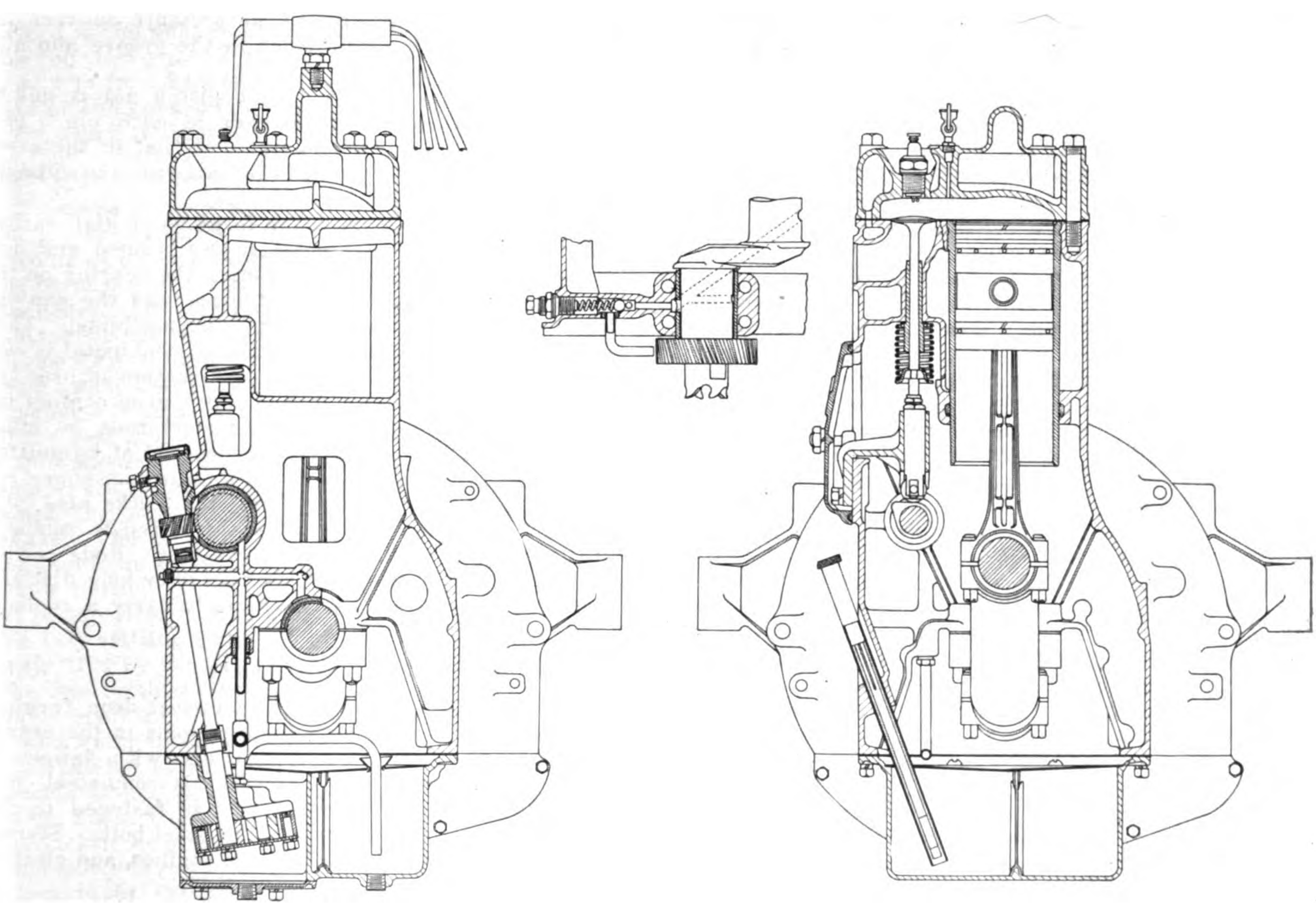


Two-ton model K truck chassis of G. M. C. line

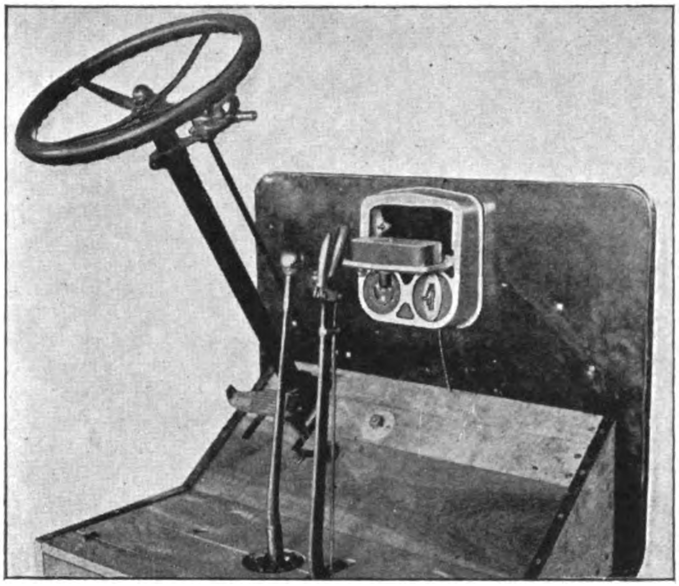
The new G. M. C. engine incorporates some features more or less novel in truck engine design. These include removable cylinder sleeves, force feed lubrication, superheated high velocity intake manifold, interchangeability of all wearing parts, removable cylinder heads, removable motor support arms, connecting rod bearings cast integral with the connecting rods, combination thermo-siphon and pump cooling system, removable valve assembly and non-scoring piston pins.

Probably the most interesting feature of the engine is the removable cylinder sleeve. These sleeves are gray iron castings, machined to very close limits both inside and out. In manufacture, they are first cut off, then rough-machined all over on the outside and inside. After a period of aging, the bore and the outside are finished. The advantages claimed for this construction are interchangeability, ease of replacement and elimination of misalignment of the cylinders because of shifting of cores in casting. Should a cylinder wall be scored through lack of lubrication or any other cause so as to necessitate replacement, it is possible to make a replacement in 4 hours—a great saving in time as compared with the 10 days to 2 weeks usually required for regrinding. Not only does this result in a saving in service cost, but also in a reduction in the lay-up time of the truck.

The cylinder liner being of uniform wall thickness, expansion of the liner will be uniform, thus obviating compression leaks due to irregular expansion. The sleeve comes in direct contact with the water, and the



Transverse sections of engine, and detail of oil relief valve. Oil pump is driven by helical gears at center of camshaft. Full pressure oil system is used. Pistons and all parts of valve actuating mechanism are lubricated by splash



Switches and instruments are assembled on an aluminum casing with hinged panel which can be lowered to give access to terminal connections

Detail Specifications of G. M. C. Series K Trucks

	K-15	K-16	K-41	K-71	K-101
Tons Capacity.......	¾	1	2	3½	5
Wheelbase, inches....	132	132	146 158	163 187	163 187
Tires, kind..........	Pnu.	Pnu.	Sol.	Sol.	Sol.
Tire size, front.......	33x4½	34x5	36x4	36x5	36x6
Tire size, rear........	33x4½	34x5	36x7	40x5 Du.	40x6 Du.
Type of wheels.......	Steel Felloe Wood Spoke	Steel Felloe Wood Spoke	Metal	Metal	Metal
Bore and Stroke.....	3½x5½	3½x5½	4x5½	4½x6	4½x6
Type Radiator Case..	P-stl.	P-stl.	Cst.	Cst.	Cst.
Type Elec. System...	None	Starting & Lighting	Lighting	Lighting	Lighting
Truck speed m. p. h..	....	25	18	17	15
Gearset placed.......	On Eng.	On Eng.	On Eng.	Amid	Amid
Transmission speeds .	3 forward 1 reverse	3	7	7	7
Final Drive Type....	Bevel	Bevel	Worm	Worm	Worm
Rear Axle Make.....	Own	Own	Timken	Timken	Timken
Total Gear Reduction	6.00	6.00	7.25 and 7.79	8.75 and 7.17	10.0 and 6.28
Brakes, foot.........	Ext. r-w	Ext. r-w	Int. r-w	Int. r-w	Int. r-w
Brakes, hand........	Int. r-w	Int. r-w	Int. r-w	Int. r-w	Int. r-w

water capacity of the jacket has been greatly increased. The sleeves are longer than the total length and throw of the piston, and the exterior of the sleeve is machined to extremely close limits to afford a good seat for the gasket. The top gasket is of asbestos, and is placed immediately under the flange of the sleeve, while the lower gasket is of compressed cork and is placed in a recess in the cylinder casting. The cork gasket is compressed when the sleeve is inserted, the lower end of the sleeve being slightly tapered. Since the sleeve is a press fit, a perfectly water tight joint between sleeve and cylinder block is obtained. After the sleeve is inserted and sealed, it is held in place rigidly by the cylinder head, which is bolted down with twenty-four ⅝-in. studs. When the sleeves require replacement they are withdrawn from the cylinder casting by the use of a special tool which resembles a wheel puller.

The separate cylinder head casting is of semi-steel and is readily removable for access to the combustion chamber, valves and piston heads. The heads are made large so as to provide a large body of water over the valves and combustion chamber.

The cylinder block and crankcase are cast in units of semi-steel, and no wearing parts which are not replaceable are secured to any part of the block with the single exception of the valve seats. These are provided with a sufficient amount of metal to allow of reseating the valves many times more than required during the normal life of the engine.

The engine has three-point support, ball and socket mountings being employed at the two rear supports. The frame on which it is carried is of the semi-flexible type. The ball and socket joint is held together by a bolt which passes through the joint and extends below the engine hanger far enough to enable the insertion of the heavy coil spring. In addition to giving a three-point flexible suspension, the supports will yield in the event of excessive distortion of the frame. Any wear that takes place in the joint is compensated, as the spring provides an automatic takeup. The front support of the engine is in the form of a collar on the starting crank housing, which is bolted to the timing gear cover. This suspension point is also protected by the spring and clamp method to allow for disalignment.

There are four piston rings, three above the piston pin and one in the skirt below the pin. Grooves are cut in the piston face immediately below each of the two lower rings. Holes are drilled from the bottom of these grooves to the interior of the piston, providing a return passage for surplus oil. The rings are of the plain, diagonally split type, except the second ring from the bottom, which is an expansion ring with an overlapping joint and is so designed that the pressure between the two pieces keeps the ring tight in the groove and also against the wall.

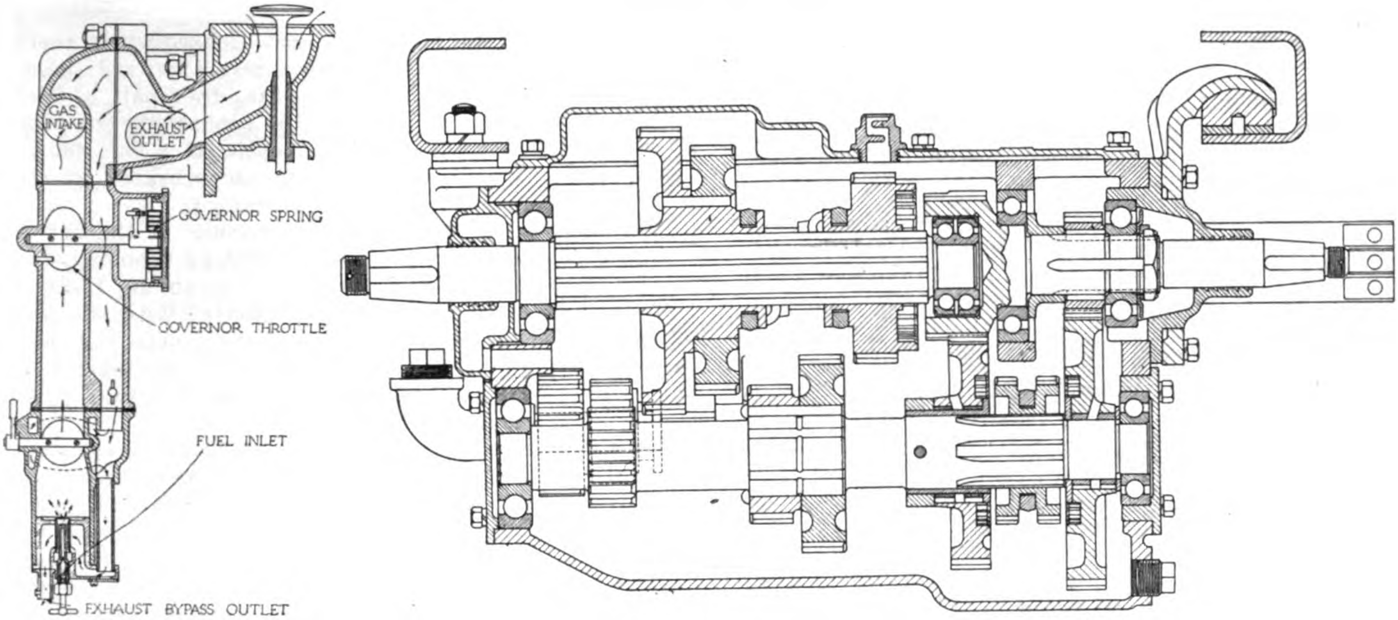
The non-scoring feature of the piston pin is due to bronze plugs inserted in the ends of each pin. This metal is exceptionally soft bronze, so that in the event of the pin working its way into contact with the cylinder wall it will not score it.

The connecting rods are drop forgings of high carbon steel, the upper end being bored and reamed and provided with a bronze bushing forming the bearing on the piston pin. The lower end of the rod and the cap are electro-plated with copper after being machined. They are then tin plated, after which the bearing metal is cast into the head. This method of construction is used because of the impossibility of securing a good contact between the bearing metal and the steel rods by other means. As a service feature, this method of babbitting the rod has been found advantageous in passenger car practice and should work out well for trucks also. Instead of rebabbitting a rod, the entire rod is replaced and the used rod returned to the factory. Rods can be readily changed by dropping the pan. For long distance transportation, it would be feasible to carry a replacement rod along in the tool box.

Provision for Starters on All Models

The crankshaft is a high carbon steel drop forging, supported by three bearings held by webs in the crankcase. The center bearing is provided with flanges to take the end thrust. The flywheel is semi-steel, machined all over and balanced, and is fastened to the flange of the crankshaft by six alloy steel bolts. Starter teeth are cut on the flywheels of all engines, and electric starting can be provided on all models.

The camshaft is drop forged of high carbon steel, the cams being forged integral with the shaft. Both the bearings and cams are hardened and ground to size. The



At left, sectional view of exhaust heated inlet manifold and carbureter. At right, longitudinal section of transmission which has two speed ranges, giving 7 forward and 2 reverse speeds. This is made possible by use of two constant mesh gears with positive clutch between them

camshaft is driven by helical gears and the oil pump is driven off the center of the camshaft by a helical gear and vertical shaft. The engine is oiled by a full force feed system. The oil pump, which is located in the bottom half of the crankcase, forces the oil to the three main bearings and to the three camshaft bearings. From the camshaft bearings it is returned to the crankcase. From the three main bearings it passes through conduits drilled in the webs of the crankshaft to the four connecting rod bearings. From the four connecting rod bearings it is forced through copper conduits secured in the side of the connecting rods to the piston pin bearings, from which it returns to the sediment chamber.

Lubrication Details

Pressure is regulated by a ball and spring by-pass valve. The capacity of the pump is such that there is a surplus of oil at all times. This surplus passes through the by-pass valve and is discharged directly on the timing gears. The oil which is forced out of the ends of the main bearings and connecting rod bearings is thrown out as spray and lubricates the cylinder walls and valve lifter assemblies. The oil pump is hung in the crankcase on a bracket to which it is securely fastened. It is of the gear type and is driven from the camshaft through a splined vertical shaft. The oil pan, which is an aluminum casting, incorporates sediment chambers through which the oil must pass before it returns to the pump intake. The first settling chamber is under and around the pump, although it is separate from the intake. The major portion of the dirt or sediment contained in the oil is deposited in this chamber before the oil passes to the last settling chamber, and it is possible to readily drain this by the removal of a plug beneath the pump. The first settling chamber has a capacity of about 1 pt., which is all the oil that is lost in cleaning the oil pan.

The water in the cylinder head and around the valves is circulated by the pump. The water contained in the jackets around the cylinder sleeve is not affected by the pump, but circulates by gravity. Thus the water around the jackets does not begin to circulate until it is heated sufficiently to set up a thermo-siphon action. The water pump is of the centrifugal type, its impeller being mounted on the inner end of the fan shaft and rotating in a recess cast in the cylinder block. The shaft rotates on a Hyatt roller bearing, and is lubricated by an Alemite connection.

On the two lighter models, known as K-15 and K-16, the radiators are of the vertical fin and tube type, the tubes being assembled in connection with the cooling fins in a single unit or core. On the three larger types, K-41, K-71 and K-101, the radiators are of the vertical continuous fin and tube, built-up type, the assembly consisting of a core which is detachable as a unit, two side members, so designed as to protect the core, the top and bottom members in the form of tanks, which insure even distribution of the water throughout the entire core.

A combination manifold and carbureter have been worked out to take care of present day gasoline. Both the vertical section of the intake manifold and the venturi chamber of the carbureter are heated by exhaust gases direct from the exhaust manifold. Dampers are provided for regulating the supply of heat, and for very hot climates a gasket can be inserted which cuts out the exhaust jacketing altogether, eliminating the hot-spot and permitting operation at atmospheric temperature. A Marvel carbureter is used.

The governor is of G. M. C. design and is of the fly-ball type. It consists of four steel balls held in a steel pressing containing four separate grooves which act both as ball retainers and channels in which the balls travel. As the channels are set at approximately 45 deg. angle to the shaft of the governor, the balls travel both outward and forward under action of the centrifugal force. The balls contact with a flat steel disc, which is mounted on a bronze bushing, and as the balls are thrown outward and forward, the disc is pressed forward. This disc contacts with a ball thrust bearing, and through this bearing connects with the governor butterfly control lever on the carbureter. Lubrication of the governor is effected by the oil which is discharged on the timing gears, so that it is at all times working in an oil bath.

The Electrical System

Ignition is by an Eisemann magneto which is mounted on the generator side of the engine and is driven through a coupling from the armature shaft of the generator. On all but the smallest model the Eisemann impulse coupling is fitted. The electric generator is of G. M. C.

design, manufactured by Remy. It has been designed exclusively for truck use, being rugged to withstand pounding and hard service. The front end of the generator is cylindrical in shape and is machined to fit an opening in a portion of the timing gear housing cast integral with the cylinder block. The driving gear is mounted on the end of the armature shaft and meshes directly with one of the timing gears. This same shaft then projects through the front end of the timing gear housing and carries the pulley which drives the pump and the fan. The generator is fitted with thermostat control and third brush regulation. The thermostat control automatically varies the amount of current delivered to the battery by the generator, increasing the charging rate in cold weather and decreasing it in warm weather.

The wiring is made up in unit form. Except on the smallest models, the instruments are assembled on an aluminum instrument board with a panel which can be lowered to give access to the switch connections and terminals. No electric lights are furnished on K-15, the smallest model. The other four, however, are provided with two electric headlights and one tail light.

No material changes have been made in the clutch, which is a multiple dry disk type, with eleven disks in the two smaller models; thirteen in the 2-ton and seventeen in 3½ and 5-ton. It will be seen by reference to the accompanying cut that the transmission is of unusual design in that it incorporates two speed ranges. This is made possible by providing two pairs of constant mesh gears. The driven gears of each pair are loose on the secondary shaft but either of these can be connected to this shaft by engaging with them a positive clutch located between the two and splined to the secondary shaft. Integral with the latter are three gears arranged in conventional fashion for meshing with the sliding gears on the main shaft. It will be seen that three forward reductions are possible in combination with each of the pairs of constant mesh gears. Consequently there are, with the direct drive included, seven forward speeds obtainable. Change from one to the other pair of constant mesh gears is controlled by a separate lever. Except for this the control is conventional. The double speed range is said to have been incorporated by the addition of only four parts to the gearbox.

This double range transmission permits of the use of a higher geared rear axle, thus promoting economy, and at the same time enables a greater maximum tractive effort. It is estimated that, as compared with the previous models, the pulling power of the trucks has been increased 30 per cent, and the economy the same. A third lever is fitted for changing the constant mesh gears.

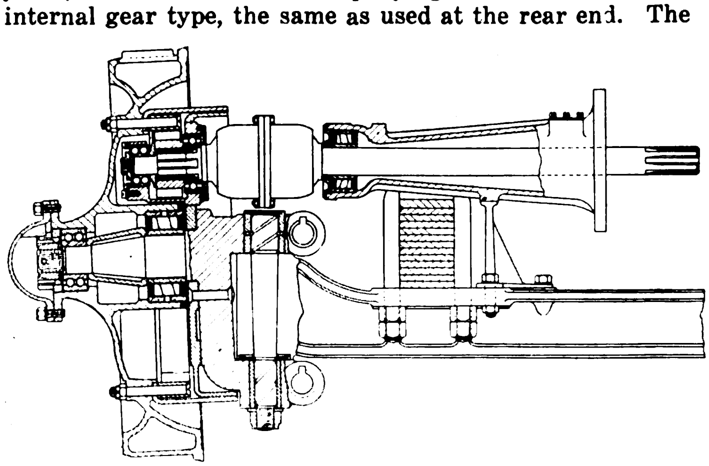
All of the G. M. C. transmissions, with the exception of that on the small model, are so designed as to enable the installation and use of both power take-off and power tire pump at the same time. The K-15, which is the smallest model, has a tire pump mounting only.

The rear axles are bevel gear-driven on the K-15 and K-16, the two smallest models, and worm-driven on the others. These rear axles have not been changed from previous G. M. C. construction, except as regards the gear ratios. The axles on the heavier models are of the Timken worm gear type. The two smaller types are equipped with steel felloe wood wheels, and the larger models are equipped with metal wheels of the hollow spoke and felloe type with the hubs cast integral. Pressed steel brake drums bolted to the inside of the wheels are used on all models. The frames are open hearth pressed steel of channel section and are all heat treated to increase the tensile strength and elastic limit of the metal. The steering gears are all of G. M. C. design and manufacture and are of the worm and split nut type. They are irreversible and adjustable, the gear being anchored in a bracket riveted to the frame and rigidly held by a heavy plate and column where it passes through the floor boards.

A Front Wheel Drive

THE most interesting feature of any four-wheel driven vehicle is the arrangement of the front drive, because the driving connection to the swiveling front wheels is the hardest problem to solve. In fact, it is in the driving connection to the front wheels that the various front-wheel drive trucks differ most.

The drive to the front wheels used on the Bollstrom truck, which has been on the market for a number of years, is shown in the accompanying cut. This is of the internal gear type, the same as used at the rear end. The axle end is of the inverted Elliot type. To the outside of the vertical part of the knuckle is secured a flanged disc similar in shape to a brake drum. This serves as support for the driving pinion bearings. The wide flange on the disc evidently makes it very rigid and gives a substantial support to the bearings. The pinion shaft is supported in ball bearings on both sides, the outer bearing (which is necessarily of limited diameter) being of the double row type.



Bollstrom front wheel drive

In order to protect the gear from mud and dust the internal gear on the cast-steel wheel is surrounded by a pressed steel drum which hugs closely the flange of the bearing supporting disc, extending across its entire width. No section of the universal joints is shown, but to judge from the length of the cover, it is a double universal, which takes care of slight mis-alignment of the center portion of the counter shaft and its ends. Felt packings are provided where the countershaft enters the gear housing in the wheel and at the inner end of the wheel hub.

THE study of the manufacture of oxygen from the point of view of the engineer is being undertaken at the Harvard Engineering School under the direction of Professor Harvey N. Davis. This study is made possible by a gift to Harvard of $5,000 from the Research Corporation, founded through the efforts of Dr. F. G. Cottrell.

Why American, British and Continental Car Designs Differ

British engineer discusses the effect of customs, climate, road conditions, taxes, operating costs, size of industry, point of view and competition upon the size, cost, appearance and design of passenger cars. Motoring here is characterized as transportation, while in Europe the spirit of adventure still dominates. Considers American braking systems defective.

By M. Olley*

THIS paper is presented rather as a record of impressions than an accumulation of facts and figures. My observations will be confined to passenger cars, with which alone I am familiar.

We will first look at the difference between the conditions in the automobile industry in Europe and America, and then consider the reasons for the difference.

The American industry is turning out large quantities of cars on a purely commercial basis. Its mind is concentrated on the ultimate consumer, and it appears to believe that the consumer rules it completely, just as the manufacturer of vacuum cleaners or sewing machines is at the mercy of the housewife.

The French and English makers are not in this position to the same extent. They do not manufacture cars in such large quantities, but to a greater extent than here each one of them supplies a strictly limited field with a specialized product of some individuality. Their profits of past years have not been entirely re-invested in enormous increases of plant and equipment and therefore, though they break and fall and rise again in new form, they are at no time quite so securely tied to the "market" as the American manufacturers.

The only qualities that their products need have, in order to sell, are that they shall transport passengers on the roads with some degree of reliability and considerable speed. Beyond this requirement there is absolute freedom.

Here, on the other hand, every manufacturer of vehicles other than motorcycles, must make something which has all the qualities of the traditional automobile —it must have an engine of at least four cylinders, almost necessarily water-cooled, with the traditional arrangement of fixings under the hood, a traditional clutch and three-speed gearbox (with the one exception) and the traditional propeller shaft to the traditional differential and live axle. Of course, it must have four wheels and a top or covered body, and the wheels even must be 56 in. apart—no more or no less. A truly crippling state of affairs.

The reasons for the differences of the industry and design of cars here and in Europe appear to me to be somewhat as follows:

First—Motoring here is transportation, pure and simple. It is rapidly coming to be the most important system of transportation in the country.

In Europe, leaving aside the recent vast increases in trucking in England, the automobile is not transportation, it is adventure. A man mounts his three horsepower motorcycle in England with the feeling of a knight-errant. Here he jumps into his four-door sedan as one boards a street car. This one fact is of the utmost importance in automobile design. One explanation of it might be that there are about ten or fifteen times as many cars here per unit of population, but I think this may be an effect rather than a cause, the car being so essential for transportation here that a vast number were produced, while the car was so unessential in Europe that it remained a rarity.

Probably the great reason for motoring being a commonplace here is the higher standard of living which brings a car within the reach of almost everyone, whereas in Europe it is still almost a luxury.

Again, in Europe the better roads, the more attractive and historical countryside (with apologies to New England), the more merciful climate, do certainly enhance the pleasure of motoring. At the same time the commuting difficulties that curse the wage-earner in this country, for some reason do not exist in Europe.

All these causes contribute toward rendering the car in Europe a vehicle of considerable romance, not merely a daily drudge, or a common household appliance.

Second—A very important factor in the automobile world in Europe is the cost of owning a car. The first cost as compared with the States is difficult to determine because of the reduced value of money, and the difficulty of assessing the true value of cars. It is best probably to take pre-war money equivalents since the value of money has decreased about equally in Europe and here, during the war.

It appears approximately true to say that a car will cost twice as much in England as in the States in proportion to living standards, and in France almost twice as much as in England.

Gasoline in England is about 80c. an imperial gallon, say 65c. a United States gallon, and in France 12 francs to 15 francs for 5 litres, or say $2.00 to $2.50 a United States gallon.

Tires appear to have fallen in price in England even more than here. In pre-war days tires there were about twice as expensive as here. Furthermore, whereas American makers understate the actual size of their tires, the European tires were far below their stated size. Perhaps as a consequence of this, the European tires will not generally give anything like as good mile-

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age as American tires of equivalent rating. As an example, the 895 x 150 European tire (which should be about 36 x 6) is actually the close equivalent of the American 33 x 5 both as regards size and wearing qualities.

Finally, taxation of cars is cruel in Europe, particularly England, where the tax is now one pound (nominal $5) per horsepower each year, horsepower being the rating on the cylinder diameter as in America.

Third—Another important factor, at least in England, is the fierce competition of the motorcycle continually developing upward to try and get the small car trade.

This condition affects the industry as well as the design. The motorcycle is favored by the higher cost of gasoline, tires and taxation, later average age of marriage, the habit of renting houses rather than buying them, with consequent shortage of garage space, and better roads and weather conditions. I imagine that in England there are at least two motorcycles to one car. There are seven firms making motorcycles in the States against 50 in England.

Fourth—The automobile industry in Europe is limited by the lower standards of living, by lower wages, also probably by a higher standard of thrift. The limitation of the industry has reacted upon itself in enhancing the cost of cars. It remains to be seen whether Ford and the other American invaders can break down this obstacle to development.

Another limiting factor is the distinct prejudice in the minds of many Englishmen against motorcars because they are an offense against the doctrine of "regular exercise." Many well-to-do city men in London suburbs do not own cars to this day because the weekend is devoted to exercise of one sort or another, cycling, walking, tennis or cricket, and a car might break down these regular habits.

Fifth—Design of cars in Europe is, of course, affected directly by climatic conditions, the open car being the popular model all over Western Europe, and the top, or cape-cart hood, as it is still called, being an accessory, for use only in severe weather.

Sixth—Road differences affect design differently in England and France, the national highroads of the latter country (and perhaps the racial peculiarities of the inhabitants) making speed the one essential.

Seventh—Design in England is affected greatly by the essential democracy of its inhabitants or perhaps by the fact that there the car is not the standard of the man.

Here a man will buy a car of cost proportioned accurately to his income or his pretensions.

There a cabinet minister or railroad president will own a Ford sedan, or will take pride in the possession of a miniature vehicle peculiar to the country, called a "light car" or voiturette, and resembling a traveling bath-tub. His social status is not governed by the car he drives, or by his income, but rather by the particular accent with which he speaks the English language.

Summarizing the conditions then, they are:

1—The spirit of adventure.
2—The cost.
3—The motorcycle.
4—The limited size of the industry.
5—The climate.
6—Roads.
7—The lack of definite money standards.

Surveying these governing conditions casually, one can trace the effects with fair correctness:

Condition 1—The spirit of adventure. The European motorist demands less convenience than the American. As an example, whereas the American demands electric starting and lighting, even on a Ford or motorcycle, many European small cars are content with electric light only, retaining hand starting; and many small cars, and nearly all motorcycles retain the old-fashioned gas lamp.

Generally, the American user demands that the car shall give useful service with the minimum of skill in handling, whereas the English, and still more the French, owner delights in a car which will give maximum results in the hands of a skilled driver.

Condition 2—Cost. This affects the Continent and England differently. On the Continent, though many excellent small cars are being produced, the best efforts of the trade seem to be mainly directed to the larger cars, and the automobile trade appears to have made up its mind to cater to the rich principally. In England on the contrary the middle class is having its demands met by the cars which I have called rather rudely "traveling bath-tubs."

These little cars have been continually produced in England since the earliest days but have always either perished because their cost was out of proportion to their performance or else have gradually developed into larger and more pretentious vehicles from year to year. But now the small car appears to have come in with a rush in England and it looks as though it would be the quantity production car of the future in that country, and perhaps in other countries.

These miniature vehicles, complete in every essential, are most excellent machines from every point of view for use where roads are good.

Condition 3—The motorcycle is becoming an institution in England and is used by old and young, and by both sexes almost equally.

On English roads and in English weather, it is the perfection of motoring as distinct from mere luxurious riding. The machine amounts to nothing in itself, weighs only 150 lb., is no bigger than an ordinary bicycle, travels 100 miles on a gallon of gas, yet transports you anywhere at 30 miles an hour average and 60 miles an hour maximum speed.

It can never lose its place in the affection of the British motorists, probably 80 per cent of whom have served their apprenticeship on motorcycles. It is a fine training for driving a car.

There is no hard and fast line of demarcation between motorcycles and cars in England, except in the matter of number of wheels. All vehicles of four wheels, however arranged, are classed as cars and taxed at the rate of one pound per horsepower, while vehicles having two or three wheels are all motorcycles in the official eye and are taxed independent of horsepower at a flat rate of £4 per annum with three wheels, and £3 per annum with two wheels. Hence there is a development away from the traditional motorcycle and sidecar combination to a machine which is in all respects a small car except that it drives to a single rear wheel instead of the customary two-wheeled rear axle.

These vehicles are nowadays of very excellent mechanical construction, and are entirely safe, because they are hung low. They are fast and efficient, making 50 miles or more to the gallon and up to 45 miles an hour. They cost up to £300.

The gradual development of the three-wheeler would have been a severe blow to the car makers had they not come down to meet it with small cars of even greater excellence mechanically, which can carry two or four persons in comfort at high speed, with a rated horsepower not exceeding 12 (R.A.C. rating).

These two movements, upward of the motorcycle and downward of the car, have determined the typical British car-type of the present day, coupled of course with the terrific burden of taxation and the high cost of fuel.

Condition 4—The limited size of the industry, and of the individual manufacturers, makes for higher cost, but for a more painstaking treatment both of the initial design and of the finished article. It makes for a car of more individuality, for a greater distinctiveness in each maker's designs, and for a greater receptiveness to designs which are highly unconventional.

It is well known that where output is restricted, the product is likely to have, and may safely have, more individuality than where output is great.

In other words, the design of the average European car is largely controlled by the Engineering Department, whereas the design of the American automobile is principally controlled by the buying public through the sales organization. In the main, this seems the explanation of the great similarity of American cars as compared with European.

Minor points of individuality are emphasized in the American advertising, which would pass unnoticed in the advertisements of a European car, in which the public would assume that there were many points of design differing radically from other cars.

Condition 5—The climate is chiefly felt in body design. There is a positive prejudice against permanently covered cars, except in the most luxurious types. The top is still only an emergency affair of waterproof canvas, and is only put up for severe rain storms.

Wings and skirting panels are less complete than in America, and the protection against mud and wet is not nearly so advanced. Generally, the weatherproofness of European cars is less perfect than American cars.

In the mechanism of the car the chief effect is that control of the water temperature has not attracted so much attention as in the States, and less care is taken on the average European car to insure an effortless start in cold weather. When night temperatures very seldom fall below 27 deg. Fahr., one can understand that a car designed purely for use in England and employing fuel far superior to American gasoline, need make little provision for forced vaporization.

The Rolls-Royce practice of fitting a vaporizing primer and regulatable jets is quite exceptional in England and purely due to its cosmopolitan use.

Condition 6—Roads. In England the road surfaces are excellent—even now, after years of neglect, the roads are still excellent whatever the English themselves may say. The moist, temperate climate keeps a water-bound macadam road in perfect condition almost forever without repair, so long as the traffic is not too heavy.

But the grades are heavy, the roads have just grown rather than been planned, and hence there are few straight stretches and few easy hills and most of the roads are narrow. The old coaching turnpikes, and occasional vestiges of the old Roman "streets" are the only exceptions. Because of the hedgerows, blind corners and hidden crossroads are the rule rather than the exception.

As a result, "handiness" is essential, cars must run well on top gear at all reasonable speeds and on all ordinary grades, and brakes must be above suspicion, ready for instant call.

In France there are three sorts of roads, the national highways, which are perfect motoring roads in every sense of the term, the secondary roads which are the opposite, and the cobbles in the towns and villages which are atrocious. The result is seen in French car design.

Speed for the national highways is the first consideration. Roaring, noisy motors which will make 4000 revolutions without flinching for hours on end; carbureters, which may or may not give flexibility, must be of the "straight-through" type, offering no obstruction to the inlet gas, and brakes, often on all four wheels, which will pull up a speeding car in a minimum distance, are demanded.

For the by-roads and city streets, with unflexible carbureters, there must be four speeds, a powerful clutch brake, an easy change lever, and plenty of slack in the transmission gears, so that the lever can be crashed over, up or down, at all speeds, without care or effort. There must be stiff springs and a sturdy framework both for high speed and for city cobblestones.

The average Continental car on English byways is uncomfortable to drive, uncomfortable to ride in, rough and noisy. But on Continental roads, it is in its element and shows to advantage, if one is a courageous speedhound.

American road conditions, now happily passing, have called for a car which can "go anywhere in high." Hence the low axle ratios, large engines, small high-velocity induction systems, and other features which cause the typical American car to "waste its sweetness on the desert air" at all speeds above 25 miles an hour.

The American car is the most convenient vehicle in the world to start, and to drive; it is the best able to get any place whether there is a road there or not; it is the paradise of the lazy driver. It is all-the-year-round transportation with the minimum of grief. But it is not a speed monster; it is not pleasant to steer (with certain exceptions) and its brakes are deplorable.

Condition 7—Price standards. In America one is proud. If one has a car it must be a real car, or at least look like one. It must be of such a size that the human figure does not noticeably overlap the edges. Makers of the smaller cars, in the illustrations of their advertising matter, fill their cars with pigmies to enhance the impression of reality. To agree with the illustrations of my own car, I should be not more than four foot six inches tall.

The American buying public is assumed to have formed its standards. It expects, or the manufacturers assume that it expects, just the same main features in a $1,000 car as in an $8,000 car.

In France, and the Continent generally, the fully fledged car is generally for the rich, and as such is complete and rather conventional. It is also distinctly expensive.

There have always been "voiturettes" in France, of one cylinder or more, but they have never been regarded very seriously and actually do not call for a full driver's license for permission to operate.

In England there are no accepted standards of design. The two standards of practice are only speed and economy. Until recently there were numbers of single cylinder cars. Now these have ceased, but an engine may have two, three, four, five, six or eight cylinders; it may be air or water-cooled; horizontal, vertical, Vee or radial.

The transmission may be of two, three, or four speeds, or, in a number of small cars, by friction discs and gears, or chains to the back axle. Chain, propeller shaft or Vee belt may be used. Hotchkiss drive or torque tube, differential gear or none, back axle or single wheel—all are acceptable to the buying public.

The actual size and shape of the cars vary enormously. The three-wheelers generally have the single wheel behind, but at least one has two wheels on one side

and one on the other. The track width of four-wheelers varies from 42 in. to 58, and the wheelbase from 80 in. to 150 in.

The tire sizes on cars vary from 27 x 2½ to 35 x 5, and wheels may be wood, steel-spoked, wire or disc. Wire wheels are in the majority.

Starting may be electrical or unassisted. Lighting, by electricity or gas; ignition, however, is at present almost universally by magneto, but the battery is slowly gaining ground.

External appearance is uncontrolled and varies from the extremely dignified to the extremely weird, and from the utmost symmetry to an indescribable lopsidedness. Among the miniature cars some most beautiful proportions are to be found, while many bodies fitted on large cars would attract jeering crowds in the States. The reverse is equally true.

As regards color, England and Europe generally demands the full run of the spectroscope. To European eyes all American cars are black. Bear in mind that anyone may ride in the most peculiar or tiniest of these cars without loss of dignity, and you will see how free and untrammelled is the scope of automobile design in England.

Perhaps what I have already said will serve to show the conditions which American cars have to meet in Europe. American cars have sold and are still selling in Europe in large numbers because they have a great reputation for reliability, and they can always be bought from stock, but they do not show to such a great advantage in Europe as in America.

The reason for this is that their engines are too big for the performance obtained from the car. (I am speaking, of course, from the European point of view). In other words, they consume too much gas.

Perhaps the following table of average dimensions will illustrate this:

Average Particulars of Cars

	American	English	Continental
Cylinders	6 (58%)	4 (69%)	4 (80%)
Horsepower (N. A. C. C. rating)	26	13.8	15.5
Bore, in.	3.4	2.95	3.1
Stroke, in.	5	4.75	5.1
Stroke Bore Ratio	1.45	1.6	1.65
Wheel track, in.	56 (All standard)	51 (42-58 range)	53 (40-56 range)
Wheelbase, in.	122	115 (88-150 range)	122 (86-146 range)
Axle Ratio	4.5	4.15	...
Number of passengers	6	3	...
Weight of chassis	...	1,800 lbs.	...
Weight of complete car, lb., probably about	3,000	2,300 (Many cars 1,500-1,700 complete)	...
Price	$2,794	£610	...

In France a number of cars are developing on American lines, unit construction, battery ignition, smooth external appearance, detachable cylinder heads, left-hand steering, and a host of detail fittings are making them appear more and more like American cars. Where they differ is in having greater speed, less top gear flexibility, but better brakes.

I cannot find the average price of French cars but imagine that the rate of exchange, import duty, etc., make competition from this side very difficult.

The American car probably is at a disadvantage in its quality of finish and the detail design of its mechanical parts, which have always looked rough and ready to the European eye. Its lower maximum speed would count against it.

Since on the Continent cars are run only by people of some wealth, the tax and fuel consumption of American cars are not insuperable objections.

To judge by pre-war experience, the smaller Continental cars are lacking in completeness, convenience and mechanical perfection. For example, the Continental designer has always appeared to lose patience when he gets to such details as the controls—accelerator connections are liable to consist of the fewest possible pieces of bent wire, and to be unreliable in proportion.

It is in England that the more interesting conditions exist. Here there has always been an admiration of the low-priced American cars, and from the first days manufacturers have been striving to evolve a low-priced car for the English market. The "£100 car" has become almost a slogan.

The failure to produce a really low-priced car has been largely due to the fact that English makers have not realized that a really good inexpensive car can only be made by quantity production, and that it was a matter of capital and tools rather than design.

The attempts at low-price have failed because they have "cut corners" in design, and produced something which either was not safe or was so unlike a real car as to be unacceptable even to the catholic taste of the country.

Now, with enormous taxation on horsepower and expensive gasoline, the conditions have changed and the English manufacturer should be able to meet American competition with a car which is perhaps a little more expensive than the imported cars in first cost, but is ever so much more economical to run, smaller, handier, with better brakes, better external appearance and generally more suitable to the local conditions. And in this respect, it is interesting to consider the following table taken from an English motor paper (**Motor, Jan. 12**):

Cost of Operation of British Cars

	Four Seater 16 hp. to 20 hp.	Four Seater Small Car	Two Seater Light Car	Four Wheel Cycle Car	Three Wheel Cycle Car
Weight (lbs.)	2,800-3,300	1,800	1,600	1,350	Under 800 lbs.
Tax	$75-100	$50-70	$50	$50	$20
Gasoline, gal. per year	300	240	199	132	102
Miles per gal.	20	27	30	45	60
Costs, gasoline	$220	$160	$145	$90	$74
Tire cost	$150	$90	$75	$60	$50
Oil, mi. per gal.	500	700	1,000	700	700
Costs, oil	$25	$17	$12	$17	$17
Total cost per year	$470	$317	$282	$217	$161
Cost per person carried on assumption of full use of seats	$117	$80	$141	$110	$80

Since the four-seater cars can be assumed to carry not more than two persons on the average, it is safe to double the cost per passenger in the two first cases.

It will be seen that the ordinary American car even of the smallest class would be at least as expensive to run in England as the most expensive type quoted.

It seems to me that England is on the point of solving its transportation problems in an effective manner. It seems also that in view of the fuel consumptions quoted, England is achieving real fuel economy, and it becomes a question whether this country might not attempt to develop on similar lines.

Surely, as a first step to fuel economy, it would be

logical to reduce the horsepower of American cars by 50 or at least 30 per cent, while leaving the axle ratio unchanged or even raising it considerably, and gaining flexibility by reduction in weight and improved carbureter design. Perhaps also by four-speed gearboxes.

It may be objected that it would be necessary to come off top speed more often, but the English light cars only have to use the gears very occasionally in ordinary running conditions, to judge by the reports of trial runs, unless exceptional grades are met, and grades in England are very much worse than here.

Objections to a wheel-track less than the traditional 56 in. are often heard. The first is that the car rocks sideways more with a narrow than with a wider track. I do not think this is so on road surfaces where reasonable speeds can be kept up. The 7-ft. gage railroads in England were proved to roll more than the 56½-in. gage, and narrow gage railroads show good riding qualities. The same argument applies to narrow gage cars on decent roads.

The objection that the narrow cars will not fit the ruts made by other cars on dirt roads or snow, I think cuts both ways. Personally, on a light car I would rather not have both wheels in the ruts at the same time. In the same way street car lines are safer to a car the track of which does not fit them.

As regards road conditions, these are certainly bad in the States as a whole but are rapidly improving, and in the Eastern states are becoming similar to English roads. I believe a light car of European design would perform very well on the ordinary roads of Massachusetts.

With reference to snow conditions, such as we have had in the past week, a narrow track would certainly not be an unmixed blessing, but I have the idea that a small car with a low bottom gear, not too much forward weight, and a really good control of the back axle would push its way through most obstacles, particularly if the road clearance were kept fairly high by sloping the transmission and using small back axle gears. Four speeds would be almost a necessity.

Engine Practice

Many European cars are built around the engine, and in fact in some of them the designer's interest appears to have waned after the engine was completed. This was a real failing of many pre-war cars.

One notices a real attempt to raise the mean effective pressure in European cars, by increased compression, inlet valve opening and induction systems. The valve in head engine is coming in with a certain hesitation, generally with a detachable head.

In at least one case of a detachable head, screwed plugs are still used over the valves. This seems good since with the detachable head, although the operation of cleaning the cylinder is made easier, there is far greater difficulty in making a quick inspection of the cylinder and valves than with the older type of non-detachable head with screwed plugs over the valves. Also, it is more necessary to inspect the interior of the cylinder when a detachable head is used because of the danger of internal water leaks.

With the ordinary type of detachable head, when once the head is detached and replaced, there is a constant fear in one's mind as to what sort of joint has been made, and the only way to find out is to detach the head again, and so on "ad infinitum."

In a large number of detachable head designs, the camshaft is on top, following aero engine practice.

The contrary school is still vastly in the majority, proving by excellent examples that a well designed L-head engine can be as efficient and as free from detonation as the valve in head.

At Olympia, two-thirds of the engines were four-cylinder, and over half the remainder were six. The two cylinder horizontal opposed engine is gaining much favor for light cars, this being a development of motorcycle design.

Air-cooling is only considered for small cars, probably because the danger of freezing is practically not existent in Europe.

Magneto ignition still holds the field in Europe by an enormous majority, but certain makers have been tempted by the very excellent American battery-ignition systems, to abandon their old loves, probably as a matter of justified economy. On small cars without self-starter, the magneto is almost universal and seems correct, since in this way the car can always get home, battery or no battery. So long as an engine is free enough to be started by hand on the magneto, there is a real advantage in having one, at least as a second string.

The battery ignition wires and apparatus extend over half of the car and a number of things are liable to happen to the wires and terminals in inaccessible places, which may take endless trouble to put right. In magneto ignition the only wires are the high tension leads to the plugs, failures of which affect one plug at a time and are easily traced, and one ground wire (which is sometimes omitted on European cars). This wire, if it breaks, will not stop the engine but will prevent its being stopped. If it is grounded it is only necessary to pull it off. Hence the European faith in the magneto, which will take a lot of shaking.

Clutches are about evenly divided between cone and plate in Europe, whereas in America the plate clutch is in a large majority. Perhaps this is accounted for by the excellent cone facing fabrics which one can obtain in Europe, and in America by the cheapness of manufacturing a plate clutch from pressings. In America it is necessary to have a clutch which will slip longer without burning, because of snow, and a multiple plate clutch is good in this respect of course, but not better than a cone clutch with heat proof facing, which is more liable to keep cool than a pack of disks.

Gear boxes have four speeds on 80 per cent of Continental cars and 50 per cent of English cars, even on a large number of the small cars. The advantage of four speeds, particularly on small cars, is evident and might be considered, one would think, for America, if the public could be educated to it. For small powers, the extra weight of a four-speed box is not great, and the speeds are needed. With a decent clutch and carbureter, the car should start on second and climb most hills on top or third, but first speed is good for emergencies.

Gear boxes are being combined more and more with the engine on European cars, particularly the small cars. But in England the majority of gear boxes taken over all cars are still independent and fixed to the chassis behind the engine, 70 per cent being fixed in this way. On the Continent about 50 per cent are fixed to the chassis and 50 per cent to the engine, and the latter method is on the increase.

Some of the English light cars using two-cylinder engines of the horizontal opposed type, combine the clutch casing and gear box with the crankchamber in a very neat form, in such a way that the whole of the working mechanism of the car is accessible by merely raising the bonnet.

Spiral bevels are coming in in a flood, and are not only ousting the straight bevel, but also the worm, which before the war seemed to be gaining favor rapidly. The

spiral bevel is undoubtedly one of the biggest contributions to automobile design since the Bilgram bevel planer.

Springs are almost always half elliptic on the front axle. At the rear there has been a landslide for the quarter elliptic and cantilever, which were fitted on 70 per cent of the cars shown at Olympia.

The half elliptic springs, so popular here, are fitted on less than one-sixth of the European cars, if one may judge by the recent shows.

Since the cantilever spring implies some sort of effective control of the back axle, the movement in this direction seems to be good. The torque tube or other axle control scheme seems too short in many European cars to be really good. In most of them it would have been possible to lengthen it considerably, with advantages in riding qualities and in holding the road.

Some of the European cars retain the fork joint at the head of the torque tube without provision for side movement of the axle, but most makers seem to realize that this is wrong and use a sphere or other universal device.

In general, it may be said that one or two torque tube designs which have recently appeared in the States are far better than the general run of the new European designs, both as regards mechanics and appearance.

Differentials—Several of the lighter English cars omit the differential altogether, and either drive on one wheel or drive both wheels through a rigid axle shaft. This practice does not appear to ruin the tires on a car of 2000 lb. or less, and is worthy of consideration in the States because of its great advantage in mud or snow. America has better tires at a lower price than Europe, which is an additional reason why America should consider dropping the differential on small cars.

Brakes—On this subject American design seems to be at a standstill, and European design better almost without exception. The good point about the American design is that both brakes are generally on the rear wheels, but this is cancelled in most cases by lack of an equalizing device.

The bad points appear to be that the external brake, which is relied on to do the work, is in effect little more than the old-fashioned strap brake tried and abandoned on bicycles. It is likely to grab, is only approximately balanced, is unequal in its application, springs a great deal before it really gets hold, is exposed to all the winds that blow and yet will heat up almost immediately. On very few cars does it ever really come free.

The internal, or so-called "emergency" brake, is generally no more than an enlarged piston ring and is best disregarded.

The smell of rubber and burnt string on any American highroad hill in the touring season is sufficient criticism of the local brake design, and the columns of the newspapers are its condemnation.

The means of applying the brakes too often consist of bent wire, and other things that spring, so that the driver cannot tell the moment at which his brakes make contact and simply keeps on pressing with his foot in the hope that something will happen soon. When it does, it often skids the wheels because the bands after slipping for a time have grabbed. Shrieking brakes are a minor symptom.

Brake facings in America do not appear to be the equal in wearing quality of those used in Europe.

The use of rods to the back axle instead of steel strip or cable, leads to rattling and frequent breakage.

One would imagine that the double internal expanding brake so often used in Europe could be made cheaper to manufacture than the general form of American band brake, since it consists of fewer parts and is a machine job from start to finish. It is better because it is weatherproof, will not run so hot, is more definite in its application, balances better and is more readily adjustable.

The side-by-side variety implies a wide drum, but a new type which is appearing lately, consisting of a single width drum with four internal shoes, each working on a quarter of the circumference, and controlled, one pair by the pedal and one pair by the lever, seems to solve this drawback.

Pressed drums can be used, but should be flanged outward on the inner edge for stiffness and cooling, and should be bored or ground to run true.

I wish to suggest that improvements on the lines suggested would form a great step forward in American cars.

Bodies—Much adverse criticism of American bodies has recently appeared in the English technical press, but when one examines it one finds that it applies wholly to the open-touring bodies, to which I imagine American manufacturers have not given much attention lately.

Recent American open bodies have aimed too much at sporting lines to be comfortable—they are not deep enough and the seating is too upright. I think the designs which are now criticized in Europe came originally from Europe in a number of cases. Europe now, however, has reverted to deep, comfortable, open bodies, such as were standard in this country before the war, using them all the year round, and therefore demanding the utmost of usefulness and comfort.

As regards closed bodies, however, this country undoubtedly leads by a very long margin in detail finish, in accessories, and one cannot help feeling, in general lines also.

The recent developments in quantity production of closed coach built bodies form another notable advance for which the States is responsible, and the quality of workmanship and material in these closed jobs seems to be at least as good as much of the custom coachwork of Europe.

America showed that the automobile was not the monopoly of the rich, and is now showing that true comfort in the automobile is equally available to the man in the street. In other words, what the public wants, it shall have.

The quantity production of coachbuilt bodies is a great step in advance, not only because of low price. By quantity production coachbuilding is lifted from an art to a mechanical science. It has been shown that wood can be worked accurately to make interchangeable parts, that it is capable of proper heat-treatment, like metal, and that results can be guaranteed.

The individual coachbuilt body is often a nuisance to the manufacturer of the chassis and the owner of the car, because it is so often found that in some particular the bodywork clashes with the mechanism of the chassis, or vice versa. By the quantity production of bodies such interference can be rooted out in the first experimental sets, electric wiring can be standardized, and a whole host of minor annoyances can thus be avoided.

Probably in Europe the open car will always hold the field because of the difference in climate. In any case, any form of covering for European cars will have to be truly collapsible.

Perhaps America will now show that a really convertible job can be produced in quantities, which will not rattle and which can be thrown wide open in the fine weather, and covered again by two persons in five minutes.

European, and particularly English, closed body designs appear to be going through a phase which one hopes may be temporary. The rear end of a number of English bodies resembles the rear end of a sausage in general design. I refer to the excessively rounded designs which are so popular in England just now and which appear so hideous to American eyes.

In touring cars the European designs are almost uniformly good, except that in some cases the desire for a disappearing hood has spoilt the lines of the car.

Aluminum sheet is now used extensively in European body work, but the treatment is not as complete as in American bodies, and exposed wood joints are used in window framings, etc., which are likely to give trouble in the event of a change of climate.

Aluminum roofs, used to obtain the rounded designs referred to above, are not satisfactory in many instances, as they tend to boom badly and they make the interior uncomfortably hot in summer weather.

As a summary I wish to emphasize the following points:

1. The use of cars is radically different on the two sides of the Atlantic, and selling points which are vital to the American public, such as self-starters, transmission locks, service organizations, etc., are of secondary importance in Europe.
2. The cost of running a car is greater in Europe and the roads are good; therefore, cars are growing smaller, and it is the small car above all things which appeals to the general public, especially in England.
   If America wishes to hold a big trade in England, she must evolve small, fast, economical cars of the utmost refinement as regards mechanical parts.
3. American bodywork, as known in Europe, is unsatisfactory. But actually American bodywork, as a whole, is of a higher quality than the European. It only remains for America to turn her attention again to producing comfortable touring bodies, for her to meet European requirements absolutely in this respect.
4. American brakes need entire redesigning from the pedal or lever to the back axle, if they are to meet European ideas. The idea of the hand brake being an "emergency" brake must be eradicated. If it is only to be used in emergency, the driver never accustoms himself to use it, and in an emergency it is never ready.
   It is immensely better to call it a hand brake, make it adjustable for wear and build it for use. It only remains to train drivers to use it frequently on all long hills, and it will then be used in emergency and may prevent a lot of accidents.
5. As regards detail design, Europe does not appear to know anything that America doesn't know. With the exception of the overhead camshaft engines, the small horizontal two-cylinder engines, the Argyll single sleeve and the Ricardo trunk piston, every European design is reflected strongly in the States.
6. If America were to build light cars on European lines for export, I believe they would be found to sell in large numbers in the eastern part of the United States, where road conditions are ready for them.
   These cars must not be built for use in cities only, however—they must have the speed and capacity for touring equal to the largest cars built in this country.

Finally

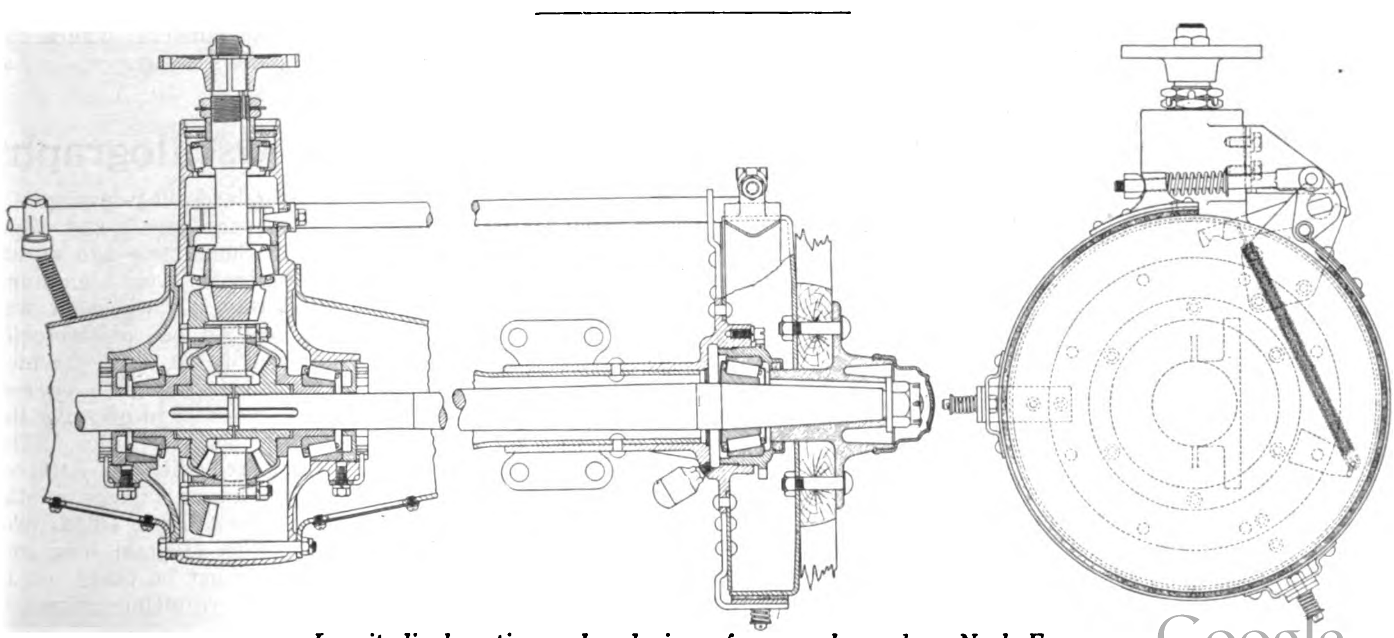
The outlook for American cars all the world over appears to me to be particularly good, because the States is now aiming not only at production, but at the production of high quality designs.

In recent American designs, equal compression volumes are often insured by machining the heads, six-cylinder crankshafts have seven bearings and are finished all over in the circular grinder, pressure lubrication is used for all moving parts of the engine, and in all ways the highest practice is aimed at, combined with strictly mechanical methods.

Other countries are trying to get the costs down, while America, having got the costs down, is trying to get quality up without increasing the costs.

It seems to me that it only remains for America to produce cars strictly suitable for European conditions, to gain a firm place in the esteem of European users.

There is no doubt that having gained a place in the regard of the European public, American salesmanship and service organization will see that the place is retained.



Longitudinal section and end view of rear axle used on Nash Four

Elbow Lines of European Cars

Many methods employed in finishing off top edge of body sides. General tendency is toward construction in which side panel is continued over the top edge to meet the upholstery. Padded top edge is disappearing.

By M. W. Bourdon

MANY efforts on the part of body builders to provide something distinctive in the top edge or elbow line are to be seen on European cars, and the accompanying sketches serve to indicate how widely diverse have been the aims and ideas of various designers.

The bolster-like effect produced, as shown in Fig. 1, by continuing the upholstery fully padded over the top edge, a finish at one time so popular, occurs very infrequently and its decline is not regretted from a practical point of view, as obviously with the full "freeboard" represented by a height of 10 to 14 in. from uncompressed cushion to top edge no use could be made of the padding as an elbow rest.

The general tendency is toward the finish shown in Fig. 2, where the side panel is continued over the top to meet the upholstery. There are a few instances where the latter cannot be seen from outside the car even when viewed from above at an angle of say 45 deg.; but this full extension of the panel has not found much favor, the general endeavor being to interpose a certain amount of padding between the unyielding parts and the passengers, even at this height. This endeavor is more or less apparent in all standard jobs, though in the "sporting" type of body the comfort of the occupants is sacrificed, presumably to obtain a racy effect.

Many body designers are reluctant to discard entirely the padding continuation to the outside edge; Humber and Arrol Johnston go so far as indicated in Figs. 3 and 4 respectively. In both cases the junction between leather lining and panel is finished off by a lead-filled metal beading, Humber securing the lining with pins into the frame and interposing a double strip of leather binding which has a small roll formed by its fold projecting below the metal bead. Angus Sanderson (Fig. 5), on the other hand, eliminates the metallic beading and finishes off the lining edge with a strip of fabric binding secured by leather covered gimp tacks, an arrangement liable to become distinctly "shabby" after comparatively short use. The sketch shows the distinct roll of the upholstery inside the top edge favored by this maker. A similar roll is used on Vinot bodywork (Fig. 6), but in this case a solid aluminum strip covers the joint of leather and inturned panel, the strip being black enameled.

A peculiar design is that on D. F. P. bodies, shown in Fig. 7, there being a pronounced step down from the top of the upholstery to the curved-in top of the panel. The latter has a vertical extension to meet the outer edge of the lining, and a double roll of patent leather binding to cover the joint. This arrangement has the clumsy appearance of the bolster edge (Fig. 1) and is without advantages over simpler constructions.

The F. N. design (Fig. 8) can hardly be considered ideal for, if the panel is finished at the outside edge vibration and distortion of the framework must obviously break the paint at the joint and cause an unsightly crack to occur. If the flat band be formed of a separate strip of metal welded on to the side panel, a comparatively expensive job would result. It must be admitted, nevertheless, that so far as appearance goes this finish has points in its favor, though the sharp outer edge would hardly be serviceable under rough usage, and there are other designs which appeal more forcibly even in appearance.

The edging used on the Phoenix body (Fig. 9) gives a neat and distinctive finish, with a simpler form of panel than is needed when the latter is rolled over to meet the lining. The panel finishes under the lead-filled beading, the rounded top edge being a moulding of wood secured to the framing. The arrangement shown in Fig. 10 (Swift) somewhat resembles the Phoenix in utilizing a moulding above the frame to carry over from panel to lining, but here a solid aluminum bead is screwed on to form the uppermost edge. This design is not so sightly as the Phoenix, for the inclined flat "band" does not harmonize with anything; it clashes with the curvature of the panels and the outline of the body.

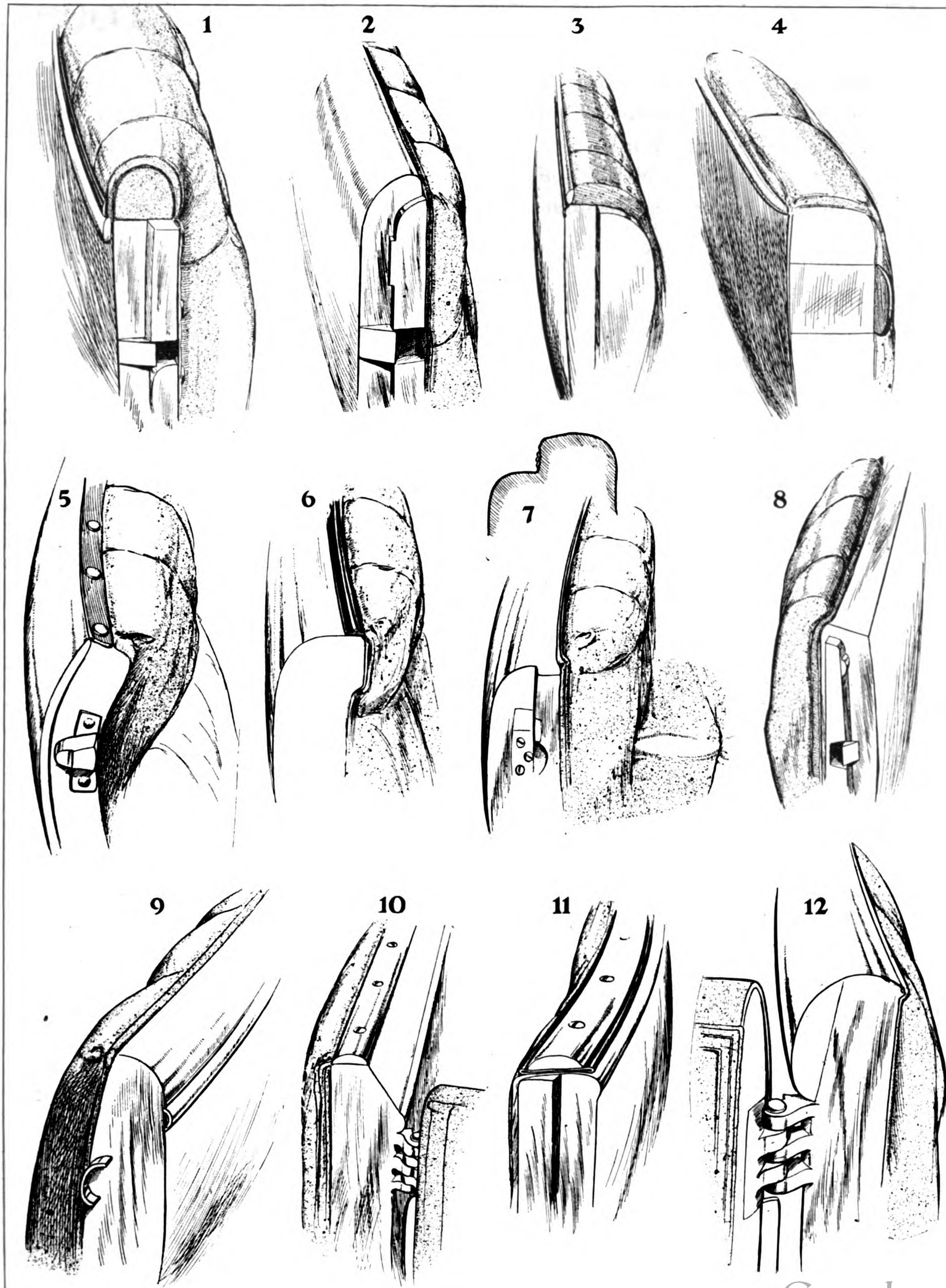
The Hillman design (Fig. 11) also embodies a polished aluminum band with a doubled leather strip beneath it to form a beading on either side. But this scheme looks cold and the "relief" it affords is not called for.

In Fig. 12 an idea is given of the Armstrong-Siddeley top edging. The panel finishes under the broad (2½ in.) half-round moulding, the latter secured to the outside of the top edge of the body framing. This moulding is finished in a slightly darker shade of paint and is a prominent feature of the body—rather too pronounced in the opinion of some people and tending to break up the lines of the body when, as in this case, it is used also (though of less width) at the corners, where the vertical joints of side and back panels occur.

Light Mirrors for Oscillographs

RECENTLY the Bureau of Standards has developed a new method for producing very small and light mirrors for use on oscillographs. Some time ago an attempt was made to produce these mirrors from aluminum, polishing the metal in the usual way. However, it was found that the metal was too soft to be satisfactorily polished and some other means had to be devised which would give a better and at the same time as light a mirror. The process, as finally worked out, consists in pressing the aluminum between two optically flat steel dies. The mirrors thus made are highly polished with the surfaces sufficiently plane to produce satisfactory images of the spot of light. The dimensions of the mirrors so far produced are approximately ½ mm. wide, 1½ mm. long, and .10 to .20 mm. in thickness. Care must be taken not to use too much pressure, as then the resulting mirror is so thin that it will not retain its plane surfaces.

Examples of Finish Used on Top Edge of European Car Bodies



Rust Prevention by Browning Process

Has been used extensively for many years for treating component parts of small arms. Produces a bluish black finish which is rendered dull by sand blasting or may be polished by buffing. Finish does not rub off, is not easily scratched and resists rust to a marked degree. Specifications for preparation of solutions and methods of application are given.

By W. C. Marshall*

IN looking over the back numbers of a prominent automobile periodical recently, the writer came across an article on rust prevention and read it with great interest. Much to my astonishment, no mention was made of the Browning process, although the process is old and used extensively by small arms manufacturers for treating barrels and component parts of small arms.

Having been connected with the works of a company manufacturing small arms in the capacity of research engineer, it fell to my lot to investigate the Browning process used in this plant and make recommendations for any changes. There had been considerable trouble in the browning room, and many rejections on account of poor browning, which the foreman said was caused by the weather. This was true to a very limited extent, because the browning depended principally on atmospheric conditions in this plant. Humidity is very necessary, either controlled or natural. In the above case it was a combination of both, the artificial regulation depending on the foreman, who did not believe in control and preferred to go by his own feelings in the matter of humidity. The time required for the whole process at this time was 96 hours. The first step in the investigation was to install automatic control of temperature and humidity and instruct the foreman to keep his hands off the valves. Recording instruments were installed to show how temperatures varied, and soon the system was working satisfactorily so far as the actual process went. The only failures thereafter recorded were due to someone trying to assist the automatic regulators by closing valves by hand and ruining whole batches of parts.

The question of browning solutions was then taken in hand, the object being to find the cheapest solution which would do satisfactory work.

Steel in a smooth or matt condition of finish is very prone to oxidize or rust if it is exposed to moisture either from the air or from the human skin. The air may carry hygroscopic particles of sodium chloride (or salt) which are deposited on the metal surface and act as a powerful oxidating agent. The exudation from the human skin may have an acid reaction which would start oxidation at once. To prevent this action in the presence of such conditions, it has been the custom of arms manufacturers to coat their products with an artificial coat of rust which will prevent the formation of any further oxides or rust. This coat is produced by acids and the operation of rusting is named "Browning," although the color produced is bluish black and not brown as the name indicates. The finish is smooth or dull, depending on the finish of the surface of the steel before browning. A dull finish is produced by sand blasting and a glossy finish by buffing. It does not rub off, scratches with difficulty and resists the rusting tendency of the air or hands to a marked degree. It wears off *very* slowly when subjected to a rubbing action, and the writer has a golf mashie head with dull finish which was browned in 1915 and still has the bluish black color intact all over its surface except on the face and lower edge where the head cuts into the ground in playing a shot. There has been no rusting except for a little on the face, in spite of the fact that the club has been badly cared for in not being wiped off nor oiled after using.

*Consulting Engineer.

The process is adapted to all kinds of automobile trimmings, looks and wears better than most of the so-called rust preventatives, and is not expensive to use.

The operations of the browning process are as follows:

1. Thorough cleaning of the parts in a soda solution.
2. Applying the browning solution evenly.
3. Keeping the parts in a room at a fairly high temperature during the rusting process.
4. Boiling in water to reduce the high oxide of iron to a low oxide.
5. Carding or buffing the surface of the parts to remove loose particles of the oxides.

Cleaning of Parts

Cleaning of the parts is done by boiling in a solution of water and sal soda. This solution should contain from 5 per cent to 20 per cent of alkali. As an example, 7 cu. ft. of water should have 61 lb. of sal soda added to give a 5 per cent solution.

After cleaning, the objects are dried and the browning solution is applied with a brush or sponge or by dipping. They are then dried in the atmosphere, a second coating of solution is applied and allowed to dry 30 minutes, after which they are placed in a dry room heated to 170 deg. Fahr. for 30 minutes. This is done to bring them to a temperature not lower than that in the humid room in order to prevent condensation on the parts when placed in it.

The humidity of this room is kept at 60 to 70 per cent and its temperature at 160 deg. Fahr.

The work is kept here for 1½ hr., the object being to hasten the rusting under the most favorable conditions, viz., high temperature and high humidity.

At the end of the rusting period, the pieces are boiled 15 minutes in clear water, dried and carded. Then they are painted again with the browning solution, dried, heated in the dry and humid rooms, and boiled. This process is repeated twice, making five coats of browning solution in all. The whole time consumed in the process is 11 hr. 28 min., divided into 31 operations as shown in the accompanying table.

The success of all the processes depends on the cleanli-

1.	Boiled in soda water	15 m.
2.	Boiled in clean water	10 m.
3.	Cooled and dried	5 m.
4.	Painted	5 m.
5.	Dried	30 m.
6.	Painted	5 m.
7.	Dried	30 m.
8.	Dry oven	30 m.
9.	Humid room	1 hr. 30 m.
10.	Boiled	10 m.
11.	Cooled and dried	5 m.
12.	Carded and painted	5 m.
13.	Dried	10 m.
14.	Dry oven	30 m.
15.	Humid room	1 hr. 30 m.
16.	Boiled	10 m.
17.	Cooled and dried	5 m.
18.	Carded and painted	5 m.
19.	Dried	10 m.
20.	Dry oven	30 m.
21.	Humid room	1 hr. 30 m.
22.	Boiled	10 m.
23.	Cooled and dried	5 m.
24.	Carded and painted	5 m.
25.	Dried	10 m.
26.	Dry oven	30 m.
27.	Humid room	1 hr. 30 m.
28.	Boiled	10 m.
29.	Cooled and dried	5 m.
30.	Carded	5 m.
31.	Oiled	3 m.
		11 hr. 28 m.

ness of the surfaces and the temperature and humidity of the air during the periods of oxidation. The control of temperature and humidity should be automatic if possible, as a slip in either one means failure of the process from the standpoint of uniformity in product. Carding is also an important part of the process. The wheels used are of fiber or wire or card cloth on wheels or belts.

Solutions

Browning solutions are made by combining many different chemicals, the object being to obtain a solution which will oxidize rapidly. Some solutions are considered very secret, but, so far as the author's experience goes, they are no better than any one of the half dozen listed below, which were experimented with for competitive purposes.

Eleven different solutions were tried on eleven different pieces of buffed gun barrels, numbered as follows:

1. R No. 1
2. R No. 2
3. Exper. No. 1
4. Ponsot
5. Springfield
6. Enfield
7. Scientific Receipts
8. No. 4
9. No. 5
10. No. 6
11. Henley

The barrel samples were treated and the results in order of merit were as below. The determination of merit of the 7 good samples amounted in this case to the estimate of worth by several good judges of browning, to whom the samples were submitted. Any one of the following solutions can be used with good results, although they are arranged in their order of merit.

The cost per gallon of the solutions in 1916, based on alcohol at \$3.16 per gallon, is shown in the table below, also their cost when using denatured alcohol (in brackets) at 60 cents per gallon.

1. Springfield	\$0.90	(.77)
2. Exper. No. 1	.27	
3. No. 5	1.45	(.43)
4. R No. 2	.35	(.27)
5. R. No. 1	.30	
6. Ponsot	\$3.38	(.86)
	1.80	(Half water)
7. No. 4	.86	(.86)

The prices of other chemicals were:

Nitric acid	\$0.11	per lb.
Iron chloride	.25	" "
Hydrochloric acid	.07½	" "
Bichloride of mercury	2.38	" "

Table No. 1

Browning Solution Formulae—Percentages by Weight

SOLUTION	Perchloride of Iron $FeCl_3$	Bichloride of Mercury $HgCl_2$	Sulphate of Copper $CuSO_4$	Nitric Acid HNO_3	Sp'ts of Nitre	Sulphate of Iron $FeSO_4$	Chloride of Copper $CuCl_2$	Hydrochloric Acid HCl	Chloride of Bismuth $BiCl_3$	Alcohol C_2H_5OH	Water
Springfield	3.9	1.2	0.6	1.8	6.2	...	...	...	...	4.0	82.3
Exper. No. 1	2.8	...	...	8.5	...	1.5	...	...	...	3.2	84.0
No. 5	8.9	...	...	...	...	...	...	...	...	40.1	51.0
R No. 2	2.1	0.7	0.7	6.4	...	...	...	...	...	2.4	87.7
R No. 1	2.8	8.5	1.5	...	...	...	...	...	...	3.2	84.0
Ponsot	7.0	...	...	4.3	...	0.5	...	7.5	–	78.2	....
No. 4	3.3	...	...	...	...	...	1.7	9.9	1.7	....	83.4

The Ponsot process used above was not the one indicated below, the solution being the same, however.

The true Ponsot process requires a dry oven heat of 248 deg. Fahr. and can be done in 6 hr. 30 min. The chemical composition of each solution is given in Table 1.

Chemistry of Browning

The chemistry involved in browning is complex, and chemists do not agree even on the simple facts. Ordinary iron rust or iron oxide is probably a mixture of ferric oxide, hydrated ferrous and ferric oxides, basic ferrous and ferric carbonates. After long exposure to the air, the amount of ferric oxide in the mixture becomes relatively large and the amount of other compounds relatively small. Rusting conditions may be varied. Dry iron in dry air will not rust, as moisture must be present before rusting can occur. It is affirmed by some that the presence of an acid and water is necessary, but this is denied by others. Evidence shows, however, that the presence of an acid is necessary for rusting.

Atmospheric rusting proceeds in the following manner. Films of moisture, holding carbonic acid and oxygen in solution, condense on the surface of iron exposed to air. An acid ferrous carbonate $Fe(HCO_3)2$ or a basic ferric carbonate $Fe(OH)_2(HCO_3)$ is first formed. The ferrous carbonate in contact with oxygen is oxidized to a basic ferric carbonate $Fe(OH)_2(HCO_3)$ or to $Fe(OH)(HCO_3)2$ or both. The basic ferric carbonate is then hydrolized by the water forming ferric hydroxide $Fe(OH)_3$, and the ferric hydroxide is subsequently more or less hydrated, forming ferric oxide.

Once rusting has started, the action is accelerated because the ferric oxide is hygroscopic. As the rusting goes on, the ferric oxide increases in quantity and with it the amount of moisture. Near the sea coast there is more or less sodium chloride in the air. This is in the form of small particles like dust. Sodium chloride is very hygroscopic; therefore, any particles of it which settle on an iron surface not only cause the above conditions, but also remain in the film as a powerful oxidizing agent.

Since atmospheric conditions are too uncertain to depend upon for commercial purposes, a combination of a number of oxidizing agents can be used in place of sodium chloride, such as oxygen, ozone, the feroxides, the oxy-acids and their salts, such as nitrous, nitric, chromic, chloric, etc., and the halogens, chlorine, bromine and sodium, permanganic acid and its salts, viz., potassium, fericyanide, etc.

Among the references used are Mellor's Modern Inorganic Chemistry, Newth's Inorganic Chemistry, and Remsen's Chemistry.

Inasmuch as the Ponsot process differs from the one described previously, it is described at length as follows in case some one desires to make use of it.

Ponsot Process

The Ponsot Process of browning produces a rapid oxidation of steel, usually by the application of two coats of a special solution.

1. Manufacture of the Special Solution.

The composition of the solution is as follows:

Nitric acid at 40 deg. Baume	65 cc.
Commercial hydrochloric acid	130 cc.
Chloride of copper	10 grams = 0.3537 oz.
Iron filings	Necessary quantity
Perchloride of iron at 45 deg. Baume	100 cc.
Commercial alcohol	2 liters = 2.113 qts.

In the dipping process the coats are applied by dipping the pieces directly into the solution.

If the coats are to be applied by means of a sponge or brush, the composition of the solution is modified by re-

placing one liter of the alcohol by one liter of water.

To prepare the solution place the chloride of copper in a porcelain vessel; on this pour the nitric acid, then the hydrochloric acid. When the copper salts are dissolved the iron filings are added in small quantities, very slowly at first and then more and more rapidly, being stirred with a glass rod. The quantity of iron filings should be sufficient completely to neutralize the acids; the reaction is complete when the red vapors become white. It is essential to use an excess of iron filings to make sure that the solution shall be completely neutral. At this time the perchloride of iron is added, then the alcohol (or the alcohol and water).

The bath is now ready for use without filtration.

Care must be taken to stir at the time of use.

2. Browning.

The necessary successive operations for browning are as follows:

(A) Cleaning components of grease or fats.

(B) Applying and fixing the first coat, comprising:

1. Applying one coat of solution by dipping or by sponge or brush.
2. Placing the pieces in dry oven at 248 deg. Fahr. (120 deg. C.) or first heat (for an average time of 20 m.).
3. Placing the pieces in steam oven at low pressure (for 20 m. exactly).
4. Placing the pieces in dry oven at 248 deg. Fahr. (120 deg. C.) or second heat (for same length of time as for first heat).
5. Placing the pieces in bath of boiling water (for at least 20m.).
6. Wiping or drying the pieces with sawdust.
7. Scratch-brushing.

(C) Applying and fixing the second coats, comprising exactly the same operations as the first coat.

(D) Greasing the pieces.

These various operations are explained in detail below.

Removing Grease and Fats From Components Before Browning

No special process is necessary. The one in use in French plants may be used, namely: Immersion of the pieces for 20 m. in a bath of boiling water containing .500 kg. (1.1 lb.) of carbonate of potash in 100 liters (26.417 gal.) of water, followed by a cleaning with whiting.

Applying the Coats of the Solution

It is important that the coats be regular and perfectly uniform. The best process is by dipping. The piece is immersed and immediately taken out with a sharp shake to prevent the formation of a drop. This precaution prevents the excessive erosion of the metal where the coat is thickest, and grooves and etchings are avoided.

The coats may be applied by means of a sponge or brush. The solution may then contain water to prevent too rapid an evaporation of the coat, which would occasion excessive thickness. The trials made at the St. Etienne factories with the sponges used in the old regulation browning process have not given good results; in spite of precautions taken to dampen the sponges, the coat was not very uniform and the pieces showed marbled surfaces. (The operators were not very expert.)

With a pure alcohol solution, the drying is instantaneous and the pieces may at once be placed in the ovens at 248 deg. Fahr. (120 deg. C).

With an aqueous solution it is necessary to wait about 30 min. so that the pieces will be dry before being put into the oven.

Placing the Components in the Dry Oven at 248 Deg. Fahr. (120 Deg. C.)

(First or Second Heating)

The oven may be of any model, the sole conditions being that it can produce a uniform heat at 248 deg. Fahr. (120 deg. C). The pieces should stay in an average time of 20 min. It is essential that only pieces having approximately the same weight be placed in the oven together so that all will heat uniformly.

The design of these ovens depends on the number of pieces they must hold.

Placing in the Steam Oven at Low Pressure

The components should be placed in this apparatus on coming out of the oven at 248 deg. Fahr. (120 deg. C.), but after a certain amount of cooling, to about 122 deg. Fahr. (50 deg. C.). It is essential that all pieces be of the same temperature at this moment, the weight of the pieces being the same. The design of the oven is determined by the number of pieces to be placed therein. A closed tank may be used, into which is poured each time a fixed quantity of boiling water. This water should be drained off after each operation.

The object of this apparatus is to produce steam at about 140 deg. Fahr. (60 deg. C) and to let the pieces cool to about 86 deg. Fahr. (30 deg. C). The parts should remain in the apparatus for 20 minutes.

Placing the Pieces in Bath of Boiling Water

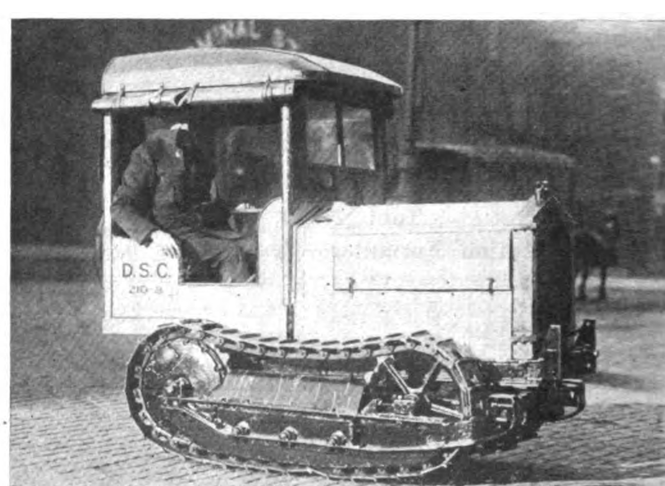
This operation is the same as in the regular Browning process, the parts remaining in the water 20 minutes.

Scratch Brushing

For this purpose it is necessary to use brushes of steel wire, the diameter of the wire not exceeding 1 mm. 0.040 in.

The detail work of the experiments was carried out by my assistant, W. D. Carpenter, and the results of their application to the work in the plant were most satisfactory in every way. The construction of cabinets or heating rooms depends on the requirements of each individual plant and the supply of air and moisture to these rooms depends on the facilities available. In any case, the control of the air supply should be automatic and positive.

Tractors in Snow Removal Service



One hundred of these Cleveland tractors were used in an effort to clear New York City streets of snow after the recent storm

Status of Commercial Aircraft Shown by Company Development

Yes, there is an actual development of commercial flying. This list of flying companies shows that there is the beginning of a transportation service in the air. Data on landing fields especially interesting.

THE fact that there are in this country 21 commercial aircraft operating companies that have flown 25,000 or more miles each will probably surprise most persons who are interested in aircraft development. Thirty companies have exceeded 1000 passengers. These figures are illuminating as to the progress made in aircraft transportation. It is interesting also to note that there is apparently a basis for charge for flight, in that the rates charged by these companies range below $1 per mile, but near that figure, although in one or two cases the charge drops as low as 60 cents per mile. It will be noted also that several of these companies are making progress in the amount of freight carried, 25,000 lbs. having been carried by one company.

The following tabulation is taken from advance proofs of the "1921 Aircraft Year Book" published by the Manufacturers' Aircraft Association, Inc.:

	Name of Company	Address	Aircraft	Air Port Facilities	Charge Short Flight	Charge Pas.-Mile Inter-City Flight	Passengers Carried	Freight Carried lbs.	Miles Flown
1	Aerial Tours Co	Seattle, Wash.	1 B.B.-L‡ 1 J.N.-4	Field (rented) and hangars at Kent, Wash.	$15.00	$1.00	1,700	......	31,500
2	Aeromarine Sightseeing & Navigation Co. (Merged with Aeromarine West Indies).	86th St. and Riverside Drive, N. Y. City.	2 F.-5-L Navy Cruiser Flying Boats;‖ 2 50-B.-2 Flying Boats	Terminal at 86th St. and Hudson River.	....	.83	800	......	7,000 (est.)
3	Aeromarine West Indies Airways, Inc.	Key West, Fla.	6 F.-5-L Navy‖ Cruisers (14-passenger)	Terminals in harbors at Key West and Palm Beach, Fla.; Havana, Cuba; Bimini and Nassau.	....	75.00 between Key West and Havana	300	......	7,200
4	Aero Limited.	20 W. 34th St., N. Y. City.	15 5-passenger H.S.-2-L Flying Boats.	Air ports (owned) at Flushing and Miami.	10.00 to 25.00	.60	4,376	1,500	200,000
5	Air Service, Inc.	536 Broad St., Newark, N. J.	1 Canadian J.N.-4 OX5 motor.	Field 1500x3000′ (leased); 1 hangar under construction.	10.00	.85	1,473	......	13,800
6	Air Transport & Photographic Co.	302 Sloan Bldg., Cleveland, Ohio.	1 Canadian J.N.	Field (leased); test hangar; hangar for 10 machines and repair shop.	....	....	......	......	Unknown
7	America Transoceanic Co.	505 Fifth Ave., N. Y. City.	1 H.-16; 1 H.S.; 3 Seagulls; 1 F Boat.	Pt. Washington, L. I.; Palm Beach and Miami, Fla.; Bimini and Nassau, Bahama.	10.00 to 15.00	.46	4,000	......	80,000 (est.)
8	Augusta Aircraft Co., Inc.	Augusta, Ga.	2 J.N.-4-D's.	Field (owned); hangar and supply depot.	....	1.00	1,000	......	15,000
9	Beaty Aviation Co.	Dallas, Tex.	2 J.N.-4-C's.	Field (owned) at East Dallas, end Gaston Ave., Dallas, Tex.; shop and repairs.	10.00	.40	515	......	6,120
10	E. B. Bridges.	Anderson, Ind.	1 J.N.-4-H.†	Field (rented) 32 acres; tent hangar, supply depot.	15.00	50.00 (an hour)	278	......	8,100
11	Canadian Aerial Services, Ltd.	Hempstead and St. Lawrence Blvd., near Montreal, Canada.	1 504-K 1 J.N.-4-C	1 hangar at Hempstead for 2 machines: 1 hangar at St. Lawrence Blvd. for 1 machine. Fields at both (rented).	10.00	.75	445	240	9,280
12	Canadian Aircraft Co., Ltd.	Winnipeg, Canada.	3 504-K's; 2 Canadian J.N.-4's.	Field with hangar and shop at St. Charles, Winnipeg.	10.00	1.00	1,500	600	12,000 (est.)
13	Cassell Motor Co.	Santa Fe, N. M.	1 J.-1.†	Field (owned) with 1-ship hangar, equipped with repair shop, gas and oil facilities.	12.50	1.00 per min.	200	200	10,000
14	Chattanooga Auto Co. (Aerial Depot)	Chattanooga, Tenn.	3 Canadian J.N.'s. 2 J.N.-4-D's; 1 J.-1; 1 Oriole K.-6.	Field (leased), hangar supply shop.	15.00	.75	......	......	......
15	Checkerboard Airplane Service	Forest Park, Ill.	7 Canadian and American J.N.'s and J.-1's.	Field (owned), 1 hangar, 8-plane capacity, service depot complete.	$10.00	.50 to .70 per mile	2,000 (est.)	......	25,000 (est.)
16	Chenoweth Aviation Co.	Richmond, Ind.	1 J.N.	Field (owned), with hangar for 3, shop and supply depot.	10.00 to 15.00	....	300	......	3,500 (est.)
17	Chester R. Clark Aerial Service Co.	1563 Franklin St., Oakland, Calif.	2 OXX6 J.-1's; 1 float.	2 fields (owned); 2 hangars (one under construction).	1.00 per min.	1.00 per min.	1,476	......	15,000 (est.)
18	Cincinnati Aircraft Co.	Duck Creek Rd., Cincinnati, Ohio.	2 Canadian J.N.'s.	Field (owned) 2680x2900 ft.; hangar 50x125 ft.	15.00	....	400	......	4,000 (est.)
19	Colorado Aviation Corp.	Glenwood Springs, Colo.	1 J.-1. 1 monoplane*	1 field (leased).	12.50	.50	1,500	......	28,000
20	Concord Aircraft Co.	65 N. Main St., Concord, N. H.	1 Canadian J.N. 1 504-K.	1 field (rented) with hangar, shop, office.	10.00	.80	500	......	10,000
21	Connecticut Aerial Navigation Co.	886 Main St., Bridgeport, Conn.	Seagulls M.F. Boat	Seaplane base (leased) with hangar and storage facilities, etc. Black Rock Harbor, Bridgeport; landing field 3 miles east of Bridgeport.	1.00 per min.	1.00	582	......	7,000
22	Curtiss Aeroplane & Motor Corp. (Main Company).	Mitchel Field, Mineola, L. I., New York.	Orioles, J.N.'s, J.-1's, Seagulls, Eagles.	Field (owned) mile square near Mineola; hangars, supplies, etc.	15.00	1.00	1,000	......	25,180

KEY TO AIRCRAFT AND ENGINE TYPES

50 and 50-B-2, three-place flying boats, Aeromarine engine; F.-5-L Navy Cruiser, fourteen-place flying boats, Liberty engine; built by Aeromarine Plane and Motor Company, Keyport, N. J.

B.B.-L., three-place land plane, Hall-Scott engine; B.-1, two or three-place flying boat; C, twin float seaplane; built by Boeing Airplane Company, Seattle, Wash.

J.N.'s of the various types, two-place land planes; Oriole, three-place land plane; Seagull, three-place flying boat; F. and M.F., two and three-place flying boats; Eagle, ten-place land plane; H.S. and H.-16, six to sixteen-place flying boats; OX, K and C engines; Liberty engines in larger types; built by Curtiss Aeroplane and Motor Corporation, Garden City, L. I., New York.

K.T:, two-place land plane; O.W., three-place land plane, Liberty engine; built by Dayton Wright Company, Dayton, O.

J.1 and J.-2, two and three-place land planes built by Standard Aircraft Corporation, Elizabeth, N. J., and rebuilt by Curtiss Aeroplane and Motor Corporation or others.

† indicates Wright engine built by Wright Aeronautical Corporation, Paterson, N. J.

‖ indicates Liberty engine built by Packard Motor Car Company, Detroit, Mich.

‡ indicates engine built by Hall-Scott Motor Car Company, Berkeley, Calif.

F.40 and F.46, French Farman; J.L. monoplane, German Junker; 504-K, British-Avro; * Lark monoplane; ** French Breguet; *** Daugherty tractor; °Laird landplane; °°British Bristol.

The operating companies report a total of 222 forced landings and 88 accidents.

(The above is based upon statements made to the Manufacturers Aircraft Association, Inc., in response to questionnaires sent to all known operators of aircraft. No opportunity has been available to determine the accuracy of the information and no responsibility is taken for the data except for the care with which the figures and facts are reported and the manner in which the summary is presented

	Name of Company	*Address*	*Aircraft*	*Air Port Facilities*	*Charge Short Flight*	*Charge Pas.-Mile Inter-City Flight*	*Passengers Carried*	*Freight Carried lbs.*	*Miles Flown*
23	Curtiss Aeroplane & Motor Corp. (Western Branch)	30 N. Michigan Blvd., Chicago, Ill.	Orioles, Seagulls, J.N.-4-D's, Canadian J.N.'s, J.-2's, Eagles.	2 fields (leased) at (1) Sheridan Rd., north of Waukegan; (2) Roosevelt Field at Des Plaines River.	10.00	....	125	......	1,600
24	Curtiss Eastern Airplane Corp.	130 S. 15th St., Philadelphia, Pa.	4 Orioles; 1 Seagull; 2 J.N.-4-D's.	Landing field with 2 large hangars, repair shop, office, etc., at Pine Valley, N. J.	10.00 to 15.00	.75	1,000	......	102,000
25	Curtiss Exhibition Co.	Kenilworth Field, Buffalo, N. Y.	2 Orioles; Canadian J.N.; 4 J.N.'s; 2 K.-6 J.-1's; 1 OX J.-1.	1 field (rented) northeast of Buffalo, with 2 hangars, shop, etc.	15.00	1.00	1,035	......	18,000
26	Curtiss Flying Station	Atlantic City, N. J.	1 C.-6 Seagull; 4 K-6 Seagulls; 2 J.N.'s; 1 K.-6 Oriole	Seaplane base at inlet and airport (both owned); 1 seaplane hangar, 200x100; 2 field hangars 8-machine capacity, shop, etc.	15.00	1.50	2,700	......	30,000
27	Curtiss-Humphreys Airplane Co.	Denver, Colo.	5 Orioles; 3 J.-1's.	Field (leased), hangars, shops.	12.50	1.00	3,500	......	35,000 (est.)
28	Curtiss-Indiana Co.	Kokomo, Ind.	20 to 30 planes; J.N.-4-D, Canadian J.N., J.-1, Orioles, Bomber.**	80-acre field (leased), ¼ mile southeast Kokomo, with hangars, shops, etc.	15.00	.50 to .75	12,000 (total)	......	500,000
29	Curtiss Iowa Aircraft Corp.	Fort Dodge, Iowa.	4 Orioles; 6 J.N.'s.	63-acre field (owned), Fort Dodge; 160-acre field (leased), Des Moines; hangars, shops, service stations both fields.	10.00	....	......	......	......
30	Curtiss-New York Aircraft Corp.	319 Main St., Buffalo, N. Y. and 505 Fifth Ave., N. Y. City.	16 planes; Seagulls, Orioles, J.N.'s, J.-1's.	Fields (owned) N. Y. City (Mineola, L. I.) and Buffalo, N. Y.	....	....	......	......	......
31	Curtiss Northwest Airplane Co.	707 Metropolitan Bank Bldg., Minneapolis, Minn.	6 J.N.-4-D's; 6 J.-1's; 3 Orioles.	Field (owned) 880x440 yds., between Minneapolis and St. Paul; cor. Snelling and Larpenteur Aves.; 2 hangars for 8 ships and 4 ships respectively; 2 shops.	....	....	3,000	800	250,000
32	Curtiss Southwest Airplane Co.	Tulsa, Okla. Ft. Worth, Tex. Dallas, Tex. Houston, Tex.	3 K.-6 J.-1's; 2 K.-6 Orioles; 5 OX5 J.-1's; 6 J.N.-4-D's; 4 Canadian J.N.'s.	Terminals at Tulsa, and Ft. Worth, 160 acres each with hangars, shops, supply depots (both owned); fields (leased) with supply depots at Dallas and Houston.	10.00	.80 to 1.00	1,500 (est.)	8,400 (est.)	25,000 (est.)
33	Earl P. Cooper Airplane & Motor Co.	San Francisco, Calif.	3 Orioles; 2 J.-1's; 1 J.N.-4-D.	Field (leased).	10.00	1.00	944	......	40,500
34	Earl S. Daugherty	Long Beach, Calif.	1 J.N.-4-D; 1 Cand. J.N.; 1 tractor.***	Field (owned) with 3 hangars and supply depot.	10.00	.75	4,300	......	45,000 (est.)
35	Dayton Wright Co.	Dayton, O.	1 K.T.; 1 O.W.	Field (owned) with hangars, supply depot, shops, etc., at Moraine City Dayton, Ohio.	....	....	250	......	10,800
36	DeLuxe Air Service, Inc.	Deal, N. J.	4 Canadian J. N.'s.	Fields (rented) at Deal and Spring Lake, N. J.; hangar and shop at Deal.	10.00 to 15.00	.75	500	......	20,000
37	Dixie Flying Corp.	Birmingham, Ala.	J.N.'s.	Field (owned), hangar, etc.	....	....	400	......	4,509 (est.)
38	Eastern Aircraft Corp.	340 First St., Boston, Mass.	J.N.-4's.	Fields (rented) at Boston and Springfield; latter station fully equipped.	10.00	1.00	......	......	30,000 (est.)
39	Finger Lakes Air Service, Inc.	Auburn, N. Y.	1 H.S.-2 Flying Boat		....	....	235	......	2,000 (est.)
40	Ft. Wayne Aviation Co.	Ft. Wayne, Ind.	2 J.-1's	Field (owned) 80 acres, with hangars, supplies, etc.	15.00	.80	150	......	1,500 (est.)
41	L. D. Frint Aeronautical Co.	Milwaukee, Wis.	1 J.N.-4-D; 1 Canadian J.N.	Field (rented) and large hangar.	10.00	.75	500	......	15,000 (est.)
42	Valentine Gephart, Inc.	Kansas City, Mo.	16 planes; J.N.-4's J.-1's.**	Field (owned) 100 acres, hangar 100x200 ft., shops, etc.	10.00 to 15.00	1.00	......	......	420,000 (est.)
43	Goodyear Tire & Rubber Co.	Akron, Ohio.	1 Pony Blimp, 3 place.	Airship stations (owned) at Akron, Los Angeles and Avalon, Catalina Islands.	....	....	400 (est.) (at Los Angeles)	......	6,000 (at Los Angeles)
44	Green Bay Aero Club	Green Bay, Wis.	1 J.N.	Field (owned) and hangar with supply depot.	10.00	....	500	......	5,000
45	Gulf States Aircraft Co.	Shreveport, La.	4 planes; J.-2's and J.N.'s.	Use State Fair Grounds, Shreveport, La.	10.00	.75	1,000	......	20,000
46	Fred'k. H. Harris	Brattleboro, Vt.	1 J.N.-4-D.	Uses Fair Field one mile north of Brattleboro.	15.00	1.00	100	......	2,000
47	Heddon Aviation Co.	Dowagiac, Mich.	2 Canadian J.N.'s; 1 Swallow.°	Field (leased), 40 acres, with hangar and supply depot.	10.00	....	......	......	6,500
48	Holbrook & MacLeod	Hanna, Atlanta, Ga.	1 J.N.-4.	Field (leased) at Hanna, Atlanta, Ga.	$10.00	$ .75	1,200	......	40,000
49	Hubbard Air Transport Co.	Seattle, Wash., and Victoria, B. C.	2 B.-1 Flying Boats.	Harbor Terminals at Seattle and Victoria.	....	....	25	......	1,700
50	Jaquith Flying Station, Inc.	317 Guarantee Trust Bldg., Atlantic City, N. J.	2 Model 50-B Flying Boats.	Platform, office, etc., at Madison Ave. and Boardwalk.	15.00	1.50	1,500	......	30,000
51	O. K. Jeffery Airplane Co.	Wilcox Bldg., Portland, Ore.	504-K and J.-1's.†	Field and hangars (owned) at The Dalles and Bend, Ore.	10.00	1.00	50	......	500
52	LaCrosse Aerial Co.	LaCrosse, Wis.	1 J.N.4-D.	Tent hangar (owned).	10.00	.75	1,500	......	15,000 (est.)
53	LaGrande Aircraft Co.	LaGrande, Ore.	3 J.-1's.†	Fields (rented) at LaGrande, The Dalles and Bend, Ore. Permanent station at La Grande.	10.00	.45	......	......	......
54	Leschi Aerial Taxi Co.	Seattle, Wash.	Model C Twin float seaplane.	Harbor terminal at Seattle.	15.00	....	600	......	9,000
55	David B. Lindsay	Marion, Ind.	3 Curtiss J.N.-4-D's.	Field (rented), with temporary hangar, etc., ½ mile south of Marion.	15.00	.75	927	......	12,400
56	New York Aircraft Exhibition Corp.	Troy, N. Y.	1 Canadian J.N.	Field (rented) at Troy, N. Y.	15.00	....	300	......	5,000
57	Floyd J. Logan Aviation Co.	Cleveland, Ohio.	2 Canadian J.N.'s. 1 J.N.-4-D.; 1 J.-1.	Field (leased) on Linndale Rd. near Cleveland; 3 canvas hangars for 10, phone, shop, supply, etc.	15.00	1.00	100	......	10,000
58	Lynchburg Air Service Corp.	Lynchburg, Va.	2 J.N.-4-D's, Orioles, J.-1's.	2 fields (rented) near Lynchburg; one hangar and shop.	15.00	....	200	......	3,500 (est.)
59	A. G. McMann.	Bettendorf, Iowa.	1 J.N.-4-D.	Field (owned) east of Bettendorf with hangar and shop.	15.00	....	500	......	5,000 (est.)
60	Martin-Sweet Motor Co.	Denver, Colo.	3 J.-1's.†	Field (owned), 40 acres with 3 plane hangar and shop.	15.00	....	1,000	......	20,000
61	Mercury Aviation Co.	Hollywood, Calif.	7 J.N.-4-D's, 2 J.-1's,† 2 J.L. monoplanes.	3 fields (leased), 2 at Hollywood, 1 Pasadena; 3 hangars at Hollywood, 1 Pasadena; repair shops.	5.00	....	15,000 (total)	......	475,000
62	Morrow Aircraft Corp.	Charlotte, N. C.	1 Oriole, 1 J.N.-4-D, 1 Canadian J.N.	Field (owned) at Charlotte, N. C.	15.00	....	500	......	7,500
63	National Airway Service Co.	217 Walsh Bldg., Akron, Ohio.	2 J.N.-4's.	Field (rented) at Akron, Ohio, with hangars, repair shops and supply depot.	10.00	....	......	......	......
64	Northwest Aircraft Corp.	Newell, S. Dak.	1 J.-1.	Field (owned), hangar and shop; 30'x50'.	10.00	.50	100	......	8,000
65	Ohio Flying School & Transport Co.	53 Central Office Bldg., Akron, Ohio.	5 J.N.-4's.	Field (owned) 8 miles northeast of Akron 80 acres; hangars, supply depot, shops.	15.00	1.00	586	......	3,450
66	Oregon Washington & Idaho Airplane Co.	Portland, Ore.	3 Orioles, 2 Seagulls 4 F Boats, 5 J.N.-4-D's; 1 J.-1.	Terminals at Portland, Astoria, Seaside, Vancouver, Marshfield, Salem, Eugene, The Dalles; 12 hangars, shops, offices, etc.; Portland hangar accommodates 18 airplanes.	10.00	....	3,852	25,000	74,600
67	Orlando Aerial Co.	Orlando, Fla.	2 J.N.-4-D's.	Field (owned) 2 miles west of Orlando.	15.00	....	......	......	......
68	Osgood & Stickney	Springfield, Vt.	2 J.-1's; 1 J.N.-4-D.	Field (rented) with hangar and supplies at Springfield.	15.00	....	3,000	......	4,500 (est.)
69	Rankin Aviation Co.	Walla Walla, Wash.	1 J.N.-4, OX motor; 1 J.-1, OX motor.	Emergency field at Walla Walla.	1.00 min.	.50	862	......	30,000 (est.)
70	Foster Russell Aviation Co.	Spokane, Wash.	1 Oriole; 1 J.N.-4-D, 1 J.-1.	2 fields (leased), one at Spokane and other at Walla Walla.	10.00	.50	1,500	......	......
71	Saginaw Aviation Co.	Saginaw, Mich.	1 J.N.-4-D, 2 J.-1's.	Field (leased), Saginaw East Side, 1 mile from city; hangars, shop, supplies.	12.50	.50	1,450	......	15,000 (est.)
72	Santa Maria Aviation Co.	Santa Maria, Calif.	3 J.-1's.	Field (leased), at Santa Maria, Cal., ½ mile square; 1 hangar.	15.00	....	......	......	......
73	Security Aircraft Co.	Minneapolis, Minn.	Orioles; J.N.'s; J.-1's; 504-K's.	Field (owned), Minneapolis; hangars, shops, etc.	15.00	1.00	3,600	......	12,000

	Name of Company	Address	Aircraft	Air Port Facilities	Charge Short Flight	Charge Pas.-Mile Inter-City Flight	Passengers Carried	Freight Carried lbs.	Miles Flown
74	Service Aviation Training & Transportation Co., Inc.	Wabash, Ind.	11 Canadian J.N.'s.	Field (owned) at Wabash, Ind.; hangar 120'x65', shop, etc.	10.00 to 15.00	.75	9,355	......	90,000 (est.)
75	Miss Neta Snook	828 Wilson Ave., Ames, Iowa.	1 J.N. biplane.	Air terminal at Ames, Iowa; hangar, supply station.	10.00 to 15.00	....	882	480	2,900
76	Starkey Battery Co.	Muskogee, Okla.	2 under construction.	Field (owned) west of Muskogee.	10.00	....	2	......	20 (est.)
77	Southern Aeroplane Co.	11 S. Church St., Charlotte, N. C.	3 F.-40 & F.-46.	Terminal at Charlotte, N. C., and Fairmont, W. Va. (one owned, one leased); hangar and supplies at Charlotte.	15.00	1.00	1,249	1,100	20,000
78	Southern Wyoming Aircraft Co.	Cheyenne, Wyo.	1 J.-1.	Use municipal field, all supplies available.	15.00	2.00	500	......	15,000
79	Syracuse Aero Corp.	239 Union Bldg., Syracuse, N. Y.	3 J.N.-4-D's.	Field (rented) northeast of city; hangar for 6 planes, service station.	15.00	.75	......	......	......
80	Tahoe Aviation Co. W. S. Stoddard Aviation Co.	Lake Tahoe, Calif. Honolulu, T. H.	1 N.-9 seaplane,† 1 J.N.-4-D.	Fields (owned) at Lake Tahoe and Honolulu; hangars and runway (under construction) at Honolulu.	10.00	....	130	2,000	2,000 (est.)
81	U. S. Aircraft Corp.	1803 3rd Ave., Spokane, Wash.	4 J.-1's.	Field (owned) with 8-plane hangar, supplies, etc.; 1 minute from city.	10.00	1.00	551	......	11,000
82	Utah Airplane Co., Inc.	343 S. Main St., Salt Lake City, Utah.	1 Oriole.	Field (rented), Salt Lake City.	12.50 to 15.00	.75	275	150	8,000
83	Vancouver Island Aerial Service	Comox Harbor, B. C.	1 J.N.-4-D converted to seaplane.	Use harbor floating-hangar and shop.	10.00 to 15.00	.75	283	600	11,000
84	Walter T. Varney, Aeroplanes	832 Post St., San Francisco, Calif.	6 J.-1's; 2 J.N.-4-D's; 1 Tourer.°°	Field (owned) at Redwood City, Cal., 2 mi.x½ mi.; hangars and supply depot.	....	....	800	......	45,500
85	Waterloo Aero Transportation Co.	Waterloo, Ind.	1 Canadian J.N.	Field (rented), 1-plane hangar, shop.	10.00	.75	350	......	3,500 (est.)
86	Western Aeroplane & Motor Corp.	Casper, Wyo.	1 J.N.-4; 2 Orioles; 2 J.-1's.	Field (leased); hangar for 5 planes, complete shops, etc.	10.00 to 15.00	1.00	500	800	4,000
87	Yakima Aviation Co.	Yakima, Wash.	1 J.N.-4-D; 1 J.-1.	Field (owned), at 3rd St., So. Yakima, Wash.; 1 hangar, shop, etc.	15.00	1.00	2,520	......	12,000
88	Zenith Aviation Co., Inc.	Santa Barbara, Calif.	2 Canadian J.N.-4's.	Field (leased) with hangars, supplies, shop, etc., at Ocean Blvd.; seaplane landing dock.	5.00	.50	1,400	......	20,000
	Total...		365 to 425	128	$12.50 (Aver.)	$0.65 (Aver.)	115,163	41,390 lbs.	3,136,550

Napier Cub Aircraft Engine

SOME additional details of the Napier Cub aircraft engine, referred to as the most powerful aircraft engine ever built, have come to hand. The engine has sixteen cylinders arranged in the form of an irregular cross, the two upper rows of cylinders being placed at as small an angle as possible (apparently 45 deg.) and the two lower rows making an angle of 90 deg. with the adjacent upper rows. Between the two lower rows the crankcase protrudes downwards to form a sump, and into the front end of that sump is cast the carburetor body, which comprises one float chamber and four mixing chambers—one mixing chamber for each row of cylinders. Half of the reduction gear housing is cast on the upper half of the crankcase. The cylinders are evidently very much like those of the Liberty engine, but have four slightly inclined valves in the head of each. Rocker arms protruding from the cam housing are employed for operating the valves, and a novel mechanism is said to be used for overcoming the side thrust on the valve stems which usually accompanies the use of this device. Three machined surfaces for bearing brackets are provided on the upper half of the crankcase on each side.

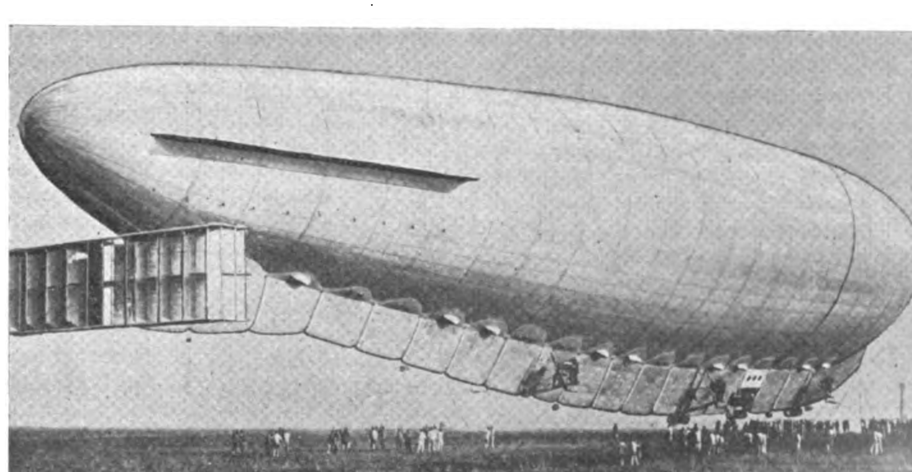
It is claimed that the Cub on its first test run showed an output of 1057 hp. The weight is said not to exceed one long ton, hence if the figure given is correct the engine weighs 2.24 lb. or less per nominal hp.

GREAT developments are predicted in French commercial air services, and it is understood that large grants are to be made to private enterprises engaged in the business. The Budget estimates for the present financial year are $10,660,000, and it is intended to ask for $15,550,000 for aviation requirements in the next financial year. Subsidies are to be given to companies operating services between Paris and London, Brussels, Toulouse and Monaco, and aerodrome facilities are being provided for airships and seaplanes at Marseilles, Algiers, Casablanca and Tunis, the intention being to establish services to North Africa. Consideration is also being given to the development of Constantinople as an air port.

Italian Airship Purchased by U. S. Army

THE Roma, here illustrated, is said to be the second largest semi-rigid airship in existence. It was recently purchased by the War Department from the Italian Government for $200,000. It is said that it would cost $1,250,000 to duplicate this dirigible here. The Roma is 410 ft. long and has a cruising radius at full speed of 3300 miles.

Except for the British Dirigible R-34, which is of quite different type, being, like the German Zepellins, of rigid construction, the Roma will be the largest airship to take the air over this continent.



International Photo.

Improved Service Obtained by Training Service Men

Every car that is sold must be kept "sold" until it stops running. The importance of service as a merchandising aid is increasing. This article describes how one large manufacturer is training competent service men for work on his product, thus insuring a uniformly high grade of service.

THIS interesting description of the work being done by one large automobile manufacturer in training service men was prepared by A. G. Bierma and read by F. J. Wells before a recent meeting of the Service Division of the N. A. C. C. It presents in detail the purposes of the course, the sources from which students are obtained, and the methods used in training them. The following transcript of the article is well worth careful attention:

The purpose of Pierce-Arrow Service Training is to supply men who are carefully selected and trained on our product, with whom to build up a competent service personnel among our distributors and thus insure as nearly as possible the uniformity and high quality of service, which is such an important factor in keeping our product sold and in making new sales.

From the practical standpoint, our training is based on the fundamental principle of educating through instruction plus practice—actual practical experience on the product under commercial conditions, plus lectures, personal instruction and examinations to insure a thorough understanding of the work covered and personal ability to handle the duties expected of the men in specific positions in our various distributors' service organizations.

From the individual's standpoint, our training is intended to give not only the mechanical knowledge required, and some skill through practice, but also personal development and the building of morale through personal contact and acquaintance with the factory, its organization and its personnel.

Sources of Candidates

Candidates for Service Training are obtained from the following sources, arranged in approximate order of greatest number of contributions:

1. From Factory fitting departments.
2. From or through direct application by letter or person.
3. From or through Employment Dept.
4. From or through Distributors.
5. From or through Roadmen and their reports.
6. From or through Advertising.
7. From or through Service Dept. Divisions.

Many of our most capable practical men have come to us from the factory fitting departments. This source has on the whole proved very satisfactory, because usually the men have been transferred on the basis of merit and more can be learned first hand of their demonstrated ability, personality and spirit.

A great many applications come through the mails from men who have either heard of our training or who know the reputation of the company and want to become associated with it. Many of these accepted have proved very satisfactory.

A few distributors and fleet owners have sent in men for regular or special training which has brought good results.

Candidates are selected through a semi-committee system. Their records of personal data and experience are first reviewed by the Director of Service Training either from the applications mailed in or by personal interview. In this way the likely candidates are separated from those unqualified. The final selections are then made or verified by conference with the members of the committee on employment and training. Adequate mechanical training and experience are required.

To insure obtaining the maximum amount of vital information, so that fair judgments may be arrived at, applicants by mail are asked to give complete information on a standard application form supplemented by a recent snapshot and a letter explaining more fully their training experience and desires.

Outline of Training

Mechanical training in shop comprises one to twelve months of productive time. Applicants, as accepted, are placed in the Factory Service Station as helpers or producers on regular production work and on regular production pay to the extent that they demonstrate their ability. They are usually placed first in the Chassis Repair division, and as they develop, showing ability, interest and the proper spirit for the work, they are pushed on through the various repair operations. When sufficiently qualified, they are transferred to the Motor Repair division, where a similar procedure is followed.

In this way experience is provided on all the important repair and fitting operations.

Toward the conclusion of the shop training those men who have shown that they possess the necessary mechanical ability, personal qualifications and right spirit toward the work, are selected for finishing training, consisting of driving, testing and trouble-shooting followed by such specializing training as may be necessary.

Service test, lasting from two to four weeks, is next given. This test is given to two to six men at a time and is available for the following groups:

(1) Men who have qualified in Productive Training Shop.

(2) Distributors' men, whose qualifications meet our requirements, when accommodations are available after taking care of regular men (1)

(3) Fleet owners' men, whose qualifications meet our requirements, when accommodations are available after taking care of regular and distributors' men, (1) and (2) above.

The work covers systematic testing, driving and trouble-shooting, as follows:

(1) Examination on mechanical work (mechanical, oral and written) as final check on mechanical qualifications.

(2) Study (disassembly and inspection) of carburetors, and electrical equipment (magnetos, distributors, switches, regulators, generators, starting motors) followed by examinations.

(3) Adjustment, tuning and testing of engines and trouble-shooting on test stand.

(4) Driving and road testing.

Final specializing training is given to such men as require it for the specific positions they seem best qualified to fill, by allowing them to act as helpers or assistants to the various men in the Factory Service Station Organization handling these specific duties; for example, prospective truck inspectors work with the local inspectors, foremen with the Service Station foremen, service salesmen with the Service Station car and truck service salesmen, service superintendent or managers with the truck inspectors, foremen, service salesmen and accountant.

To supplement the mechanical work in the shop, to afford a better basis for understanding it and to stimulate thought, study and personal development, two series of lectures are given, Shop Lectures and Service Training Lectures.

The shop lectures are open to all the men in the service station, attendance being required of those in training. Three courses are included:

(1) Construction and Operation of the Motor Car.

(2) Evolution of Design and Construction of P-A cars and trucks.

(3) Automotive Electrical Equipment—Fundamental electrical principles and applications, construction and operation.

The Service Training Lectures cover a discussion of Service Station problems, such as stock and tool keeping, repair order system, routing work, handling men, shop costs, truck inspection, etc. They are open only to the men in the finishing courses.

Progress of Men Closely Watched

The progress of the men is closely followed and checked by means of critical observation and periodic reports, conferences and examinations. Records are kept of these to assist in judging the fitness of the men and to assist the Committee on Employment and Training in the proper placing of the men when finished.

High morale, "spirit," is in large measure, the factor that determines more than any other the larger and permanent success or failure of an organization.

In our case, one purpose of service training is to infuse into the men as much as possible of a spirit of service; for the company, which is training them; for the agency or company employing them; for the customer whom he may serve.

This is partly a matter of morals and ethics and partly a matter of mutual understanding between and appreciation of men.

Means to this end, as provided by the training system, include:

1. An intimate knowledge of the factory and its product through visits to its various parts and observation of the nature and character of the work done, and the actual work done on the product as it passes through the men's own hands in the Service Station.

2. The personal attention given to each man through the various stages of his training by all the men concerned with training.

3. Personal contact and acquaintance with the Service Department personnel through interviews, conferences, lectures and occasional association in other activities.

4. Contact and acquaintance with important executive heads of the administrative personnel of the company through attendance at informal talks or get-togethers.

5. Informal get-togethers or service suppers to promote mutual acquaintance between the men and to afford contact with important factory and department executives.

6. Occasional picnics, games, etc.

Placing Men

The placing of men may be outlined as follows:

1. **Men Wanted or Required.**
   - a. For distributors, men are requested or required
     - (1) to supply men with factory training and acquaintance with the product.
     - (2) To replace men leaving.
     - (3) To fill new positions.
     - (4) To establish entire new organizations.
   - b. For Fleet Owners are requested:
     - (1) All-round mechanics for maintenance repairs, testing, trouble-shooting and emergency service.
     - (2) Truck repair master mechanics, foremen or superintendents.
   - c. For Service Department men are occasionally needed for
     - (1) District Service Representatives (Roadmen).
     - (2) Office organization.
     - (3) Factory Service Station.
   - d. Types required include Head Testers, all-round Service men, foremen and truck inspectors, Service Salesmen, Superintendents and Managers, roadmen, technical men with service experience, etc.
2. **Men Available** include
   - a. Men just completing factory service training.
   - b. Factory trained men who, for legitimate reasons, desire to make a change or having left the organization, wish to return to it.
   - c. Experienced distributors' men who, for legitimate reasons, desire to make a change or having left the organization, wish to return to it.
   - d. Experienced non-P-A men.

The greatest difficulty in successfully meeting field requirements is to have the right men available at the critical time of need. The requests or needs for men in the field are usually irregular and unexpected as to type and time required and often epidemic. Sometimes the annual averages of men required can be fairly approximated, but the time element cannot be anticipated. This is further complicated by the fact, that, although the training shop affords a small reservoir with a little flexibility, good men are so scarce that they must be accepted for training usually very close to the time when they become available rather than at any arbitrary time set by the factory; and, furthermore, nothing positive is known as to their capabilities until toward the close of their training, which extends over a period upward of nine months and cannot be fixed absolutely. The same difficulty applies to outside men; they cannot remain out of work very long, neither can a distributor, as a rule, wait very long for a man.

To facilitate the proper handling of requests, as nearly complete records as possible are kept on file by the Field Organization Department relative to the field requirements and the qualifications of the men available.

In some cases placing of men is accomplished by placing employers and men available in direct communication with one another to make their own arrangements.

In most cases, however, the placing of men is closely guided by the Field Organization Department in order to place the best qualified men in the most strategic positions and in such a way as to constantly increase the number of service stations with factory trained men in charge and to build up the service in centers important and strategic from a sales standpoint. Both men and employers usually hold the factory largely responsible for the success of these arrangements. Therefore, in all such cases, it is clearly recognized that no such arrangement can be long successful unless it is agreeable and profitable to the man, to the employer and to the Pierce-Arrow Motor Car Co. For this reason most of this work is done by conference with the members of the Committee on Employment and Training, who combine their resources of knowledge and understanding (gained through correspondence, field trips and personal contact) of the company's field needs, the nature and disposition of the employer and his organization and their needs, and the nature and disposition and other qualifications of the men.

Some idea of the value of this training may be gathered from the fact that there are now in the field service organizations of our distributors somewhere in the neighborhood of 160 men who have had a thorough factory training and are familiar with our product and who are occupying positions of more or less responsibility from that of service manager down to that of all-round service men.

Not only is this a splendid asset to the company in maintaining Pierce-Arrow service standards in the field which has had a material influence on sales, but through the maintenance of the training work the company has been enabled to fill in a number of serious breaches in our field service organizations. For example, in January, 1919, when the Cincinnati agency changed hands from the Hanauer Automobile Company to the Cunningham-Holmes Company, it became necessary to build a sales and service organization from absolutely nothing, not even a building. With the aid of the department a building was selected and leased, plans for remodeling made and the work supervised, tool equipment ordered and its installation supervised, stock equipment recommended, ordered and placed in order in the stock room and a factory trained personnel installed in the service department, including service manager, shop foreman, truck inspector and head tester, so that a going concern was provided and established even before the building was completed. Similarly in Denver in 1919 when Mr. Arthur Kumpf took over the agency from Tom Botterill, in addition to assistance with his building layout, Mr. Kumpf was provided with a shop foreman, truck inspector and tester, and an all-round service man for Colorado Springs, so that he had a working organization almost from the outset. Such complete reorganizations are not always possible unless the proper calibre of men are available at the time of need, but such results as have been attained would have been all but impossible were it not for the facilities of the training shop and its small reservoir of carefully selected and trained men.

Pierce-Arrow Service Training inaugurated originally about 1906 as a chauffeurs' school, has been in operation now for about 14 years and out of this has evolved the system as outlined.

The following is a summary of the work done during 1918 and 1919:

	1918	1919
MEN ENTERED		
Regular	33	34
Special, from agent	9	5
From owner	1	.
New men	3	2
Old men returned	7	5
	—	—
Total	53	46
MEN QUIT, DISCHARGED		
Regular	12	9
Special	1	—
	—	—
Total	13	9
MEN PLACED		
By Department		
With agent	18	26
With owner	3	2
With factory departments	12	9
Returned to		
Agent	9	5
Owner	1	—
	—	—
Total	43	42

From this it will be seen that the present average rate of output is about forty-two men per year.

At the present time there are some ninety-one places where recognized service is rendered by our distributors and of these fifty-two have in their service organizations one or more men with more or less Pierce-Arrow service training who are giving satisfactory service.

Freezing Points of Alcohol-Water Mixtures

THE Air Service, Engineering Division, McCook Field, has worked out a tabulation of freezing points and specific gravity of alcohol and water mixtures which are applicable to automobile as well as airplane practice. A number of tabulations have been gotten up by various individuals and curves printed showing freezing points. It has been noted that marked discrepancies can be found among these various tables and it is of value to have one which has the sanction of the McCook Field laboratory.

As a result of the examination of various anti-freeze solutions by the Air Service, it was found that alcohol-water mixture gave the best results, considering temperatures at which ice crystals would form in solution, running temperature for radiator mixture, ease with which solution can be prepared by the mechanics, and cost of materials involved for producing the mixture.

It should be remembered that mixtures of alcohol and water have a much lower boiling point than water alone. For this reason it is well to keep the water temperature below 167 deg. Fahr. where possible and never allow it to reach 176 deg. for any considerable length of time, as loss of alcohol will take place very rapidly. The following tabulation gives the freezing point of alcohol-water mixtures:

FREEZING POINTS OF ALCOHOL-WATER MIXTURES

Percentage of Alcohol by Volume	Temp. Deg. Cent.	Temp. Deg. Fahr.	Percentage of Alcohol by Volume	Temp. Deg. Cent.	Temp. Deg. Fahr.
0.0	0.0	+ 32.0	25.0	— 11.5	+ 11.3
2.5	— 2.0	+ 28.4	27.5	— 12.9	+ 8.8
5.0	— 2.8	+ 27.0	30.0	— 14.8	+ 5.4
7.5	— 3.2	+ 26.2	32.5	— 16.0	+ 3.2
10.0	— 4.0	+ 24.8	35.0	— 18.3	— 0.9
12.5	— 4.7	+ 23.6	37.5	— 20.0	— 4.0
15.0	— 6.0	+ 21.2	40.0	— 22.1	— 7.8
17.5	— 7.1	+ 19.2	42.5	— 24.0	— 11.2
20.0	— 8.5	+ 16.7	45.0	— 26.9	— 16.4
22.5	— 9.5	+ 14.9	47.5	— 28.8	— 19.8
			50.0	— 31.1	— 24.0

Preventing and Controlling Factory Fires

There are two major phases of factory fire prevention. The one concerns the use of fire resistive materials in the construction of buildings; the other relates to elimination of potential fire centers of one kind and another through the plant. This article discusses both factors.

By C. A. Briggs

SOME thirty or forty years ago when fire resistive buildings of the steel beam type were first erected fear was expressed by some officials of insurance companies that if this new type of "fireproof" building were to become popular, insurance against fire would soon be unnecessary. Since that time there have been innumerable instances of the fallacy of this idea. The fact is often overlooked that while the building itself may be of fire resistive material, there are few buildings which do not contain a sufficient quantity of combustible material to cause a considerable fire.

Some persons, however, still indulge in this false feeling of security, taking it for granted that their lives and goods are safe in what we term to-day fire resistive buildings. But this is not the case. Take as an example the destruction by fire of the Vanderbilt Addition to the Fine Arts Building in New York, with the loss of many priceless paintings, sculptures and other irreplaceable art treasures. This fire occurring the day before the opening of the thirty-fifth annual exhibition of the Architectural League caused architects throughout the country to sustain an almost personal loss.

While these things are distressing, there is reason for hope if through this awakening architects will have brought their professional training and research to bear upon the fallacy of what we used to term "fire proof" buildings. We have learned long since to say "fire resistive," but there are degrees that must be recognized even in the use of this term. Many architects, however, now feel very keenly their responsibility as regards the material they specify in buildings that from the nature of their use should be as far as possible proof against fire. The replies from a questionnaire sent out to a number of architects of schools, hospitals and asylums, however, seem to indicate that any approach to fire resistive or slow burning construction is accepted by some as "fire proof" and that no provision is made for the material that might be housed in these structures.

Regardless of the character of construction, any building that has or may have combustible contents, should have ample provision made for fire protection, usually some standard type of sprinkler system. This conclusion is based upon an exhaustive study, by the National Board of Fire Underwriters, of recent fires in buildings that were supposed to be non-hazardous.

It has been stated before the Structural Engineers Society of Pennsylvania that there is in the ordinary office building 100 ft. wide and 100 ft. deep, twelve stories high, enough fixed combustible material to run the Mauretania 24 hours, which in that time burns 1200 to 1300 tons of coal.

In an excellent article entitled "Steel Furniture and Trim," C. E. Worthington discusses the great value of steel furniture and metal trimmings, which unfortunately have reached a price that makes their general use almost prohibitive. Experiments have proved that steel desks, filing cases, metal waste baskets and other metal office equipment have a high preventive quality. A few years ago metal window frames, sash and casings could be had for very near the cost of wood, and it is to be hoped that this condition will not be long in returning.

FACTS ABOUT FACTORY FIRES

A CLEAN factory seldom burns.
Fire loss is not limited to fire damage.
All fires are preventable, except those due to arson, lightning, and explosion.
It is not only what a building is made of that counts, but also what it is filled with.
All fires begin as small fires.
America's annual fire loss is more than $250,000,000.

The National Fire Protection Association says in one of their recent bulletins, "We must come eventually to the equipment of all commercial, factory and office buildings with metal window frames and wired glass. This will mean the abolition of the conflagration hazard in our cities. Fires will then be unit fires, extinguished easily by a competent fire department within the building in which they originate, for the protection of window openings not only prevents fire from entering but prevents fire from issuing out of the burning building. We may expect an occasional exceedingly hot fire to break down the defense of an adjoining building, but it is obvious that a conflagration could not get under way with fire resistive construction with properly protected window openings."

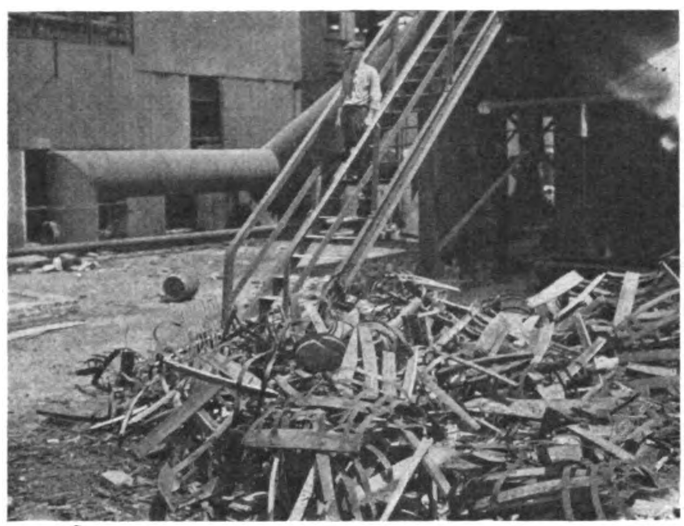
While emphasis is laid heavily upon metal window frames and wired glass, there are other openings in the side walls to be considered. These include such things as ventilators, unused exhaust vent openings or drips. We recently read of the complete gutting of a building that was equipped fully with metal window frames, shutters, etc., because the flames shot through an opening the size of a man's hand from an adjacent burning building.

Whatever the resistive quality of the building, rein-

forcement, consisting of adequate fire fighting apparatus must be provided.

But building material is only one phase of fire protection work. The other important factor relates to those numerous bits of negligence which are usually the cause of fires. The present attitude of public opinion regarding the liability of fires from easily avoidable causes is taking a definite trend. Already the cities of New York, Cleveland and the State of Pennsylvania have laws which provide that any person, firm or corporation on whose premises fire originates because of negligence or failure to comply with any law or ordinance shall pay to the city the full value of the services of the fire department and any damage in person or property resulting thereto in extinguishing or attempting to extinguish such fire. These laws are forerunners of what may be expected in many cities and states in the near future. In other words, the American people are to be made to recognize their responsibility for the elimination of fire causes and the prevention of these enormous unnecessary losses.

The National Board of Fire Underwriters recently announced that property worth $1,416,375,000 was destroyed by fire in the period from 1915 to 1919 as revealed in the quinquennial analysis of 3,500,000 adjustments made by the Fire Underwriters during this five-year period. This loss is the equivalent of 283,275 houses at $5,000 each, or more than enough to shelter the total population of a state the size of Connecticut.



A commonly overlooked fire hazard. Accumulation of rubbish which may easily contain nucleus for a serious fire. In this case it is also a tripping hazard to employees using the stairway

Electricity was given as the chief cause of fire loss with a total for the five years of $84,086,471. Matches and smoking was found to be second with $73,474,348 and defective chimneys came next with $56,650,915. Other causes in their order were: stoves, furnaces, boilers and their pipes, $55,133,181; spontaneous combustion, $49,702,886; lightning, $39,828,489; sparks on roofs, $29,271,585, and petroleum and its products, $25,910,434. Incendiarism contributed $21,596,965 to the damage, and miscellaneous unknown causes completed the total.

By far the greatest proportion of this immense fire loss occurs in industrial and manufacturing property and it would seem that the prevention of fire destruction is not progressing in the same way that other life and property protective measures are doing. If fire hazards were attacked with the same enthusiasm and in the same systematic manner which is now being observed in accident prevention, sanitation, welfare and housing problems, a more favorable report from year to year would appear instead of a steadily upward trend in fire losses. In 1918, moreover, there were 15,000 lives lost in flames in this country.

The illustrations used herein of fire hazards are not exceptional and they doubtless could be duplicated in hundreds of instances.

The automobile industry has definite fire dangers. Every manufacturing establishment has its own peculiar fire hazard. The lumber business, the paint and varnish industry, enameling plants and garages, for instance, all have what might be termed a distinct fire hazard. And the automobile industry in its highly organized state, has in some form, all these fire dangers with which to contend. This makes it advisable, if not imperative, that insofar as possible fire resistive buildings be used and that effective equipment be kept in readiness to fight the fires which are apt to break out where paints, varnish, gasoline and other volatile liquids are handled.

Under these conditions, too, a fine bit of discrimination must be exercised when the flames are approached. If it be an enameling vat or an oil tank that has caught fire, for example, it should not be attacked with a line of hose from a water hydrant. There is also an element of danger in training a stream of water on a blazing motor.

There are certain kinds of chemical extinguishers on the market that must be used with discrimination if they are to be effective. The essential thing is to select equipment suited to the existing hazards, keep the equipment in good condition, in the right place, and under the care of men who are apt to use good judgment in an emergency.

The selection of fire extinguishers is a very important factor and the judgment of experts should be followed. The claims of various concerns manufacturing this material cannot always be relied upon and it is wise to call for aid upon such agencies as the Underwriters Laboratories, Chicago, or the Factory Mutual Laboratories, Boston, either of which can give expert advice as to the proper equipment suited to your case. The selection of fire hose is especially difficult, since it is practically impossible to distinguish between good rubber lined hose and bad, when it is new. Hose bearing the Underwriter's label can always be relied upon as having passed the test required.

The Safe Practices pamphlets which are issued by the National Safety Council, Chicago, contain excellent advice and guidance on practically every phase of the fire problem and they should be consulted for a more detailed study of this subject.

With the help of such concerns within range no manufacturer should find himself unprepared should fire visit his premises. However commendable it may be to prepare to stop fires after they have started, it is vastly more commendable, though less spectacular, to be able also to say, "'My house is in order,' go where you will, in the unfrequented corners of the basement, in the storage loft, look under benches, in dark corners and cupboards and you will not find me negligent. I have removed the evidence and as far as humanly possible I will not be guilty of contributing to the 'national ash pile.'"

A GERMAN syndicate has made an offer to the Brazilian Government to establish automobile, balloon, and agricultural implement factories in the State of Minas Gereas, according to a cablegram to the British Foreign Office from the Brazilian consul in Berlin. Special concessions in duties and freight rates are requested.

Norway Bars Passenger Car Imports

Destruction of roads not built for automobile traffic and depreciation of krone laid to large importations of motor cars. Motor traffic, which is considered a luxury, subjected to rigid regulations. Maximum weight of truck and load is 5 tons. Pneumatics or larger solid tires required.

A. L. FIELD, American representative of Sigurd Gran Rishovd of Christiania, Norway, writes:

"The large importation of motor cars into Norway during the last two years is usually blamed for the falling of the Norwegian krone to about half of its normal value in international exchange.

"The increased use of motor cars and motor trucks on Norwegian roads, which were built for light traffic only, has damaged them so seriously that all the main roads, even those built in the last two years, will have to be entirely reconstructed.

"Motor traffic is considered merely a luxury here, and this, together with old traffic regulations, has discredited the automotive industry with the authorities.

"In an endeavor to improve the exchange, the Norwegian Government has taken the drastic action of restricting the importation of everything they consider a luxury, and the first thing singled out was the passenger car. Norwegian dealers in passenger cars were not permitted to import more cars than they had in transit and paid for, before and on the first of August last. No more passenger cars will be permitted to enter Norway before the rate of exchange has improved considerably.

"Owing to the enormous expense of rebuilding the Norwegian roads, the authorities have found it necessary to regulate traffic to suit the roads instead of building the roads to carry the increased traffic.

"This was done by drawing up new regulations for motor trucks, the Government Road Commissioner being appointed the chairman of committee designated to draw up the necessary regulations. Under them, motor trucks of 1¾ tons load capacity, and less, are not permitted on the roads unless they are equipped with pneumatic tires. The committee, not satisfied with the standard size tires used on American trucks, decided that tires from 1 to 2 in. greater than the standard size would have to be placed on American trucks if they were to be used on the Norwegian roads.

"It is also specified in the regulations that the weight of the truck and the load together must not exceed 5 tons. This practically limits the trucks to 2½ ton sizes or less.

"The accompanying chart is the result of the efforts of the committee appointed to draw up the new regulations for motor trucks."

AN exhibition of agricultural machinery and a series of motor tractor trials are to take place at Lerida, in Spain, from April 1st to 10th next. All kinds of agricultural machinery will be admitted, including machinery used in the derived industries. Manufacturers of fuels, lubricants and all accessories used in connection with agricultural machinery will also be allowed to exhibit. The address of the Organizing Commission is, Urgel, 197, Barcelona.

Norwegian Regulations Regarding Tire Sizes

Effective Jan. 1, 1921

Unless special permission is granted by the Road Commissioner, motor cars are not allowed on country roads with tires below the sizes specified herewith.

Front Wheel					Rear Wheel					The stated axle loads correspond to the following load capacities in tons.
Weight on axle at full load, lb.	Pneumatics		Solids		Weight on axle at full load, lb.	Pneumatic		Solids		
	Inch	mm.	Inch	mm.		Inch	mm.	Inch	mm.	
					2420	Single 4½	Single 120	Not permitted	Not permitted	
1540	4½	120	Not permitted	Not permitted	3080	Single 5 Dual 4½	Single 135 Dual 120	Not permitted	Not permitted	1
1980	4½	120	Not permitted	Not permitted	3740	Single 6 Dual 4½	Single 150 Dual 120	Not permitted	Not permitted	1¼
2200	5	135	Not permitted	Not permitted	4400	Single 7 Dual 5	Dual 135	Not permitted	Not permitted	1½
2640	5	135	Not permitted	Not permitted	5280	Single 7 Dual 5	Dual 135	Not permitted	Not permitted	1¾
2960	6	150	5	120	5940	Single 8 Dual 6	Dual 150	Single 8 Dual 5	Dual 120	2
3300	6	150	5	120	6600	Single 9 (10) Dual 6	Dual 150	Single 8 Dual 5	Dual 120	2¼
3740	6	150	5	120	7260	Single 10 Dual 6	Dual 150	Single 8 Dual 5	Dual 120	2½
4180	7	(175)	6	140	7920	Single 10 Dual 6	Dual 150	Single 10 Dual 5	Dual 120	2¾
4400	7	(175)	6	140	8800	Single 10 Dual 6	Dual 150	Single 10 Dual 5	Dual 120	3
4840	7	(175)	6	140	9680	Single 12 Dual 6	Dual 150	Single 11 (12) Dual 6	Dual 140	3¼
5280	8	(200)	6	140	10560	Single 12 Dual 7	Dual 175	Single 12 Dual 6	Dual 140	3½
5940	8	(200)	7	160	11880	Single 12 Dual 7	Dual 175	Single 12 Dual 6	Dual 140	4

The FORUM

Hub Standardization

Editor AUTOMOTIVE INDUSTRIES:

This question of Hub Standardization has been given by me much thought and leaves me in a somewhat peculiar position which I think it well to place before the industry through your magazine so that the subject can be ventilated.

From the point of view of the manufacturer, interested in quantity production at a low price, there is no question but that a large measure of standardization should be adopted and put into effect. I feel that the standards at present before discussion will save expense in the manufacture of roller bearings; they may save some slight expense in the manufacture of hubs, and they will certainly save some expense in the manufacture of wheels. At any rate, from the manufacturing standpoint, the existence of standardized hubs will eliminate many troubles which arise and will have an effect of rendering our inventories more liquid and by the reduction of cost may, perhaps, have an effect on the actual merchandising.

The above is a selfish view, based solely on my own desires as a manufacturer. At the same time, however, there is a lurking suspicion in the back of my mind that such standardization may lead eventually to loss of individuality. This is a question which has not yet, however, come up seriously, though looming in the background, and thinking again, as a manufacturer, of the immediate dollar, I am inclined to dismiss it.

It is, however, in my other capacity as an engineer, thinking more in terms of the industry as a whole than of one particular section of it, that I am inclined to question the desirability, or even advisability, of this at this time. I feel that as an engineer, and a member of the S. A. E., I should be asked to take a much broader view of the whole industry rather than a more intimate, selfish view of a small portion of it, namely, wheel makers and makers of axles for sale to assemblers. I feel that if this step be taken that it must, perforce, lead to other steps being taken, with an ultimate deadening of initiative in many other important parts of the car or truck.

Please take the existing standards that surround the front axle, lay out those proposed on a sheet of paper, lay out the center lines for the spring pads, which are practically standardized by virtue of the standardization of the width of the frame, lay out the felloe bands and tires with their position relative to the center of the axle, all of which has been standardized, and you will be surprised to find how little remains to be standardized on the front axle. It is all very well to state that each of these has been standardized irrespective of the other, but if you standardize a series of points, Euclid's law that a straight line is the shortest distance between two points, naturally brings about a standardization of the connections. Therefore, with these points standardized, it is a most elementary proposition to sketch in the balance and have a standardized front axle. There remain, virtually, only the yoke on the steering spindle and the depth of the spring pad from the steering spindle; standard clevises for the steering tie rod practically complete the picture.

The front axle is practically the first thing one sees in the truck or car. Study the advertisements of a number of makes and you will often see them surmounting a hill, evidently showing great power or great speed, with the front axle very prominently displayed. Is it a wise thing to reduce all axles to the same dead level of size and shape? A friend of mine, who has just returned from England, was driving a prominent American car over there and states he was asked repeatedly was his car one or other of a number of makes, and was told that it was very difficult to distinguish American cars because they all look so much alike.

It seems to me that any step that tends to a leveling of design is greatly to be deplored and should be considered very long and very fully before being adopted. In this connection, I would like to add that the time interval between the initiation of this proposed standardization, approximately June, 1920, and the time it was brought up for approval, January, 1921, is altogether too short. It savors too much of politics rather than the mature deliberation of an engineering body.

Again, I confess to a feeling that such a sweeping standardization, which will bring about increased production, must necessarily standardize on the basis of the weakest link in the chain. For example, it is stated in the report that the spindle is of such size that even 1035 steel can be used for emergencies. Nobody in their sane senses would dream of using 1035 steel on the truck front spindle, subjected to such heavy work as it has to withstand, but necessarily a proposed standard must take in a poor quality of steel.

Next in order come the bearings. Here again, the different bearings which are made in quantities have to be considered, and the one of the lowest load carrying capacity, with a reasonably large production, is the one on which the standardization must be based, thus penalizing the much higher grade bearing which, for the same space occupied, has a much higher load carrying capacity. The standardization of bearings by size, rather than capacity, has the effect of lessening the attempts to put in increased value, either of material or workmanship, into a given size. It is then up to the salesman for the bearing to base his selling argument entirely on a question of life, and no other point. He cannot preach economy because by the use of the higher priced bearing, being smaller in size, he is able to save in other materials. This is a point which might be argued on by reason of the fact that a large number of producers want two sources of supply and unconsciously set up a standard in themselves based on the lower quality bearing. This is true for production purposes, but is not true when one considers the best design.

I have a feeling that this bearing standardization by size for certain types of hubs, is actually based on the fact that there has been a failure to standardize sizes of roller bearings in the same logical sequence as exists in ball bearings. Because of this failure to do the thing properly, we are compelled to do this improperly, with possibly detrimental results at a later date to a true standardized logical series of roller bearings.

I am willing to concede, however, that a standardization of taper roller bearings over a limited number of hubs will

bring about more economical results for the manufacturer in the long run. These sizes can be made up in larger quantities and be carried on the shelf with a certainty of disposal, and will tend in many ways to stabilize employment in each factory. It is a truism that the factory having the largest number of customers for a particular object is in the best shape to weather any of the usual industrial depressions and is also in the best shape to stabilize seasonable variations in manufacture.

When it comes to hub standardization, I find myself in grave doubt as to how far this should go. I cannot see that it effects any saving whatsoever. On the contrary, I can see nothing but new expense for dies, for patterns and tools, and an addition to the existing types by a new type. As an engineer, interested in the broad aspects of economy, I would rather have seen the committee pick out a number of existing hubs and standardize on them rather than adopt a completely new line. I feel that if a standard dust washer and standard locking nut are included that it is only a little step more to standardize the complete hub, including the hub cap attachment. Personally, I would, however, rather not see a standardization of these two small parts, not because I feel that the proposed idea is not good and that I know of something better, but simply because on the part of one of them, namely, the dust washer, I feel that we have not reached a final satisfactory design. On the locking device, some factories are tooling up to make one type better than any other and this should be left to stand.

All of the above leads me to a feeling that there is coming a parting of the ways in the S. A. E., for engineers who are concerned with the manufacture of specialized products, or for engineers who are concerned with the industry as a whole. I have not the slightest objection to such standardizations as outlined above, in fact I am in favor of them provided it is distinctly understood that they are for a localized or specialized group of manufacturers. I do feel, however, very strongly that they should not be made a part of the national Society dealing with engineering affairs in a broad way, as such standards are not, and cannot be, true standards in every sense of the word. I would venture to suggest that some other word be adopted to signify such standards as a distinction from what might be called "national" or "fundamental" standards. I do not like the word "standards" at all in this connection; "recommended practices" is slightly better, but again it does not express the facts. For example, how can one say this is a "standard" or even a "recommended practice," when the White Motor Co., admittedly one of the finest truck builders in the country, has a hub totally different from that proposed, and further will in all probability never adopt the one proposed. Similarly, with some other manufacturers who could be named, their probability of adopting the proposed standard is almost nil.

As I said, I do not know what this name should be and have little suggestion to offer. There should be some very strong distinction, and further voting on such proposals should be limited strictly to the groups that will benefit by this work and should not be opened broadcast to the Society. I would suggest, Mr. Editor, that you open up the columns to a discussion on this and to a suggestion of how best this shall be handled. Perhaps a suggestion like this—"axle manufacturers' standard practice," or "wheel makers' approved practice"—might be adopted.

Last on this subject, I would like to add a few words more, although I already feel I have taken up a lot of your space. Many of these standards, or recommended practices, are adopted for the sake of saving the designer some time and allowing him to think of higher things. It is admitted that the most valuable part of this work lies in the committee meetings where the members discuss their own practice very intimately and with great benefit all around. Might I suggest that the S. A. E. gather together many of these engineering practices, just as Professor Unwin used to do in his textbook on Engineering Design, and submit them as part of the work of the Society for consideration. This would lead to a much more intelligent action when the time came for approving the particular practice.

For example, take the case of this hub standardization. It would be in order to have the Society print drawings showing typical Timken hubs, another with typical Eaton hubs; similarly, typical practices of the White company, the Pierce-Arrow company, Packard company, Riker company, etc., could be embodied and these practices would be a distinct guide to a draftsman or designer in arriving at his own conclusions. There is no use disguising the fact that every one of us, when redesigning some part of his car or truck, takes out his yardstick and goes down and measures the other fellow's work. The S. A. E. would be doing a wonderful thing in collecting a lot of this information, publishing it, and eventually, providing the tendency were shown, they could collect this, boil it down, and adopt an approved practice. This practice should be based on what is best, and not on what is average. As I have pointed out several times, the average is just as near to the bad as it is far from the good.

An afterthought occurs to me. Why should not the hub cap be standardized inasmuch as this would lead to a considerable economy in manufacture by the hub odometer people? Please note in asking this question I am not suggesting it is advisable to do it, or desirable, but am simply asking a question that seems to be just as logical as others.

JOHN YOUNGER.

THAT certain kinds of research work having to do with specialized industry cannot be carried out advantageously at universities, but should be entrusted to the research associations which are able to concentrate on particular problems is the contention of F. W. Burstall, Professor of Mechanical Engineering at Birmingham University. At this university the study of the internal combustion engine is being attempted on lines somewhat different from those which have been in vogue previously. Professor Burstall wants to obtain results as to the behavior of internal combustion engines which shall be independent of any particular type of engine or kind of fuel. For this purpose he has constructed an engine in what he terms a theoretic form to show all the changes of temperature which take place in the working fluid.

A small motorcycle used in Switzerland. The weight is said to be but 32 lb., the speed 15 m.p.h.

Number of Working Hours as Related to Production Cost and Rate

The factor of mental fatigue enters into the question of working hours as well as that of physical fatigue. The relation of working hours to unit production costs was brought out in a letter from an automotive manufacturer, which is quoted and discussed here by Mr. Tipper.

By Harry Tipper

FROM one of the subscribers of AUTOMOTIVE INDUSTRIES I have received a letter concerning the relation between hours, production efficiency and fatigue which is of unusual interest, and for this reason I am quoting liberally from the letter as follows:

In one of the plants employing approximately 3000, working hours were reduced from ten to nine, piece work prices remaining the same per piece, under the new schedule as obtained before and hourly rates increased the necessary percentage so that a man's labor for nine hours paid him the same as had been paid for ten previously. The actual net result of this move was to slightly decrease actual cost of production per unit.

In the other plant, employing approximately 600 men, time was reduced from ten and one-half to nine and one-half hours per day. There was practically no piece work in existence. Hourly rates were increased so that a man's earning capacity in nine and one-half hours at least equalled and in some instances, so as to avoid splitting a cent for an hour, a man's earnings were better in nine and one-half than had previously been obtained in ten and one-half. And in comparing the costs per unit of production between 1916 and 1919, during which time the original hourly average rate had been increased about 75 per cent, the actual cost of production per unit in 1919 was about one-half of 1 per cent less than in 1916.

The move, of course, was not made with the primary idea of reducing costs below the pre-war costs, but the move was made, however, on account of knowledge gained in the former experiment with 3000 men and it worked out to extremely good advantage with the crew of 600.

This company is not reducing hourly rates. We are, however, shading selling prices and it is being done by slight reductions in costs of both material and labor. The labor reduction is being accomplished by letting the individuals who actually do the work, realize the fact that the management of this institution does not pretend to believe that the mentality or brains of the institution are contained in one particular cranium.

Apropos to the long hours, fatigue, etc., I have had during the past eight or ten years a good many conversations with rather high class employees, although they were plain workmen, not officials in any capacity, of some of the big, high speed, intensively advertised manufacturing plants and it seemed safe to conclude from these conversations that absolutely the only reason why men stayed with them was because of the money that there was in it. They confessed though, that at the speed at which they were driven and at the hours that they were forced to put in, they dreaded daily, going to the place, as virtually they were more tired on arrival at the shop in the morning than they were after they got into action. Furthermore, these particular men seemed to find it necessary to take time off semi-occasionally to recuperate.

These instances are not unusual in their indication that the number of hours worked does not have a very close relation to the production rate and that the operation of a ten-hour day may not be economical even though the pay is based upon a day's labor and not upon an hourly payment.

There are many other instances where the reduction in the working period has led to an increase in the efficiency, so that the earnings of the worker could be maintained or even enlarged while the labor cost per unit has decreased.

The question of hours is necessarily bound up with the question of fatigue and the last paragraph of the quotation is interesting because it affords the reason for the effect secured in the instances indicated in the earlier paragraphs. High speed, concentrated work on repetitive operations is fatiguing in the extreme and the effect of the repetition of similar motions on the nerves and muscles has been known for a considerable time to the medical profession. Not so much is known of the mental fatigue which results from this type of work, and the effect which that mental fatigue has upon the actual physical condition.

It is not economically sound to arrange the working periods so that there is an accumulated fatigue which cannot be overcome in the periods of relaxation. Not only is this the case, but the effect of the fatigue from concentrated work is to demand a type of relaxation that is not really a relaxation at all, but simply changes the character of the mental pressure.

The strained concentrated character of the repetitive work in the needle trades, directly demands the activity of the dance, the emotion of the melodrama and the mental stimulation of sentimental excitement as a relief from the narrow concentration of its efforts. In a much more definite form it demands the relief which induces the schoolboy (on his release from the class room) to indulge in fight, noise and all the physical activity which he can secure. In the older persons the demand is more sophisticated and relieves itself through the channels which I have mentioned.

At the first glance this sounds as though it had very little to do with the working efficiency, but the accumulated fatigue results in the establishment of a minimum pace that is only increased under pressure of economic fear. It results also in a degeneration which was definitely observed by medical students in Great Britain before the war, and which lead to a complete revision of the army tests in that country.

Unforunately, the knowledge which we have gathered medically has not been applied industrially so that we could determine the most economic period for the working hour under various conditions of operation. We are still misled into thinking that because a man works ten hours, he does more than he could in nine hours.

We are still under the impression that the hour's work is subject to a definite limitation, and that we lose the production effect because the working period is shortened. This persists, despite the fact that many careful observations have been made, indicating the production curve average under different conditions and drawing some conclusions from these examinations as to the relation between production, fatigue and work. These observations, however, did not go far enough, as they do not take into account the part which is played by the mental fatigue arising out of the destruction of the incentive and the elimination of interest in the work. These factors affect the production capacity to a great degree and they influence the accumulation of fatigue to an extent which has not been admitted.

This question has no relation to the demand of the labor union for shorter hours, and it is not affected in the least by the circumstances of that demand. It is a matter of arriving at the working period which will produce a maximum production and therefore the minimum cost per unit produced.

It calls for a consideration of labor cost in its definite relation to the production effect, and it requires a careful study of the work, the concentration and repetition demanded by the work, the reaction upon the man and the fatigue induced by the continuance of that reaction over a definite period. It is an intensely practical way in which to study the human relations in the plant with the possibility of a great practical benefit on both sides.

This is the kind of study which must be given to the human question if we are to be thoroughly informed thereon and thoroughly efficient in our consideration of it.

There is no possibility at the present time of determining with reasonable accuracy the working period which is of the greatest advantage in connection with definite lines of work or definite industrial occupations.

We operate blindly on eight, nine, ten or twelve hours, according to custom and tradition, and without any knowledge of the advantage or disadvantage accruing from this method. As a rule, we are not even patient with the man who desires to investigate such matters and are inclined to dub him impractical, or suspect him of sympathy with the workers to the detriment of the employer.

Sooner or later, however, we shall be forced to consider the question and to consider it with proper investigation and study. It will pay us to consider it, because we can only work at the greatest production efficiency when the worker is operating with the least fatigue and with the quickest recuperation.

Opportunities for Dealers Visualized in Exhibit

SOMETHING unique in the line of factory sales extension effort was introduced by the Nordyke & Marmon Co. during the New York show and is scheduled to become an important feature of the Marmon exhibits in several of the season's larger shows.

It is known as the "Dealer Opportunities Exhibit" and is designed primarily to attract the attention of desirable dealers and sell them the Marmon idea. The exhibit comprises a series of screens upon which are mounted specimens of the various sales extension activities of the factory sales organization and presenting a detailed outline of what the factory is doing to assist its dealers in merchandising its products.

While it is expected that the exhibit will interest many dealers and influence them in the desirability of the Marmon contract and its promise of real merchandising assistance, it is not the plan of the Nordyke & Marmon sales department to depend entirely upon the exhibit to make the contact with these individual dealers at the shows. The exhibit is, rather, a closing room, where dealers that are desirable through territorial location or for other reasons, may be brought by Marmon distibuters for a detailed exposition of the Marmon merchandising plan—where the closing effort in the sale of a Marmon dealer contract is made.

Within a few days after the exhibit was opened in New York factory representatives in attendance noted not only the fact that it was selling Marmon to the dealers who were casual visitors, but it was selling existing Marmon dealers on the advantages of their contracts.

The exhibit shows how the factory sales organization is prepared to assist in the merchandise of Nordyke & Marmon products through its advertising, sales letter, sales and service instruction, territorial analization and other activities in the interest of its dealers.

To some of the Marmon dealers it proved a revelation for, while they were more or less familiar with the things the factory was doing toward sales stimulation, many of them realized for the first time that they were not availing themselves fully of the opportunities that were within their reach and they left strongly sold.

One of the features of the exhibit that was particularly interesting to visiting dealers was the Marmon plan of territorial analization. In this section maps showing graphically the distribution of population, property valuations, car registration, wealth distribution and road conditions in specific dealer territories were shown. The factory sales extension department is preparing to extend this service to all of its dealers on request.

AN Alloys Research Association is being formed with an Alloys Information Service as the first step. This is to be co-operative on the part of those interested in metals and their alloys. An advisory committee, composed of 17 prominent technical men, was formed some time ago and this committee has evolved a plan, in conference with the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, whereby a service of a different scope from any now existing can be carried on for the benefit of the alloy men. The Research Extension Division of the National Research Council, Washington, D. C., which is aiding in the organization, will be glad to supply fuller details about this service.

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Better Brakes Needed

BRITISH and other critics of American cars say with more or less justice that the design and construction of the brakes fitted on our cars do not compare favorably with the practice common abroad or even with the practice with respect to other parts of our cars. This criticism does not, of course, apply to all American cars, but it is true in general that careless design and faulty workmanship is more common in connection with brakes than with any other important part of the car.

Brake drums frequently run out of true, and the band brake so frequently used on the rear wheels almost never bears evenly and usually drags at one or more points. It is true, as one of our correspondents has pointed out, that the band brake is easily adjusted, and can be readily taken off and relined without removing the wheel, but these aside from light weight seem to be about the only points in its favor, at least so far as its use on the rear wheel drums is concerned. On the other hand, it catches dirt, frequently squeaks or rattles and is, in short, too unmechanical to find a place on a well-designed car.

More study of brake lining materials should result in some betterment in construction, and methods of testing linings now being investigated at the Bureau of Standards should be helpful in this direction. There is much to be said also in favor of the use of transmission brakes, and, on the higher grade cars, of front wheel brakes.

Beyond question there is much room for improvement in braking systems as applied to the average American car. The subject is deserving of more study, and should not be overlooked at this time when the wise and progressive car manufacturer is seizing every opportunity to improve his product.

A Basis for Tax Revision

IT is curious that frequently some person will reduce a seemingly complicated problem to a primary analysis and will be hailed as accomplishing a great work. A recent example of this sort of reasoning and its effect is the Federal tax platform as issued by the National Automobile Chamber of Commerce.

It occurred to some one on the N. A. C. C. tax committee that the drafting and application of a tax program was a technical problem and that the average automotive manufacturer had no more reason for attempting to solve it than he would of going into his engineering department and laying down the details of the design of a vehicle he proposed to manufacture. Rather the manufacturer and the board of directors would generally outline the vehicle, provide the funds to employ the proper technical staff and say to the chief engineer, "We want results."

This theory was applied to the tax situation. The men on this tax committee reverted to the almost forgotten theory of democratic government that it is "of the people, by the people, for the people." In other words, the people should and must inform the technicians in charge of governmental work how much they shall have to spend on this work, just as the stockholders, speaking through the directors, tell the factory administrators how much money they can have for the coming period of activity.

As a part of this platform, the N. A. C. C. declaration holds that this generation, which has borne the direct injury of the war, should not be required to pay the entire bill of costs—that this cost should be refunded to spread the cost over at least two generations. This is the first proposal tending toward a decision as to how much should be levied in taxation.

As a second proposition, it is suggested that an analysis of governmental appropriations be made with a view of finding where economy can best be made. It is taken as a truth that the new administration is quite willing to carry into effect its pledges for a business and economical administration. Then it remains only for the people, through their spokesmen, to point out wherein they want economy enforced. It is believed that it is reasonable that representatives of business and civic and industrial organizations can speak for the people.

This platform of the N. A. C. C. has been widely distributed and the committee is receiving many let-

ters of praise, a number of which employ superlatives in recommending this plan.

The plan, as printed, points out forcibly that class taxes are objected too, that especially is it the view that excessive profit and surtaxes are not considered wise. Also that a sales tax does not seem desirable. But these points are not the major ones. The committee will submit that IF a sales tax is necessary, and that IF other objectionable taxes are necessary, that the method of employing them for the raising of the necessary money for the government should be decided by tax experts with a view of even justice.

It is interesting to note that the N. A. C. C. has not asked any association or person to adopt its tax platform, but that the committee has only asked if the principles set forth are common. It is much preferred that other associations use the principles in their own way. The committee has learned that it is not entirely a pioneer in this method of attacking the problem. A similar tax plan was drafted some weeks ago by the Rubber Association of America, but was not given publicity.

There is evidence that, with the technicalities dropped, there will be a nearer approach to agreement on a common tax platform.

Unemployment Responsibility

THE problem of unemployment, though never so acute in this country as in England, is important enough to merit serious consideration. A fundamental question for discussion in this regard is that of responsibility. Does the world owe a living to every man able and willing to work? If so, upon what group or agencies rests the responsibility for providing profitable employment or at least subsistence in times of unemployment?

In England the government, the trade unions and a few employers are assuming a part of that responsibility. There it is a matter of pressing need; some action is necessary immediately, whether fundamental lines of action have been determined or not. The article by C. H. Northcott in a recent issue of AUTOMOTIVE INDUSTRIES discusses the British situation.

Under an industrial organization such as we have to-day with the power of employment and unemployment in the hands of employers, it would seem that a considerable part of the responsibility must rest upon that group. Industrial depressions which take away from many men the opportunity to earn a living are, in a certain sense, an indictment of our industrial organization.

Even in this country conditions become so acute as regards unemployment at times that some immediate remedial measures are necessary. As Henry S. Dennison remarked recently in connection with the unemployment benefit plan being worked out at his plant, "There is a very definite need present right now; something needs to be done. It doesn't do to be too academic about the proposition at such a time. We are trying to work out a practical scheme at our plant to meet present conditions. We think we are on the right track."

And in the meantime, this question of the final resting place of social responsibility under our present industrial system should be carefully thought about by every industrial executive. Some general agreement having been arrived at on this score, the next step involves practical means for putting into action the principles conceived.

Fuel Economy Comparisons

WHAT low fuel economy we are getting in kerosene burning tractors is well brought out by the results of the Nebraska tests circulated at the Columbus show. In stationary gasoline engine practice it has long been the rule to figure on a consumption of one gallon per 10-hour day per horsepower, which is equivalent to 10 horsepower hours per gallon. Considerably better results are possible under specially favorable conditions. For instance, tests made on a 185 hp. B.M.W. aircraft engine at McCook Field showed a fuel consumption of only 0.42 lb. per horsepower hour. As the gallon of gasoline weighs about 5.75 lb., this corresponds to 13.7 horsepower hours per gallon. This, according to the Air Service, is the best figure ever attained in its tests and may be regarded as the practical limit for the present.

By way of contrast it is interesting to note that one of the tractors tested at Lincoln developed only 2.45 horsepower hours per gallon of fuel and the average of all sixty-five tractors tested was only 4.5 horsepower hours per gallon. This average would be even lower if the few tractors burning gasoline had been disregarded, as these on the whole consumed relatively less fuel than the kerosene tractors.

There is just as much energy in a gallon of kerosene as there is in a gallon of aviation gasoline; slightly more, in fact. That the fuel economy of tractors is only about 50 per cent that of fairly large stationary gasoline engines is due chiefly to two causes, as follows: (1) Low compression must be used with the kerosene to prevent knocking, and (2) a good deal of the kerosene either passes through the engine unburned or else burns so late in the power stroke that practically none of the heat of combustion can be turned into useful work.

It may seem unfair to make a comparison between the fuel economy of a tractor engine burning kerosene and a large size aircraft engine burning a special grade of gasoline, as there is very little chance of attaining the economy of the latter with the former. A more useful comparison is obtained if we confine ourselves to apparatus using the same grade of fuel and working under similar conditions. In this connection it is of interest to note that the best performance from a fuel economy standpoint in the Nebraska tests was 6.57 horsepower hours per gallon, as compared with a low figure of 2.45 h.p.h. These consumption figures were obtained while the tractors were on an endurance run in which it was important that they should maintain their rated output. It is not at all unlikely that in some cases the poor economy is due to difficulty in maintaining the rated power, fuel being used in excess to increase the output, but it is doubtful if higher economy would be obtained in regular service.

Industry Looks for Steady Gains

MELLON NOT COMMITTED ON TAX PROGRAM; IMPORTANT CONFERENCES SET FOR THIS WEEK

WASHINGTON, March 7.—Secretary of the Treasury Mellon to-day advised AUTOMOTIVE INDUSTRIES that he had not formed definite plans as to tax recommendations. The secretary stated that he would give this subject thorough consideration and undoubtedly map out a tax program for submission to Senate and House Committees early in April. He has not committed himself to proposed revisions though it is known that as a banker he held very decided opinions concerning the need of abolishing the excess profits tax and providing more equitable substitutes. Before taking office he intimated he favored a corporation tax and a small retail sales tax.

It is understood that the secretary will confer with President Harding this week in an effort to obtain his views on this vital matter. Chairman Fordney of the House Ways and Means Committee, Senator Penrose, chairman of the Senate Finance Committee, and other congressional leaders directing fiscal legislation, have been summoned for conferences with the chief executive. These conferences will have an important bearing on hearings which are scheduled for early April.

The Senate committee on appropriations reported that the last Congress reduced the total appropriations by nearly $1,500,000,000 from official estimates for expenditures during 1922 and approximately $900,000,000 less than total expenditures for 1921. These reductions would indicate a lower tax rate but many bills have been vetoed and may be reintroduced with larger amounts, so that actual expenditures authorized will be difficult to determine for several weeks.

Optimism Reigns at N.A.C.C. Meeting

Shows Break Depression—Farmer Buying Weak — To Push Safety Campaign

NEW YORK, March 5 — Sane optimism pervaded the members' meetings of the National Automobile Chamber of Commerce here this week. The spirit manifested was in marked contrast with that which has been apparent for the past few months. The manufacturers are convinced that the tide of business depression has turned and that the trend of trade will be steadily upward from now on.

While the manufacturers were confident that the readjustment of the industry to post war needs has progressed well beyond the turning point, they do not expect a record-breaking business in 1921 but they do believe that sales will exceed the fondest hopes they dared express two months ago. At that time they were hopeful, but not sanguine, that the shows would bring a resumption of buying. Now they are convinced that the annual expositions have done more than they ever did before for the industry.

There was a perfectly frank discussion of the situation among both passenger car and truck manufacturers. The situation in the passenger car field is undeniably better than in the commercial vehicle end of the business but the market for trucks is strengthening.

Business has not gone ahead by bounds but the expansion has been steady although slow. The belief is almost unanimous that it will continue and that the volume of orders which has been coming to factories the past few weeks has not been a mere flash in the pan.

South Weakest Trade Point

Reports gathered from 20 distribution centers by the National Automobile Dealers Association were read to the manufacturers. They showed a decided upward turn in sales everywhere except in the south and in South Dakota. They have risen to 75 per cent of normal in some districts. There has been a marked increase in sales of used cars but they have been made at much reduced prices. This opens the way for sales of new vehicles.

The improvement in business has come chiefly in the larger cities and trade still is dull in the smaller cities and in the rural districts. Two factors are largely responsible for this condition. One is the fact that the purchasing power of the farmers has been largely reduced and the other is that the credit situation in the rural sections still is unsatisfactory. The resources of small town banks are mostly tied up in frozen loans and many of them have borrowed as much as they can from the Federal Reserve or from the larger banks with which they have connections. Credit conditions in the larger cities are no worse and in some places are better.

One of the chief obstacles in the way of sales in the truck field is that the railroads now have more idle cars on their lines than they have had in ten years. This number is now approaching half a million. The falling off in freight has been the direct result of business depression and has limited the market for trucks.

Ex-Governor Smith Talks Trucks

The truck manufacturers were addressed by Alfred E. Smith, former Governor of New York, who is now chairman of the board of the U. S. Trucking Corp. in this city, the largest company of its kind in the country. He pointed out that storage facilities for trucks are entirely inadequate and that if they were enlarged there would be a much better potential market. His own company leaves in the street each night, 2000 horsedrawn vehicles but it must find roofs to shelter its trucks. There are almost no storage facilities in lower New York.

Both passenger car and truck makers were addressed by John Moody, president of Moody's Investors Service, who discussed "business and financial conditions and how they affect the automobile industry." He emphasized strongly his belief that 1921 would be a year of adjustment for the industry. He declared that no one industry can stand out against lower prices and asserted that even the cost of steel must go down.

While in New York, the manufacturers discussed informally among themselves means they are employing to assist the small down dealer in promoting sales. Several companies are giving these dealers advice and assistance not only in salesmanship, but on finance.

A decided stimulus to the work of accident prevention is expected to follow the appropriation by the directors of $5000 for prizes to school children of the United States for the best essays on how to lessen the number of automobile fatalities. The plan for offering these prizes has not yet been worked out in detail and other agencies engaged in the same work will be consulted before the regulations covering the contest are announced.

Should Check Accidents

The N. A. C. C. directors feel that it is distinctly up to the automotive industry to help prevent accidents. They are much concerned over the situation and believe many of the fatalities are due to the overloading of trucks, the lack of playgrounds for children and reckless driving. While 78 per cent of the automobile accidents are due to the carelessness of pedestrians themselves, the frequency which such accidents are occurring, is injuring the industry.

The N. A. C. C. does not believe the examination of drivers will do any good,

(*Continued on page* 578)

Klingensmith Joins Gray Motors

To Work with Beall on New Light Car

Will Start Production in Summer —Company Has Strong Financial Backing

DETROIT, March 8—F. L. Klingensmith, former general manager of the Ford Motor Co., set at rest rumors as to his future plans by the announcement to-day that he would associate himself with F. F. Beall, former vice-president in charge of manufacturing of the Packard Motor Car Co., in the production of a new 4-cylinder car to retail at around $1500. Associated with Klingensmith and Beall will be W. A. Blackburn, former factory manager of the Cadillac Motor Car Co. who will occupy the same position with the new concern.

The new company will be known as the Gray Motor Corp. and is a reorganization of Gray Motor Co. which has a large plant at Mack Avenue and Terminal Railroad where the company has been manufacturing engines for several years.

Beall joined Gray Motors upon his resignation from the Packard Co. last summer and has developed a high grade engine which has proved a success. The corporation is well equipped for the manufacture of engines in large quantities for commercial use in addition to its own car requirements.

The car will be brought out in the summer. It will have a 112-inch wheelbase, 3½x5 engine and unusual body lines. The success of Beall at the Packard plant assures the highest grade workmanship on the new product. The car will be marketed through 10 distributing centers, each with an assembly plant, and cars will be shipped from Detroit unassembled, reducing sales expense and freight and it is contemplated by this policy to sell the car at the same price in every city. The same arrangement will be carried out in foreign fields.

Directors Name Officers

At a meeting to-day of directors of the new corporation, Klingensmith was named president; Beall, vice-president and general manager; G. H. Kirchner, president of the First State Bank of Detroit, treasurer and J. B. Moran, secretary and assistant treasurer. Klingensmith was with the Ford company for 15 years and the last six years as vice-president and treasurer. He resigned Jan. 1. Since that time there has been much speculation as to his future and the announcement of a combination with Beall is pleasing to his friends.

Klingensmith's long experience with Ford in financing and sales, Beall's mechanical and production experience and the financial backing of men prominent in money circles, are believed to assure the development of another large automobile company in Detroit. In a statement to-day Klingensmith said:

"I consider myself especially fortunate in being able to form a partnership with Beall in view of his splendid training and long experience in quantity production of high grade automobiles. He received his early training in bicycle manufacturing and later spent 12 years with Brown & Sharpe at Providence, R. I., became an official and left the company to join the Packard organization. I consider Beall the best qualified man in the automobile industry to-day from manufacturing, designing and metallurgical experience to develop a new car." The car will be known as the Gray and, equipped as it will be, is expected rapidly to take rank with popular-priced cars now in the market.

SHORT MONTH HINDERS NEW FRANKLIN RECORD

SYRACUSE, March 7—The extra working day in February, 1920, was the only thing which kept the H. H. Franklin Mfg. Co. from setting a new February production record this year.

Shipments for the month totalled 952, thirty-five less than was turned out in the leap year February. The factory was on a 40 car a day schedule which would have carried it over the top by five.

During February the total number of orders received aggregated 1107, the output falling 155 short of meeting demand. Only 850 cars had been scheduled for the month's output but this was increased when the heavy flow of orders became apparent.

The March schedule calls for production of 1031 cars.

Firestone to Decide on Production Policy

AKRON, March 7—Directors of the Firestone Tire & Rubber Co. will meet March 11 to act on the quarterly dividend payment due this month, and also to make definite decision as to the extent of contemplated increase in production. Although Firestone is not contemplating employing any more men for the time being, it is understood that the company plans an appreciable production increase early in April, and expects to follow it with a s'ill greater increase about the first of May.

Economy Forces Out Overland Officers

Assistants Take Over High Positions—Think Production Near —Contracts Changed

TOLEDO, March 7—The policy of enforced economy in the Willys-Overland Automobile Co. here was emphasized again this week when President John N. Willys, here for three days, announced the severing of relations of Treasurer Frank K. Dolbeer with the company. Dolbeer will be succeeded by his assistant, J. H. Gerkens, in handling the finances of the company.

Dolbeer has been associated with Willys for many years. It was while John N. Willys was operating a bicycle repair shop at Elmira, N. Y., and selling talking machines on the side that their friendship began. Dolbeer was "on the road" for a phonograph company. When Willys began to build up his organization here he summoned Dolbeer for one of the big tasks.

The company has not made any announcement of its production plans. The number of cars on hand is down to the very minimum now and production is expected on a small scale most any time. A few Willys-Knight fours are being built now—most of them directly on order of the dealers.

Willys held several conferences with Walter P. Chrysler, the executive vice-president, and Charles B. Wilson, vice-president in charge of the Toledo plant. The policy adopted in regard to economy and building up a new organization has been carried out in disposing of several contracts this week.

The advertising contract, which has been held by the Martin V. Kelly Co. since the beginning of the company's operations here and which is one of the largest contracts of its kind in the world, has been turned over to another firm.

It is understood by Toledo bankers that the bankers' creditors' committee has practically forced President Willys to give over control of the plant to Chrysler, with full power to weed out all unnecessary individuals.

At the present time there are only one or two of the old family of officials left at the Toledo plant. Most of the places made vacant have been taken over by assistants, come up through the ranks.

HENRY FORD D. T. I. PRESIDENT

DETROIT, March 7—Henry Ford has been elected president of the Detroit, Toledo & Ironton Railroad to succeed Joseph A. Gordon. Several other changes were made.

U. S. Army Trucks Sadly Depreciated

Stocks Left in France Allowed to Go to Ruin Through Lack of Care, Reports Show

Complete official inventories of American army supplies sold to France show that on Nov. 1, 1920, their value was 2,066,800,000 francs or $413,360,000 at the normal rate of exchange. Motor vehicles and automotive supplies represented 326,800,000 francs or $65,360,000. It is understood that an effort will be made to reimport to the United States, duty free, an enormous quantity of these stocks, not only automobiles but other goods.

PARIS, Feb. 18 (*Special Correspondence*)—All American Army stocks in France are expected to be liquidated by the end of next July, according to a statement made before the French parliament. Two of the biggest American automobile camps have been disposed of. They are the Pruniers camp, near Romorantin, which has been sold to the Parrot Company for 35 million francs and the Bourg camp, near Langres, sold to the Meynil & Souchal Company for 25 million francs. The M. T. C. repair park at Verneuil, which was the biggest single organization of the Motor Transport Corps in France, has not yet been sold.

Emmanuel Brousse, in a long speech before the French House of Representatives, has given close details of the manner in which the American stocks were received by the French and disposed of by them. For more than a year Brousse was in charge of the liquidation of stocks, and although his speech was a justification of the work he did, he did not hesitate to point out the gross mismanagement and the scandals connected with this organization.

Stock Sold for $400,000,000

The American stocks were purchased in July, 1919, for 400 million dollars, at a time when the dollar was worth about 7 francs, but owing to carelessness or neglect the value of the dollar was not fixed when these negotiations were concluded, so that the French Government does not know how much it will have to pay for the material received. Wholesale robbery of the American camps began before the American army left France, and was continued on even a bigger scale when the troops had gone home. While the American Army had 100,000 men to police their forty parks, the French had only 1500 troops. The Quartermaster Corps depot at Gievres, guarded by 18,000 American troops, was entrusted to 800 French soldiers.

An American captain, according to Brousse, stole 1500 Cadillacs from the Montoir camp, in addition to thousands of tons of goods, sufficient to load two steamers, which were sent from St. Nazaire to America. The captain was sentenced to one year's imprisonment by the Poitiers court.

The camps were generally so difficult to reach, and the vehicles were generally so deeply bogged that all but a few professional speculators declined to attempt to reach them. Brousse inaugurated the system of selling complete camps, in contra-distinction to the earlier method of disposing of single vehicles or small groups. The results in the case of the Bourg and Romorantin parks were marvelous. An expert's report on the automobile camp at Bourg in which the M T. C. left 9000 automobiles, states under date of July, 1920, that this camp, which is four miles from the town of Langres, is on clay ground of such a nature that the slightest rain makes all work impossible.

From the end of September it is practically impossible to operate this camp, and if the material is allowed to remain there until the end of December, 70 to 80 per cent depreciation will have to be allowed for. In winter it is very common for this country to be covered with more than 3 feet of snow.

Important Repairs Needed

At least 50 per cent of the automobiles are in a very bad mechanical condition by reason of their exposure to the elements and the long time they have remained in the mud. Not a single vehicle can be considered in new condition, and all of them need very important repairs before they can be used. Many of the aluminum crankcases have been attacked by the acids contained in the soil. Quantities of frame members are warped by reason of the trucks bedding in the mud. There are no facilities for repairs, much of the material is standing out in the open, and the sheds are in such poor condition that they cannot last through the winter.

No inventories existed when the stocks were taken over. Nobody knew what was in the camps, nobody knew where material was to be found. The American Army declared it left behind 65,000 automobiles, while the French estimate that they did not receive more than 40,000. There were 200,000 boxes of automobile spare parts which had not been opened when the French took charge of the stocks, and nobody knew exactly what these boxes contained.

SLOUGH TRUCK SALE POOR

LOS ANGELES, March 8—Indications are that the sales of American army trucks reimported into this country from England by the Slough Trading Co. have undergone a bad slump. When the sales began the representative here of the British company did a good business, but trade soon fell off and more than half the consignment of 75 is still on hand. There is very little mention heard now of these army trucks.

Pocket Veto Kills Truck Dumping Bill

Much Legislation Unfinished as Congress Ends Session—Economies Affect Industry

WASHINGTON, March 7—President Wilson's pocket veto of the Army appropriation bill put an end to legislation designed to sell or transfer surplus army trucks and automobiles. The Senate and House had passed the bill as received from conference in which the House conferees had prevailed upon the Senate managers to an amendment requiring the sale of not less than one-half the surplus trucks and cars.

The conferees could not agree as to appropriations for the Air Service which the Senate insisted should be adequate. The Senate failed to reach a vote on the Naval appropriations bills and as a result the item for purchase of aircraft equipment will be carried over into the extraordinary session. The Senate amendments concerning the disposition of tractors as carried in the Fortifications bill were accepted by the House and the measure received the approval of the President before his retirement from office.

Under the terms of this bill, the War Department is authorized and directed to transfer 1250 tractors to the Bureau of Good Roads for distribution to the States for use on highways. Senate leaders and War Department officials predicted that the transfer will put the Army on the market for new tractors within a year.

The adjournment of the Sixty-sixth Congress left many pressing bills on the calendar for reintroduction at the present session. One of the notable features of the past session was the failure of the Senate to approve the continuation of the Federal aid appropriations. At the time of the rejection of State aid program it was indicated that the plan of national highways indorsed by the automotive industry would be given consideration at this session.

Defense Council Cut Off

The policy of economy pursued by the House and Senate affected many Governmental organizations in which the automotive industry had a direct interest. The Congress failed to provide funds for the maintenance of the Council of National Defense, which had under way several studies in standardization and highway transport. It is stated, however, that pressure will be brought to bear on the Sixty-seventh Congress for a special appropriation that the work may continue.

Recommendations of the Secretary of Commerce for the extension of the research activities of the Bureau of Standards into problems relating to the automotive industry were ignored by the House and Senate and, as a result, the activities of the Federal scientists will be restricted.

Associations Near Unity on Tax Views

N. A. C. C. and Rubber Association Committees Reach Agreement—Sales Tax Favored

NEW YORK, March 7—Considerable progress has been made the past two weeks in the direction of concerted action by all branches of the automotive industry on the question of Federal taxation. It is confidently believed that before hearings are begun by the House Ways and Means Committee at the extra session, the various organizations representing the industry will have united upon a definite program.

A working agreement already has been reached between the tax committees of the National Automobile Chamber of Commerce and the Rubber Association of America. The committees of the two organizations presented to their directors reports which were practically identical. Both called for economy in governmental affairs, especially in relation to the military establishment, for the funding of the war debt and for a sales tax to provide whatever additional revenue is necessary.

Directors of the National Automobile Dealers Association have decided to stand with the N. A. C. C. on the tax question. A similar position will be taken by the American Automobile Association, and the Trailer Manufacturers Association is expected to fall in line. The Motor and Accessory Manufacturers Association has not yet appointed a tax committee, but it has been committed informally to some form of sales tax, and it is hoped that its views will be adjusted to those of the other organizations.

The tax committees of the N. A. C. C. and the Rubber Association have begun energetically the work of gathering statistics and data regarding the views of other associations on the tax question and will strive to convert as many as possible to their views. As a matter of fact, considerable progress already has been made in this direction. The sentiment in favor of a sales tax instead of increased excise taxes upon industries which have been classed unofficially but arbitrarily as luxuries is growing, in spite of the recent referendum of the United States Chamber of Commerce.

Sales Tax Easy to Collect

The general belief is that a tax on retail sales will be more easily collected than a turnover tax. Estimates show that it would yield all the revenue necessary and that it would impose only about one-quarter as heavy a burden on the ultimate consumer as a turnover tax.

C. C. Hanch, chairman of the N. A. C. C. tax committee, will spend the next few days in Washington investigating the tax situation. No attempt will be made to obtain the views of legislative leaders until the extra session begins. The House leaders themselves, who will initiate the tax legislation, are not united upon any plan. The chief objection to a sales tax is that it would fall directly upon the ultimate consumer whose vote might be influenced by the feeling that he has been discriminated against. Economists agree, however, that this form of tax is the most equitable which can be imposed, and efforts will be made to show consumers that they will pay the taxes, no matter what form they may take.

Representatives of the various organizations connected with the industry are expected to meet frequently for a discussion of the tax program. While it is believed they will unite upon a plan, it is probable each branch of the industry will ask for a separate hearing at Washington rather than make an appearance as a united industry with a single spokesman.

Raw Material Prices Retard Normal Return

WASHINGTON, March 5—Nationwide inquiry by agents of the Federal Reserve Board shows that the movement toward better conditions was slightly retarded during February principally on account of changes in the prices of basic raw material. Consumers were apparently uncertain as to the trend of prices inasmuch as current purchasing was restricted to immediate needs. One of the encouraging features of the past month was the improvement in employment.

The Board stated that the price reduction in semi-finished and finished steel products, as quoted by independent steel producers, and those in crude and refined oils, disturbed conditions for a time. The month was quiet financially with only a moderate demand for investment securities. Wholesale prices in January declined somewhat less rapidly than in December. The discrimination in purchasing as evidenced in the retail trade brought about movements towards lower price levels. Throughout the agricultural districts it is reported that the mild winter has been highly beneficial to crops and undoubtedly spring truck crops will soon be moving. This fact would indicate a renewed use of motor vehicles in transporting the farm products.

ADD TO FOREIGN TRADE BOARD

NEW YORK, March 7—Three new members have been appointed to the organization committee of the Foreign Trade Finance Corp. They are H. M. Swetland, president of the United Publishers Corp. and the National Publishers Association; W. C. Redfield, former Secretary of Commerce, and Jerome T. Thralls, secretary of the Discount Corp.

DEARBORN OFFICERS CHOSEN

KALAMAZOO, MICH., March 5—The Dearborn Equipment Co. at its annual meeting named the following officers and directors for the ensuing year: President, J. H. Penniman; vice-president, J. W. Bermes; secretary-treasurer, C. S. Bush; directors, the above and H. B. Garvey and William Shakespeare, Jr.

Goodyear Holders Favor Finance Plan

Unanimous Consent of Merchandise Creditors Sought Before Stock Meeting

AKRON, March 7—A canvass made by officers of the Goodyear Tire & Rubber Co. shows that sufficient personal and proxy votes of stockholders have been received to ratify the $85,000,000 refinancing program. It is hoped that when the meeting adjourned from March 4 to March 15 is held practically all of the merchandise creditors will have given their consent. More than 80 per cent already have done so. It is now believed that adoption of the plan is assured. In announcing the adjournment of the special stockholders' meeting, a statement was issued which said:

"Officers of the Goodyear Tire & Rubber Co. announce that they have been advised by the merchandise creditors' committee that owners of more than 75 per cent of the merchandise indebtedness dealt with by the 'plan of readjustment' have consented to the plan. While the company is gratified at the progress made by the merchandise creditors' committee, in view of the large amount involved, the plan cannot be carried out so long as creditors holding any substantial amount of the company's debt have not assented.

"Accordingly, the company does not feel justified in completing the changes in its corporate structure contemplated by the plan until substantially all the creditors have filed their assents with the committee, and the meeting of the stockholders called for to-morrow, March 4, will be adjourned until March 15, by which time it is hoped that the remaining creditors will have signed assents."

It is understood that some creditors who have refused to assent to the plan, are holding out in the hopes that as a last resort, interests friendly to the company will buy them up, and thus enable them to settle their accounts in full for cash rather than to accept part in cash and the balance in prior preference stock. Although it is considered probable that such steps might be taken it is stated that too large an amount of merchandise indebtedness is represented.

To Pay Stock on Contracts

Just what effect this attitude will have upon the final consummation of the plan is problematical. Unanimous creditor assent is sought by March 15. It is understood all merchandise claims of under $1000 will be paid in full. It is also understood that the plan of readjustment stipulates 25 per cent cash payments and the balance in prior preference stock, on all merchandise indebtedness. Men familiar with the details of the refinancing plans say contract creditors will not be paid any cash in settlement of claims, but will receive $125 in prior preference stock for every $100 of indebtedness held.

Cleveland Factories Increase Production

Outlook for March Business Is Pronounced Good—February Much Improved

CLEVELAND, March 5—February's business at all automobile plants in this city exceeded by a good margin the volume in the previous month.

Reports from the Grant factory indicate a very favorable business this year. January's production program of 150 cars was exceeded, and when the books are closed for the month of February the program of 250 cars for the second month of the new year will have been exceeded. Orders are on the books for 200 cars for delivery in March, while the program for March calls for 300 cars. As the Grant Co. is now using the Walker motor exclusively, the latter company also has increased production greatly in the last two months.

The Templar company also has enjoyed good business thus far in the new year. February sales tripled those for January, while March business already booked far exceeds the business done in January.

At the Winton company, where operation has been greatly limited for some time, in common with other factories, production is to be increased on March 15. Already workmen have been notified to report, and machinery has been thoroughly overhauled. The company expects April to be a better month than March, while business booked for March is better than the record for January.

At the Chandler plant it was stated that the volume of business in February was greatly in excess of that in the previous month, and that the management is looking forward to better business in March.

The Peerless management reported an increase in the month just closed over the record for January, while March is expected to prove that a genuine business revival is on.

Allen Motor Reduces Receiver Indebtedness

COLUMBUS, March 7—The affairs of the Allen Motor Co. are in a better position now than they have been since the receivership began, according to a report submitted by a creditors' committee headed by R. C. Wolcott. A reorganization of the personnel has been made whereby the overhead has been reduced $6,600 a month. Orders have been coming in at an encouraging rate. Those now on hand number approximately 300, of which 69 are for immediate shipment with payment upon delivery. No cars are being shipped to dealers who cannot pay cash. Shipments in February numbered 54 cars.

Receiver's indebtedness was reduced $49,000 in February and outstanding drafts were reduced $80,000. It is hoped that by April 1 all receiver's indebtedness can be paid exclusive of receiver's certificates, as well as all bills for current requirements, and that during April some headway can be made in the reduction of the receiver's certificates. Purchases will be confined to actual requirements against bona fide orders for immediate shipments, and no further accumulation of inventory will be permitted. Altogether the situation is more hopeful than it has been at any time since the receivership began.

BUSINESS RENEWALS

EAST PALESTINE, OHIO—The McGraw Tire & Rubber Co. has resumed operations on a limited scale after having been closed for several months. Manufacture of tubes and tires has been begun.

BEREA, OHIO—The Dunham Co., manufacturers of automobile castings, is turning out a considerable quantity of castings for customers in various parts of the country. It has a daily capacity of from 125 to 150 tons.

CLEVELAND, OHIO—The Pennsylvania Piston Rings Co., Inc., manufacturers of individual cast piston rings, started operations on a full time basis March 1 in its foundry and machine shop.

STOCKTON, CAL.—The Croyer Motors Co. has broken ground for the first unit of its new plant in which a new type of tractor will be manufactured. This company formerly made the Sampson tractor but its plant and equipment were sold to the General Motors Corp. The first unit is to be a building 90x440 feet.

PHILADELPHIA—The L. H. Gilmer Co., manufacturers of belting and other woven products, announces that it has accumulated sufficient orders so that the main factory at Tacony is running full time and two departments with double shifts 18 hours a day. The company says that prospects are very bright for a satisfactory year.

SPRINGFIELD, OHIO, March 4—Sales demands are beyond expectations, said officials at the Springfield works of the International Harvester Co. Since the first high speed trucks have been delivered there is a general demand, it was stated. Production at the Springfield works is now under headway. The indications are that the big plant will be called upon to increase the schedule.

SPRINGFIELD, OHIO, March 4—During a visit of officials of the Kelly-Springfield Motor Truck Co. from New York and other points to the plant here it was stated that the indications are that the plant will soon be under headway and that the outlook for the year is encouraging.

Optimism Reigns at N. A. C. C. Meeting

Will Expand Statistical Department—To Join International Commerce Chamber

(*Continued from page* 574)

for investigation discloses that good but reckless drivers are responsible for most of the mishaps which are not due to pedestrians themselves. Strict enforcement of the present motor vehicle laws would do much to remedy the situation. In most states the statutes are adequate for proper punishment of careless drivers, either imposing jail sentences or forfeiture of license.

The directors decided to expand the statistical department of the N. A. C. C. and in the discussion of this subject there was much commendation of the statistical number of AUTOMOTIVE INDUSTRIES. It was felt that by the expansion of the department, further valuable aid would be given such publication in the preparation of statistics of the industry.

It was decided to join the International Chamber of Commerce because it was believed it would be a stimulus to the development of foreign trade. J. Walter Drake, chairman of the export committee, urged the members of the chamber to give their wholehearted support to the Foreign Trade Finance Corp. which recently has been organized.

Toledo Parts Factories Report Larger Orders

TOLEDO, March 7—Allied industries at Toledo are showing signs of business pickup. The Bock Bearing Co. reports that its outlook for March is 50 per cent better than February. The plant here was operated for the first 15 days of last month.

The Tillotson Mfg. Co., which makes carbureters, reported that a few more workers may be put on production later in the month. President H. C. Tillotson says orders are growing but most are being filled out of stock which the company accumulated during the fall.

J. W. Bunting, president of the Bunting Brass & Bronze Co., declared that business was steadily increasing and that his plant would increase its output if improvement continued.

Most automobile manufacturers here believe that 1921 will be a "40 per cent year."

WHITE WORKS TWO SHIFTS

CLEVELAND, March 7—The White Motor Co. now has a working force of 5000, which is divided into two groups of 2500 each. Each group will work three days a week and there will be no change in wage rates at present. About 1200 men were laid off March 1. When men are hired later on it probably will be at a slight increase.

Miller Tire Surplus Nears Depletion

Calls in Stocks to Meet Demands —To Go Slow on New Production

AKRON, March 8—Miller Rubber Co. is the first tire concern to announce that the predicted tire shortage has arrived, By order of Akron officials of the company all available supplies of tires are being brought in from branches in sections of the country where sales are slow, in order to meet the rush demand for orders from dealers in other sections of the country.

Miller has taken this means of meeting heavy spring demands, rather than to immediately quicken production, as it will create a quicker turn-over of stock and enable the company to enter a more stable basis of production when an increase of marked proportion is deemed necessary.

This same policy is being adopted by practically all other Akron tire concerns which are endeavoring to have factory stocks completely absorbed before any heavy production increases are enforced. All factories report surplus stocks diminishing rapidly, and have issued statements indicating that as soon as such supplies are completely exhausted, production will be increased commensurate only with actual current demand.

This is taken to mean that it will become the policy in the rubber industry in the future not to provide too far in advance, but to keep production on an even keel and parallel with actual demand, so as not to clog dealers' shelves with surplus stocks, and so as also to prevent a repetition of the crisis and necessary heavy retrenchment in the tire industry, created when sales slumped last year. Had rubber factories at that time not had surplus stocks on hand, and had they reduced production so as to hold it even with actual demand, practically all such concerns would have breezed through the depression period with small losses.

DETROIT EMPLOYMENT GAINS

DETROIT, March 4—The Employers' Association of Detroit reports 8008 additional men employed in the 79 factories affiliated with the association during the last week in February. On March 1 the 79 firms were employing 62,878 men. This is a gain of 17,905 since Feb. 1. Constant addition to the employees' roll at the Ford plant has had much to do with the increase.

JIG BUSHING TO START WORK

PONTIAC, MICH., March 4—The Jig Bushing Co., makers of bushings for automobile plants, will start production on a full line of its products at its new factory here, April 1. The concern is a new one in the local field and is owned by O. R. Briney of Pontiac and L. M. Richards of Cleveland.

CARS FOR CLERGYMEN TO DOUBLE EFFICIENCY

CHICAGO, March 7 — "Every pastor should have a car," is the assertion made in an editorial printed by the *Northwestern Christian Advocate*, one of the official papers of the Methodist Episcopal church.

"The minister's efficiency is doubled, trebled and even quadrupled by the use of the 4-wheeled chariot of the Apocalypse," says Dr. E. Robb Zaring, the editor. "He can visit sections where shoes, horse or human, could not penetrate. Every pastor should have a car, every rural pastor particularly. The people that the rural pastor serves probably have theirs. Pass prosperity to the parson."

Improvement Gratifies Milwaukee Industries

MILWAUKEE, March 4—Concerns in the automotive parts and equipment industries in Milwaukee and vicinity report a gratifying betterment in their business, which consists of something more than feeling, according to the latest review of local conditions compiled by the First Wisconsin National Bank of Milwaukee. The summary says:

"One company reports a sales increase during the past month of about 100 per cent over the previous month.

"The automotive industries do not expect to do any such an amount of business as last year. Only a fair year is expected. Necessary replacements of parts and accessories in itself provides a medium of business for firms engaged in this line.

"Milwaukee motor truck interests report improved prospects. The outlook for trucks this year looks a little better than that for passenger cars. Future prices in parts and accessories depend upon what happens in the steel market. None of the Milwaukee plants are yet operating above 50 per cent of capacity. Little dependence is placed on export business for this season."

PETERS CUTS BODY PRICES

BALTIMORE, March 5—The Peters Auto Body & Spring Works has made a 15 per cent reduction in the prices of commercial automobile bodies. This was made after a careful study of the present situation by Charles H. T. Peters, who decided to give the public advantage of lower prices without reducing the quality of the bodies built.

OAKLAND BODY PLANT STARTS

PONTIAC, MICH., March 4—The Oakland Motor Car Co. resumed operations in its body plant here, giving employment to 200 men. The Standard Parts Co., which has been closed for some time, expects to resume next week with a force of 150 men.

Australia Looks for Return to Buying

Improved Crops Expected to Bring Easier Conditions—Favor British Products

SYDNEY, NEW SOUTH WALES, Jan. 28—(Special Correspondence)—Automobile trade in New South Wales has slowed up seriously since last October because of the expectation of a fall in prices. Many prospective purchasers canceled their orders and prospects have been hard to find. The one encouraging factor in the situation is that there are comparatively small stocks on hand in Australia and the supply on hand will not last more than four months even with the few sales now being made.

The shortage of stocks is due to cancellations by dealers when the buyers' strike began, and further cancellations resulting from inability to remit payments because the banks could not sell Australian drafts. Added impetus to cancellations was given by the expected advent of European cars. The Government and newspapers have urged that English goods be pushed for patriotic reasons and this has had its effect.

Purchasing power in Australia has been limited because of short crops for the past few years resulting from droughts. The drought has now broken, however, and it is expected that many persons who have been clinging to their dilapidated motor vehicles will soon be in the market for new cars. A marked increase in business is expected by May or June if prices become firm.

Another serious factor is the high price of gasoline, which is now selling at $1 a gallon. There is slight probability of production of gasoline in this country in the near future.

While motor trucks are not popular in Victoria and South Australia, there is a good market for them in New South Wales, which has more of them than all the rest of Australia put together.

Truck Manager Finds Service Methods Wrong

NEW YORK, March 4—Manufacturers, dealers and service men alike were criticised last night by C. R. Collins, general manager of the National Association of Commercial Haulers, in an address before the Automotive Service Association of New York. He cited many instances to prove that the service is not satisfactory and told of the growing installation of private repair shops by large fleet owners and of the associations of passenger car and small truck owners, maintaining cooperative shops.

Collins said that if service conditions do not improve materially, some system such as the English and Continental guilds will step into the place and all purchases and repairs will be made collectively and without the necessity of the middleman.

Trucks Gain Trade As Railroads Slump

New England Shippers Find Rail Lines Inefficient and Rates Unsatisfactory

BOSTON, March 5—It has been admitted that Boston business houses have been driven to the use of motor trucks because of the breakdown of the railroad transportation system in New England.

Action by the board of directors of the Boston Chamber of Commerce in voting to ask an investigation of New England railroads by the Interstate Commerce Commission, and that of the executive committee of the New England Traffic League in sending an open letter to the directors of the New England roads calling for the removal of heads of these companies, created a decided stir in railroad circles yesterday.

While both organizations aim to bring about the same result—a more efficient handling of New England railroads—they have adopted different methods, the former making its appeal to Washington, whereas the Traffic League wants to deal directly with the directors of the roads.

Both organizations set up the claim that there should be an inquiry as to whether the roads are being operated efficiently and economically.

Speaking through the transportation committee of the Associated Industries of Massachusetts, which is the clearing house for more than 1600 interests in this State, the industrial forces of the Commonwealth have emphatically declared that the proposed 10 per cent advance in steam railroad rates will not solve the railroad problem for New England.

In a statement issued to-day by the committee, of which W. P. Libby, traffic manager of the Plymouth Cordage Co. of Plymouth is chairman, the Associated Industries of Massachusetts said:

"The Associated Industries of Massachusetts has learned that 250 industries are now using motor trucks in competition with the railroad, and this results in a net loss in revenue to the New England railroads of approximately $2,000,000. The 1914 census of manufacturers shows that there are in New England 19,660 separate and distinct industries, and this may possibly furnish a proper basis upon which to estimate the total net revenue loss to our New England railroads.

"The investigation of the motor truck competition reveals the fact that there are hundreds of instances of great differences in costs. A few of the items are as follows:

"Boston to Lynn, shoe findings, railroad rate 34½ cents, motor truck rate 22 cents.

"North Dighton to Boston, textiles, railroad rate, 37 cents, motor truck rate 35 cents.

"Boston to Fitchburg, confectionery, railroad rate 46 cents, motor truck rate 40 cents.

"Lowell to Boston, the railroad rate on the first three classes comprising thousands of articles ranges from 31 cents to 46 cents per 100 pounds, while the truck rate ranges from 30 to 40 cents.

"These specific instances are much more impressive in consideration of the fact that the motor truck rates in every instance include store door pick-up and delivery service, whereas to the rail rate must be added for the same service a surcharge of from 15 to 25 cents per 100 lbs. or per package for delivery.

"Another factor that should also be taken into consideration is the fact that the average saving in time by truck transportation as against railroad service on 144 routes is 44.65 hours per route.

"It is no secret that there is a movement on foot to establish motor truck and steamship service on points such as Bridgeport, New Haven, New London, Providence, Fall River, New Bedford, Boston, Beverly, Portsmouth, Portland, Bangor, etc. The establishment of such service in co-ordination with the truck lines from the important industrial centers will have a disastrous effect on the revenues of the railroads."

Reduction of labor costs, these Bay State industries claim, is the only relief for New England railroads.

African Gold Coast in Market for Trucks

OTTAWA, ONT., March 4—Writing to Ottawa from the Gold Coast Colony, West Africa, Canadian Trade Commissioner W. J. Egan states that the colony will shortly be in the market for motor lorries. The standards required are to carry a load of ½ ton and 1 ton. The total weight of the lorry and one ton freight must not exceed 5000 lb. while the ½ ton capacity motor lorry is naturally expected to weigh less.

The price set by the Government is from $2000 to $2500 but they may consider $3000 if necessary.

If the running mechanism is such that a speed of not over 15 miles per hour can be made this will be a strong recommendation. A certain lorry has been in use but the desire of the authorities is to get a lorry better suited to their needs than the present one, that is, one that will stand up against the strain of a tropical country and give a reasonable time of service. Drivers are raw natives so a fool-proof style of lorry is necessary and if the proper car can be introduced this will be made a standard and as the transport of the country is very largely motor, orders for vehicles would amount to hundreds each year.

Orders will be placed in April this year and prices of spare parts and the capacity of the factory should be given with any other particulars thought advisable.

FORD CLEANS OUT GROCERIES

DETROIT, March 4—Ford Motor Company is liquidating the stock of groceries and will discontinue its grocery store as soon as stocks have been exhausted. The shoe, clothing, drug and meat stores, however, will be continued. Mr. Ford assigns his reason for closing the grocery to rapid downward trend of grocery prices.

N. A. C. C. Points Out New Truck Markets

School Consolidations Necessitate Vehicles for Pupils—Rail Rates Make Business

NEW YORK, March 4—Twelve thousand consolidated rural schools in the United States are using vehicles for transporting pupils. About half the equipment is motorized and the remainder horsedrawn. The National Automobile Chamber of Commerce has sent a bulletin to its members pointing out the sales possibilities in this field. It is pointed out also that 194,000 one-room schools not yet consolidated, promise a future motor vehicle market. Pennsylvania now has under consideration 275 new consolidations.

The use of motor vehicles for consolidated schools has been urged by P. P. Claxton, United States Commissioner of Education. The bulletin explains that J. C. Muerman of the United States Bureau of Education has provided the following suggestions on body styles:

1. Top ventilators are desirable.
2. Preferable to have driver's seat in the same compartment as passengers, so that he can keep control of children.
3. As much weight as possible needed on front wheels. Present tendency is for large school buses to have too much weight on rear wheels.
4. Two exits important, in case of fire, capsizing, or stalling in drifts.
5. Where four rows of seats, running lengthwise of bus; are provided, ample aisle space should be allowed, using maximum possible width of body.
6. Upholstery—if not too expensive, removable khaki upholstery over leather or leatherette would be preferable to plain leather currently used, as the khaki could be removed and washed.

Another bulletin sent out by the motor truck committee of the N. A. C. C. states that if railroad rates are further advanced in Massachusetts, 532 members of the associated industries of that State have stated that they would use motor trucks exclusively. In many cases this would necessitate new fleets.

A survey recently completed by the truck committee shows that 2765 Maryland farmers are using trucks. A similar survey in Kentucky indicated that there was a real need for more trucks in 13 counties.

BRITISH TO TEST TRACTORS

LONDON, Feb. 8—(*Special Correspondence*)—The 1921 British tractor trials will be conducted by the Society of Motor Manufacturers and Traders and regulations and entry blanks are now being published. One of the features of this year's demonstration will be fitting a recording dynamometer to every tractor in the field, which dynamometer will be carried throughout the demonstration. A special machine has been designed for which world patents are claimed.

Citroen Cuts Price to Absorb Taxes

Takes Action as Protest to Government — French Market Poor—Finances Easier

PARIS, Feb. 16—(Special Correspondence)—Citroen has made another cut of 10 per cent in the price of his cars, thus bringing the price of the four-seater down to 14,310 francs. The sedan is listed at 21,600 francs. This cut is made in the form of a 10 per cent discount to cover the luxury tax applied in France on all automobile sales. Instead of this tax being paid by the client, Citroen now pays it for the client, and makes use of this publicity to protest against the Government tax.

Citroen still holds the position of marketing the cheapest car of French construction on the market. Renault, who is now in direct competition with Citroen, with a four-cylinder 10 hp. four-passenger model, officially maintains his price at 21,000 francs, but as dealers hold stocks, sales are often made at 16,000 francs, and sometimes a little lower.

Since the new year the revival of business on the French market has been very slight. There is an impression abroad that further price reductions may be expected shortly, and because of this the public is holding off. De Dion Bouton is contemplating a cut of 4000 francs, thus dropping the price of the 10 hp. model from 21,000 to 17,000 francs. Price reductions up to the present have not given the results that were expected. In the case of Ford, who initiated the movement in France, there was no result at all.

A net profit of 7,126,383 francs for the year 1920 was declared at the annual meeting of the Lorraine-Dietrich Co., compared with 12,379,127 for the year 1918-19. This concern has two independent branches, the factory at Luneville being interested chiefly in railroad material, and the works near Paris producing automobiles.

The automobile program of the company consists of a 15 hp. 6-cylinder automobile of high grade, but laid out with a view to cheap quantity production. Although the car was shown at the automobile exhibitions more than a year ago, production has not yet begun.

Schneider to Make Tractor

The Schneider Co. at Le Creusot, the biggest armament and general engineering concern in France, has secured a predominating control of the Brasier Automobile Co. It is intended, under the new management, to continue work on the new Brasier factory at Grenoble, where the four-wheel drive Pavesi tractor will be built. This factory was begun during the war by a group of French automobile manufacturers, and was used by them for the production of aviation engines. As hydroelectric power is readily and cheaply obtained in this district, it was decided to extend the works after the armistice and undertake tractor construction. The Pavesi machine is of Italian origin, and is now being built at Grenoble under license. The French car department has approved this type of tractor and has placed orders for a certain number.

The Zebre Automobile Co. being in financial difficulties, a meeting has been called to consider the advisability of either winding up the concern or reorganizing it under new management.

Recall Dealer's Sales Rights

The automobile department of the French company of Gaston, Williams & Wigmore has practically ceased to exist. This firm had exclusive selling rights for Voisin cars, a monopoly of the sale of G. N. cyclecars on the Continental market, and through its subsidiary company, Gaston, Ltd., had the Citroen exclusively in Great Britain.

Voisin has decided to do his own marketing. The commercial service of the G. N. cyclecar is being handled by the Salmson company, builders of this machine, and Citroen will very shortly open up his own English selling organization. Voisin is completing tests of a high-grade 12-cylinder automobile, which probably will be uncovered to the public at the next Paris show.

Daimler to Re-enter French Car Market

PARIS, Feb. 18 (*Special Correspondence*)—The arrival of directors of the Daimler Motoren Gesellschaft of Stuttgart of this city leads to the belief that the leading German automobile company is about to re-enter the French market. The German Daimler Co. possesses handsome showrooms in the Avenue des Champs-Elysees, Paris, and is entitled to take possession of them. At the present time these buildings are being used temporarily by a philanthropic organization for the benefit of French soldiers. The Daimler workshops and spare parts depots, at Suresnes, in the suburbs of Paris, were pulled down during the war and the ground used for an extension of the French arsenal.

Up to the present no German automobile firm has sought to get on the French market by direct representation. The Benz Co. of Mannheim has a dealer in France, but he has not yet received cars for sale. The Bosch Magneto Co. of Stuttgart has a selling organization in Paris and is doing a small amount of business in magneto and lighting sets.

Report Ford Has Sold Canadian Interests

DETROIT, March 10—Confirmation is not obtainable of a report that Henry Ford has sold his Canadian interests for $4,000,000. The report has it that the sale includes rights in all British possessions except England, Scotland and Wales. Neither Henry Ford nor Edsel Ford could be reached to discuss the report.

United States Ships 1516 Cars to Belgium

Exports for Year Surpassed Only by France—Higher Tariffs Urged for Protection

BRUSSELS, Feb. 15 (*Special Correspondence*)—In 1913 Belgium imported 1100 automobiles and exported 3100. During 1920 the imports were 4468 complete cars and chassis, and the exports 1729 cars and chassis. France did the greatest volume of business with Belgium, the number of vehicles being 1647, composed of 1061 complete cars and 586 chassis. America came a close second with a total of 1516, of which 1380 were complete cars and 136 were chassis. Germany sent 528 automobiles into Belgium last year. Great Britain was Belgium's best client, for during the year she took 352 complete cars and 256 chassis. Holland was the next best customer.

Country	Exports from Belgium		Imports into Belgium	
	Complete Cars	Chassis	Complete Cars	Chassis
Germany	7	20	466	62
United States	4	3	1380	136
France	95	62	1061	586
Great Britain	352	256	120	38
Italy	2	7	235	234
Spain	127	..	..	..
Holland	225	..	55	..
Portugal	134	..	..	..
Other countries	253	191	87	8

The Belgian industry is divided, at the present time, into two hostile camps. Importers, for the most part representing French and American firms, are using all their influence to prevent the Government increasing the import duties on automobiles, while the manufacturers are sparing no effort to get Government protection, in the form of increased duties, against foreign competition. The present Belgian import duty is 240 francs per 100 kilos, compared with 80 francs before the war.

Manufacturers claim that as the weight of cars has not increased, while their value has tripled at least, the percentage is no higher now than it was in 1914. A high-class foreign car catalogued at 30,000 francs pays about 2400 francs import duty, being equivalent to 8 per cent of its value, which is the same percentage as in pre-war days. On this account the manufacturers of Belgium claim that they should be given a 45 per cent ad valorem import duty.

A Government decree on this subject is now in preparation, but it is not known whether the new duty will be 33½ per cent, as in England, or 45 per cent as in France.

INDIA INCREASES CAR TARIFF

WASHINGTON, March 8—According to a cablegram from Consul General A. W. Weddell, Calcutta, under date of March 1, the Government of British India has increased the duty on automobiles from 7½ per cent ad valorem to 20 per cent, effective March 1.

Many Plants Place Orders for Parts

Hold Over Shipments Released for Delivery—Better Action on Payments

NEW YORK, March 7—Indisputable evidence of improvement in business conditions was given at meetings of groups A and B of the credit department of the Motor and Accessory Manufacturers Association held on the same day at Cleveland and New York. Upon request from headquarters, members attending were prepared to give information regarding the placing of new orders, release of shipments on old orders, collections as compared with the previous month and production of cars. It was disclosed at the two meetings that the following manufacturers have placed orders for new material in varying quantities:—

O. Armleder Co.
Briscoe Motor Corp.
Jas. Cunningham Son & Co.
Dort Motor Car Co.
Elgin Motor Car Co.
Ford Motor Co.
Franklin Mfg. Co., H. H.
Gardner Motor Car Co.
General Motors Corp. (Buick Div.)
General Motors Corp. (Cadillac Div.)
General Motors Corp. (Sheridan Motor Car Co.)
Gramm Bernstein Motor Truck Co.
H. C. S. Motor Car Co.
Haynes Auto Co.
Hendee Mfg. Co.
Hupp Motor Car Corp.
International Motor Co., Inc.
Lincoln Motor Co.
Locomobile Co.
Maxwell Motor Co.
Moon Motor Car Co.
Nelson Motor Car Co.
Reo Motor Car Co.
Studebaker Corp.
Stutz Motor Car Co.
Yellow Cab Mfg. Co.

Releases of shipments on old orders were reported as being received by members from the following:

Acme Motor Truck Co.
Auburn Auto Co.
Autocar Co.
Briscoe Motor Corp.
J. I. Case Threshing Machine Co.
Chandler Motor Car Co.
Chevrolet Motor Co.
Cleveland Automobile Co.
Commercial Truck Co. of America.
Day-Elder Motor Corp.
Diamond T Motor Car Co.
Dodge Bros. Inc.
Ford Motor Co.
Franklin Mfg. Co., H. H.
General Motors Corp. (Buick Div.)
General Motors Corp. (Cadillac Div.)
General Motors Corp. (Oakland Div.)
General Motors Corp. (Olds Div.)
Graham Bros.
Grant Motor Car Corp.
H. C. S. Motor Car Co.
Hudson Motor Car Co.
Hupp Motor Car Corp.
Liberty Motor Car Co.
Lincoln Motor Co.
Locomobile Co.
Mercer Motors Co.
Moon Motor Car Co.
Nash Motors Co.
National Motor Car & Vehicle Co.
Northway Motors Corp.
Packard Motor Car Co.
Pierce-Arrow Motor Car Co.
Reo Motor Car Co.
Standard Steel Car Co.
Stevens-Duryea, Inc.
Studebaker Corp.
Templar Motors Co.
Walker Vehicle Co.
Ward Motor Vehicle Co.
White Co.
C. H. Wills & Co.
Yellow Cab Mfg. Co.

The quantities reported in both instances vary quite materially, as do the number of members with whom new orders or releases have been placed.

A report prepared by C. A. Burrell, manager of the credit department, says:

"As regards payment of accounts to our members, there seems to be comparatively little change from their experiences during January. In but few instances are accounts being paid in full, when due, or even for some time after due date. In the great majority of instances paper is being offered in settlement of accounts and being renewed in whole or in part when it becomes due. There does, however, seem to be a tendency to take care of accounts, either by partial payments and note or by all paper, somewhat more promptly than during the last few months.

"Members of the groups generally report a better condition of affairs than existed before the first of the year, and the prevailing tone seems to be more optimistic. Reports made by those who have endeavored to arrive at a percentage seem to indicate that business is ranging about 20 per cent to 33-1/3 per cent of what might be considered normal, though the latter figure is probably somewhat high.

"Labor conditions show no material change. Manufacturers in many instances are doing their level best to furnish as much employment as possible for their help, in some cases alternating between different groups of employees in an effort to satisfy all as nearly as possible."

Zeppelin Negotiates for French Financing

NEW YORK, March 4—Advices from London say that great indignation has been aroused in Germany by the report that negotiations are in progress for a French company to acquire a controlling interest in the Zeppelin company.

In the course of an interview, Director Coleman of the Zeppelin company states that his company reluctantly arrived at the conclusion that it can no longer exist as a purely German enterprise, and that it was essential that it should be converted into an international organization.

With that end in view he admitted he was in negotiation with a French company in Paris, but the negotiations have not yet advanced beyond the preliminary stage.

A. E. A. TO MEET MARCH 30

CHICAGO, March 7—The Automotive Equipment Association has called a meeting of its directors and membership committee to be held at the Congress Hotel, March 30 and 31. The meeting will be equally divided between jobbers and manufacturers, and separate sessions will be held to confer on questions of interest to them, after which a joint session will be held to discuss constructive measures. Questions taken up in a preliminary way will be further discussed at the June meeting.

Moock Seeks Ideas on Car Chautauqua

Manufacturers' Aid May Be Asked to Defray Expenses of Dealer Education

ST. LOUIS, March 7—A motor vehicle Chautauqua to educate small town dealers in all phases of their business has been proposed by Harry G. Moock, general manager of the National Automobile Dealers Association, and he is now getting the ideas of leaders in the industry on the subject as well as gathering data which would be of value in putting his plan into effect.

It is Moock's idea that there are thousands of dealers in the smaller towns who never have had a chance to learn the most modern methods of conducting their business, such as cost systems and the latest idea in salesmanship. He proposes to hold sessions of the Chautauqua at the principal distributing centers and make the sessions available to all dealers upon the payment of a nominal fee which would insure their interest in the courses provided.

If the plan is put over, a faculty of experts in all branches will be provided for the traveling university. They would be qualified to teach service, accounting and selling. Their lessons would bring out the most advanced ideas in all branches of the business and it is believed dealers would get knowledge and ideas which would prove invaluable to them.

No definite plan has been worked out for financing the project, but it is believed the manufacturers would be sufficiently interested in the project to help defray the expenses. The returns they would receive from the increased selling ability of their dealers, it is believed, would recompense them many times over for any expenditure they might make in this direction.

DEALERS DISCUSS CONTRACTS

MACON, GA., March 4—Dealer contracts and franchises under which they sell automobiles and motor trucks comprised one of the principal subjects discussed at a meeting here of automobile dealers from 20 Georgia counties surrounding Macon. An open discussion relative to plans and methods of selling used motor cars was also an important feature of the meeting, the dealers of the various towns exchanging their ideas.

NAME FINANCE DIRECTORS

BOSTON, March 5—Complete new directorates for the Mutual and Commercial Finance corporations, the automobile finance companies promoted by the H. V. Greene Co., have been elected at adjourned annual meetings of the two concerns. The new directors are Patrick F. Sullivan of Lowell, Samuel L. Powers, Gen. John H. Sherburne, George A. Rich and Guy W. Currier. Arthur R. Stubbs was elected treasurer.

Tax Removal Helps Ontario Business

Demand for Cars Follows Removal from Luxury Classification—Reserve Stocks Low

TORONTO, March 8—The motor business in this city and throughout the Province of Ontario has improved perceptibly during the past month. January business was not more than 60 per cent of January, 1920. The selling season here opened in February and this year the open winter has been a needed stimulant.

One factor that has contributed to stimulation of sales was the removal of the luxury tax, which removal is equivalent to a very pronounced price reduction. On the Cadillac touring car the removal of the luxury tax has reduced the price from $7,300 to $6,475. On a Chevrolet model 490 the reduction is approximately $125. The reduction of the Roamer touring car is from $5,875 to $4,950. Some of the Ontario distributers have been compelled to absorb the luxury tax as they had paid it on cars purchased but which were not sold when the tax was removed. In some instances the manufacturers have shared the absorption of the tax with the dealers on a fifty-fifty basis.

The Toronto dealers were not overstocked with cars when business opened in February. Recently Cadillac sales have been 60 per cent of a year ago on closed cars, and 40 per cent on open cars. In February Franklin business approximated 50 per cent of normal. Motor trucks started selling in February, the comprehensive highway program which has been under way for two years serving as a good stimulant. The Packard branch has made recent sales to industrial organizations, as well as to organizations engaged in highway construction.

The Hyslop organization, selling Cadillacs for the province, and also having a large accessory department with salesmen traveling all of Ontario, has found accessory business is approximately 100 per cent. Increased sales effort has been necessary to keep it at this figure.

Expect 65,000 Output in 1921

Robert H. Combs, operating the Prest-O-Lite Co. of Canada, Ltd., and the National Carbon Co., which manufactures Prest-O-Lite batteries for Canada, and Columbia dry cells, estimates that 80,000 motor cars were built in Canada in 1920, and that Canada has factory capacity for 150,000 automobiles per year. The production of Canadian factories for 1921 is problematic but Combs believes it will approximate 65,000 vehicles, which is 15,000 less than last year.

The leading factories producing in Canada are Ford, McLaughlin, Chevrolet, Willys-Overland, Grey-Dort, Studebaker, Maxwell, Briscoe, Chalmers, and two smaller concerns. Ford has capacity for approximately 100,000 cars per year, and estimates on the capacity of some of the others are: Grey-Dort 15,000; Chevrolet, 12,000; McLaughlin, 10,000; Willys-Overland, 10,000; and Studebaker, 3500.

There are in Canada four truck manufacturers with whom business is slow.

The Prest-O-Lite Co. of Canada, and the National Carbon Co. are located in a new factory finished a year ago. It is a modern plant in every respect, fitted with production machinery. The dry cell factory is working at 100 per cent and the starting and ignition battery department at 40 to 50 per cent.

The tire business in Canada has been slowed down practically the same as in the United States. This applies to the Goodyear Tire & Rubber Co., the Dominion Rubber System, which is the United States, Dunlop Tire & Rubber Co., and the Gutta Percha Rubber Co. Firestone is building a new factory in Hamilton.

Durant to Try Out Experimental Cars

NEW YORK, March 8—W. C. Durant expects to have completed by the last of this month the experimental cars which will be given thorough tests before they are put in production by Durant Motors, Inc. No details regarding them have been made public but it is understood there will be two models, the lower priced of which will sell at less than $1000.

While many cities are hoping they will get one of the Durant factories no statement in regard to locations has been made since the decision to locate one in Flint and another on the Pacific coast. Even the Flint site has not been settled upon.

Durant Motors stock is now quoted on the curb market at around 20 and it is understood there will be another issue of 100,000 shares of no par value common at $20 a share.

Production and distribution personnel are being built up. The latest announcement is that Roland T. Meacham of Cleveland has been appointed Ohio representative.

Receiver Seeks Consent to Forge Company Sale

CLEVELAND, March 7—Creditors and stockholders of the Forest City Machine & Forge Co. have been directed to show cause March 19 why the receiver, Francis W. Treadway, should not sell all the assets of the company to I. T. Kahn of Cleveland who has offered $300,000 for them. An appraisal made last June fixed the value of the assets including land, buildings and machinery at $740,802.

The total liabilities of the company are $352,195. There is a first lien of $57,500 against the property on the purchase price of the land as well as a mechanics lien for $14,462 and receiver's certificates amounting to $15,000. If Kahn's offer is accepted, there will be about $200,000 for distribution among the creditors. The receiver states that all attempts at reorganization have failed and that he has been unable to get any other offer for the property.

Congress Condemns Army Car Purchases

More Assertions of Wasteful Methods Made—Attack Contracts Recently Signed

WASHINGTON, March 8—Bitter partisanship marked the final report of the House Select Committee on Expenditures in the War Department, in which the policy pursued by the Secretary of War in the purchase and sale of automotive equipment used by the American Expeditionary Forces is condemned. The Committee contended that its inquiry "shows the power wielded by the motor industry, or a part of it at least, through the War Industries Board, was disadvantageous to the interests of the Government in time of war."

The majority report charges that material worth millions of dollars was wasted and misapplied, that the War Department failed to provide adequate motor equipment for the overseas forces, that thousands of automobiles and trucks were wrecked because of the lack of spare-parts, that tires valued at from $3,000,000 to $20,000,000 were left to rot at one place alone, that no American-built tanks reached the front, and that the War Department paid excessive sums for motor equipment. The Graham Committee denounces the policy pursued by the Secretary of War in still purchasing trucks.

The Graham Committee was divided along party lines. The minority report contends that the report of the majority is biased, erroneous, and totally misleading. They point out that mistakes were inevitable in the great war and that the majority gives no recognition to the accomplishments of the Army. The minority claims that "the majority ignored the fact that it is in evidence in the record that the shortages (in motor transport equipment) were primarily due to the lack of adequate sea transportation."

In this public denouncement which the committee will undoubtedly spread broadcast, an attack is made upon the Secretary of War for his approval of an order in February, 1920, over the objection of the Quartermaster General, for the purchase of 75 trucks, known as the "Militor," at a cost price of $8,000 each, totaling with additional tires and spare parts, $726,000.

The committee further insists that the War Department "has paid out to the Militor corporation a total of $1,280,213 for 75 trucks, whereas the same company offered to produce 500 trucks for only $274,000 more. Eighty-one Militor trucks are to cost $2,063,903.20.

LOUISVILLE STARTS SALES

LOUISVILLE, March 7—Though sales during the week of the thirteenth annual automotive show were about 50 per cent less than last year, according to conservative estimates, they have increased since the close and a general revival of trade is in progress.

February Production Shows Large Gains

Shortage of Materials in Two Factories Prevents 40 Per Cent Increase

DETROIT, March 9—Indisputable evidence of the upward trend of the automotive industry is reflected in the step-up in production in Detroit territory during February as compared with January, reports showing a total production in February of 53,040 against 14,615 the previous month. These figures include 31 factories in Detroit and Michigan, and Willys-Overland and Knight plants in Toledo.

What appears to be an increase of approximately 38,000 in the February figures, includes Ford production in Highland Park and branches, totalling 35,000 cars and trucks, about 10 per cent of which were trucks. With the Ford figures eliminated, increase in February was 3425. Ford figures were not included in the January totals because the Highland Park plant was closed, although, according to a statement by Henry Ford, approximately 30,000 cars and trucks were assembled in the assembly branches.

The increase was general throughout the territory, though sharp decrease has been noted in the figures of two of the largest producers, due to various causes. This prevented what otherwise would have been an increase of about 40 per cent in production over January. The instances of decrease were not due to recession in demand, but rather to lack of certain materials, lack of complete working organization due to employees having left when depression became acute, unbalanced inventories which forced certain departments to remain idle while others were working steadily, and similar handicaps brought about by the long period of depression.

March to Extend Increases

That March production will be far ahead of February, with all indications pointing to steady improvement, is certain, in the opinion of leading manufacturers who already have started out on greatly increased schedules. Studebaker plants, which were building 525 of the larger cars in the Detroit plant each week during the first part of February, closed the month with a total in Detroit of 2500 and started in March 1 on a schedule of 665 weekly. The plant has not taken all the men back, but rather increased working time to five days a week instead of four. A schedule of five and a half days will be entered on April 1.

Paige production in February jumped to approximately 63 per cent of normal, and the plant is now operating on a 75 per cent production basis, or about 72 cars daily, according to President H. M. Jewett. The big demand for cars, Jewett said, necessitates a gradual step up until it will be the greatest output in the company's history by April 1. It is expected to hit normal, 90 to 100 cars daily, in a few days. Paige is building trucks only on orders, though Jewett reports the truck end as "showing signs of life."

Packard reports good sales demand, and they are adding to the working force each day. Vice-President Roberts says trucks are moving and activity in that end will increase steadily. The company produced about 30 per cent of normal in February. The Dodge plant is still down and officials have not announced the opening date.

Reo is again working 4000 men full time and 1000 half time. The plant built about 2100 cars and speed wagons during February in ratio of three speed wagons to one car. The company is now producing about 75 per cent of normal—approximately 120 daily.

Hupp built about 700 cars in February and has started on a schedule of 1000 for March. Officials report a steady improvement.

Buick is working 65 per cent of the normal force full time and building about 200 cars daily. One thousand seven hundred cars went to owners in January and 2900 cars in February, with prospects for March of double that total, according to A. B. Batterson.

60 Per Cent for Olds

Olds built about 60 daily in February, chiefly smaller cars. This work jumped to 90 daily, yesterday's output, which is about 60 per cent of normal. Dort is moving conservatively, and while dealers report many prospects and improved actual demand, production will be increased slowly and in keeping with sales. The company built 700 cars in February.

Chevrolet is working a full force part time and during February produced around 85 cars daily.

The Hudson-Essex February output was about 15 per cent of normal.

Exports of Automobiles, Airplanes, Trucks, Farm Tractors, Motorcycles and Parts for January, 1921, and Seven Previous Months

	Month of January				Seven Months Ending Jan.			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	2	$29,180	17	$114,775	36	$162,480	53	$216,955
Airplane Parts..	..	43,060	..	24,499	..	215,266	..	108,310
Commercial Cars	1,720	2,726,264	1,561	2,516,639	9,785	19,555,452	14,406	24,543,916
Motorcycles	2,398	664,288	4,322	1,473,390	16,365	4,513,391	29,101	6,529,061
Passenger Cars.	8,004	8,977,926	5,819	6,893,541	48,203	52,523,854	73,007	90,311,365
Parts, not including engines and tires......	..	4,649,192	..	9,679,295	..	27,337,219	..	52,272,843

Engines

	Month of January				Seven Months Ending Jan.			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas.	3,259	$539,269	231	$65,691	20,867	$3,145,669	9,007	$1,641,046
Marine, gas.....	657	1,826,497	792	307,466	5,339	1,912,586	4,858	1,863,063
Stationary, gas..	2,058	291,821	2,707	612,842	15,562	2,096,982	19,675	3,684,035
Tractor, gas.....	1,678	1,481,949	1,578	1,730,974	10,175	9,124,933	12,368	12,035,004
Total	7,652	2,495,536	5,308	2,716,973	51,943	16,280,170	45,908	19,223,148

Banks Would Combine All Willys' Interests

NEW YORK, March 9—Bankers' committees for the Willys Corp. and the Willys-Overland Co. are working together to adjust the closely interwoven affairs of the two companies. Considerable progress in this direction already has been made. While the greatest reticence is maintained, it is understood that nine-tenths of the bank creditors already have agreed to an extension of time for the payment of loans. In the case of the Willys Corp. this extension would carry maturities to May 1.

While the banking interests identified with the two companies are by no means identical, it is understood that they are in practical agreement on what should be done. So far as can be learned, their program calls for a consolidation in one corporation of all the interests with which John N. Willys is identified.

No More Mails for Car Speed Contests

WASHINGTON, March 9—Automobile manufacturers and dealers staging speed and endurance contests in the transportation of mails will not be permitted to carry postal matter without advance authority in each case from the Post Office Department. An order was issued here to-day by Otto Praeger, second assistant postmaster general, advising postmasters throughout the country that no dispatches of mail matter for tests or experimental purposes involving automobiles, airplanes, or other vehicles will be permitted without special authority.

Complaints have been made to the Postmaster General that persons presenting themselves to be employees of the postal service have applied to postmasters for mail matter to be dispatched on certain test trips of automobiles, and also for mail equipment.

INDUSTRIAL NOTES

Dwight P. Robinson & Co., Inc., engineers and constructors of New York, has opened branch offices in Montreal in the Dominion Express Building. Alexander C. Barker, vice-president, is in charge of the office.

Hunter Motor Car Co., which recently purchased a site at Harrisburg, Pa., will begin production of passenger cars about July 1.

Auto Specialties Co., St. Joseph, Mich., has bought the patents of the Burgess Shock Absorber Co. and, after completing improvements of the plant, will enter upon the manufacture of shock absorbers.

American Broach & Machine Co., Ann Arbor, Mich., is building an addition which will permit of employment of 60 men in addition to the present factory force of 40.

Independent Pneumatic Tool Co. has moved the location of its Pittsburgh office to 718 Bessemer Building.

Michigan Copper & Brass Co., Detroit, is working on a production 15 per cent of normal.

A. C. Mannweiler Lamp Co., Fort Wayne, Ind., has changed its name to the Anthony Wayne Lamp Co. and has moved to a new location. Additional equipment has been installed and the company is now in a position to manufacture large lamps of all types.

Rauch & Lang Occupies New Chicopee Factory

SPRINGFIELD, MASS., March 4—Rauch & Lang, Inc., now are settled in their new factory located on a 14 acre tract at Chicopee Falls. The plant is entirely new and was built and equipped especially for the manufacture of the Rauch & Lang electric automobile. It has approximately 100,000 ft. of floor space on one floor of brick and steel saw tooth construction with an open area 30 x 32 ft. between posts. Construction engineers have declared the plant one of the best in the country for the manufacture of automobiles.

Bodies are being built by the Baker Rauch & Lang Co. of Cleveland, but the chassis parts are being manufactured almost entirely at Chicopee Falls. The company reports that the number of orders coming in exceeds expectations and it looks for a good spring business.

Dodge Power Plant Ready for Service

DETROIT, March 4—The new $3,500,000 power plant, one of the units in Dodge Brothers $8,000,000 expansion plan, has been completed. The power plant was built by the Dodge Brothers construction department entirely and safeguards the factory against future emergency such as the breakdown of the Detroit Edison plant last year, upon which practically all Detroit factories were dependent. The power plant is designed for an installed capacity of 40,000 K. W. and requires approximately 25,000 gal. of water a minute for each 10,000 K. W. unit.

In the absence of a natural water supply near the factory or space sufficient for establishing a cooling reservoir, it became necessary for Dodge Brothers engineers to construct a water tower 146 ft. long, 32 ft. wide and 104 ft. high. This mammoth tower is capable of cooling 18,000 gal. of water a minute from a temperature of 105 to 85 degrees when the outside temperature is 72 degrees and the relative humidity 60. It makes possible the repeated use of the same supply of water with a loss of only 5 per cent due to evaporation. The tower is of substantial type and is capable of withstanding a wind velocity of 90 miles an hour.

Equally remarkable in connection with the power plant is the fact that no coal will be shoveled in and no ashes shoveled out, as everything is to be operated automatically. A car dumps the fuel cargo into a hopper and another car comes along and receives a load of ashes.

Reo Sales Company Wins Appeal in Patent Suit

DETROIT, March 7—The United States Circuit Court of Appeals for the second circuit has handed down a decision in a suit brought by William Barber against the Otis Motor Sales Co. of Utica, N. Y., declaring that the valve gear used in automobiles manufactured by the Reo Motor Car Co. does not infringe the Barber patent. It was also held that the Barber patent itself was invalid. This litigation has been pending since 1915 when Barber brought suit against the Reo distributor in Utica and won the case under such circumstances that he claimed that the decree of the Federal court of that district was also binding upon the home corporation at Lansing, Mich.

Barber's decree was affirmed by the United States Circuit Court of Appeals, but Barber then started suit against the Reo Motor Car Co., Inc., of New York, evidently under the misapprehension that it was the parent company whereas it is only a sales organization. In this case he sought an injunction against the exhibition of Reo cars at the New York automobile show in 1917.

The New York suit was decided against him and the Michigan suit was deferred pending the outcome of the litigation in the east. In view of the apparent conflict between the two Federal courts in New York City, the Court of Appeals sent the Utica case back for a new trial. The new trial was given in January 1918 and on May 20 the Federal Court of Utica again sustained the Barber patent. The defendant again appealed and the decision of the Circuit Court of Appeals in its favor is the result.

U. S. TRUCK GUARANTEES PRICE

CINCINNATI, March 4—The U. S. Motor Truck Co. has guaranteed its prices against decrease until July 1. This announcement was contained in a letter addressed to all distributers, dealers and salesmen. The announced purpose of the company is to do its share in stabilizing the automotive industry.

METAL MARKETS

STEEL producers, with few exceptions, feel very much like the man who prepared a sumptuous feast only to have the guests whom he had bidden to his festive board disappoint him. For weeks and weeks the "independents" had been carving prices in the hope that they would bring out a crush of buyers. When the latter failed to materialize, at least one of the "independents" became sufficiently disturbed to announce an upward revision of prices "to meet those of the U. S. Steel Corporation." For all that, it is admitted in all quarters of the steel industry that further downward readjustment of values is certain to come in due time. It is deplorable, however, that orderly progress in this direction is being retarded by what old-timers in the steel market call the chronic aversion of buyers to placing orders in a declining market. It is quite possible that steel prices will present still more of a crazy quilt in point of variation between the different interests before liquidation in production as well as in values has run its full course. This liquidation, which has not yet been completed in steel, appears to be an accomplished fact in the pig iron market, where output of merchant furnaces is now less than 40 per cent of capacity. In the Middle West, strikes in union foundries are impeding the quickened flow of pig iron from blast furnaces to foundries, but in spite of this untoward factor and the light melt of open shops, an improvement in foundry demand is noted. Inquiry for sheets, perhaps the best barometer of conditions in the automotive industries, is improving very slowly but steadily. There has been much more activity in the market for sheet bars, non-integrated sheet mills that cater to the automotive industries and that depend for their supply of bars upon other mills now being in a position to buy at prices permitting them to compete with more chances of success for sheet business. The aluminum market remains dormant so far.

Pig Iron—Several inquiries for foundry and malleable iron from automotive foundries are in the market. Prices appear to have reached very near bottom. Recent Interstate Commerce Commission decisions, refusing suspension of higher freight rates on ores from certain mining points to Lake Superior ports, make it doubtful whether the generally looked for cut in ore prices can be made such as to lessen iron production costs materially.

Steel—Sheet bars are reported to have been sold at as low as $35. Offers of wire rods at $47 failed to find buyers. So far there has not been sufficient fresh inquiry for cold-rolled strip steel from automotive sources to bring about the establishment of a dependable market level under the changed order of things, but cold-rolled strip steel producers are in a flexible mood of mind, and, when business in worth-while tonnages is once offered, surprisingly low prices will be forthcoming as the result of genuine competition. Sheet prices continue in a state of flux, but sheet mills specializing in highly finished automobile sheets are anxious for orders.

Aluminum—Virgin ingots, 98 to 99 per cent, have been offered in the "outside" market at as low as 23c. The market is decidedly a buyers' affair.

Copper—Strenuous competition has set in between two of the leading interests and, as a result, 12½c. has become merely a basis for cutting under when business offers.

Lead—Following sales at as low as 3.75c., the market strengthened and 4c., New York, is now an inside price. Foreign competition has been eliminated.

FINANCIAL NOTES

Hayes Mfg. Co. reports a loss of $189,328.28 for 1920 in the report as of Dec. 31. This, with other deductions, wiped out the surplus and leaves a deficit of $129,936.54. The company had a surplus of $142,770.33 at the beginning of the year, from which preferred dividends of $59,468 and common dividends of $22,500 were deducted. Current assets Dec. 31 amounted to $1,109,112.25, of which $1,002,920.34 is credited to inventories calculated on market value. Current liabilities total $191,955.40. Accounts payable were $97,-614.61; accounts receivable, $98,541.01, and cash on hand, $10,150.70. Reserve for depreciation was $392,106.68. President H. H. Smith reported the shutting down of the plant had proved disastrous.

Motor Wheel Corp. report as of Dec. 31 shows total assets of $9,629,942.29. Current assets of $4,479,381.74 include inventories on hand and in transit of $2,891,822.48; notes and accounts receivable, less reserve, $868,385.66; Liberty Bonds, at market value, $54,114.85, accrued interest $2,429.87; cash and short-term bankers' acceptances $662,628.88. Current liabilities include accounts payable, $79,785.96; accrued wages, $46,699.47; accrued local taxes, $26,037.01; provision for Federal income and profits tax, $112,035.74.

Michigan Stamping Co. reports sales totalling $4,804,143.56 and profits of $441,456.06 in its annual statement. Total assets are listed at $4,352,881.19 and surplus is $316,974.71. Accounts payable total $159,892.08; accounts receivable, $664,195.64; Government bonds are listed at $172,886, land contracts at $143,487.92 and inventories, $1,346,679.85.

Stromberg Carburetor Co. has passed the quarterly dividend on common stock. The company paid a dividend of 50 cents in the December quarter. Net profits for 1920 operations, after all allowances, were estimated at $410,000, or $5.45 a share, on the 75,000 shares of capital stock outstanding.

Wire Wheel Corp of America reports net sales for 1920 as $3,234,100, as compared with $2,885,474 in 1919. Profits before deductions for patent depreciation and dividends amounted to $485,825, all Federal taxes and other depreciation being deducted. The balance sheet shows a surplus of $1,563,686.

Acason Motor Truck Co. will increase its capital stock $150,000 by the issuance of 8 per cent cumulative preferred stock in denominations of $10 a share. The issue will be disposed of through the company's connections to eliminate brokerage charges.

Atlas Drop Forge Co., Lansing, Mich., reports earnings in 1920 of $364,311.37 and total assets $935,174.07, with current assets $689,215.67. Inventory is given as $86,673.81 and reserves on Federal taxes $131,468.21.

Continental Motors Corp. has passed the quarterly dividend on its common stock due at this time. In the last quarter a dividend of 1 per cent and in the previous three-quarters 2 per cent was paid.

Hendee Mfg. Co. has declared a regular quarterly dividend of 1¾ per cent on preferred stock payable April 1.

BILTWELL LOSS INCREASES

AKRON, March 7—The State Savings & Trust Co. of Akron, and the Merchants National Bank of Massillon, receivers for the Biltwell Tire and Rubber Co. of Barberton, report a net loss of $40,000 in operating expenses since they assumed control of the plant and were named receivers on July 26, 1920.

The net loss covers the period from July 26, 1920, to February 5, 1921. Assets of the company including materials, cash and accounts receivable, total $150,-219.34 and liabilities have increased to $190,504.65. The loss consists principally of contractual obligations for raw materials, and depreciation in inventories, it is stated.

Chandler Sales Gain, Net Profits Fall Off

NEW YORK, March 4—Chandler Motor Car Co. in its report for 1920 shows gross profits of $9,440,000, which compares with $6,650,000 in 1919. Net profits after all deductions amounted to $4,213,000, equivalent to about $15 a share on the 280,000 shares of capital stock. In 1919 profits were $5,652,000, or $26.92 a share on the 210,000 shares then outstanding. The amount reserved for taxes in 1920 is $2,428,250, while the amount written off for inventory depreciation was $736,139. The company also established a loss of $165,702 during the year through the sale of Liberty bonds.

Inventories are carried at $6,524,000 in the general balance sheet as of Dec. 31, 1920, which compares with $4,302,-000 in 1919. Cash on hand increased to $940,000 from $66,541. The profit and loss surplus at the end of the year totaled $5,971,000 as against $7,225,000 in 1919. The latter total was figured before allowance for Federal taxes.

Total sales for the year were $38,757,-501.89, a gain of about $11,000,000 over the $27,866,967.13 total in 1919, said President F. C. Chandler in his remarks to stockholders. Business prospects for 1921 have shown considerable improvement, he said, since Jan. 1.

JORGENSEN POSITION GOOD

WAUPACA, WIS., March 7—Satisfactory reports on the condition of its affairs were made to the stockholders of the Jorgensen Mfg. Co. at its annual meeting. The assets total $266,397, about half of which is in cash and accounts receivable. The total current liabilities are only $20,581, including a mortgage on the property and unpaid dividends. Charles L. Bryden of Berlin, Wis., and E. H. Jones of Weyauwega, Wis., were elected to the board of directors. F. Jorgensen, C. H. Jorgensen and Julius C. Jorgensen, who have conducted the business of the company since it was organized, were unanimously re-elected.

TO LIQUIDATE INTERLOCKING

AKRON, March 10—The receivership for the Interlocking Cord Tire Co., made temporary by the local courts Jan. 17, has been made permanent, and Elihu Harpham, receiver, has been directed by the court to liquidate the affairs of the concern, which has assets not exceeding $150,000 and liabilities, including judgments held by creditors, exceeding $350,000. Talk of the formation of a new company to take over the plant is being indulged in but it was not regarded as serious by the rubber trade here.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, March 10—The inauguration of Mr. Harding and the deliberations of the Supreme Council in London last week apparently had no significant effects in financial circles. The foreign exchange market was quiet and steady, with a firmer tone toward the end of the week, while the bond and stock markets declined, but only fractionally. The Stock Exchange on last Saturday experienced the quietest day in nearly seven months. Sales for the day at 146,200 shares compared with 126,160 on Saturday, August 14, 1920.

The money market was also quiet, with call money firm at 7 per cent, and with a range of 6 per cent to 7 per cent. While funds were said to be plentiful in the call market, there were, on the other hand, few offerings in the time market, and transactions were light, with rates unchanged from the week before.

Loans of the New York Associated Banks declined $17,782,000, making a total reduction in loans since October 16 of $515,013,000. Excess reserves over legal requirements at $3,983,650 marked a decline for the week of $10,357,330. Net demand deposits increased $21,-415,000.

The ratio of total reserves to deposits and Federal Reserve note liabilities combined, for the New York Federal Reserve Bank, was the highest since last September. The ratio was 42.2 per cent, as against 40.5 per cent the week before. Total gold reserves increased $24,994,000, and total cash reserves $23,210,000. Total bills on hand declined $29,847,000, total earning assets $27,855,000, and net deposits $9,389,000.

The Federal Reserve banks as a whole continued the steady progress which was interrupted the week before for the first time this year. Re-discounts declined nearly $45,000,000, to the lowest point for the year. Gold reserves increased $22,777,000, while net deposits declined $34,800,000, and Federal Reserve notes in circulation $9,095,000. As a result, the ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against net deposits, increased from 58.1 per cent to 59.3 per cent.

JOHNSON RECEIVER APPOINTED

SOUTH BEND, IND., March 7—The Union Trust Co. has been appointed receiver for the Johnson Motor Wheel Co., which offered no objection to the appointment. The receiver was directed to carry on operations and to work up the inventory now on hand. The company has a total indebtedness of $200,000, most of it bank and merchandise claims. A creditors' committee was appointed in December and decided to accept notes payable Oct. 1, 1921, providing the company would levy an assessment against the stockholders to raise $125,000. This the stockholders refused to do.

Men of the Industry

Robert S. Wilson who has been manager of the truck tire department of the Goodyear Tire & Rubber Co. has been promoted to the position of manager of the western division with headquarters in Chicago. His territory will cover 10 states. Wilson, is a Princeton graduate, joined Goodyear in 1912. His first work was checking inventories. He became manager of the solid tire department in 1917 and with the advent of the pneumatic tire for trucks, his duties were broadened to include the entire truck tire department.

Harry Wilkin Perry has resigned as general manager of the Trailer Manufacturers Association of America. His resignation will become effective as soon as his successor has been appointed. Perry became manager of the Association when it was organized two years ago going there from the National Automobile Chamber of Commerce where he had served for eight years as secretary of the Motor Truck, Good Roads, Export and Legislative committees.

J. P. Matthews is now in active charge of the Midwest Rubber Manufacturers' Association as secretary and general manager. He was for several years general purchasing agent for the Mason Tire & Rubber Co., during the course of which employment he visited the Straits Settlements to investigate the crude rubber situation.

Robert E. Page who recently has been engaged in field organization work for the Hawkeye Truck Co. and the Nelson Motor Truck Co. and who formerly was in the foreign sales organization of Dodge Bros. has been appointed general sales manager of the O'Connell Motor Truck Co. of Chicago. He will undertake at once the building up of a national sales organization for this company.

N. H. Van Sicklen, Jr., vice-president of the Van Sicklen Speedometer Co., will be in charge of the Elgin, Ill., plant, following its absorption by Stewart-Warner. His first assistant will be Edward McDonough. George Underwood, former superintendent, retires. It has been decided to remove the sales office from Elgin to Chicago.

J. M. Dine has been appointed vice-president and general manager of the Oldfield Tire Co. of Akron. He has been identified with the rubber industry for fourteen years, first with Goodyear and then with Firestone. Other officers chosen were B. M. Robinson, secretary; H. L. Allsopp, treasurer, and M. E. Moffett, assistant treasurer.

R. H. Johnston, who has been vice-president of the White Motor Co. with headquarters in Washington, has resigned, to enter the investment banking business in New York. He formerly was manager of the White branch in New York and president of the New York Dealers Assn.

T. W. Van Sickle, for several years sales representative of the New Departure Mfg. Co., has organized the V-S Sales Co., with office at 856 Penobscot Bldg., Detroit. The company will be direct manufacturers' representatives in Detroit and Michigan territory.

W. A. Murfey, sales promotion manager of the Standard Motor Truck Co., will handle sales and service on Standard trucks direct from the factory. A large building at the factory has been set apart to house this department, and an expert mechanical staff will have charge of the work.

Harold W. Slauson, who has been in charge of the motor department of "Leslie's Weekly" for the past nine years, has joined the Kelly-Springfield Tire Co. and is in charge of the engineering service department at the main offices, New York.

W. R. Campbell, who has been acting temporarily as treasurer of the Ford Motor Co. has definitely decided not to serve permanently in that capacity and it is understood he will return to the Canadian plant of which he has been in charge for some time.

Howard W. Maxham has resigned as superintendent of automotive transportation with the American Bosch Magneto Corp. to take charge of the maintenance department at the Amesbury, Mass., plant of Gray & Davis, Inc.

W. H. Holmes, advertising manager of the Packard Motor Car Co., has left that organization and will enter the advertising agency field April 1. His resignation was tendered Monday and became effective immediately.

Archibald Black, of the firm of A. & D. R. Black, consulting engineers, Washington, D. C., has been appointed an aeronautical engineer with the United States air-mail service.

H. A. Longshore, vice-president, and Frank B. Wilson, advertising manager of the Climax Rubber Co., Columbus, have established executive offices in New York at 505 Fifth Avenue.

R. T. Walsh, formerly advertising manager of the King Motor Car Co. and later with the Apex Motor Corp., has joined the organization of the Service Corp. in the Detroit branch.

B. Moss McKenzie has resigned as general purchasing agent of the Ford Motor Co. of Canada. He has not announced the reason for his retirement nor his plans for the future.

W. G. Torrance, formerly with the purchasing department of the Timken-Detroit Axle Co., has taken over the sales end of the Lincoln Steel Products Corp., Detroit.

Hubert E. Hartman, assistant secretary and general attorney for the Ford Motor Co., severs his connection, March 15, to enter business for himself.

L. F. Jollat has been made manager of the Detroit branch of the Miller Rubber Co. Jollát comes to Detroit from Cleveland, where he was with the Goodrich organization.

John H. Samuels has been appointed St. Louis district representative for the Midwest Engine Co. Samuels was formerly with the tractor plant of the Moline Plow Co.

C. J. Welch, assistant general sales manager of the United States Rubber Co., has been elected a director of the company.

W. H. Van Dervoort Succumbs to Illness

MOLINE, ILL., March 7—W. H. Van Dervoort, head of the R. & V. industries in East Moline, died at the family home in Moline, after a year's illness. He was 52 years old and for 22 years had been in partnership with O. J. Root his former classmate, in manufacture of gasoline engines and automobiles.

He was born in Ypsilanti, Mich., Feb. 28, 1869, graduated from the mechanical engineering department of Michigan Agricultural College and took post-graduate work at Cornell. He returned to Michigan as instructor and later went to the University of Illinois as assistant professor of mechanical engineering. In 1899 he quit pedagogy to establish the first factory in Champaign. Two years later the R. & V. plant moved to East Moline where it has since been located.

During the war he was a member of the munitions standard board and of the national war labor conference board. In 1919 he was a member of the board of five sent abroad to study industrial conditions in Europe. He had been president of the Society of Automobile Engineers and a member of the committee on management of the American Motor Car Association, which later became the Automobile Chamber of Commerce.

Dayton Section S. A. E. to Discuss Aviation

DAYTON, OHIO, March 9—The Dayton section of the Society of Automotive Engineers will meet March 22 at the Engineer's Club. Four talks on aviation development will be given. G. M. Williams, general manager of the Dayton Wright Airplane Co. will talk on commercial aviation, covering accomplishments in this line since the armistice.

C. F. Taylor, the engineer in charge of the power plant laboratory at McCook Field, will discuss developments in power plants and in fuels which have made possible flights at high altitudes, increase in compression ratios, and increase in engine size and efficiency.

Propeller construction will be treated by F. W. Caldwell, chief of the propeller branch at McCook Field. Lieut. C. N. Monteith, chief of the airplane section at McCook Field, will speak on aircraft design and performance, paying particular attention to the newer phases of airplane construction.

DETROIT COST CHAPTER FORMED

DETROIT, March 4—Detroit Chapter of the Industrial Cost Association was organized at a meeting attended by a score of officials connected with various Detroit plants held at the Tuller Hotel Wednesday. J. W. Stannard of the American Auto Parts Co. was elected chairman; E. M. Brown of the American Blower Co., vice-chairman; and A. Rae DuBell, secretary-treasurer of the Adams X-Ray Co. was named secretary-treasurer.

Waller Crow, secretary of the Schaffer Engineering & Equipment Co., Pittsburgh, spoke briefly in outlining the aims of the association.

A. A. Alles, Jr., secretary and treasurer of the National Association, told of the steps taken thus far and read a long list of executives who were members.

WOULD FIGHT OHIO BILLS

CLEVELAND, March 5—Ohio automobile interests—producer, distributor and retailer—were urged to unite their activities in a common fight to prevent the automobile and truck being taxed off the highways, at a meeting of the Automotive Association of the Chamber of Commerce.

Calendar

SHOWS

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

Mar. 14-19—Washington, Annual Automobile Show, Washington Automobile Dealers' Ass'n, Rudolph Jose, Chmn.

Mar. 19-26—Detroit, Annual Automobile Show, Detroit Automobile Dealers' Ass'n, Morgan-Wright Building.

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

FOREIGN SHOWS

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

Apr. 20 - May 5 — Mexico City, Mexican Automobile Show, National Theatre Bldg.

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

May 24-28 — West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

Oct. 12-14, 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

July 24—Grand Prix, Le Mans.

S. A. E. MEETINGS

Boston section—March 18—Engineers' Club.

Buffalo section—April 19—Paper on "Carbureter Performance," by F. C. Mock.

Dayton section—May 3.

Detroit section—March 25—Discussion of "The Relation Between the Industry and the Department of Engineering Research of the University of Michigan," by Prof. E. A. White. Detroit Board of Commerce.

Metropolitan section—March 16—Paper on "Brakes," by H. G. Farwell. Automobile Club of America.

Metropolitan section—April 14—Paper on "Low Grade Fuel Carburetion," by A. H. Beach.

Minneapolis section — April 6 — Discussion of repair equipment.

Washington section—March 18—Highway and Highway Transport Trading. Cosmos Club.

Washington section—April 1—Aeronautical Engineering Session.

Duesenberg Team Enters for French Grand Prix

PARIS, Feb. 28—(*Special Correspondence*)—By reason of the formal entry to-day of a team of four Duesenberg cars in the French Grand Prix race, on July 25, immense additional interest is given to the French classic. Two of the Duesenbergs will be in the hands of American drivers and two in the hands of Frenchmen, the persons selected, because of their knowledge of local conditions, being Albert Guyot and the amateur driver M. Inghibert. The latter was scheduled to drive a Ballot in the French race, but abandoned this mount in favor of the Duesenberg eight head.

This is the first occasion on which a modern American racing team has lined up in an important European automobile race, and the encounter is looked upon with unusual interest for while the American machines which were sent to Europe fifteen years ago were decidedly inferior, it is admitted that modern American racing cars are capable of holding their own with the best in Europe.

The number of starters in the Grand Prix now stands at 19, as follows: 4 Ballot, 3 Darracq, 2 Sunbeam, 2 Talbot-Darracq, 3 Fiat, 1 Mathis, 4 Duesenberg. There is a possibility of a team of three Italian Itala cars being entered and one each from the Belgian firms of D'Aoust and Abadal.

BRITISH SHOW DATE SET

LONDON, Feb. 25—(*Special Correspondence*)—The Society of Motor Manufacturers and Traders have fixed their car show for the dates Nov. 4 to 12 inclusive. It will be preceded by the French (Paris) show and will be followed in December by the Belgian show. It is not announced whether the British car show will be held at Olympia or, as last time, jointly at Olympia and the White City. A section of the trade would prefer the show to be held solely at the White City rather than in two sections, and there is plenty of space at White City for the complete show.

Mexico Sets Show Date from April 20 to May 5

NEW YORK, March 7—Confirmation that the date of the first automotive exhibition in Mexico City will be April 20 to May 5 has been obtained by EL AUTOMOVIL AMERICANO, the Spanish automotive publication of the Class Journal Co. The show date was originally set to be April 10 to 25 and in an announcement by the Bureau of Foreign and Domestic Commerce the first week in April was given. However, the later date has been finally chosen, as was revealed in the telegram from the show management. Passenger cars, motor trucks, tractors and equipment lines will be exhibited in the new National Theater Building which is being thrown open to the public for the first time. Information from the show management is that practically all of the 45 American cars represented in Mexico City will be exhibited.

AUSTRALIA CUTS WHEEL TAX

OTTAWA, ONT., March 5—Ottawa Trade and Commerce Department is advised that Customs regulations for Australia in regard to motor car wheels have been modified. By the order of the Minister of Trade and Custom there, wheels made expressly for and usable only with motor cars shall be classed for Australian tariff purposes under the item applicable to motor car chassis. The order went into effect Nov. 30. The effect of this order is to reduce the British duty on motor car wheels imported separately or loose, from 40 to 7½ per cent and on Canadian and other wheels from 55 to 17½ per cent ad valorem.

S.A.E. Book New York and Detroit Speakers

NEW YORK, March 7—The Metropolitan Section of the S. A. E. at a meeting on March 16 at the Automobile Club of America will discuss the subject of brakes, H. G. Farwell reading the paper. An invitation is extended to all members of the industry to attend the meeting, which will be preceded by a dinner at the clubhouse at 6.30 p.m.

After the discussion of Farwell's paper, a moving picture film produced by the Bantam Ball Bearing Co. will be shown. This company was among the first to solve its industrial troubles through co-operation between the management and the employees. The success of the company, as a result of this action, which was taken a number of years ago, has caused them to reproduce the episode in the form of motion pictures.

The Detroit Section's guest on March 25 will be Prof. E. A. White, who is at the head of the Department of Engineering Research at the University of Michigan. This department was established to enable the industries to make use of the excellent engineering laboratory facilities of the University and maintain a co-operative connection between manufacturers and technically trained men. This talk will be significant because of the recent decision of the S. A. E. to co-ordinate research work in the automotive industry.

ROTARY TIRE RECEIVER NAMED

ZANESVILLE, OHIO, March 5—Upon the application of Edward O. Sterns and others who are stockholders, B. H. Loveless has been appointed receiver for the Rotary Tire & Rubber Co. C. W. Bryson of Columbus, vice-president of the company, declares that it is solvent and claims that the receivership proceedings were brought in order that certain contracts can be set aside.

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What Is the Average Life of Cars and Trucks?

Analysis of registration, production, export and import figures over a period of years leads to the conclusion that the average life of the 2,000,000 cars retired from service in last 7 years was about 5.3 years

By P. M. Heldt

As highway transportation develops and passenger cars and trucks become practically the sole means of road travel the proportion of first purchasers of cars and trucks in the total of car sales will decrease, and the demand for new cars each year will become more and more nearly equal to the number of cars which drop out of service. For this reason it is becoming increasingly important for the trade to know how many cars will be required for replacement of those withdrawn from service.

If we know the average life of a car or truck it is a simple matter to estimate the number required for replacement in a given year, but it is an easy matter to go astray in efforts to determine the average life.

For instance, one method of reasoning is as follows: "There is no reason why a car should not last indefinitely, because all wearing parts can be replaced, and in case of the breakage of any part, even if it be such an important one as the frame, it is always cheaper to buy a new part and substitute it for the broken one than to buy a new car."

This argument was put forth in a letter recently received from a company which makes a strong point of the fact that the aggregate price of all the parts going into its car is no greater than the price of the complete car. The proposition sounds quite plausible, but in practice things do not work out quite that way. The writer knows personally of a low-priced car that was in service by a salesman for three years, during which time it traveled about 30,000 miles. It was then considered no longer sufficiently reliable for this rather severe class of work and the company owning it disposed of the machine for $85.

For two years more it was used more or less by the new owner, who then found it so unsatisfactory that he bought a new car (of the same make). This car, therefore, if it had been retained in commercial service for its whole life, would have lasted less than 3½ years. This seems a short life, yet the service the car gave was considered quite satisfactory. It must be remembered that the car went out on the road day after day, summer and winter, and that its routes could not be selected according to road conditions, but were determined by business opportunities.

On the other hand, we often hear of cars that have been in service for 10 or 12 years and are still giving excellent service. For instance, a considerable number of Packard "eighteens" are in taxicab service in New York now, and as these cars were manufactured in 1909 and 1910, they are close to 12 years old. This illustrates the point that there is a great difference between the life of the average low-priced car and the average high-priced car. The high-priced car represents a large investment and this alone creates considerable aversion to scrapping it as long as it is at all serviceable. The better grade cars, moreover,

owing to the methods used in manufacturing them, do not acquire, at least to the same extent, that shabby appearance and rattly sound that are characteristic of most of the cheaper cars after several years of use. Furthermore, if the car is of a type that lends itself well to some commercial application, that in itself tends to prolong its life, because obsolescence of outward form and of certain mechanical features does not count against a car in these services nearly as heavily as in private use. Furthermore, a taxicab company can, for example, give the car the greater care needed in its advancing years more economically than the private owner.

Since 1912 AUTOMOTIVE INDUSTRIES has compiled annually statistics showing the number of cars registered in the different states, and the number of cars turned out by our factories has been ascertained by the National Automobile Chamber of Commerce. With these figures and the figures of imports and exports, obtainable from the Department of Commerce, as a basis, it should be an easy matter to approximate very closely the *average* life of all cars that have ceased to be used at a given date.

How Replacements Are Determined

The registrations have increased from year to year and the new cars put in service each year partly make up for cars which drop out of service and partly account for the increase in registrations over the past year. The number of cars newly put in service each year is equal to the American production plus the imports and minus the exports. In the accompanying table the production, exports and imports, and the deduced figure of cars newly put into service, are given for each year from 1905 to 1920. By subtracting from the registrations of one year the registrations of the previous year and subtracting the remainder from the cars newly placed in service during the year, we find the number of cars registered the previous year which were not registered during the current year—in other words those retired from service. For instance, in 1916 there were registered 3,585,000 cars and in 1915 2,480,000 cars. This makes the increase in registrations for the year

$$3{,}585{,}000 - 2{,}480{,}000 = 1{,}105{,}000.$$

In 1916 there entered service in this country 1,503,000 cars, which is

$$1{,}503{,}000 - 1{,}105{,}000 = 398{,}000$$

more than the increase in registrations, hence that number were retired in the course of 1915.

The term "retired" as used above requires an explanation. These cars are not registered any longer but a large proportion are still in existence; their useful life has apparently come to an end, but in an emergency a considerable number of them can become active again. This was well illustrated in 1918 when the increase in registrations over the previous year was greater than the total number of cars produced. This was the last war year, when many people who wanted to buy cars could not get them, owing to the restrictions on automobile manufacture and railroad transportation. Not being able to buy a new car, everybody evidently held on to his old one and—more than that—some of the previously "discarded" machines (including many, no doubt, placed in storage by owners absent during the war) were put in service again and figured in the registrations.

By the above method we can calculate the number of cars that disappeared or were retired for each year since 1912. This has been done and the figures are given in the table. It may here be remarked, parenthetically, that the average life of cars depends not solely upon their durability but also upon their liability to accident. Some cars disappear after a year or two owing to serious collisions, fires, etc. On the whole these accidents probably do not greatly affect the average life, but whatever effect they have is taken account of in the following calculation.

The next step is to calculate from the registration, production and retirement figures the average number of years each car was registered. A distinction is here made between the length of time for which a car is registered and its actual life. This is necessary for the following reason.

During the first year some cars are registered for a whole year and others only for a month or two, because new cars are placed in service throughout the year, and if the end of the registration year is only a month or two off, the car has to be registered for that short period of time and counts as one of the cars registered that year. The active period of life represented by that registration therefore varies from a full year to a month or less, and it is not far wrong to assume that the average period is one-half year. During the last year of registration the car, of course, remains registered for the whole year, unless it should be destroyed by accident and the registration cancelled—which is a rather rare case. Therefore, the probability is that a car that appeared in the registration records for six years had an active life of about five and a half years.

Substantially the same result is arrived at by another method of reasoning. The great majority of the cars are put in service in the spring and are finally withdrawn late in the fall and as they count in the registration lists for both the first and the last year of their lives, although their active life is one-half year less than the number of registration years to their credit.

Cars Withdrawn From Service Each Year

Now let it be assumed that each car has a definite life such that it may be registered during six consecutive years. That is, whether it passes out of use through accident, through wear or through obsolescence, this occurs after it has been registered for six years. Then, since in 1910, for instance, there were placed in service 179,580 new cars, this exact number of cars would be registered for the last time in 1915. All cars placed in service previous to 1910 had already disappeared before 1915 and all placed in service subsequent to 1910 would be registered again in 1916. Therefore, in 1916 the number of registrations would be equal to the number of 1915 registrations, plus the number of cars placed in service for the first time in 1916, minus the number of cars manufactured in 1910. Thus by working backward, that is, by subtracting from the number of cars registered any one year, the number placed in service that year and then subtracting the remainder from the number registered the previous year we find the number of cars scrapped the previous year, and it is then only necessary to find out how many years earlier an equal number of cars were placed in service and add one, to determine the number of yearly registrations to the credit of each car. (One is added because the car is registered both the year it went into service and the year it was withdrawn.) For instance, in 1916 there were registered 3,585,000 cars and trucks and in 1915, 2,480,000 cars and trucks, which gives an increase of 1,105,000. As there were 1,503,000 new cars placed in service in 1916, the number of cars scrapped in 1915 was

$$1{,}503{,}000 - 1{,}105{,}000 = 398{,}000.$$

This figure is nearly midway between the numbers of cars placed in service in 1912 and 1913, which would lead

to the conclusion that the average number of registrations of all the cars was

$$\frac{(1916\text{-}1912) + (1916\text{-}1913)}{2} + 1 = 4\frac{1}{2}$$

The above method of calculation can be applied equally well in actual practice, for, although the number of years that cars in actual use are registered is not a definite figure, the average number of registrations per car is definite. However, taking a single year, as above, gives rather unreliable results. For instance, in 1915 the last cars of the two-door type, with the old style of offset bodies and without lighting and starting equipment were getting along in years, and many cars that might have been used a year or two longer were discarded. Another factor that may have increased the number of retirements that year was that Fords sold for $325 for runabouts and $365 for touring cars, and these low prices may have induced many owners to dispose of their old cars sooner than they would otherwise have done. Other cars also were at the bottom prices during that year.

How True Average Results Are Obtained

This difficulty can be eliminated by taking, instead of a single year, a period of several years. The longer the period the more dependable the result. For instance, if we assume again that all cars have a life sufficient for six annual registrations, then all cars placed in service between 1906 and 1913, inclusive, would be scrapped between 1911 and 1918, inclusive. In this way the retirements are extended over periods of both high and low prices, of general prosperity and depression, of lack of factory capacity and of surplus capacity, and a true average, more or less independent of temporary economic conditions, is obtained.

The first year for which registration figures are obtainable is 1912. However, the number of cars which appear to have been scrapped in 1921 is exceedingly high, which may be due to errors in the compilation of the registration figures—a task which always involves many pitfalls. From 1913 on the number of cars retired annually increased fairly constantly until 1918, as would be expected from the constant increase in production. Hence the writer decided to disregard the result of the compilation of registrations for 1912.

It was shown in the foregoing that if the cars withdrawn any one year have a life of say, six years, then the number of cars withdrawn that year is equal to the number of cars newly placed in service six years earlier. As this relation holds for one year as well as for another, it follows that the number of cars withdrawn during a number of successive years is equal to the number of cars newly placed in service during an equal period of years which preceded the period during which the retirements took place by a time equal to the difference between the years of last and first registrations of each car. The total number of registrations of each car would be one greater than the numerical difference thus obtained.

From 1913 to 1919 inclusive, a seven-year period, there were withdrawn from service a total of 2,089,247 cars. It is now necessary to find an earlier seven-year period during which an equal number of cars were first placed in service, and the interval between these two periods then gives a measure of the average life of the cars, after a certain allowance has been made. This earlier period has to be found by trial and error.

During the seven-year period, 1908-1914, there were newly placed in service 1,942,073 cars. This is slightly less than 2,089,247, the number withdrawn from 1913 to 1919. If the number of cars placed in service during this period had been equal to the number retired during the period 1913-1919, the interval between the year of introduction in service and the year of retirement would have been

1913 (1919) — 1908 (1914) = 5 years,

and the total number of registrations of each car would have been one more, or six. Since the number of cars introduced in service during the 1908-1914 period is slightly less than the number retired from 1913 to 1919, we have to take a later period, which makes the interval

STATISTICS BY USE OF WHICH AVERAGE CAR LIFE IS DETERMINED

Year	No. of Cars Produced in U. S. A.	No. of Cars Exported	No. of Cars Imported	No. of Cars Newly Entered Service	Total No. of Cars in Service	No. of Cars Retired from Service
1905	25,000			24,000		
1906	34,000	2,200	1,295	33,100		
1907	44,000	2,894	1,093	42,200		
1908	65,000	2,164	1,347	64,200		
1909	127,731	3,686	1,645	125,690		
1910	187,000	8,443	1,024	179,580		
1911	210,000	15,807	972	195,165		
1912	378,000	23,720	868	355,148	1,033,000	203,859
1913	485,000	26,889	748	458,859	1,288,000	62,431
1914	569,045	26,000	386	543,431	1,769,000	117,400
1915	892,000	64,000	403	828,400	2,480,000	398,000
1916	1,583,000	81,000	1,037	1,503,000	3,585,000	381,260
1917	1,868,000	80,000	260	1,788,260	4,992,000	8,000
1918	1,153,000	47,000	178	1,106,200	6,106,000	402,656
1919	1,974,000	82,000	1,656	1,893,656	7,597,000	735,500
1920	2,241,000	172,000	1,500	2,070,500	8,932,000	
					Total	2,089,247

measuring the average life of the cars smaller. During the seven-year period, 1909-1915, there were introduced in service 2,706,273 cars, which is very much greater than the number retired during the 1913-1919 period. If the number introduced during the 1909-1915 period had been equal to the number retired during the 1913-1919 period, then each car would have been registered only five times. Since the number of new cars of the 1908-1914 period is much nearer to the number of retirements of the 1913-1919 period than the number of new cars of the 1909-1915 period, it follows that the average number of registrations per car is much nearer to six than to five. The exact average number of registrations per car can be found by interpolation as follows:

Difference between numbers of cars placed in service in the 1909-1915 and the 1908-1914 periods

$$2,706,273 - 1,942,073 = 764,200$$

Difference between cars scrapped in the 1913-1919 period and cars placed in service in the 1909-1915 period

$$2,706,273 - 2,089,247 = 617,026.$$

Dividing the latter difference by the former,

$$617,026 \div 764,200 = 0.81.$$

Actual Average Life 5.3 Years

From the above it is seen that the actual average number of annual registrations was 5.81. As above explained, the average active life of the car is one-half year less than this and is, therefore,

$$5.81 - 0.5 = 5.31 \text{ years.}$$

This was the actual average active life of all the cars that went out of service in the United States from 1913 to 1919 inclusive.

High grade cars will last considerably longer, espe-

(*Continued on page* 594)

Move to Unify All Interests in Hub Standardization Work

Ball and roller bearing makers, wood and metal wheel makers, axle manufacturers and others commercially interested join with S. A. E. representatives in meeting at Detroit for purpose of furthering efforts to standardize front axle hubs. Still hope to formulate standard adaptable to use of either ball or roller bearings thus avoiding possible deadlock.

By J. Edward Schipper

EFFORTS at hub standardization are reaching a point where either definite and satisfactory progress will soon be made, or the situation will reach a deadlock which it may be impossible to break for years. The difficult part of the problem arises from seeming impossibility of securing a standard bore for front axles for trucks which is suitable for both ball and roller bearings. The reason for this lies in the fact that for similar capacities the outside diameters of the ball bearings are greater than those of the roller bearings. This alters so many material dimensions that it is extremely difficult, if at all possible, to arrive at a single standard for both.

Hope has not yet been abandoned on this matter, however, and a special committee of ball and roller bearing men is at work on the proposition at the present time for the purpose of reaching a final decision as to whether or not it is going to be possible to adopt a single standard.

It will be remembered that although the report of the committee on hub standards made at the winter meeting of the S. A. E. was accepted by the Truck Division of the Standards Committee, it failed to pass the Standards Committee as a whole, largely because of the opposition of ball bearing manufacturers who felt that they had not been given an opportunity to present their side of the matter. The report which was presented at that time, failed to include the qualification, that the proposed standard was solely for roller bearing front truck hubs, which the ball bearing manufacturers stated worked an injustice to their side of the business. As a result the matter was turned back to the committee for further consideration.

A meeting was called at the Detroit Athletic Club on March 3 by C. C. Carlton of the Automotive Wood Wheel Manufacturers' Association, at the instance of this association, the Society of Automotive Engineers and the Automotive Metal Wheel Manufacturers' Association. At this meeting, which was attended by an extraordinarily representative list of bearing and axle manufacturers, the fact was brought out that to date the two wheel associations had spent about $20,000 in carrying the standardization work along. The object of Mr. Carlton's meeting was to enlist the support of the bearing and axle manufacturers who are as much or possibly even more interested in the work than the wheel manufacturers. This support is evidently to be given, judging by the attitude taken by representatives of manufacturers at the meeting, with the result that a committee is now at work to carry along the investigation for the purpose of determining whether or not it is possible to arrive at a single standard.

The report of this committee is of utmost importance and is being awaited by wheel, bearing and axle manufacturers with considerable interest. Whether or not this work is to progress smoothly and rapidly, or whether it is to be deadlocked in the same way that ball and roller bearing work has become deadlocked in some of its details in other branches of standardization, will depend in large part upon the report to be made by this committee.

As matters stand at the present time, it is very likely that if it is impossible to arrive at a single standard, an effort will be made by axle and bearing manufacturers interested in roller bearing installations to bring out a standard adapted solely to roller bearing installation, as it seems very possible to do this in a way acceptable to all roller bearing and axle manufacturers, although the dimensions may not be ideal. In fact, it is very possible that these dimensions will never be really standardized, but will be accepted eventually as recommended roller bearing practice. No action is likely to be taken in this respect, however, until a report is secured from the ball and roller bearing committee which indicates whether or not it is going to be possible to arrive at a single standard.

Flange Diameter and Bolt Circle

In the meantime, it is probable that quick action will be taken on the standardization of flange diameters and bolt circles for wood wheel hubs. The wood wheel manufacturers are anxious to have this matter settled at the earliest possible date, as at present they are being compelled to meet small differences in dimensions which have no basis in engineering merit or necessity. A committee has been appointed also to take this matter under consideration and to attempt to have a report ready for the truck division of the Standards Committee at its meeting on March 15. It has been pointed out by the wood wheel manufacturers that they entered this question solely because of their interest in the flange diameter and bolt circles. After they had started this work they found that the metal wheel manufacturers were more vitally concerned with the bore of the hub and the bearing installation, and the standardization work was enlarged to meet all wheel interests. This has been carried along and it seemed, until the objections arose at the winter meeting of the S. A. E., that it was about ready for adoption.

One of the points which has been frequently brought up by critics of the hub standardization work is that it is the first effort of the Society to standardize a design. F. G. Hughes of the New Departure Co., brought forth some arguments at the meeting at the D. A. C., stating that he hesitated to have the S. A. E. standardize a design and,

furthermore, believed it to be impossible to use the load capacity as a basis, because the location of the center of gravity of the truck would have a marked influence on the dynamic stresses to be encountered by the parts. He stated that he believed it was perfectly possible to standardize the flange diameter and bolt circle, but did not believe it desirable to include a form and style of spindle, etc., on account of the great variation in dynamic stresses, due to the shift in center of gravity and other influences.

Cornelius T. Myers, consulting engineer, who has been retained by the wheel interests to carry out the detail work necessary for the formulation of these standards or recommended practices, stated that he had worked with a number of manufacturers and committees on this subject and found that they all believed it possible to standardize as far as roller bearings are concerned because of the immaterial differences in practice which exist. Regarding the question of bearing spacing in these front hubs, he stated that no engineering reason existed for the infinitesimal differences which prevail.

Myers said further that the subject of bearings was actively canvassed and studied for five months and it was the unanimous opinion of the sub-committee of five and of the Truck Division of the S. A. E. Standards Committee that ball bearings could not be made interchangeable in any series of hubs which could be laid down because there are fundamental differences in the design of ball and roller bearings which call for differences in dimensions which cannot be composed. To quote Myers further: "The decision of these men to offer as the first step in the standardization program a series of hubs equipped with roller bearings was based on the fact that in the past two years some 95 per cent of the bearings used in the front hubs of motor trucks having load capacities of from 1½ to 7½ tons were roller bearings. All the prominent axle companies agreed that the designs submitted were in line with the best practice and should be followed in new construction. Four roller bearing companies can furnish interchangeable bearings for the proposed standard hubs. The bearings selected are cheaper than bearings now being used on well-designed axles for similar load capacities. The bearings selected are those which will be in quantity production by the roller bearing manufacturers.

"The subject of a standard series of hubs to take ball bearings should be considered by itself and submitted to the S. A. E. when all particulars with regard to it are thoroughly discussed and approved, not only by bearing manufacturers but by manufacturers of axles and of motor trucks."

Myers gave it as his opinion that the success of the proposed standard would depend upon the favor with which it was received by the motor truck trade and not upon the individual preferences of any class of parts manufacturers. "If the proposed standards for roller bearing hubs appeal to the motor truck trade, parts manufacturers will certainly cater to this demand. If the motor truck trade is willing to pay 15 or 20 per cent more for roller bearings, hubs and wheels in order to adopt standards where ball bearings can be installed in hubs of the same dimensions, this is a matter for the motor truck trade to decide. Ball bearings would not be strictly interchangeable with roller bearings in any event, but the suggested type would allow axle manufacturers to machine the same hub castings by means of different tool equipment to take whatever type of bearing the customer wished.

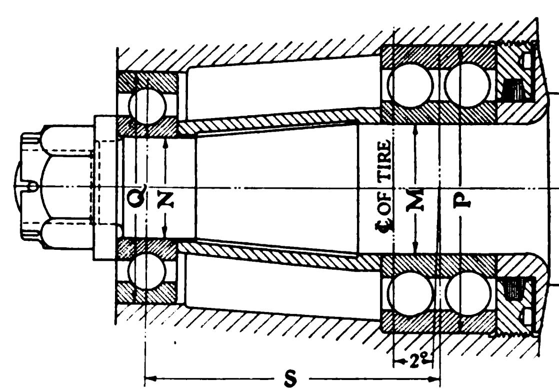
"It is my opinion that the program already approved by the Truck Division of the S. A. E. Standards Committee should be given formal sanction so that 95 per cent of the motor truck trade would be able to take advantage of it, and that work should be carried on to place a similar series of hubs for use with ball bearings before the industry at the earliest possible moment; that to delay the adoption of the roller bearing series in the hopes of getting a really serviceable interchangeability with the ball bearing series would tend to continue the present condition of affairs in many new designs which are at present projected, namely, a multitude of small and unessential variations in design details, the sum total of which constitute a very considerable burden on the truck industry."

T. V. Buckwalter of the Timken Company, urged the adoption of a standard on an economic basis. He stated that it is more a problem of economics than of engineering. He said further that the static loads were the only basis which it was possible to use in making the design and that variations in center of gravity, etc., if they were exceptional, would have to be taken care of by special design anyway.

Discussions of this kind occupied most of the day at the D. A. C. meeting. It was quite apparent that the general trend of opinion at the meeting was favorable to adoption of some form of standard or recommended practice, and if possible, a single standard for both the ball and roller bearings. There were a considerable number, however, who believed that the insistence on a single standard would deadlock the proposition in such a way that nothing would ever be accomplished.

F. W. Gurney of the Gurney Ball Bearing Co., stated in his belief it was by no means impossible to work out a single standard for the two types of bearings and asked that time to give this matter fair consideration be granted the committee, of which he is a member. This was agreed to by all present.

Previous to this meeting at the D. A. C., the ball bearing interests had called a meeting of their own and had drawn up a set of suggested standards for ball bearing front hubs to be incorporated in the report to be made to the Standards Committee, so that in any event, both ball and roller bearings would be given consideration in this work. The proposals they make are incorporated in part in the table and cut given herewith. No action, however, will be taken on these ball bearing front hub dimensions until it is determined whether or not it is going to be possible to arrive at the single standard. The drawings of the ball bearing



Suggested standards for ball-bearing front axle hubs, proposed by representatives of the ball-bearing manufacturers. Not yet adopted or acted upon

Hub No.	Radial Outer Bearing No.	Double Row Inner Bearing No.	Dimensions in Inches M	N	P	Q	S
5	307	809	1.7715	1.3778	3.9370	3.1496	4
6	308	310	1.9683	1.5746	4.3307	3.5433	4¼
7	309	311	2.1652	1.7715	4.7244	3.9370	4½
8	310	313	2.5589	1.9683	5.5118	4.3307	5
9	311	314	2.7557	2.1652	5.9055	4.7244	5¼

Tolerances on M and N + .0000, — .0005; on P and Q + .0010, — .0005.

front hub suggested for standardization were exhibited at the meeting at the D. A. C.

F. W. Gurney, in his discussion of the possibilities of the single standard, stated that he believed a single standard could be worked out which would incorporate many of the dimensions which were approved for roller bearing practice. The difference which would exist between these and the proposed single dimensions would, of course, be concerned with the larger diameter necessary for equal capacities. Some discussion as to differences in fit between the outer cage of the ball and roller bearing was brought forward, but it was pointed out that this was rather a question of tolerance than dimensions, as there was no idea of so manufacturing hubs that interchangeability would exist between the ball and roller bearing hubs; that is, there would be no intention of sending out a hub originally equipped with roller bearings and then changing it to ball bearings after it had been in service, or vice versa. Consequently, tolerances allowed in manufacture would take care of the question of fit.

The economic side of this hub standardization work is of such importance that it forms one of the most interesting pieces of attempted standardization which has come before the automotive industry in years. It is one of the matters which an impartial observer realizes will be of value to all branches of the industry, but at the same time, there are some knotty problems involved in arriving at a standard or recommended practice which will be fair to all. One is reminded of the discussion on tire sizes which was carried on through the S. A. E. for years and finally settled by the War Industries Board during the war. A single act of this board, which had the authority, was able to settle a question which had been one of the moot points in the tire business for years. Many of the discussions which centered around the adoption of the bell housing for automobile engines are also called to mind.

There is no question but that a standard is much needed and if it is going to be possible to arrive at a single standard for both the ball and roller bearings, an almost ideal situation will have been created. If it is impossible, however, it would be far better to have even five ball bearing standards and five roller bearing hub standards for trucks, giving a total of ten, than to continue the sixty or more which are commonly manufactured at the present time.

What Is the Average Life of Cars and Trucks?

(*Continued from page* 591)

cially if their annual mileage is not very great and if they are carefully driven. On the other hand, the average low priced car does not last as long, particularly if used in arduous commercial service, as by salesmen, physicians, liverymen, etc. One reason why the average is rather low is that the high-priced cars, which in a general way last longer than the low-priced machines, are greatly in the minority. For instance, suppose that a taxi concern operates two makes of cabs, 10 cabs of one make having an average life of four years and one cab of the highest grade of construction having a life of 12 years. Then the average life of the two makes of cab is

$$\frac{4+12}{2} = 8 \text{ years}$$

but the average life of the 11 cabs is only

$$\frac{(10 \times 4) + 12}{11} = 4.73 \text{ years.}$$

It is to this latter figure that the value of 5.31 years for the average active life of all cars corresponds. That is, the short-lived cars are in the majority and they pull down the average in proportion to their numerical strength.

The average life deduced above covers, of course, both passenger cars and commercial vehicles. There is no means of determining the lives of the two classes separately, as in many states no distinction is made in the registrations. As the quality of design and workmanship varies as widely as in passenger cars, there is probably as wide a range in useful life in the one class as in the other.

Since the foregoing computations are based largely upon registration figures, the accuracy of these figures may be questioned. We make no claim of absolute accuracy, but the registration figures we have compiled are probably more representative of the use of automotive vehicles than any other compilation. A statistical company often employed by banking concerns recently estimated that there are 600,000 cars in use in this country that are not registered. This estimate appears to be too high, even after reading the full report of the investigations upon which this company based its estimate. There is, however, a considerable number of cars in use and not registered. Laws such as those governing the registration of automotive vehicles are easily evaded by persons willing to take the risk and necessary trouble to avoid paying the fees imposed and thus save a few dollars. To offset this, however, there are the cars which are twice registered. The commissioner in charge of registration in New Jersey estimated that 15,000 of the cars registered in that State also are registered in other states. This is true of several of the states which have a heavy summer and winter resort business and in states in which trucks and cars are normally used much in two or more states. These and other features of registration probably balance each other in a sense and leave registration figures the best basis upon which to calculate, even if they are not a strictly accurate guide to the number of cars in actual use in the country.

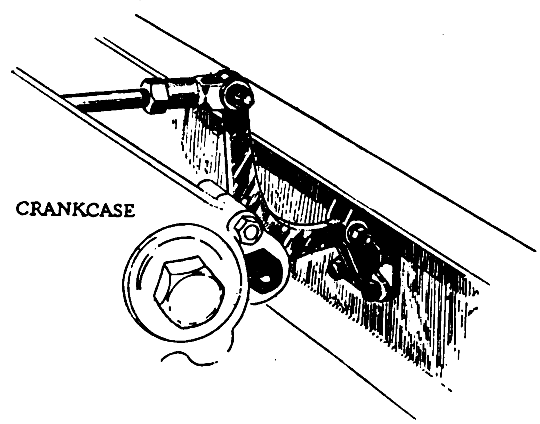
THE original four-cylinder Stearns tractor engine was made in two sizes, 4¾ x 6 in. and 5 x 6 in. Recently a smaller size has been added which can be furnished in three sets of cylinder dimensions, namely, 4 x 6, 4¼ x 6 and 4½ x 6 in. A total of 51 parts are interchangeable on all five models. The new engine is built much lighter than the earlier model and is furnished with an aluminum crankcase for trucks and light tractors. The valve cover is also of aluminum. Electric starting and lighting equipment is optional with this model, the engine being designed with mountings for the starter and generator. Either three-point or four-point suspension can be provided and the size of bell housing is optional. The larger engine is now furnished with a gear drive for the fan and generator, provision being made for mounting a generator by the S. A. E. standard flange mounting. This fan and generator drive goes onto the gear cover of the regular model and is interchangeable with the regular cover.

Mechanical Features of the Rolls-Royce Chassis

Many refinements embodied to increase convenience or add to durability. Slotted skirt aluminum pistons, constant acceleration cams, vibration damper, adjustable governor, hand primer, dual brake drums, special brake adjusting devices, and rivetless frame are among the unusual features. Hand fitting and careful inspection characterize manufacture.

By P. M. Heldt

THIS article has been prepared after the writer had visited the plant of the Rolls-Royce Co. of America, Inc., and was given an opportunity to study the chassis while the parts are in process of construction and assembly. The chassis has been manufactured in England continuously for the last 17 years, and the American product is identical to the British, not only in design, but in method of construction. In fact, the duplication is so exact that a well-known American engineer who is thoroughly familiar with American production machinery and methods, when given an opportunity to inspect in detail two chassis, one American and one English built, placed side by side, was unable to detect any difference definitely indicating which was which.

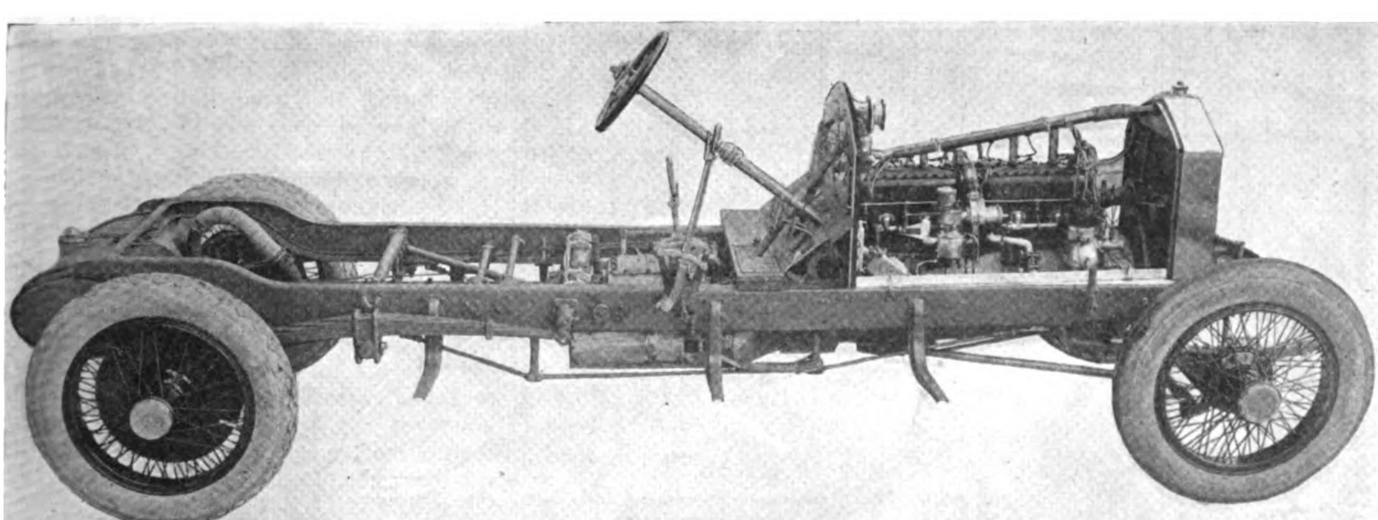


Front engine bracket

Our purpose is primarily to describe some features of the chassis and details of construction which are different or more elaborate than usual. Since the chassis is one of the highest priced of any produced either in this country or in Europe, it is natural to expect the use of the highest grades of material and workmanship, as well as elaborateness of design in respect to those features tending toward the greater comfort and convenience of owner and operator, and longer life of the car.

The engine has six cylinders, 4½ by 4¾ in., cast in two blocks of three, and with a seven-bearing crankshaft of 2¼ in. diameter. The crankshaft is forged from nickel chrome steel and is finished all over, and the bearings are lapped after being ground, to obtain a smoother surface than is possible to obtain by grinding. The crankshaft is, of course, heat-treated, and it is noteworthy that the heat treatment is applied only after most of the surplus stock has been removed, in order to ensure more rapid and uniform cooling on quenching.

The bearing caps in the crankcase are made of nickel steel, heat-treated, and are held in place by means of bolts, rather than studs screwed into the aluminum. For boring out the main bearings in the crankcase, dummy aluminum caps are made use of. The steel caps are ground. The bronze-back, babbit-lined bushings are ground on the outside and are fitted into the crankcase and the bearing cap with bluing to


The Rolls-Royce chassis

insure a perfect seat, so that the joint will stand an oil pressure of 20 lb. per sq. in. Solid bronze liners are placed between the two halves of the bearing, white metalled on the side toward the shaft. Adjustment for wear of the bearings is made by filing down the liners

The engine is supported on the frame by a flexible four-point support on which the Rolls-Royce firm holds a patent. The forward end of the crankcase rests on two bell cranks, one arm of each of which is connected to a frame bracket and the other two arms of which are connected by a tie rod (see sketch). The fulcrum of the bell cranks is on the crankcase. This construction protects the crankcase against stresses due to frame distortion.

Aluminum alloy pistons are used. Trouble from slap and seizing is prevented by slitting the skirt longitudinally on the pressure sides at a slight angle, and circumferentially at the bottom of the ring belt. The four piston rings have an unusual section, being 3/32 in. wide and .137 in. deep. This gives a very large wearing surface at the sides of the ring and evidently is intended to obviate the trouble of rapid wear of the ring grooves sometimes experienced with aluminum pistons. The rings, moreover, are "pinned" so they cannot creep in their grooves, the pins consisting of bolts through the piston wall, with nuts on the inside of the piston, the threaded portion of the bolt being split and spread apart to prevent the nut coming loose.

The cylinders are ground, but in order to obtain a better surface than can be obtained by grinding the cylinders are lapped in with a dummy piston. The valves are made of chrome (rustless) steel and the valve springs of chrome-vanadium steel. Rolls-Royce use the constant acceleration cam which has a concave flank, and in order to grind these cams (which requires the use of a grinding wheel of very small diameter) they had to develop their own grinding machine. Rocker levers carrying the cam rollers are interposed between the cams and the push rods to prevent side thrust on the pushrods. The rocker levers are pivoted on plates bolted to the side of the crankcase and are made from nickel steel, machined all over and hardened. The cam roller is mounted in a yoke on the lever. The roller pin is hollow and has a lug formed on it which fits into a slot on the lever, so that the pin cannot turn. A rivet through the pin fixes it endwise. Unlike the great majority of present-day engines the Rolls-Royce does not have the valve springs and adjusting mechanism inclosed, evidently because inclosure would interfere with adjustment of the valve clearance. Noiseless operation of the valves has been insured by making the valve parts as light as possible and by carefully shaping contour of the cam.

The engine is fitted with a vibration damper designed to eliminate torsional vibration of the crankshaft. This is in the form of a friction-retained flywheel at the forward end of the crankshaft. In addition, the timing gear pinion is mounted on the crankshaft in such a way that driving force is transmitted to it through coiled springs. There are eight of these springs, located between four integral keys in the bore of the pinion and four similar keys on the outside of the driving member. A frictional vibration dampener is also provided to prevent the pinion from oscillating rapidly between the springs. This timing gear drive is claimed to reduce noise and wear throughout the engine.

Connecting-rods are machined all over and are held to very close weight limits. The connecting-rod bolts are made hollow for lightness and are made with an integral lug which fits into a recess in the rod to prevent the bolt from turning. Oil is supplied to the floating bronze bushing at the upper end of the rod through a small tube extending up the shank of the rod.

A carbureter of Rolls-Royce design is fitted. This is of the double-nozzle type and has a piston type of throttle valve. At idling and low speeds only one nozzle is operative. An automatic air valve is fitted which not only controls the amount of air admitted to the car-

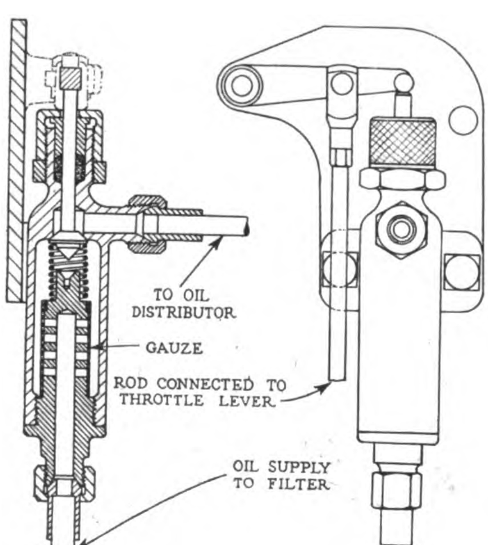


Fig. 1—Oil valve and filter

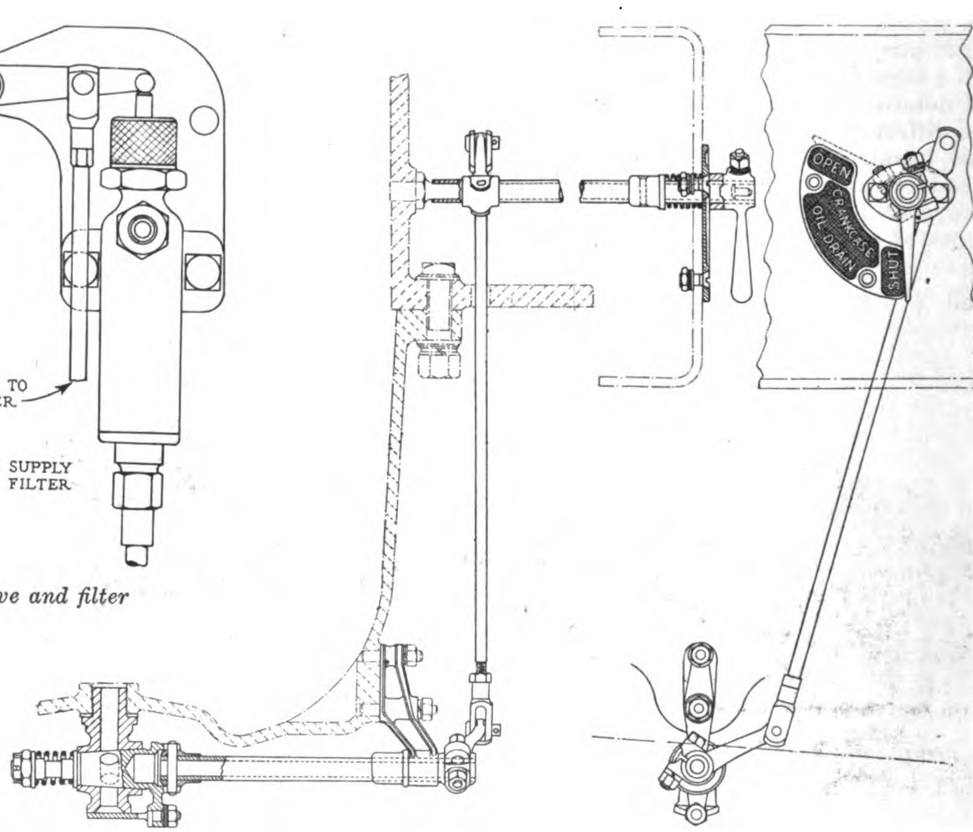
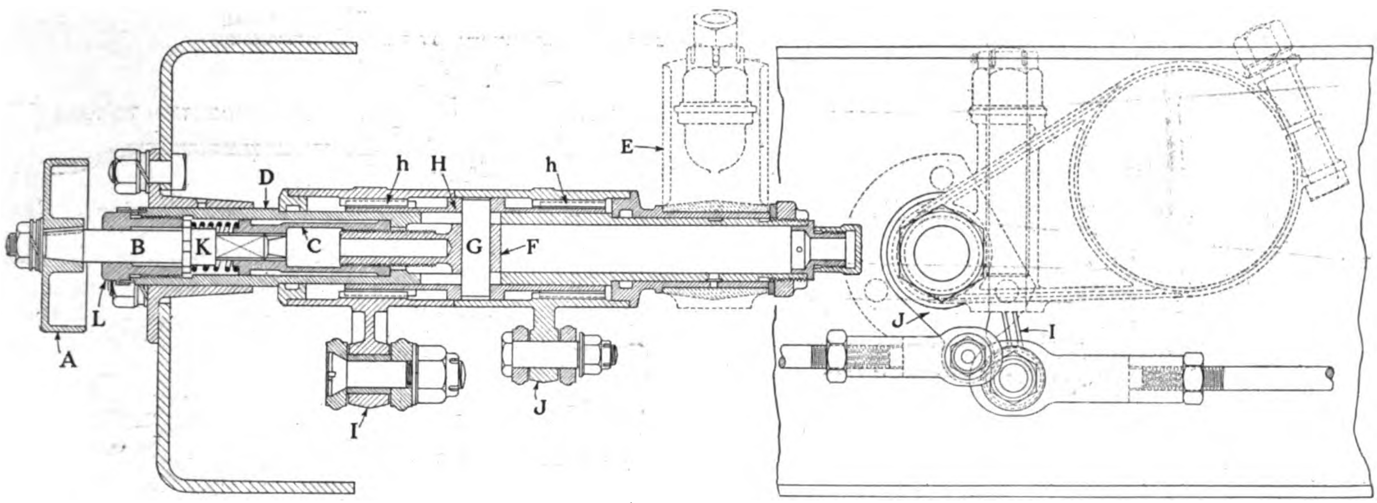


Fig. 2—Oil cock and actuating arrangement



Arrangement of foot brake adjusting device

bureter, but also the vacuum, and, therefore, the cutting-in point of the high speed nozzle. Both nozzles are provided with needle valve adjustment, these valves being controllable (through a small range) from the driver's seat. The air entering the carbureter around the high speed nozzle is drawn through a heater.

The oil pump is of the gear type and has the pressure relief valve formed integral with it. It is driven through a square tube which opens up in case the pump becomes jammed by foreign matter, thus forming a safety link in the drive. The water pump, of the usual centrifugal type, has the peculiarity that water enters the casing from both sides, so that all end thrust is eliminated. It is driven through a universal joint somewhat similar in form to a Hookham joint, the central member being a fiber block. Fuel feed is by air pressure, and the air pump for this purpose is mounted on the governor casing and driven from the governor shaft. This pump is so designed that the pressure is automatically limited to 2-lb. p. sq. in., so that no relief valve is required. Such relief valves are said to be a frequent cause of air leaks.

A governor on passenger car engines is a rarity, but the Rolls-Royce is fitted with one. It acts on the throttle valve and is under the control of a lever on the steering column. When the accelerator pedal is depressed the action of the governor ceases. The advantages claimed for the use of a governor are as follows: In coasting down hill, if the governor is set to say 10 m.p.h., it will hold the throttle closed as long as the car exceeds this speed, and thus save fuel. When driving in traffic the engine can be allowed to idle at a very low speed, for the governor will open the throttle immediately the clutch is engaged and keep the engine from stalling. In gear changing, especially changing down, the governor is useful in getting the speed at which the engine should run when the clutch is disengaged.

The fan consists of sheet aluminum blades bolted to a steel center.

Engine lubrication is entirely by force feed, the pressure being maintained between 3 and 20 lb. Under normal conditions the cylinders are oiled by the spray from the crankshaft, but when the throttle is more than two-thirds opened by the accelerator pedal, an oil valve controlling a direct feed from the pressure system to the cylinders (Fig. 1) is automatically opened by the accelerator, and the cylinders then receive an extra supply of oil. There is a filter within this valve, which prevents foreign matter from getting to the cylinders. An oil level cock in the oil sump is operated by a lever on the left side of the frame (Fig. 2). This cock is fitted with a cover which prevents dirt from entering and stopping up the tap, and this cover is connected to and moves with the tap. A reserve oil tank, with a capacity of 1⅝ gal., is secured to the left side of the frame, and oil can be transferred from this tank into the crankcase by opening the cock at the bottom of the tank. In cold weather, if the oil is very viscous, pressure can be applied to force it from the tank to the crankcase by connecting a tire pump to the top of the tank. The oil pipes are of copper and the fittings are brazed, making a very secure job.

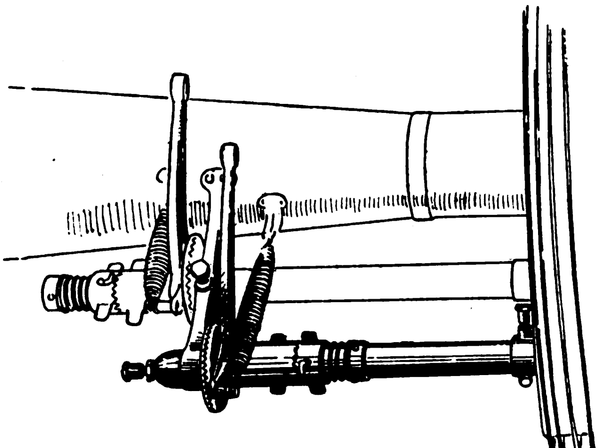
Two entirely separate systems of ignition are provided, one a Watford high tension magneto and the other a battery system made by the Rolls-Royce firm. Both are controlled by a compound switch located at the base of the steering column and operated by a knurled nut at the center of the steering wheel. There are four positions to this switch, namely, magneto alone, battery system alone, both together and all off. In circuit with the coil of the battery system is a ballast coil which tends to keep down the current flow at low engine speeds and also prevents injury to the coil in case the engine should stall and the operator forget to open the switch.

To eliminate chatter in the magneto drive, a small spring-loaded brake is provided, which clasps a ground drum on the magneto, thus introducing a slight countertorque. This makes the drive silent and reduces wear of the universal joints.

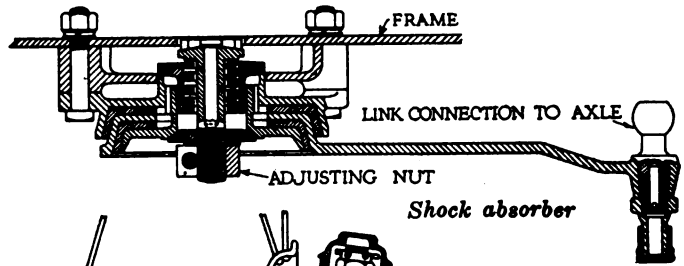
The radiator is of the true cellular type and has nickel silver (German silver) top tank and side plates. It is supported by two ball joints on a cross member of the frame and stayed by a bowed steel strip from the top to the engine. The engine bonnet is of aluminum and is provided with a double hinge at each joint.

In order to facilitate starting and reduce the drain on the battery in cold weather, an engine primer is fitted. A U-tube is connected to the bottom of the carbureter float chamber and fills with gasoline from the float chamber through a check valve, to the level of the gasoline in the float chamber. One side of this U-tube is connected to a hand air pump on the dash and the other to a spraying nozzle in the inlet manifold. The air pump is given a few strokes, whereby a measured quantity of gasoline, together with a certain amount of air, is injected into the inlet manifold through the nozzle, the fuel being thoroughly sprayed and intermingled with the air. Although an electric starter is fitted, a hand starting crank is permanently fixed in place, being held by a leather socket.

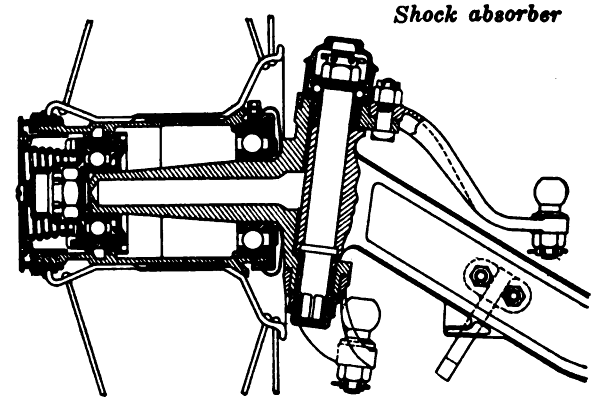
The flywheel is secured to the flange on the crankshaft



Devices for adjustment of rear brakes



Shock absorber



Section of front hub and steering knuckle

by means of tapered bolts and rivets fitted into tapered holes. The clutch is of the reversed cone type and has a lining of friction material which is secured to the clutch cone by means of staples, said to make a much more secure fastening than rivets. Provisions are made for lubricating the clutch pilot bearing from the engine lubricating systems. The center hole through the crankshaft extends through the clutch pilot and at the end of the pilot there is a valve, which is automatically opened when the clutch is thrown out, remaining open as long as the clutch is out. In order that too much oil may not get through to the clutch pilot during this period, the oil is required to pass through a cotton wad. The clutch facing is always steeped in oil. A clutch brake in the form of a spring-controlled fiber pad is provided and presses against a special ring secured to the clutch cone. The position of the fiber pad and the spring lead can be adjusted.

The four-speed transmission is of the selective sliding gear type, and has quite a number of special features. In the first place, the gearcase is cast in a single piece, of aluminum, and has a three-point support upon the frame. Helical constant mesh gears are used to eliminate noise. The first drive shaft, carrying the constant mesh pinion and the direct drive clutch, is mounted between two large ball bearings. The second secondary shaft is mounted on three ball bearings, giving a very rigid support to same and tending toward silent operation of the gears. The driving shaft is also supported in three bearings, a plain pilot bearing in the end of the first mentioned shaft, and two ball bearings, one of which is in the partition wall in the case, which also carries the central bearing of the secondary shaft. The transmission is lubricated with oil of the same viscosity as a good grade of steam cylinder oil and proper provision is made for preventing leakage of oil from the case.

The rear axle is a full floating design, with a housing built up of forgings comprising large diameter flared tubes. The parts are assembled by means of a large number of square-headed bolts. The final drive is by helical bevel gear, with a reduction ratio of 3¼ to 1. The differential gear is of the spur type, and the side gears are forged integral with the axle shafts. Lubrication of the axle is by oil of the same viscosity as that used in the transmission, provision having been made for retaining it in the axle housing. The bevel gear as well as the pinion can be adjusted to secure a proper mesh.

Thrust and torque reaction are taken on a torque tube with a spherical joint at the forward end. In order to locate the two bearings on the bevel pinion shaft as far apart as possible, and thus reduce the lead on the bearing directly back of the pinion, the torque tube is made in two parts joined end to end, and one bearing on the pinion shaft is placed near this joint. The propeller shaft itself is also made in two parts, with a universal joint of the spur and internal gear type between them.

The propeller shaft universal joint is of the ring type. The ring is made in the form of two half rings, and in order to relieve the clamping belts of shearing strains, the surfaces of the joint are serrated. The pins of the joint are tapered and are fitted with hardened steel sleeves which bear in bronze bushes fitted into the ring. Oil lubrication is used for the universal joint, the pins being drilled out so that centrifugal force will carry the oil to the bearing surfaces.

An important feature in connection with the universal joint is the large hollow steel sphere in which it is inclosed. This is made of two drop forgings bolted together, the whole being bolted rigidly to the frame. On the outside of this steel ball is a large spherical bronze socket which forms the front end of the torque tube. Both ball and socket are ground to a close limit of accuracy.

Both sets of brakes act directly on the rear wheels, but there is a separate drum for each, the drums being made of hydraulic forgings. The inner brake is the hand or emergency brake and the shoes are fitted with cast iron liners, while the foot or service brake is the outer one and is lined with Ferodo brake lining. The foot brakes are unusually large, the drums being 17.1 in. in diameter. These drums are provided with cooling flanges ¾ in. deep, cut from the solid, and it is stated that this brake can be applied for long periods without overheating.

All brackets and levers of the brake mechanism are made of drop forged steel, heat-treated. Both sets of brakes are provided with brake equalizers of the differential gear type, neatly inclosed in aluminum housings mounted on cross tubes on the frame.

The foot brake adjustment is, perhaps, the handiest device of the kind ever put on a car (though by no means the simplest) and is covered by a patent. All the operator has to do to adjust the brake is to turn a small handwheel at the side of the frame, the adjustment being self-locking. A sectional view of this mechanism is shown herewith. The handwheel A has the end of its stem B squared to engage with the cap nut C supported

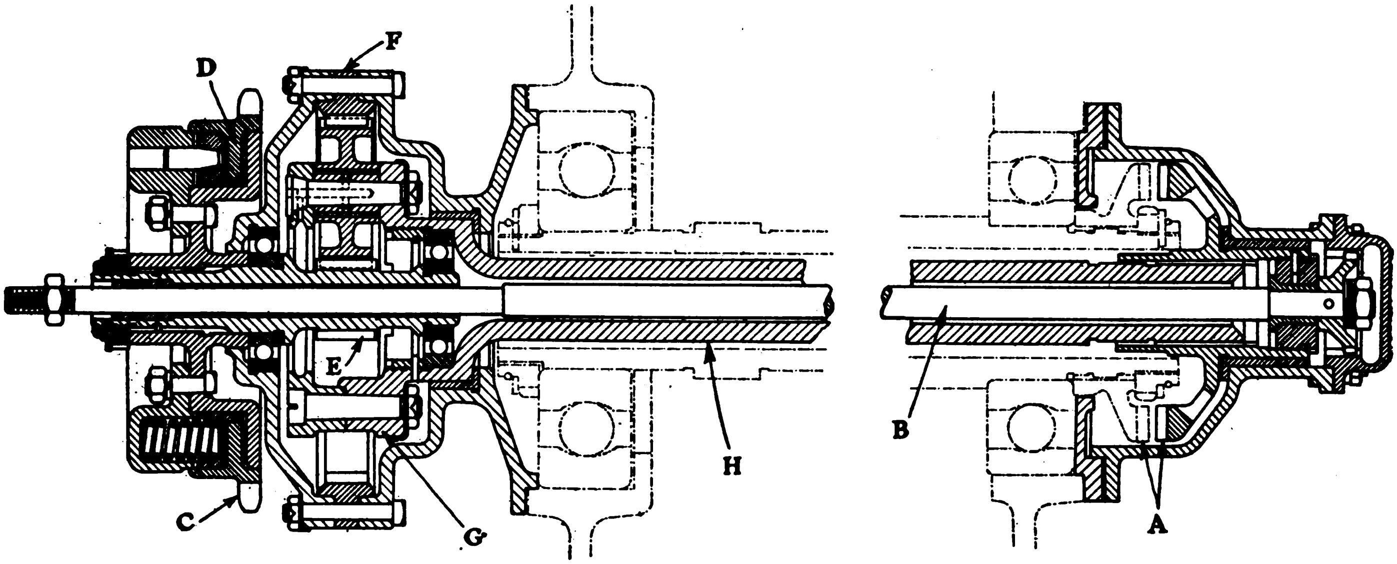


Fig. 3—Arrangement of epicyclic starter gear on secondary transmission shaft

in the tubular member D, which extends between the frame side bar and a bracket E fixed to a tubular cross member of the frame. When nut C is turned by means of handwheel A it draws screw F toward the frame side member. This screw is held from rotating by a pin G extending through slots in tubular member D parallel to the axis thereof, and the ends of the pin extend into holes in the tubular sliding member H, which has steep pitch screw threads of opposite hand cut on it at its opposite ends (h,h). These screw threads engage with similar female threads in the hubs of lever arms I and J, one of which connects to the brake pedal and the other to the brake shaft at the rear axle. Thus when handwheel is turned, tubular sliding member H is pulled through the hubs of levers I and J, causing these levers to turn through slight angles in opposite directions, thereby effecting the adjustment. Ratchet K, which slides along the squared portion of the stem of handwheel A and engages with a corresponding ratchet on the end of hub L, under the pressure of spring M, locks the adjustment.

In addition to this adjustment there are adjustments at the rear axle for both the service and emergency brakes. These, too, are of a very handy type and are illustrated by the sketch herewith. The hub of the lever on the rear brake shaft is made of large diameter and provided with serrations on one side which engage with similar serrations on a dummy hub fast on the shaft. A nut on the shaft screws the two hubs together, thus holding the two serrated surfaces in engagement. The nut itself is provided with coarse radial serrations on its outer face with which engages a sliding locking collar mounted on a key on the shaft. This collar is pressed in the direction of the nut by a coiled spring. When it is desired to make an adjustment, the locking collar is forced away from the nut against the light spring, and slightly twisted around so it will be held in the disengaged position by a pin fastened in the shaft, which extends through a slot in the collar running axially to allow of the motion and circumferentially to effect the locking.

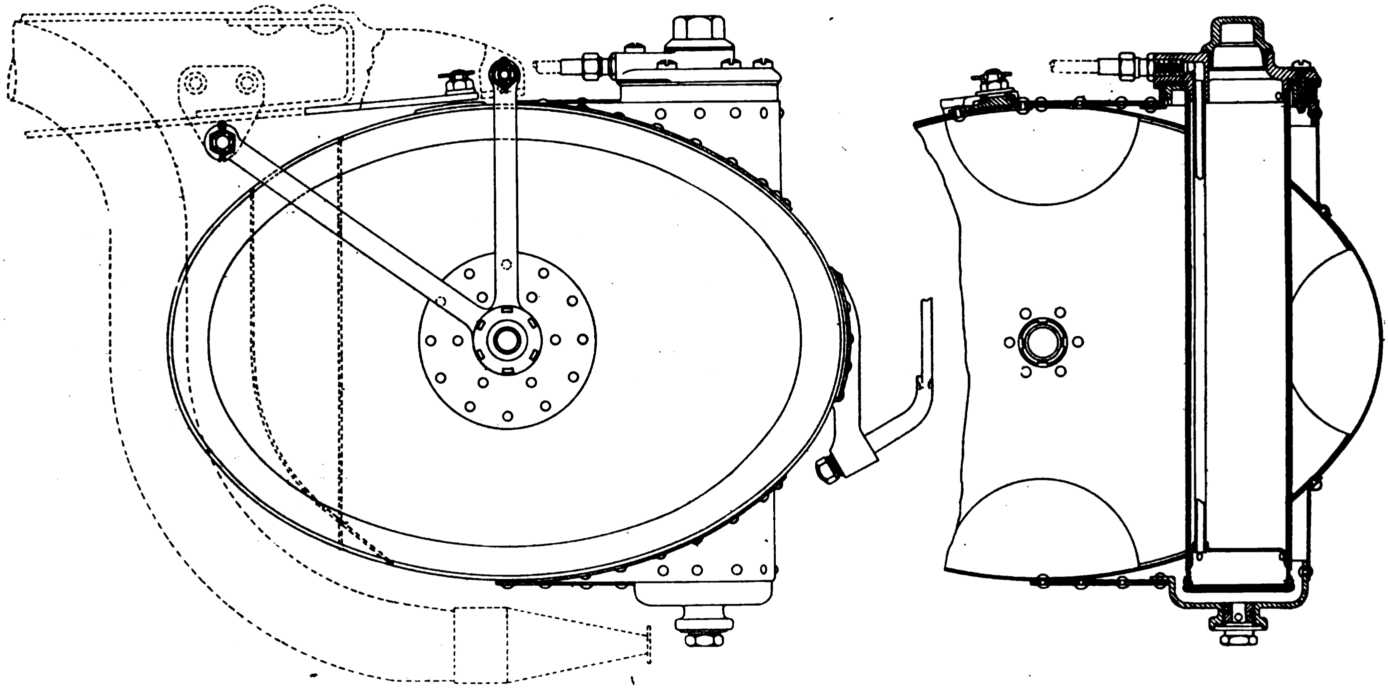
Wire wheels are used, and though these are made by the Dunlop company, they embody Rolls-Royce inner and outer hubs. A serrated drive is used, embodying a large number of teeth and large driving surfaces, with conical supports for both ends of the wheel hub to prevent wobbling. The retaining nuts are positively locked and cannot back off while running. Both hubs are made of pressed steel and are turned down to very light sections.

The mud pan is made of aluminum and is provided with louvres so as to increase the circulation of air through the radiator and prevent the heat and gases from the engine getting into the driver's compartment. This pan extends the whole length of the engine and transmission.

Steering is by a screw and nut mechanism, the nut being split in halves lengthwise, to permit of fitting it accurately to the screw and of making adjustment for wear when required. The nut operates a rocking lever to which the steering arm is secured. This rocking lever is mounted on ball bearings and the steering arm is secured to the rocking lever by means of tapering serrated hubs, these serrations being formed by a process worked out in the Rolls-Royce plant. A feature of the steering gear is that the bearings supporting the worm shaft are located very far apart, whereby the load on the bearing close to the worm is reduced. The ball journal and thrust bearing are located halfway up the column. The control levers are pivoted on brackets brazed to the operating tubes. These brackets can be rotated by disengaging the lever from serrations on the quadrant, as the lever fits into a slot in the bracket. A small spring and plunger keep the lever in contact with the serrations. The control linkage is very carefully made, yoked fittings being used almost exclusively, and when a car passes inspection there is absolutely no play in these connections. Leather boots are fitted to the ends of both the drag link and the steering tie rod.

Front springs are half elliptic and are flat under load. They have solid forged eyes on the master leaves. Shock absorbers of Rolls-Royce design are fitted at the front of the chassis. These are of the friction disk type, two leather conical shaped cuts fitting between conical steel disks. A spring, readily adjustable for pressure, forces the disks into contact. The rear springs are of the flat cantilever type, and as they have numerous leaves the friction between leaves is sufficient for damping the spring action, hence no shock absorbers are used at the rear.

The front axle is an alloy steel forging, and the steering knuckles are of the inverted Elliott type, with the pivot axes inclined so as to meet the ground at the center point of tire contact. The steering arms are fixed to the knuckles in a very secure manner. A flange is forged on the steering arm, which abutts a similar flange on the top of the steering knuckle, and the two flanges are bolted



Gasoline tank

together. Steering arm forgings are finished by filing all over and are then examined microscopically for flaws. This method of finishing up parts is used throughout.

The generator, which is of the Lucas make, is driven from the front of the gear box by a leather link V belt. The belt tension can be adjusted by means of a nut located on the outside of the frame. Voltage control is by the third brush system. A pressure of 12 volts is employed and the wiring is on the insulated return principle, except, of course, as regards the ignition wiring. The switch box, located on the instrument board, contains the battery cut-out switch, lamp switches, generator field fuses, charging switch, terminals for the generator, battery and lamp connections and a socket for an inspection lamp. A junction box is fitted to the front of the dash on the right-hand side. The cables leading from this junction box are inclosed in aluminum conduits or troughs bolted to the front side of the dash. These troughs are easily removed for inspection and give a neat appearance to the wiring.

The starter is located on the left-hand side of the gearbox and drives to the secondary shaft of the gearbox through a jaw clutch. A planetary gear on the starter, together with another on the gearbox, connected by a chain drive, give a total reduction from the starter armature to the crankshaft of 23 to 1. The sprocket wheel at the transmission is provided with a friction coupling to protect the starter and its gearing in the event of a backfire. A sectional view of the starter drive mechanism located on the transmission is shown in Fig. 3. The jaw clutch A is engaged automatically by an electro-magnet energized when the starter button is depressed. The operating motion is transmitted to the clutch through the rod B extending through the hollow secondary shaft of the gearbox. Referring to the drawing of the starter drive, power is received from the starter by the sprocket C, is transmitted through the friction coupling D to the central pinion E of the planetary set. The ring gear F of this set is held stationary and the power is taken by the planetary spider G, a part of which is forged integral with the hollow shaft H passing through the gear box secondary shaft. This planetary gear gives a reduction of 6 to 1.

All exhaust fittings are either riveted or acetylene-welded. The exhaust gases, before entering the muffler, are passed through an expansion chamber. Both the expansion chamber and the muffler are lagged with asbestos covered with a steel sheath to prevent heating of the body. An exhaust cut-out is provided.

The gasoline tank, of 21 gal. capacity, is made from tinned sheet steel. All joints are lapped, soldered and riveted. There are several baffle plates which stiffen the the tank. All tanks are tested under hydraulic pressure. As the gasoline enters the tank it is filtered through a monel metal screen of very large area, and on leaving the tank it passes through another monel metal screen. The tank is suspended by hangers from the frame passing over the ends of a tube extending centrally through the tank lengthwise, and is held from rotating by a stay from the rear cross member of the frame to the filler fitting.

The frame side members have a section 6 in. deep and are strengthened by an under-running truss. They are made of nickel steel. All cross members are of tubular form, made from seamless nickel steel tubing and are secured to the side members by drop forged fittings pinned and brazed. No rivets are used in the frame, all parts being secured to it by taper bolts passing through taper reamed holes.

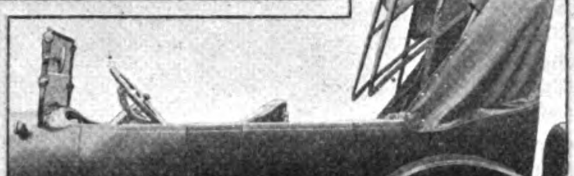
A NEW parallel attachment for drawing boards, which does away with the use of the T square, has been placed on the market by the New York Blue Print Paper Co. It is claimed to be more convenient than the T square and also to give better results. The metal parts of the Precise parallel attachment are of aluminum and the whole attachment weighs under 2 oz. These parts comprise one plate with double pulley, one plate with two small pulleys at the ends of the straight edge, four brackets with a hole in each, a small grip to hold the cord firmly and sufficient silk cord for operating. The double pulley acts as a T square head, being provided with a shoulder for the purpose. The cords, running parallel, are hidden in the straight edge. The straight edge can be quickly adjusted to any angle desired and can, it is claimed, then be depended on for parallel line work.

Seasonable Announcement of Spring Top

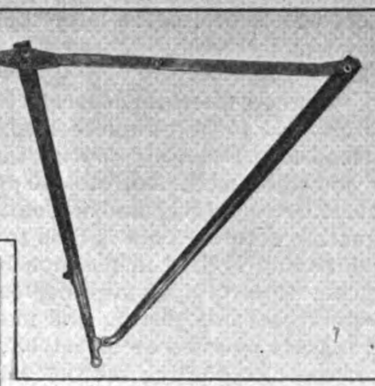
AN automobile top which rises automatically as soon as a button is pulled to release a spring is manufactured by the Automotop Corporation. The bow sockets of the top are of the same form and bear the same relation to each other as in the ordinary top. Springs located between the body and the upholstery impart to the bow sockets the necessary motive power. Concealed hangers located inside the car are invisible from the outside of the car at all times. A pull button, situated at any convenient part of the car, releases the bow sockets from their hangers. This pull button is connected to the hanger finger releases by coppered steel wires. When thus released the spring actuated fingers throw themselves clear of the bows, permitting the springs to raise the entire top out of its boot into the final position of the main bows. From this point of operation the linkages connecting all of the bows come into play through the weight of the bows and top fabric, causing the entire top to assume its final horizontal position. It is then only necessary to pull down the snap locks fastening the forward bow to the windshield posts. A fabric side curtain pocket extending across the forward bow when the top is up covers the nest of bows, fabric and hangers when the top is down.

To take down the top, the windshield fasteners are released and by a light pressure of the hand on the forward bow, the entire top is pushed back into the boot and the hanger fingers snapped over the bow sockets. The top can be put up almost instantly, and taking it down requires less than fifteen seconds.

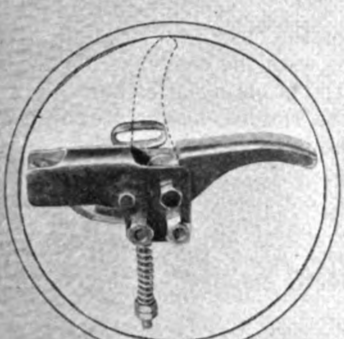
Top in raised position.



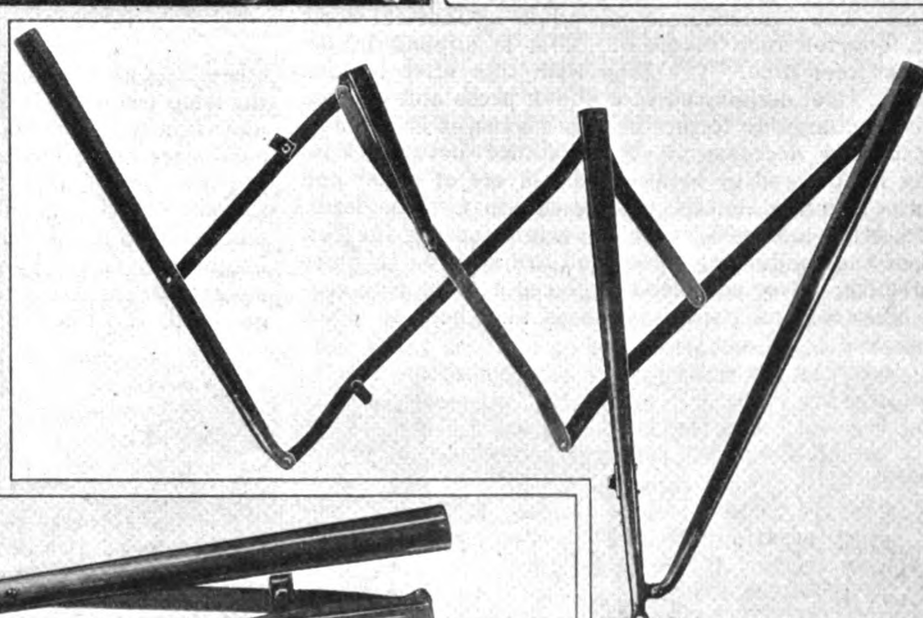
Top rising automatically from boot.



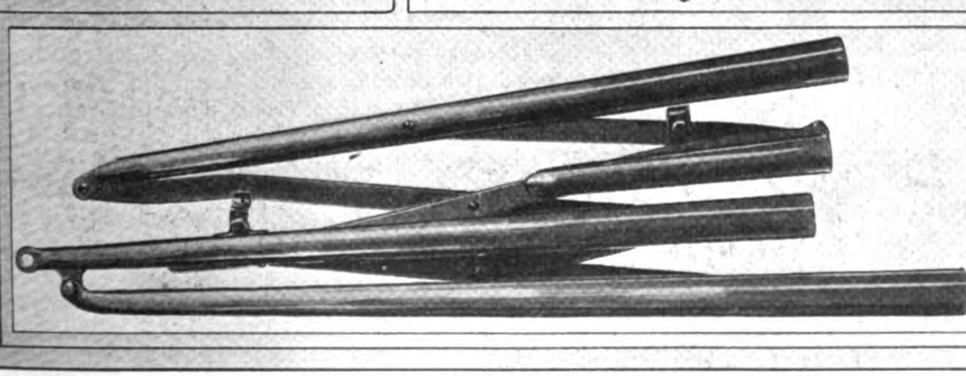
Bow sockets fully extended.



Hanger with finger in horizontal position Released position shown dotted.



Bow sockets shown in intermediate position.



Bow sockets in down position.

Refinements in a Battery Ignition System

Novel features claimed include a straight line contact with one floating point which prevents pitting. Duplex system differs from other systems in that either high frequency spark or single spark can be used as desired.

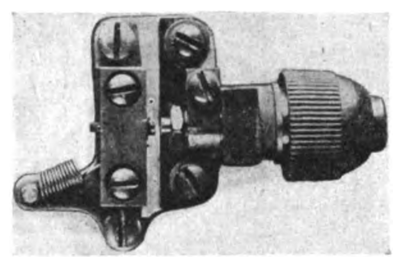
By J. Edward Schipper

THE Philbrin battery ignition system, which has been on the market for a number of years, has been refined in several details and brought up-to-date. The system was exhibited at both the New York and Chicago shows and is being offered for all lines of automotive work.

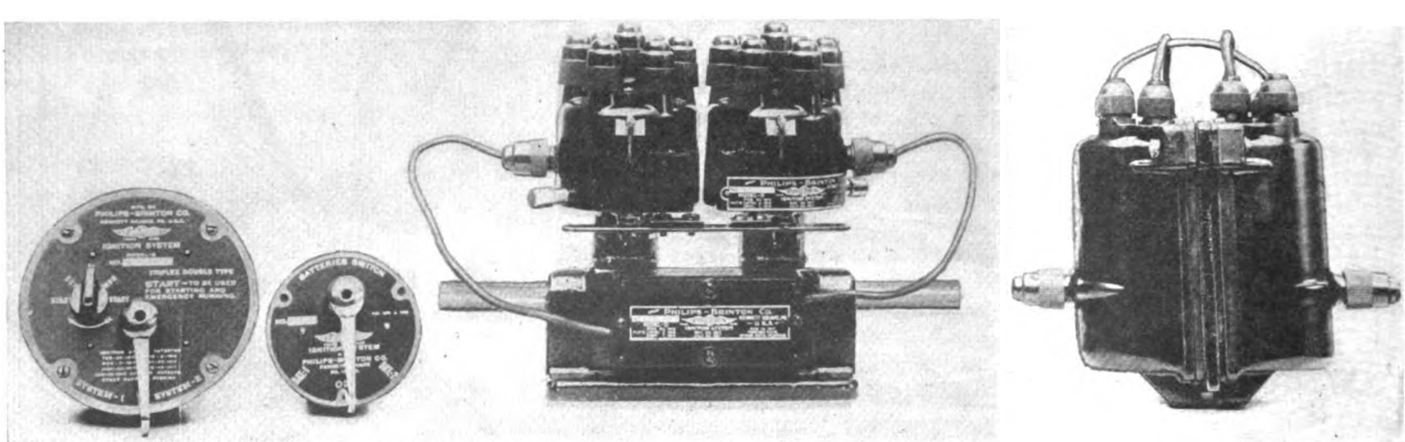
It is an open circuit system incorporating some features which are claimed to be unique. These include a straight line instead of a swinging contact movement of the interrupter movable part, said to insure uniform contact over the entire surface, and a floating contact shaft in the adjusting screw. This is free to move back and forth or revolve and is held in position by a helical spring. This spring imparts a turning movement to the contact shaft, which prevents pitting and mating of the points. A third feature claimed as an advantage is that the circuit is closed gradually and at the point of maximum saturation is broken instantly by the contact plunger dropping abruptly off the end of the cam tooth.

Probably the feature of greatest interest is the condenser, which is made up of sheets of aluminum foil with one layer of hard and one layer of soft paper in between. The condenser is wound in cylindrical form over a quarter inch mandrel. This is slipped into a seamless steel tube. The tube with this filler is then put into a steel die, placed in a punch press and pressed into the rectangular form. By this means, it is claimed, a substantial decrease in the distance between conductors is obtained by bringing the layers of paper and foil into intimate contact with each other. The leads, 3/32 in. wide and .003 in. thick, extend across the full width of the conducting plate, and are secured in place with shellac. Over each lead is placed a protecting covering of varnished paper, which is also held in place with shellac. It is an objection to the use of aluminum foil for condensers that it is difficult to make a satisfactory connection to the leads, but it is claimed that by the method above described a perfect connection is obtained between the brass and aluminum, as the raw edges of the brass strip are forced into the aluminum while transforming the shape of the condenser in the die.

The process of impregnating the condenser is as follows: The leads are connected in a 220-volt circuit in series with a lamp which is before the operator. The condenser is then placed in a bath of wax, the temperature of which is approximately 280 deg. Fahr. In the course of 10 sec., bubbles are seen coming from the ends of the condenser. Owing to the high temperature of the wax, moisture between the folds of the condenser and in the paper is converted into steam. This steam acts as a conductor of the current. In about 15 sec. the lamp (which is in series with the condenser) is seen to glow faintly. Meanwhile, the bubbling at either end of the condenser has become quite violent, as the steam, escaping from the condenser, tends to cause a partial vacuum, thereby drawing in the wax which takes the place of the moisture that has been expelled. The light glows brightly up to the point of maximum conductivity of the steam saturated condenser. After that point the light gradually dims as the dielectic strength of the condenser



The Philbrin single-spark interrupter



Parts of Philbrin ignition systems

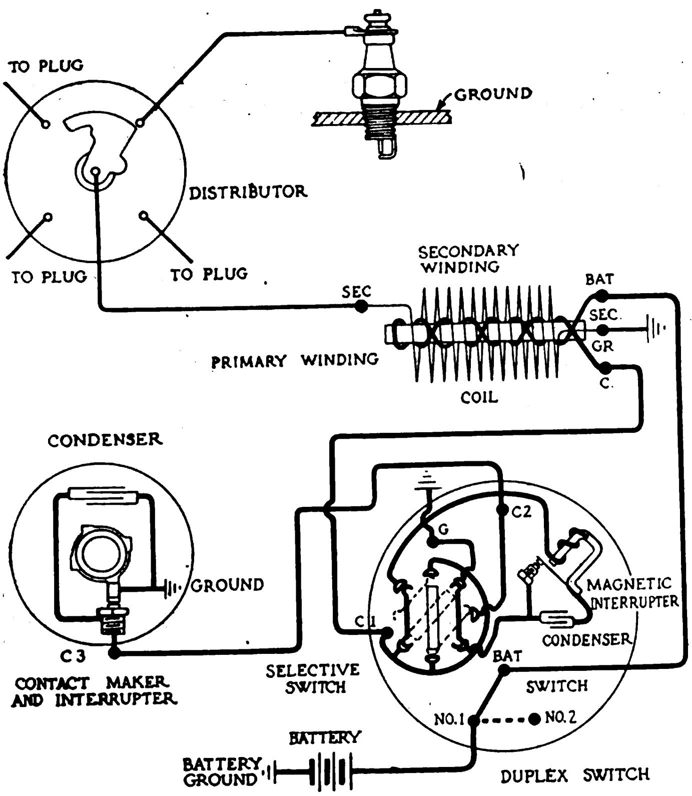


Diagram showing principle of operation and internal winding of Philbrin duplex ignition system

builds up due to the absorption of the impregnating wax until the light goes out entirely. The condenser is then left in this bath about 25 min. so as to insure thorough impregnation, the current being kept on throughout the whole period. Previously, it was necessary to dry the paper carefully before using, but in this process the moisture in the paper is utilized to help impregnate the condenser.

The coil is of the non-vibrating, open core type. The primary winding consists of two layers of wire wound around an iron wire core. This primary is secured in a laminated tube having 1/16 in. thickness of wall and composed of layers of "Kraft" paper and varnished paper.

The secondary, which is made in two sections, is mounted on the outside of this tube. Two and one-quarter turns of varnished paper are used for the insulation between the layers of the secondary winding. The coil is embedded in a bakelite case, which makes it oil and moisture proof.

The Philbrin duplex system differs from other ignition systems in that it uses either the single spark or the high frequency spark. These combined systems employ the same coil and distributor and are controlled by a common switch. In this switch is located a magnetic interrupter or high speed vibrator. This vibrator produces from 50,000 to 60,000 sparks per min. For some classes of work a frequency in excess of 100,000 is used. This switch is provided with a selective switch button which selects the system desired, either the single spark or the high frequency.

When the single spark system is being used, the timing is done by breaking the primary circuit. When the button is in the high frequency position, the magnetic interrupter in the switch is operating continuously. The timing and distributing is done by means of a distributor blade with a trailing tail, and the action is as follows: When the forward edge of the blade is approximately .015 in. from the distributor pin, the spark jumps to that point and the sparks are distributed to that cylinder throughout the power stroke. As the tail of the blade leaves this pin the sparks continue to jump back to the pin, since the cylinder connected is under a lower compression than that connected to the pin which the forward edge of the blade is there approaching, until the forward edge of the blade is within approximately .015 in. of this distributor pin, when ionization of the air takes place and the spark jumps to this distributor pin and repeats the same cycle of operations.

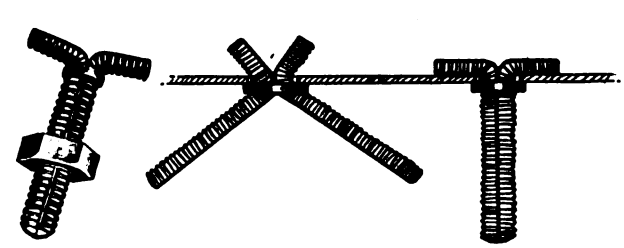
These sparks are synchronized, as no commutator is employed in the primary circuit, but the circuit is closed through the magnetic interrupter as long as the switch is in this position. Each time the high frequency system is turned on, the polarity is automatically reversed, as the button is turnable only in a clockwise direction. This system is used for starting a cold motor and for emergency running, as when excessive oil conditions are encountered, or when a poor carbureter adjustment is used. It is not possible to have both the single spark and the high frequency turned on at the same time.

The single spark double system is used where it is desired to produce two synchronized sparks in the cylinder of an engine. Two distributors and two contact makers are then employed, only one of the contact makers being used at a time, the other being held in reserve. With this system, no high frequency spark is employed.

The duplex double system is used where it is desired to produce two synchronized sparks in the cylinder of an engine. This is done by employing one contact maker and two distributors mounted on a common base. Two coils are employed with their primaries wired in series. This produces two independent secondary sparks, each going to its own distributor. The high frequency system operates the same as before described.

The triplex double system is used where it is desired to produce two synchronized sparks in the cylinder of an engine. The only difference between this system and the duplex double system is that two contact makers are provided, but only one is used at a time, the other being held in reserve. This system was developed at the request of the Baldwin Locomotive Works three and one-half years ago. It is claimed that it made the use of large locomotives practical and that other methods had utterly failed on these locomotives.

A SPLIT bolt which can be secured into the panels of sheet metal bodies is manufactured by the Savage Expansion Bolt Corp. It may be described as a length of screw-threaded rod split lengthwise through the center, each half having one end turned at right angles. To fasten the bolt into a sheet metal panel which is accessible from the outside only, a round hole the size of the bolt is made in the panel, the halves of the bolt are then put with their turned head portions together and the bolt is forced through the hole, after which the nut is drawn up tight, anchoring the bolt firmly in the panel. If it is desired to secure a sheet metal or similar bracket to the panel, this can, of course, be put under the nut.



A split bolt for use in sheet metal body panels

Hardness and Its Relation to Ductility and Fatigue Range

The meaning of the term hardness is clearly explained, and various methods of measuring this quality are discussed. The relation of hardness to ductility and fatigue range is pointed out and the tendency to demand high ductility at the expense of other desirable qualities is discussed.

By Dr. Walter Rosenhain, F.R.S.

THERE are probably few properties of metals which are of more general importance to the engineer than "hardness." This is a property, or more probably a group of properties, which it is extremely difficult to define and which it is correspondingly difficult to measure, but the term none the less corresponds very definitely to something which, in engineering materials, and particularly in such structures and machines as are involved in automobile engineering, is extremely necessary. It is, therefore, worth while to devote a little consideration to what we really mean by the term "hardness" and how we can define and measure it in the first place and how it is to be best obtained and utilized afterwards.

The general conception of "hardness" is perhaps best understood if we think of it as the opposite to "softness." Now softness is the typical quality of a material which is easily displaced. If we can push a finger into a piece of clay or wax, we speak of it as "soft." Hardness, therefore, as the opposite of "softness" we may fairly regard as the power of resisting displacement or "pushing away." But here we meet the real difficulty—that materials can be "pushed away" in a variety of different ways. The pushing away may be done by direct pressure or thrust, as when an indentation or punch-mark is made, or it may be done by lateral pushing or shear, as occurs in some forms of cutting or scratching, or—finally—it may be done a little piece at a time, by abrasion or wear. Yet we term the power of resisting all these different kinds of displacement "hardness" and try to measure this property by measuring the resistance of the metal to one or other of these various forms of displacement.

That "hardness" measured in one of these ways does not necessarily measure the power of resisting the others becomes quite plain if we think of one or two special cases. Thus suppose that a material or body were built up out of a regular pile of small, strong flat plates placed one upon the other. Indentation of such a pile by vertical pressure upon its upper surface would meet with very great resistance, and the apparent "hardness" would be very great. Yet the little flat plates could be pushed away along the surface with great ease, and hardness measured as resistance to that kind of displacement would appear very low indeed. Again, whole layers of the little plates could be pushed along with comparative ease if a lateral or shearing force were applied, and again the "hardness" would be low. Although this is an extreme case, and real metals are not built up in such a peculiar manner, yet it serves to illustrate the point that we cannot, as a matter of course, assume that a body having a high hardness number as measured by indentation methods, must also have high resistance to scratching or abrasion. In actual materials there is, fortunately, some linking up of properties. As a rule, for instance, high tensile or compressive resistance is accompanied by high resistance to shear also, and this generally implies a high degree of resistance to local shearing or abrasion.

There are, however, important exceptions to this latter rule. All ordinary tests are made fairly rapidly and can therefore ascertain only the properties of the material as it exists at the moment of test. Yet there are some materials which undergo very profound changes of internal constitution and structure if exposed to certain special working conditions. This applies, for example, to a certain group of special alloy steels which contain enough of the added elements, such as nickel or manganese, to keep them in what is known as the "Austenitic" condition, in which they are relatively soft and non-magnetic. Some of these steels, if subjected to mechanical deformation involving plastic strain, become converted into what is known as the "martensitic" state, in which they are very "hard" and magnetic. Tested in the ordinary way, such a steel appears to be comparatively "soft." Yet the wearing surface of a rail made of such a steel becomes converted, under the stresses to which it is locally exposed, into the hardened form of the steel and resists wear to a most surprising extent. From the point of view of hardness-testing, materials which behave in such a manner are fortunately rare, but for many purposes they are extremely and increasingly important.

The usual methods of hardness-testing rely upon the assumption that resistance to one method of displacement implies a corresponding degree of resistance to all other methods of displacement. Since in many materials there is an approach to compliance with this assumption this is a useful process, but it is important to bear in mind that it is based on such an assumption which may, and sometimes does, break down seriously here and there.

The most widely used of all hardness tests, particularly in England, is the Brinell ball indentation tests. This test is so well known that it is not necessary to take up space by any detailed account of it, and we need only consider it from a very general point of view. What it measures is something which depends upon the general "strength" of the metal; in most cases the "Brinell Number" is directly proportional to tensile strength. This, no doubt, is an advantage where it is desired to save the trouble of making a tensile test if a simpler test like the ball-test will serve the purpose, but from the point of view of actual hardness-testing it is less satisfactory, since it becomes clear that the ball-test shows little or nothing that is not already known from the well-explored tensile test. None the less, the real utility of the ball-test cannot be

doubted, particularly since it allows of the rapid exploration of relatively large surfaces of metal with a view to ascertaining the uniformity of the material. The test can be applied without seriously damaging many objects, and for the purpose of ascertaining whether a given material has been correctly made or treated so as to attain a given degree of "hardness," it leaves little to be desired except in the case of extremely hard metals, such as fully hardened steel. There, the deformation of the ball becomes serious as compared with that of the material under test and the resulting figures are apt to have very little value. Apart from that difficulty, however, uniformity of ball-hardness is a very good guarantee, throughout successive productions of the same kind, of uniformity of composition and treatment. On the other hand, comparison of the "hardness" of widely different materials in terms of the ball-test is a much less reliable proceeding.

The Brinell or ball-indentation test has the further rather serious disadvantage that the "hardness number," which is generally found by dividing the load applied by the total area of the spherical indentation produced, is not entirely independent of either the size of the ball or the load employed. It does not, therefore, represent as it is intended to do, the load per unit area which the metal under test is capable of supporting without further deformation. Attempts have been made in two directions to improve upon the ball-test by making the indentations in a slightly different way. In one, usually known as the Ludwik Cone Test, the indentation is made by pressing into the metal under test a steel cone having a sharp point. All indentations made with such a cone are geometrically similar and there is no need to use different cones with metals of widely different "hardness"; the applied load can be varied without destroying the geometrical similarity of the indentations. This method gives excellent results until the attempt is made to apply it to very hard materials—then the point of the cone, and with it the test, are liable to break down, as the local stresses become excessive.

In another direction the attempt has been made to replace the hardened steel ball of the Brinell test by a flat-ended parallel punch. This method also presents important advantages, but it has not yet been studied sufficiently to be capable of general application. In an entirely different direction, however, important modifications of the hardness test have been developed. These developments have taken the direction of making the application of the indenting instrument very brief indeed and thus of producing an indentation by impact rather than by "static" or steady pressure. In England this line has been followed by Prof. Edwards, who was mainly concerned with a problem which is of very direct importance in connection with automobile engineering. This is the determination of the properties of materials at such high temperatures as those to which they are exposed in the interior of an internal combustion engine. Pistons, valves, cylinder heads and even connecting rods all have to do their work at temperatures which are high enough to produce a material change in all the physical properties of our materials. It is, indeed, often found that of two materials the one which is weaker at the ordinary temperature is appreciably the better of the two at, say, 600° Fahr. (250° C). Tests of hardness at various temperatures are, therefore, of very considerable interest and value. There is, however, a difficulty in making such tests in the ordinary way by the ball-indentation method, because the exposure of a hardened steel ball to such a temperature as 600° Fahr. for any length of time softens and spoils it to a serious extent—and at still higher temperatures, such as come into consideration in connection with exhaust valves, the steel ball becomes useless if left in contact with the heated test-piece for more than the fraction of a second. It is for this purpose that Edwards has developed a ball-impact test, in which the heated test-piece is indented by means of a cold steel ball which strikes the test-piece and rebounds from it before the ball has had time to be affected.

As a general rule, Edwards has found that the ball-hardness as found by impact does not vary very much from the "static" hardness in such cases where direct comparison can be made, although a few metals furnish marked exceptions to this parallelism. Curiously enough, iron or very mild steel is one of the most striking exceptions. This case has, however, been fully explained in a manner first anticipated by the writer and subsequently fully verified in his and other laboratories. It is found that the exact manner in which iron, or the "ferrite" of very mild steel, undergoes deformation is different when the stress applied is "static" from that which occurs when the stress is due to a blow or is "impulsive." In the latter case, microscopic examination shows in the vicinity of the indentation a large number of fine lines running across the ferrite crystals—generally known as "Neumann's Lines," which are entirely absent near a statically-produced indentation. This discovery, while it explains the discrepancies in impact hardness numbers, is still more important because it shows definitely that what occurs in ferrite under impact is quite different from what occurs under steady loading—a circumstance which lends added importance to the whole question of impact testing.

The method of ball-hardness testing under impact, as developed by Edwards, still relies—both for tests at ordinary and at high temperatures—upon the subsequent measurement of the indentation produced. A somewhat similar impact-hardness test has been developed—at an earlier date—by Shore in quite a different direction. In the well-known Shore Scleroscope, which originated in America, the impact of the "hammer" also produces an indentation but no measurement of this is included in the test—all that is measured is the height of rebound of the hammer after falling upon the surface to be tested from one standard height. What the height of this rebound really measures is simply the amount of energy left in the hammer after making the indentation. This depends upon how much the metal which has been struck has been displaced or indented and how much energy has been absorbed in this process of indentation. There are also other losses of energy, such as the heat generated at impact and losses by elastic and other displacements of the piece of metal as a whole, but in most cases these are fortunately small enough to be neglected in this type of test. To a certain degree of approximation, therefore, the rebound in the Shore Scleroscope measures the resistance of the metal to indentation under impact, and this is clearly, a particular kind of "hardness." Again, in the majority of materials, this property appears to run nearly, if not quite parallel with ordinary Brinell ball-hardness, and—like the latter—with tensile strength. There can, therefore, be no doubt as to the convenience and value of the Scleroscope test, provided that it is used with care and with an intelligent appreciation of its limitations. In order to realize how serious these limitations may be if the test is applied—for example—to a thin piece of metal not quite adequately supported, it is instructive to make a Scleroscope "hardness" determination on a piece of fairly stout celluloid sheet, first placing this direct on the metal base of the Scleroscope and afterwards interposing a fairly thick piece of india-rubber. In the latter circumstances the rebound is higher than that obtained from the hardest steel. On the other hand, it is only fair to point out that for the testing of very hard materials, the Scleroscope working with a diamond-ended "hammer" has a distinct advantage over other ball-indentation methods. It appears to the writer, however, that while the Scleroscope in its present

form is very simple and easy to use, its value as a testing instrument would be very much increased if it were possible to vary the height of fall of the hammer.

Quite recently, Dr. Haigh, at the Royal Naval College, Greenwich (England), has worked out an entirely different method of hardness testing. Recognizing the difficulty which arises in the case of hard metals from the deformation of the ball or other tool used for making indentations, Haigh has developed a method in which the indenting implement and the indented specimen are made of the same metal and are caused to indent each other in a symmetrical manner. Two square-sectioned bars or prisms of the metal to be tested are prepared of exactly equal dimensions; these are then held securely in jigs and, with their lengths at right-angles to each other, and edge crossing edge, are pressed together with a known load. The two prism-edges indent one another symmetrically, and the amount of this indentation is a measure of the hardness, just as in the Brinell test. This ingenious test is still in its infancy, and suffers from the obvious disadvantage that it can only be applied to specially prepared test-pieces, but it offers some entirely new possibilities in hardness-testing and it may be destined to throw new light on some of the difficult problems connected with this subject.

In addition to the purely mechanical tests of "hardness" which we have just considered, there are a number of others based on such methods as scratching or abrasion which do not appear to be as yet capable of any high degree of precision. So far as abrasion or resistance to wear is concerned, it still seems that actual trial in service is the only really reliable test where the comparison of different materials is concerned. At most, a test-model designed to imitate the conditions of service may be employed for trial purposes, but if the test is to be a quick one, the similarity to service conditions must inevitably be violated and the resulting data to that extent rendered doubtful. It is, therefore, reasonable to state the position in this way, that while ordinary "hardness" tests of the indentation or Scleroscope type furnish a general guide as to the "hardness" of metals even from the point of view of resistance to abrasion, it is not safe to rely too much upon such guidance except in the case of a single class of material in which the correlation between these tests and wear in service has been definitely established. To put the matter in concrete form, the relative degrees of hardening of a set of pieces of the same carbon steel could be safely ascertained by the ball or scleroscope test; but of a bronze and a steel giving identical "hardness numbers," one might give very much longer life in service than the other.

Ductibility

Even the general kind of guidance which can thus be obtained from ordinary hardness tests, however, is of immense value in the selection of materials and in deciding upon their treatment. That hardness is of vital importance in engineering construction is, of course, obvious. On the other hand, increased hardness nearly always brings with it a corresponding decrease in ductibility, and the rival claims of these two properties deserve a little consideration. Both the designer, the maker and the user of engineering products have a deep-rooted desire for ductility in their materials. It has, of course, been pointed out that an automobile back-axle which has been seriously bent by an accident is no more serviceable than one which has broken short off, and it is doubtful whether an accident is likely to be rendered less serious by the mere fact that damaged parts have given way by bending rather than breaking. The extreme demand for ductility which still exists in many quarters is probably to a large extent a heritage from the days—now seemingly remote, but really not very far back in history—when wrought iron was the principal material for all engineering construction. In that material, ductility stood for good quality in all respects and material which "broke off short" was rightly regarded with suspicion. When steel was first substituted for wrought iron, it was natural that the same demands for ductility should be made upon it, and in very mild steel these demands can of course be met. But the demand has extended, to a certain extent, to all other materials, and for many years engineers have thought it essential to sacrifice much to this requirement of ductility.

That there is need for ductility in many places is not, of course, to be denied. The exigencies of constructional operations often require a little "cold setting" of parts, and even where such operations are entirely avoided, the inevitable errors, or rather variations of workmanship still require that the material shall have the power to yield slightly in order to secure a more uniform distribution of load. But for these purposes, as a rule, quite a small degree of ductility is adequate; no adjustments of the kind mentioned demand any such ductility as would correspond, for example, to an elongation of 20 per cent on 2 inches in a tensile test. It would seem, therefore, that the real need for ductility for its own sake under service conditions is quite small. It is, therefore, only as a test for quality of the material that it can be given any very great importance. If that is the case, however, it should be regarded from a point of view rather different from that ordinarily adopted: ductility should only be valued as a quality to be aimed at so long as other and more immediately important qualities are not sacrificed.

Fatigue Range

Thus, in the majority of the working parts of an engine, it is the fatigue range—i. e., the range of alternating stress to which a piece can be safely subjected for an indefinitely long series of repetitions—which really measures the value of a material. Now this "safe range" under fatigue is associated very closely with the property of "hardness" which we are here considering, and like hardness, it can be obtained, as a rule, only at the expense of ductility. Now consider the case of a crank-shaft. Failure under fatigue is of vital importance; but provided the shaft will stand the small amount of straightening which may be necessary at one stage of its manufacture, of **what further use is ductility in a part which would become useless if it were a few hundredths of an inch out of line? Yet the demand for a relatively high degree of ductility in most specifications definitely limits the hardness and with it the safe fatigue range of the material employed.** Among materials having the same fatigue range, it would no doubt be justifiable to select that which showed at the same time the highest degree of ductility, although even there the selection should be based rather upon the results of a notched-bar impact test than upon ductility alone. But, **given a certain minimum amount of ductility, depending upon the nature of the service required, it appears to be traditional rather than logical to value higher ductility at the expense of hardness and fatigue resistance.**

More directly concerned with the subject of hardness is the question of material exposed to actual abrasive wear, such as gear-wheels, shafts running in bearings, etc. Here there are two divergent lines of practice which are of interest in the present connection. They may be described as the "case hardening" and the "all hard" respectively. So far as actual hardness tests are concerned, identical values can be obtained from materials of both kinds, although it is important to remember that in the ball-indentation test there is danger of obtaining much too low a value if the indentation is made in a very thin, hard case lying upon a soft core. With identical hardness numbers one may, in

this case where the materials are otherwise similar in constitution and structure, assume that actual wearing properties as against abrasion will be identical for the "cased" and the "all hard" materials so long as the case is not worn through. Actually, however, it is usually easier to obtain a high hardness number from a cased article than from one which is entirely hard. The reason is that a more severe quenching process can be safely applied to a properly cased article than to one which consists entirely of high-carbon steel. In the latter case the volume changes due to hardening occur throughout a much larger mass and there is a greater tendency to crack. In the cased article, on the other hand, flaking of the case may occur if the transition which occurs between case and core is not sufficiently gradual.

The sort of consideration just mentioned, which governs the degree of hardness attainable, applies also in other directions. Apart from the question of cost, the preference for cased articles to some extent derives its inspiration from the desire for ductility which has been discussed above. While the extreme ductility of a very mild-steel core encased in hardened high-carbon material can hardly ever come into play, there is yet something to be said on the other side. Where "all hard" steel is employed, the article is often so treated as to become fully hardened throughout, and the whole material is thus put into a condition in which there is a total absence of all ductility. This, it would seem, is carrying the doctrine of "hardness at all costs" decidedly too far, since some little degree of ductility is undoubtedly not only useful but even necessary in most engineering objects.

Looking back over the whole subject which we have here passed under review, it is clear that hardness and the other physical properties which appear to be so closely associated with it, are of fundamental value in engineering construction the further study of the methods by which it can be obtained and tested and measured is therefore a field of great importance.

Government Report of British Aircraft Autumn Trials

THE Air Ministry's report of last year's early autumn trials of British airplanes and land and waterplanes, including both normal and special commercial aircraft types, has recently been issued. The report eulogizes the progress made, especially in commercial type aircraft by way of contrast with those which were adapted for commerce from war machines. A special tribute is paid to British magnetos as fitted to the competing machines. The report says, "When a few mechanical details have been improved," there is little doubt that the British magneto will be the best in the world, and that the British manufacturers of magnetos as shown by this trial will "be ahead of any foreign rivals." The advantages of a fair margin of extra engine power despite the extra cost also are emphasized.

The report, like the trial, while useful technically, does not seem likely to help a revival of civil aircraft building which at the present is almost dead. The Government's decision to grant $300,000 this year as a conditional subsidy to aircraft builders, promulgated this week, seems to be timed auspiciously for this report, but it is felt that the sum is insufficient for any technical development. As matters stand only the Handley Page Co. seems likely to benefit, since it is the only one qualified to compete for the subsidy. The conditions prescribe that competing companies must be British, and must be able to show that on a maximum of forty-five days in each period of three months flights have been completed in both directions by aircraft of British manufacture, fitted with British made engines, within a fixed maximum period of time allowed for each journey.

The routes at present approved are London to Paris, London to Brussels, and London to Amsterdam. Extensions to these routes and additional routes, such as England to Scandinavia, on which the possibilities of a service employing flying boats or amphibian machines, or a mixed service of sea and land aircraft, can be demonstrated, may be approved.

The sum offered compares poorly with the amount, $750,000, recommended to be allotted by the Government's Advisory Committee in June last. Moreover, the scope is limited to continental routes. The aircraft industry naturally wants to develop inland air services, in which respect Great Britain compares unfavorably with France and Germany.

The following points are gleaned from a *Times* interview with Mr. Handley Page following the announcement of the Government's grant.

The sum, he considers, is good, having regard to the present financial stringency. It will be useful in developing long distance flights in other countries, such services being of the sort already subsidized by foreign governments. It may lead to reduced charges, since even the present scale of charges is profitable without obtaining full loads. There will follow development all round.

Mr. Handley Page, also, does not ignore the possible danger of a Government subsidy retarding progress because of the tendency to lean on Government support. But he seems more concerned that the help was not forthcoming earlier, as it might have prevented the passing out of certain pioneer aircraft firms. He also thinks that as the grant (at present) is for one year only, it is not likely to develop the betterment of the commercial airplane, because such new machines if put in hand now would not be ready for flying on service next year.

Lowering Costs by Greater Production

AN effort to obtain lower costs by greater production and increased efficiency instead of by lower wage scales is the general program of S. F. Bowser & Co., Inc., manufacturers of oil and gasoline storage systems, Fort Wayne, Ind., and is also the program of other local industries, according to S. B. Bechtel, manager of the Bowser plant. Labor during the year 1920, according to Mr. Bechtel, was unproductive generally and was only about 45 to 55 per cent efficient. Already this year, he declares, there has been an increase locally of 25 per cent in labor's efficiency. Labor alone is not held responsible for this condition by Mr. Bechtel, but industrial management is also declared to have been inefficient to a great extent during the period of war-time high prices and abundance of orders. During 1920 approximately 15 per cent of all local labor was absent on every working day and this has now been reduced to 2 per cent.

An Elevating Dump Body

Is designed for use primarily for dumping from an elevated position but can be used in same way that ordinary dump body is employed. Is operated by hydraulic hoist and is provided with 18 ft. telescoping chute.

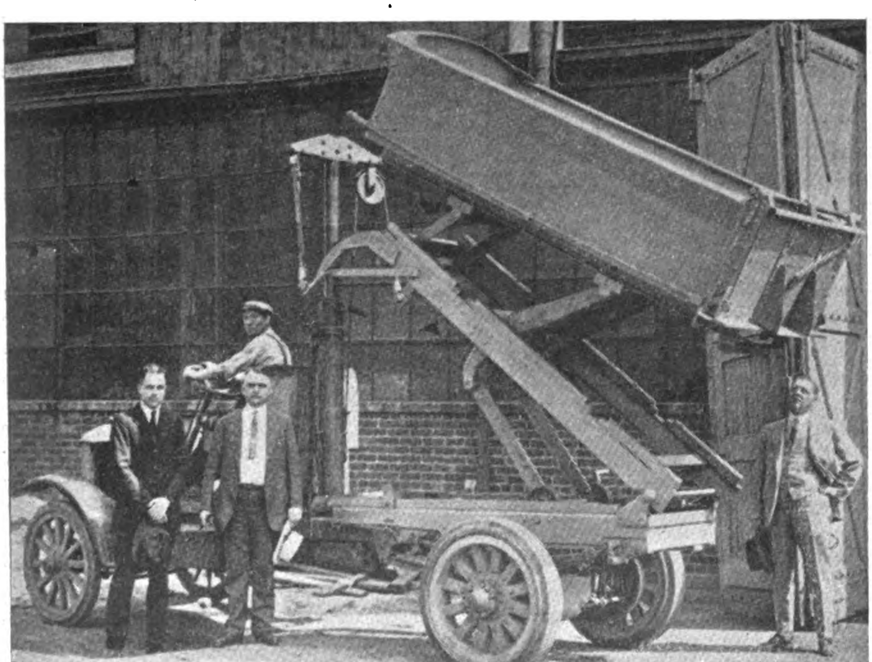
TO meet a demand for an elevating dump body embodying a simple operating mechanism, the engineers of the Federal Motor Truck Co. evolved the design herewith illustrated, on which a number of patents have been applied for. This body is intended to be used primarily for dumping a load from an elevated position, but it may also be used as an ordinary dump body.

This type of body is extensively used in the coal business, in road building (dumping into concrete mixers) and in garbage collection (dumping into a large body). It is composed of three principal units—a dump body, very much like an ordinary body; a hydraulic hoist, and an elevating mechanism under the body. The body has two dumping positions—the elevated position, which raises the lower end of the body 6 ft. above the ground, and the ordinary dumping position.

The dump body is the ordinary type of body with a flat, sliding bagging chute door in the tail gate and carrying an 18-ft. telescoping chute in a cradle under the body. The hoist is the Federal Motor Truck Co.'s standard heavy duty type, except that cross arm at top is secured in a solid instead of a pivoting bracket.

The elevating mechanism comprises a frame extension arranged above the chassis frame, strengthening the frame and carrying the shafts, brackets, etc.; an elevating frame pivoted at the rear and carrying the lifting arm at the front and the main elevating lever at the center, this frame being elevated just as with the ordinary dump body; a main elevating lever pivoted at the center of elevating frame, the lower end being anchored to the frame by pull rods and the upper end elevating the body; pull rods pivoted at the lower end of the main elevating lever, the lower ends having a cross shaft which is engaged or disengaged by release hooks; a shaft holding two large cast steel hooks is connected by brackets to the frame extension just above the rear axle. On the right end of this shaft, and outside of the frame is a hand lever, which throws the hooks forward to engage the pull rod shaft for the elevating position, or backward to release the pull rods for the ordinary dumping position. The front elevating member, being joined to the body and the main elevating frame, lies almost flat when the body is down, and advances toward an upright position to give sufficient angle for dumping when the body is elevated.

Body in ordinary dumping position



Body elevated into high dumping position

The body is elevated into the dumping

(Continued on page 621)

Proposed Methods of Automotive Gear Inspection

Gear Makers Association developing standard practice for inspection of their product. Size of hole, wear of gages, tapered holes, keyways, tooth bearing, splined shafts and methods of test are some of items considered.

A SUB-COMMITTEE of the American Gear Makers Association Standards Committee, of which E. J. Frost is chairman, is developing standard methods for inspecting gears commercially. At the Lake Mohonk meeting of the A. G. M. A. an interesting report was presented on the subject of inspection, but no action was taken on it. The following rules for gear inspection, therefore, are at present only committee recommendations, but it is quite likely that at the next meeting, to be held at Cincinnati in the spring, they will be made recommended practice by the Association.

Inspection of Bores—Cylindrical holes up to 3 in. diameter shall be inspected with "will and will not go" plug gages, the "will go" end to have a diameter the same as the smaller limit and the "will not go" equal to the larger limit given on the customer's drawing.

Tolerance for wear to be allowed before discarding gages:

TABLE I

Size of Hole, In.	Class 1	Class 2	Class 3
0 to ½	.00007"	.0001"	.00015"
½ to 1	.00010"	.00015"	.00020"
1 to 2	.00015"	.00020"	.00030"
2 to 3	.00020"	.00025"	.00040"

Tapered Holes

Tapered holes shall be inspected with tapered plug gages and the quality of fit determined by painting the gage with red lead or prussian blue, when a full bearing shall be shown.

Proper depth of reaming or grinding shall be indicated by a stepped shoulder located at either end of the plug, as the case may require, the height of the step and relationship to the taper agreeing with limits given on customer's drawing.

Keyways

Keyways in both straight and tapered holes and for both single and multiple keys shall be inspected for width of keyway by using "will and will not go" bar gages, gaging the width only.

For alignment and depth, a plug gage shall be used, which has body diameter equal to the small limit of the hole and a key long enough to reach the entire length of the keyway, the width and height of the key gage agreeing with the customer's small limit.

If the maximum depth is important, a similar gage shall be used as a "will not go," having a key height equal to the maximum shown on the customer's drawing.

Woodruff Keys

A hardened gage similar in shape to a Woodruff key but slightly thinner than standard, shall be used, and a keyseated ring gage slid over it. The latter should check for depth and alignment and also show if radial. If both minimum and maximum depth are required to be verified, two keyseats can be put in the ring, these agreeing with the two limits on customer's drawing.

For width, use a "will" and "will not go" bar gage, both ends of which shall agree with the customer's limits.

Test Stands

The smaller sizes of spur, spiral and internal gears, shall be checked for pitch diameter, eccentricity and irregular teeth by inspecting on a hand stand, the essentials of which should be, rigidity in construction so that none of the parts can spring, and one rigid and one freely sliding head, so arranged that the movement of the sliding head will actuate a dial indicator.

The studs on which the work is mounted shall be at right angles with the surface on which the one head slides and parallel with each other within 0.002 in. in 12 in.

The size of the studs shall not be smaller than the "will go" end of the plug gage used for gaging the hole, and the same tolerance for wear shall be allowed as given in the table.

This stand may also be used for determining the quality of tooth bearing, provided satisfactory master gears are used.

For the determination of noise, a power stand shall be used, the essentials of which shall be the same as those of the hand stand, except that it shall be provided with power which may be applied in either direction, and there shall be a power brake.

The indicator shall be omitted and the movable head shall be controlled by a screw adjustment and clamping device.

In the hand test stands, it will be found an advantage, when once the stud holes are accurately bored in the heads, to bush them with hardened steel bushings, straight on the outside and tapered on the inside, so that the wear of putting the studs in and out can be largely taken care of by the taper, and new bushings can be substituted when the old ones are badly worn, without disturbing the accuracy of the original bored holes.

Master gears in pitches finer than six, shall be within an eccentricity limit of .001 in.

In disputes concerning eccentricity, where master gears of proven accuracy are not available, a hardened gear with teeth cut away so as to have but one of its teeth in engagement at a time, may be used by rolling through the arc of contact and then ratcheting to the next tooth.

Bevel gears shall be inspected on hand or power stands for quality of bearing, and on reversible power

stands equipped with hand brake, for noise.

These stands shall be rigid in construction, the belt pull shall be downward rather than upward, so as to tend to seat the movable heads rather than pull them away from their bearings, the spindles shall lie in the same plane and be at right angles with each other within an error of .002 in. in 12 in., and the tapers of the holes in the spindles shall, if possible, agree with those in the bevel generating machines, so that work can be examined without removing from the arbor on which it was cut.

In straight tooth bevels, conical pointers may be used to prove whether the teeth are radial or not.

The above applies to such gears as are used in truck, tractor and automobile construction and not to the larger mill gearing.

Tooth Bearing

Questions of tooth bearing shall not be determined in the final assembly, but by inspection on test stands, as noted above.

Splined Shafts

For width of spline, root and outside diameter, use a "will" and "will not go" snap gage, made to dimensions given on customer's drawing for the work, or use a micrometer set to the same dimensions.

For accuracy of spacing, use a ring gage having one portion ground to maximum diameter of outside of keys and at one end an annular portion with a diameter of hole equaling the maximum diameter of the body of the shaft and milled and ground away so as to leave projections whose width and angle of face shall equal the minimum space between keys as given on the customer's drawing.

Sizes of Collets for Holding Stem Gears

Use holes in collets or bushings equal to the maximum shaft size plus the amounts given in Table I, when new, and also allow the same amount as given in Table I for wear before discarding.

Fixtures for Testing Internal Ring Gears When Held by the Outside

Add to bore of fixture, when new, the amount given in Table I and also a like amount for wear before discarding.

Shifter Grooves

For diameter of bottom of groove, use "will and will not go" snap gage, slightly thinner than width of groove, or use micrometers.

The gage should be made to limits given on customer's drawing.

If the shifter groove has a fillet in the corner, a similar allowance plus clearance shall be made in the gage.

For width of groove use a "will and will not go" bar gage made to customer's limits for the work.

Thread Gages

Use plug or ring gages made by a reputable concern and in case of dispute, have checked by the Bureau of Standards. "Will and will not go" gages should be used for accurate work.

Machine for Checking Tooth Shapes

It is recommended that this association have designed and built an instrument for determining the accuracy of involute curves in cutters or work, and that it be installed in the Bureau of Standards at Washington.

Disputes

All disputes over the accuracy of micrometers, gages, etc., may at the request of buyer or seller, be referred to the Bureau of Standards, whose report shall be accepted as final and the expense of such testing borne by the owner of the instruments tested, unless otherwise agreed upon.

In making comparisons of dimensions, the same temperatures shall be used as are maintained by the Bureau of Standards.

First American Airway to Be Constructed in 1921

THE establishment of well organized air routes throughout the country is essential to the progressive development of commercial and civil aviation. With properly equipped airways, flying will become a safe and efficient mode of traveling in this country. For this reason the proposed creation of a model airway between Washington, D. C. and Dayton, Ohio, during 1921 is a fact of special interest.

The project is being fostered by the Army Air Service, which is able to provide such equipment as is available for creating the route, but cannot purchase land or make financial expenditures. The expense will fall upon local civic and commercial organizations to whom the benefit of the airway will eventually accrue.

Certain stations on the airway will have gasoline, oil and spare parts for both Government and civilian aircraft. Charts will be made of the entire route at the request of the Army Air Service and also a photographic map of the route will be prepared. Oblique aerial photographs of every city, landmark and landing field will be taken and arranged into such form as to provide a guide to the route. Copies of these books can be signed for at one end of the route and turned in at the end of the journey. Flyers along the route will be in constant radio communication with each other and with the various ground stations and in case of fog or clouds will be directed along the route by radio. Should a group of commercial ships desire to negotiate the route unequipped for wireless, then an airplane so equipped can be dispatched with them along the route and they can "follow the leader" in perfect safety.

A system has been devised for marking the landing fields along the route for purposes of identification and will serve as an aid to navigation. Each State is being divided into one hundred parts from west to east, and lettered alphabetically north to south, each letter representing a distance of 30 miles. A field in the northern part of Eastern United States marked O-55-B would be in Ohio, about half way across the State, and between 30-60 miles below the northern border. Since commercial aircraft will probably negotiate a 30-mile distance in slightly over 15 minutes locations by this system are sufficiently close together for navigating purposes. More minute detail will be provided in certain subdivisions of the system at or near landing fields and in the laying out of signs and letters.

A Machine for Multiple Drilling and Tapping

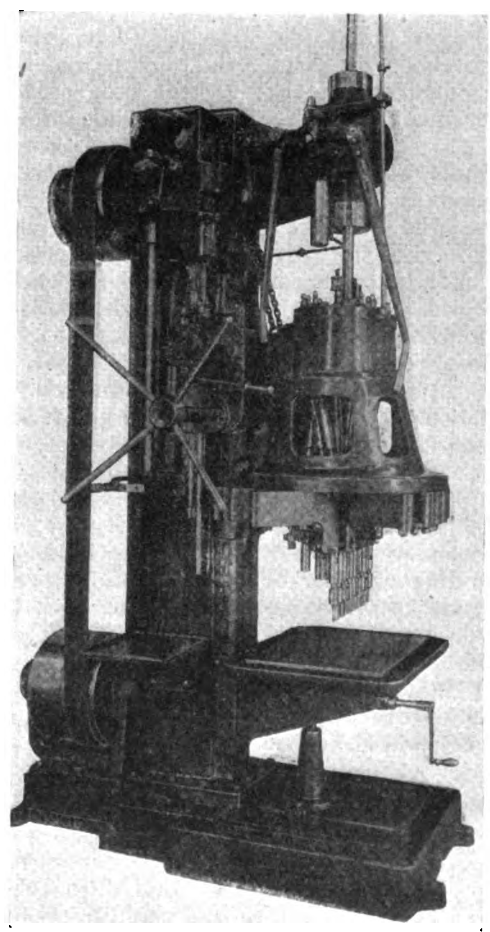
Employs automobile type friction clutch in main driving pulley to enable the power to be shut off when a change in direction of rotation of spindles is made, thus overcoming disadvantage of earlier machines.

GREAT success has been attained in the multiple drilling of motor castings and other similar parts, the reduction in cost over the use of a single spindle drill being such that no progressive concern can afford to do without multiple drills. Multiple tapping of holes has also been attempted, but has not been uniformly successful, owing to the want of a satisfactory device for reversing the direction of spindle rotation when the taps have reached a predetermined depth. Friction clutches that have been employed for this work operated at too low speeds, and would not retain their adjustment. Positive clutches employed were subject to too great shock, and consequently were short-lived and subjected the machines to too severe strains. The Fox Machine Co. has placed on the market a multiple spindle tapping machine which is claimed to overcome these objections.

The upper drive pulley at the rear of the speed change box is built into a single drive plate friction clutch. Any of the standard automobile clutches, such as the Hoosier, Borg & Beck, etc., can be used on this drive. At the front of the machine is a lever with a cam surface, which either disengages this friction clutch or allows it to engage, thus furnishing the means for stopping and starting the machine.

On the vertical drive shaft to the head is a positive driving clutch with twelve right hand teeth on one side and twelve left hand teeth on the other. These teeth engage opposing members, which are carried by bevel gears, the gears being driven by a bevel pinion mounted on the horizontal shaft which runs into the speed change box. The operation of this clutch, which is used for reversing, is also controlled by a lever at the front of the machine. This lever is interconnected with the lever which disengages the friction clutch.

When the tapping lever is moved from forward to reverse position, or vice versa, the first part of the movement disengages the friction clutch driving the machine. Further motion of the lever carries the solid tooth driving clutch from one position to the opposite one, this being accomplished while the power is off. After the positive clutches are in engagement, the final motion of the tapping lever allows the friction clutch to again engage, and the power is then transmitted through the positive clutches, driving the spindles in the reverse direction. Special provision is made against the possibility of the teeth of the clutches striking one on top of the other when being reversed, which would prevent the clutches from becoming engaged.



Multiple spindle machine for drilling and tapping

When the tapping attachment lever is pulled forward, the spindles are given a right hand rotation. A heavy spring is put under compression, and is latched in this position. An adjustable stop on the vertical stop rod is so set that when the taps reach the desired position, the stop comes in contact with the trip arm, which releases the spring held under compression. The movement of this spring carries the tapping attachment lever automatically from the forward to the reverse position. Thus, the operator does not have to trip the tapping mechanism when the desired depth of hole is reached.

The machine illustrated taps 5/8 in. holes in cast iron plates, 1¼ in. thick, in 5 sec., a maximum of 6 hp. being consumed. The main drive shafts are mounted upon ball bearings.

Special attention is called to the fact that all springs used are exceptionally heavy and entirely inclosed, so that the operator cannot tamper with them. Another feature is that, after the tapping attachment lever is thrown forward and the automatic trip locked in position, the operator can move the tapping lever back and forth, to reverse the direction of the taps, as rapidly as he desires, before the taps reach their bottom position. This is of special importance in the case of breaking a tap. The operator reversing the spindles under these conditions does not affect the tripping of the mechanism when the taps finally reach their lowest position. The multiple spindle tapping machine shown is a Fox D-22. This mechanism is also applied to the D-12 and D-32 machines.

THE Packard Motor Car Co. has designed a 12-cylinder V-type aircraft engine developing 400 hp. for altitude flying, known as Model 1237. The weight is 735 lb., giving a specific weight of 1.85 lb. per hp. It is built on the over-dimensioned, super-compression principle.

Where Is the Motorcycle Going?

With the coming of business depression and the falling off of foreign orders, the old question is again arising as to "What's wrong with the motorcycle?" This article is the first of a series of two which discusses from the standpoint of an interested observer the conclusions reached after a careful survey and a general analysis of the situation

By Norman G. Shidle

CONSTRUCTIVE criticism is almost an essential to the healthy growth of an industry. Probably no industry has been subjected to more criticism of this—and other kinds—than the automobile industry; certainly no industry has grown more rapidly and gained so strong a position in a comparatively short time. Certain phases of such criticism can sometimes be given better by an interested and intelligent onlooker than by those actively interested in the advancement of a particular part of the industry.

An examination of the field would indicate that such criticism has been lacking to a large extent in the motorcycle industry. Outside criticism has usually come from those whose only knowledge consists in having the quiet of their neighborhood disturbed by the open-cutout speed demon who still leaves behind him an oral as well as a visual impression in the being of bystanders. Criticism from this class of persons has been widespread and vigorous, but is not usually constructive. Much of it can never be printed in the Sunday school books.

The fact that the motorcycle industry is so largely concentrated in a few organizations has made the motorcycle press very strongly dependent upon the good-will of these few for its existence. As a consequence, criticism from this source has sometimes been weighed not alone on its qualities of justice in deciding whether or not it should be printed, but also in regard to the likelihood of its meeting with disfavor in one or another of the controlling concerns. Such a condition is not always conducive to the publication of that frank and honest criticism which is one of the chief functions of the business press and which ultimately works to the progress and advancement of the industry as a whole.

Progress of the Industry

It is worth while to examine what has been the progress of the motorcycle industry under these conditions, how it stands at the present time and along what lines future development is likely to go. The discussion logically divides itself for analysis into these sections:

1. Is the motorcycle industry progressing at a normal rate; that is, does it show a normal healthy growth during recent years?
2. Merchandising:
   a. Past policies.
   b. Present ideals; how far realized; co-operative possibilities.
   c. Future development.
   d. Undeveloped merchandising fields.
3. Motorcycle design:
   a. Mechanical features.
   b. What weight machine for future business?
   c. Weight and cost of machine as related to future development of the industry.

The progress of an industry can be measured in a general way by production figures, sales—as denoted by registration and export figures—and by financial statements. The latter standard is difficult to use for the motorcycle industry because of the numerous firms that have entered and left the field during the last ten years. Production figures, however, can be estimated with a fair degree of accuracy, while export and registration figures are available in most instances.

The chart shown herewith presents the relation between motorcycle production, domestic sales and exports since 1913.

An examination of the production curve alone shows that the progress of the industry has not been steadily upward. Beginning at a peak in 1913, motorcycle production dropped sharply until 1915, when an upward turn was taken. This rise continued rather gradually until 1917, when another drop began. Since 1918, however, production has increased each year, the most rapid rise taking place during the last year.

Nor is there any indication that this variation in production progress is due to the coming and going of the several companies which have entered the field for a short time and gone out. Something like this same line would be found if production were charted for only the companies which have remained steadily in production throughout this period.

In other words, the curve indicates that during the last eight years the motorcycle industry has been doing little more than holding its own. While it is true that during 1918 and 1919 the manufacturers were unable to supply the domestic demand for machines, it must be remembered that these years were in every sense of the word unusual merchandising years; years in which the demand was abnormal and automatic; years during which heavy demand for machines did not necessarily indicate any real progress for the industry.

When it is recognized that there are some 14,000,000 more people in this country to-day than in 1913, it becomes evident that the motorcycle industry has not progressed in proportion to its increased possibilities for development, even taking into consideration the unfilled domestic demand of 1918 and 1919.

But any consideration of motorcycle progress, especially during recent years, must take into serious account the export trade. The accompanying chart shows, for instance, that over half of the 1920 production was shipped to foreign countries. This fact alone might account to a large extent for the extremely slight increase in domestic motorcycle registrations during the last year.

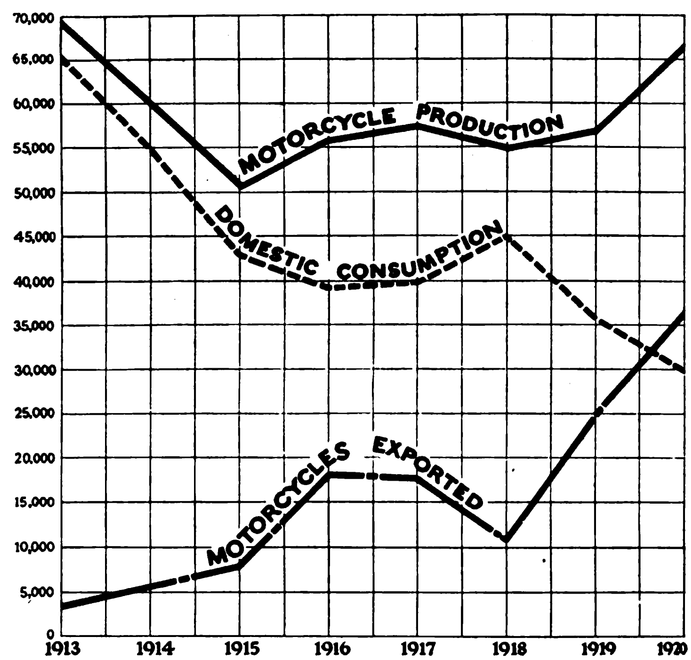
It is interesting to trace the gradual increase in the percentage of foreign business done by the motorcycle industry. The percentage of production sent to foreign countries since 1913 is as follows:

	Per cent		Per cent
1913	5.8	1917	29.2
1914	10.4	1918	18.6
1915	15.7	1919	44.0
1916	30.8	1920	55.5

These figures show a steadily increasing proportion of American motorcycle production being sold abroad. This increase is materially broken only by the 1918 figure, which can probably be accounted for by the fact that some of the motorcycle plant manufacturing facilities were turned to other lines of government war work as were many automobile plants; also to the difficulties of making foreign shipments during this period.

Studying these percentages in connection with the chart and the curve showing the relative trend of domestic and foreign business, certain rather definite indications stand out.

While motorcycle production during these years has been about holding its own, domestic business has fallen off very greatly. This indicates that only because of greatly increased foreign business has a market been found for the same number of machines as were formerly produced. Even recognition of the unfilled domestic demands of 1918 and 1919 cannot nearly account for a difference in domestic consumption between 1913 and 1920 of 31,000 machines.



Relative trend of motorcycle production, domestic consumption and exports

This means that there has been during the last eight years a drop in domestic consumption equal to the production capacity of the largest manufacturer and more than equal to the actual annual production of any of the large manufacturers for at least seven years. In other words, the industry as a whole at the present time is dependent upon the maintenance of this large foreign business if it is even to continue the production of as many machines as in the past. And the trend of the domestic consumption curve is downward at present, although domestic business, in the long run, must probably be relied upon as the foundation of the prosperity of the American motorcycle industry.

This not a healthy condition. What has brought it about?

When the failure of motorcycle registrations to increase was brought to the attention of one manufacturing executive recently, he said something like this: "Foreign orders have been very enticing during recent years. We have had large orders for twenty-five, thirty or fifty machines in many cases from one source. These orders came almost unsolicited, and, being for large quantities, gave us an opportunity to plan our production regularly for a period ahead. We took these orders for this reason. Consequently, we could not supply the domestic demand for a time and have not intensively cultivated the domestic field during recent years."

To an outside observer, this might seem a somewhat short-sighted policy. It savors a good deal of taking the path of least resistance without due consideration of the more fundamental and enduring phases of the motorcycle merchandising problem. The very fact that many of the foreign orders came without any great effort on the part of American manufacturers is some indication that the demand was abnormal. In any business the mere filling of present orders is not conducive to permanent progressive development.

The result in the domestic field is likely to be dissatisfied dealers, for one thing, and a natural clogging up of domestic merchandising channels due to disuse. Foreign business is highly desirable and the foreign field should undoubtedly be cultivated and extensively utilized. But when it overshadows domestic trade so that there is a possibility of decay setting in, a danger is presented.

This does not necessarily mean that such a danger point has been reached in the case of the motorcycle industry, but the trend of the curves is such as to make a serious consideration of this factor very pertinent. The figures and curves presented would seem to indicate the justice, in a general way, of this conclusion.

The motorcycle industry in the United States has, at the best, merely held its own during recent years. One present need is a careful study of the domestic market, and an intensive effort at development and cultivation in this direction. This development to be molded along lines directed toward a permanent progress for the industry, on the basis of far-sighted intelligent merchandising policies, with an increasing emphasis upon the permanent features and a decreasing consideration of purely temporary advantages.

Domestic Merchandising

There have been innumerable defects in the domestic merchandising of motorcycles. Some of these major defects still appear. No one recognizes this fact more fully than the executives of the various motorcycle companies, and definite efforts to remedy the faults are being put under way. The chief difficulties are so well known and understood as to need little discussion, so far as looking backward is concerned. They may be listed here, however, as a foundation upon which to base a discussion of remedies and future possibilities. The chief troubles are probably included in this list:

1—A class of dealers, skilled perhaps on the mechanical phases of their business, but lacking in merchandising ability and the social graces which accompany it.
2—Lack of cleanliness and attractiveness in dealers' showrooms and repair shops.
3—The predominating class of riders being those who pay little attention to personal cleanliness; and who

pay a similar amount of attention to the feelings of others by operating their machines in a noisy, unpleasant manner.

4—The overemphasis of the sporting phases of the motorcycle, particularly as shown in the speed and power mania.

5—The failure of some manufacturers and many dealers to visualize the merchandising possibilities of the motorcycle in a broad way; to build their business with an eye to permanent future progress.

6—The numerous road records that have been attempted, with the effect of advertising the motorcycle favorably to a few and unfavorably to many. In the same class were the motordrome races of several years ago.

A previous paragraph has stated that these troubles have been recognized by the manufacturers. This statement, perhaps, should be qualified to some extent, since the manufacturers do not entirely agree that all of the points mentioned are defects, and there is not entire accord as to the way in which even those recognized as defects should be remedied.

In the matter of raising the level of dealer representatives, progress is undoubtedly being made by the chief manufacturers. A survey of the dealer organization of one of the largest reveals a considerable number of high grade business men, intelligent, well-dressed, pleasant, courteous, and efficient. But it can scarcely be said that this number is anything like a majority as yet. Progress is being made; but is it being made rapidly enough? If it is necessary to wait until all the low grade dealers die before replacing them with progressive high grade men, the motorcycle business may suffer serious difficulties in the meantime.

Obviously, it would be absurd to disrupt a dealer organization by making a wholesale clean-out at any given time, but it must be recognized that every dealer with a dirty shop, interested primarily in mechanics to the detriment of courtesy, is a definite drag on the industry as a whole. The type of dealer determines to a large extent the type of rider. And every noisy, dirty, hell-bent-for-election rider loses more potential motorcycle sales than the fact of having him for an actual buyer is worth.

The very fact that the motorcycle industry is concentrated in a few hands sets up the danger of its getting in a rut. No industry can stand still for an indefinite length of time. It must go forward or it must go backward. There is always the danger in any small group of becoming bound by tradition, of becoming tied up in the round of "the way it has always been done," of lacking the shock of contact with new ideas that is necessary to progress.

Tradition when it is thoroughly good is an invaluable aid to any industry. But when it contains a number of unfavorable features it is a very great handicap. Thus in the matter of motorcycle dealer representatives, it would seem that a very definite and straightforward campaign were necessary to raise the level of this group if the industry is to go forward to its best possibilities.

This campaign can take two lines:

1. The education of the present dealer personnel.
2. The changing of the present personnel for a higher grade of men.

At the present time most of the effort is being extended in the first direction. It is a slow process, since very bad material upon which to work is presented in many cases. The manufacturer having obtained the vision of future progress for himself must sell the ideals and methods to many individual dealers, some of whom, possibly, are utterly incapable of understanding them.

While the work of dealer education is undoubtedly helpful and necessary, it is questionable whether or not it can get results quickly enough to offset in any marked degree the harm that this "uneducated" class of dealers is constantly doing to the ultimate progress of the industry.

With these facts in mind, the possibility of very definitely starting out to wipe the slate clean insofar as this type of dealer is concerned, is worth very serious consideration by motorcycle manufacturers.

The matter of cleanly and attractive salesrooms would be automatically solved by the substitution of a higher grade of dealers. The problem of rider education would also be somewhat softened. This would be true not only because of the fact that the dealers would naturally appeal to a better class of rider, as well as to those who now ride, but also because the dealer himself would set an excellent example as a rider.

The truth of these facts is attested by an observation of the results obtained already by that group of dealers already in the business who may be said to constitute men of superior ability and merchandising effectiveness. There are such men selling motorcycles to-day. But there are not enough of them. And the favorable impression which this small group makes upon the public at large is still much more than offset by the unfavorable impression made by the other group, which still predominates rather strongly.

Weight of Chassis Components

IN his paper prepared for the annual meeting of the S. A. E., D. McCall White gave some figures on the weight of parts of the LaFayette chassis which are of interest. It should be pointed out that this chassis has a 348 cu. in. engine developing 90-95 hp. at 2800 r.p.m.

The weight of a stripped chassis, complete with electrical equipment, battery, radiator casing, oil, grease and four tires, is 2570 lb. The weight of the engine averages 7.2 lb. per hp. complete with flywheel, all accessories, including carbureter, throttle and ignition, control rods, lighting and ignition units ready to run as in the car. The transmission complete with clutch and torque ball casing, universal joint and brake equalizer, weighs 160 lb. The front axle weighs 106¾ lb. The rear axle complete with torque rod, propeller shaft and driving shafts, weighs 385.94 lb. The steering gear complete with control rods, steering arm and ball, tubes, spark and throttle gears, weighs 34¾ lb. The weight of other parts is as follows:

	Lb.	Oz.
Clutch hub	4	12
Piston	1	9¼
Single connecting rod (finished*)	1	13¼
Forked connecting rod (finished*)	1	15¾
Camshaft (rough)	22	
Camshaft (finished)	9	12½
Crankshaft (finished)	31	
Wrist pin (finished)		2¾
Tappet roller pin (finished)		.64
Tappet (finished)		2.6
Valve (inlet and exhaust same wt.)		4.8
Tappet set screw (finished)		½
Fan and generator shaft	1	4½
Main transmission shaft	5	10¾
Rear hub (finished)	6¾	
Propeller shaft	18½	
Rear driving pinion and shaft	4	6.4

*Without bushing.

Program Outline for the Foreign Trade Convention

Topics selected for annual gathering in Cleveland in May are of constructive value. Advertising and financing are prominent among the subjects. Motorcycle foreign trade has been developed in excess of domestic trade. Automotive developments in many countries.

THE program for the Eighth National Foreign Trade Convention, which will be held in Cleveland May 4, 5, 6, 7, has been outlined and is quite constructive in its scope. The general theme is "American Foreign Trade and Its Present Problems." The program, following the reception and preliminary meetings on Tuesday, is as follows:

WEDNESDAY, MAY 4

First General Session .... 10:00 A. M.
1. American Trade and Its Influence on Foreign Exchange.
2. The Causes of Inflation and Its Effect on the Exchanges.

Second General Session .... 2:30 P. M.
1. Influence of American Investment Abroad.
2. The Settlement of Our Export Balance.
3. Frozen Credits—What They Are and How to Thaw Them.

Group Sessions .... 8:00 P. M.
Group I—Commercial Education for Foreign Trade.
Group II—Foreign Credits (in Co-operation with the National Association of Credit Men).
Group III—Problems of the Export Manager (in Co-operation with the Export Managers' Club).

THURSDAY, MAY 5

Third General Session .... 10:00 A. M.
1. The Effect of Double Taxation on Foreign Trade.
2. Foreign News and Foreign Trade.
3. Discriminations Against American Trade.
4. A Reasonable American Policy for Foreign Loans.
5. Adequate Foreign Service Essential to Our Foreign Trade.

Group Sessions .... 2:30 P. M.
Group IV—Special Export Problems of the Manufacturer (in Co-operation with the American Manufacturers' Export Association).
Group V—Foreign Trade Advertising.
Group VI—Inter-American Trade Relations.
Group VII—The Interest of Agriculture in Foreign Trade (in Co-operation with the American Farm Bureau Federation).

FRIDAY, MAY 6

Fourth General Session .... 10:00 A. M.
1. American Maritime Policy.
2. Marine Insurance.
3. Inland Transportation for Foreign Trade.
4. Return Cargoes.

Group Sessions .... 2:30 P. M.
Group VIII—Banking Service to Foreign Trade (in Co-operation with the American Bankers Association).
Group IX—Merchandising and Forwarding (in Co-operation with the American Exporters and Importers Association).
Group X—Trade Relations with the Far East.

Banquet .... 7:30 P. M.

SATURDAY, MAY 7

Fifth General Session .... 10:00 A. M.
1. Reports of Group Sessions.
2. Final Declaration of the Convention.

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Tientsin as a Car Market

APPROXIMATELY 600 motor cars are in daily operation in Tientsin, China, which is rapidly becoming an important motor car market, as dealers there handle the cars and trucks going to Peking and a wide stretch of Chinese territory, including Mongolia and stretching over into many parts of Manchuria and Siberia. According to the Oriental Motor of Shanghai, the city of Tientsin has six car importers, which handle a number of American and European lines.

Several passenger services are operated out of Tientsin and one is contemplated between Tientsin and Peking. The latter trip, it is calculated, will require somewhat more than five hours of traveling.

Efforts are being made by the North China Motor Club to revise the motor license system, which is now quite bad. Each of the foreign concessions, of which there are six, and the native city require a separate license and, unless each license is paid, driving is restricted.

Recently Consul General Fuller of Tientsin wrote to the Department of Foreign and Domestic Commerce:

"There is considerable complaint, however, because there are no distributers of American automobile accessories, especially tires, in China. Any American firm which maintained ample stocks of accessories at a central distributing point, such as Shanghai, and could supply local houses without delay would increase the sales of its product in the district."

—

British Tractor Prospects

THE position and prospects of farm tractor business in Britain may be gaged from the following comments based on information disclosed recently in the legislature:

According to a Ministry of Agriculture return, the acreage of land in England and Wales under arable cultivation on June 4 (last) was 12,020,000 acres, being 289,000 acres less than a year earlier, and 379,000 acres less than on June 4, 1918. On the other hand there were 1,022,000 more acres in arable condition on June 4 last than on the corresponding date in 1914.

Allowing 250 acres per tractor, the added 1,022,000 acres arable since 1914 would find work for 4088 machines and for 1516 more, but for the return of 379,000 acres to fallow since 1918. On the same basis of computation, the 12,020,000 present arable acreage should require 48,080 tractors

to work it steadily, without allowing for a contingent—say 10 per cent—of stand-by machines.

It is doubtful if there are more than 12,000 tractors available in Britain, but since the holding of the tractor trials last year, and the possibility of its becoming a yearly event farmers are awakening to their value and necessity.

The high cost of farm labor, foodstuffs for cattle, and the better financial return more or less guaranteed to farmers for their cereals, are factors tending to the good of the tractor movement in Britain. Nevertheless it is necessary that the price be got down to not exceeding $1,300 (pre-war rate of exchange) if their sale is to be developed.

The type looked for is something on the Fordson model, but not necessarily with a barrel-like cast chassis. The mechanism must be enclosed and self oiling and the drawbar capacity should be equal to three ploughs cutting 5 x 10 in. (British farmers won't plough deeper or wider than 6 x 11 in. in light land, and two furrows on heavy land). The haulage capacity should be equal to pulling a 4 ft. x 8 in. threshing machine, and the belt power should cover the requirements of that size—the largest and most used—of threshers. The belt should lead fore and aft and not transversely and should be capable of some variation of speed.

Makers here are beginning to provide two diameters of pulley, usually one at either end of shaft, and others are listing a pair of interchangeable pulleys of varying diameters. The high speed engine tractor won't suit. The sort required is a medium speed engine of fairly large bore and preferably with vertical cylinders, amply jacketed to prevent boiling. Detachable wheel grips—preferably angles—also are essential, and they should be such as can be removed or replaced in an hour.

Foreign Trade is Major

IT is interesting and exceptional to learn that there is one branch of the automotive industry that has regarded foreign trade so highly that it has accorded to this trade a greater distribution of its products than it has to the domestic trade. This is the motorcycle division of our industry. On another page of this issue a motorcycle manufacturer is quoted as quite frankly stating that his company found foreign trade so easy to handle and so satisfactory, that no attempt was made to meet all of the domestic demand. As a result of this peculiar situation, the foreign trade in motorcycles has become greater than the domestic trade.

This incident should be a worth while thought to some other automotive exporters. It is also true that one large producer of trucks has built a considerable trade by looking to only foreign outlets.

Czecho-Slovak Show

THE week of May 28 has been selected for the thirteenth International Automobile Show to be held in Czecho-Slovakia, according to a report of the Bureau of Foreign and Domestic Commerce. It will be under the direction of the Czecho-Slovak Automobile Club (Ceskoslovensky Klub automobilistu) in the Industrial Palace and other buildings at Prague and cars, trucks, tractors, motor plows, motorcycles and equipment will be exhibited. Seventy-four exhibitors were represented at the successful showing last year. Application blanks and information may be obtained from the club or from the Czecho-Slovak Legation at Washington.

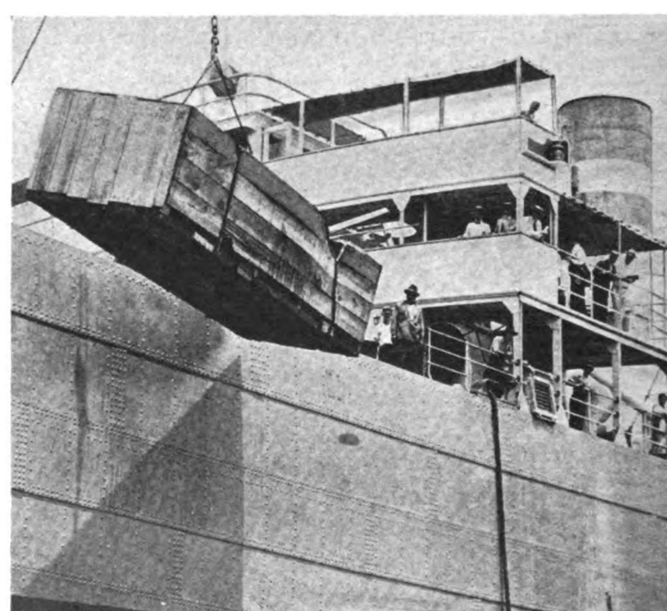
An Australian Car

A MELBOURNE correspondent of the London *Times* "noting the inability or unwillingness of British motor car makers to cater for the Australian trade," (to quote his own words), points out that Australia has need of a light, medium-priced and economical car; that America has filled the bill, but the advanced rate of exchange and customs duty has tended to raise the price unduly. Accordingly an effort to market a home-made car is being made at Sydney. There a "Six," made of American parts, is being assembled and, he says, is sold as an Australian car! It is proposed now to make all of it excepting the engine in Australia, and the engine is to be of Australian design. The scheme is largely due to S. Hamilton Grapes, who for several years was the Australian representative of the Albion Motor Co. of Glasgow. The selling price of the new "six" is estimated at below $2000.

Market for Spark Plugs

THE markets for spark plugs in China, India, Indo-China, Japan, Netherlands, East India and Australia are discussed in a report of the Bureau of Foreign and Domestic Commerce dated Feb. 4, 1921. In making up the report, several of the consular officials have given late estimates of the number of automobiles in their districts. The consular district of which Tientsin, China, is the center, reports a census of from 1500 to 2000 passenger cars, 60 motor trucks and 75 motorcycles. Ceylon is said to have about 3000 motor cars and 1600 motorcycles. Indo-China is estimated to have from 5000 to 6000 motor vehicles, and the statement is made that in Japan there are considerably more than 6000 automobiles and 3000 motorcycles. The number of cars in the Melbourne, Australia, consular district (including the states of Victoria and Tasmania) is placed at 22,265, with motorcycles approximately 13,685.

An Export Crating Experience



Here is a graphic lesson in export packing. You will note, by looking closely at this photograph, that the truck crate has broken under the strain of the lifting chains. This photograph was made on the New Orleans dock by a photographer who was seeking to illustrate an article on export shipping. It was not made as a warning to shippers, but that appears to be its best use. The lumber specifications of this crate are not available, but the shipping firm has had much experience in export

Wide Field for Motor Trucks in Textile Industry

A survey conducted by *Textile World* indicates that many textile manufacturers are getting great satisfaction from the use of trucks. Light trucks are finding increasing favor, while many users are studying the pneumatic equipment problem seriously. The results of this valuable survey are summarized here.

JUST before the business slump hit the textile trade an interesting survey was conducted by *Textile World* concerning the use of motor trucks in that industry. A questionnaire was sent out and replies were received from 414 mills located in various parts of the country. In selecting the list of mills to whom the questionnaire was sent due regard was paid to size, character of product and location, with idea of showing average conditions in the various branches of the industry and different sections of the country.

The foreword to the report of this survey states that "as much care was taken to exclude large mills known to be extensive users of motor trucks, as in eliminating a large number of small mills that could not be expected to use trucks. In fact, with the exception of one large corporation using 55 trucks, none of the other mills reporting uses more than seven trucks. It would have been quite possible to load the report by adding a half-dozen large corporations who are known to have anywhere from 25 to 35 trucks, and we are not certain that such inclusion would not have given a fairer average result, for one of the surprises of the questionnaire has been the large number of small mills reporting the use of two or three trucks ranging up to five tons each."

The answers to certain of the questions bring to light interesting information of vital interest to those concerned with merchandising trucks. The report as published by *Textile World* comprises not only a presentation of figures obtained but an exceptionally clear analysis of what those figures mean in the light of the circumstances involved. For this reason the report is summarized here as being of special value to truck sales managers.

The questionnaire included ten questions, some of which brought forth more accurate answers than others. Several of the questions pertained to the cost of operation of the trucks. The statement of the report concerning the answers to this group is rather striking:

Answers to these questions, the report states, "are too incomplete to render them of material value, and disclose the fact that very few textile manufacturers keep cost and other statistical data relating to their trucking." It is likely that a similar survey in other fields would show similar results, and the lack of accurate operating cost data in connection with most trucks is a factor which must always be taken into consideration.

Despite the fact that accurate costs had not been kept, however, the answers to the question "Relative cost of present haulage as compared with old?" indicates, according to the report, that "the great majority of textile manufacturers using motor trucks are entirely satisfied with the results obtained, even in certain cases where they estimate that the cost of motor trucking is greater than that of haulage by horse-drawn vehicles." Seventy mills answered this question intelligently and of this number 42 stated that motor trucking is less expensive than horses, while 13 said that the expense was about the same. The other 13 believed the cost of trucking to be greater.

Number of Firms Using Trucks

The 414 answers showed that approximately half of the firms used motor trucks. Of this number 153 actually owned trucks, while about 20 per cent more have their trucking done on contract. There was no indication that the location of the plant had any influence on the use of trucks, although bad roads might limit the use, of course, in a specific instance.

Small Trucks Popular

One important question related to the size of trucks used. The replies indicate that there is more work for light trucks of less than 1½-ton capacity than for any other kind. The proportion is as follows:

	Number	Per cent of total
1½ ton or less	118	35.4
2-3 ton	95	28.4
3-4 ton	66	19.8
5 ton	45	13.5
5-10 ton	10	2.9

These figures indicate that more than 60 per cent of the trucks used in this industry are 3 tons or less in size. This carries out the opinion expressed by some truck experts that the trend in truck use will be toward larger numbers of medium-sized trucks, with the gradual reduction in numbers of the larger capacity vehicles.

Touching upon this angle of the matter, the reports say: "When textile mills first started to utilize motor trucks they confined their purchases to two to five-ton sizes for their heavy trucking of raw materials, and finished goods; they were not long in learning that for small loads and quick work these heavy trucks were uneconomical and the use of trucks of 1½-ton and smaller has been rapidly increasing. The tendency to-day among textile mills of medium and large size is to utilize a standard equipment consisting of one or more trucks of 1½ tons or less, a two to three-ton truck for medium-sized loads and a three to five-ton truck for heavy work; another important development is the utilization of five to ten-ton trucks for the hauling of coal and ashes, and some of the smaller mills located at a distance from railroads are using these big units. Another interesting

development among textile mills is the utilization of both small and large motor buses for transporting operatives to and from their work, thus making it possible to secure the services of help in adjacent towns and villages. The equipment of the largest mill organization reporting is as follows: 1½ tons and smaller, 12; 2 to 3 tons, 18; 3 to 4 tons, 20; 5 tons, 5. It may be of interest to note that most of the finishers use medium and large size trucks, while knitters favor the small sizes. The finisher's loads are usually heavy and the haulage for long distances, while knitter's loads are usually light. The character of goods trucked by cotton and woolen mills varies as widely as the size, character and location of the mills themselves, but the tendency, as previously noted, among medium and large-sized mills is toward a standardized equipment consisting of small, medium and large-sized trucks. The same statement applies to the large silk mills, although the use of 1½ ton and smaller trucks is quite common in this part of the industry."

Opinions on Pneumatic Tires

Two of the questions asked related to the use of pneumatic tires. These questions were as follows:

1. Do you use solid tires?
2. What do you think of pneumatics on trucks?

Answers to these queries brought 140 replies. Of this number 117 or 84.5 per cent, are using solid tires, while the other 23, or 16.5 per cent, reported pneumatics in use.

The replies indicated, however, that textile users of trucks are giving very serious attention to this question. They show that the present use of pneumatics in the textile industry is confined chiefly to the lighter trucks and for long distance work where speed is an important factor.

A considerable number are also using pneumatics on the front wheels of heavy trucks with the idea of saving the engine from unnecessary vibration. There seemed to be considerable sentiment, however, for the use of pneumatics on heavy trucks for long distance work for the purpose of decreasing vibration and thus lengthening the life of the truck and also for making possible a higher rate of speed.

Trailers

Only 9 of the 145 mills which answered the question regarding the use of trailers stated that they did use such equipment. On this point the report states that "most of the mills answering in the affirmative make use of trailers for long distance haulage of raw material or finished goods, either between widely separated mills of their own, or to and from freight stations, processing plants, or raw material markets. It may also be stated as our opinion that demountable bodies are much more likely to become standard equipment among textile mills for trucking purposes than trailers."

Type of Goods Hauled

The truck salesman must know, of course, the type of goods to be hauled if an intelligent sale is to be made. The report asked the various manufacturers what sort of material they were carrying in their trucks and brought forth rather comprehensive answers on this point. A summary of the information contained in these answers is presented by the following quotation from the report:

"Textile raw materials, goods in process, finished goods and mill supplies are the principal classes of merchandise for which motor trucks are used, and they are handled in a large variety of forms, but very few of them require the use of special bodies. Textile raw materials are handled in bales and bags ranging in weight from 150 to 1000 lb. Yarns and other stocks in process are handled in bags and cases as a rule. Finished goods are usually cased or baled, and range in weight from 100 to 500 lb. Mill supplies are of large variety, but require no special form of truck or body that is not utilized for other similar purposes; for instance, many mills are using five to ten-ton coal trucks for their coal and ashes, while others are making use of special bodies for carrying lumber."

The answers to this questionnaire as a whole present a great deal of information specially valuable to the salesmanager and offer a number of suggestions for further investigation and analysis.

Structural Analysis and Design of Airplanes

FOR the official information and guidance of the Air Service and those interested in aeronautics, the Engineering Division, McCook Field, recently published a book bearing the above title. The more specific object of the book is to give designers reasonable methods for the structural analysis and design of the component parts of an airplane structure. The view is expressed that the acceptance and use of a single system of analysis will tend toward uniformity in design and ease in checking calculations and in making comparisons between different airplanes.

The general procedure followed in the book is to take as examples of the different structural units of an airplane, actual standard designs chosen to illustrate as many phases of the work as possible, and to follow through each step of the analysis and structural design. All the main equations and computations are given in full. These are supplemented by explanations, drawings and diagrams where necessary for clarifying the text.

The following chapter headings may give something of an idea of the scope and method of treatment of the work: Principles of Applied Mechanics and Strength of Materials, General Considerations, Wing Stress Analysis, Miscellaneous Designs, Airplane Chassis, Control Systems, Control, Surfaces, Fuselage, Appendix.

The fact that the book was compiled by the Structure and Aerodynamics Branch, Airplane Section, Engineering Division, is sufficient guarantee of its authoritativeness.

Vital Factor in Time Study

THE essential relation of the time-study man to harmonious industrial relationships has been emphasized in AUTOMOTIVE INDUSTRIES from time to time. The opinion of a well-known consulting engineer on this point is of interest. William O. Lichtner of the Thompson Lichtner Co., said recently before the Society of Industrial Engineers:

"One of the first things to be impressed upon the minds of our would-be time-study man is that he is studying human beings like himself. This means that no one should be allowed to enter this field until he has learned the lesson of properly regarding the human element."

Automotive Fuel Injection Engines Possible

Editor AUTOMOTIVE INDUSTRIES:

It is hardly necessary to assure you that work such as that accomplished by Mr. Ricardo and described in his article in your issue of Feb. 24 ought to make most of us feel very small indeed. A point to emphasize, however, is that, for experimentation on such a variety of engines and with such a variety of experimental features, great resources appear to be necessary. As far as this country is concerned, I think even now, after so much awakening to the importance of the subject of fuel economy, it is not yet superfluous to emphasize to manufacturers the fact that investigation and research pay, and that for real progress quantitative measurement and scientific detail analysis are every bit as necessary as invention.

AUTOMOTIVE INDUSTRIES deserves high credit for bringing this paper of the great English engineer before the American public. There is no question that in this country we have now talent enough and inventive genius enough to duplicate and perhaps improve upon any results obtained abroad the minute we are set going strong in the right direction. If Mr. Ricardo's paper is to serve as a stimulus for work in a new direction, it is somewhat unfortunate that it should have come when capital is so reluctant to go into research and new development work.

In one point I should like to differ with Mr. Ricardo. He speaks of his bitter experiences with Diesel engines. Unquestionably the automotive Diesel engine is not an easy problem to solve, yet the fact is that one of the great mail order houses of the country now lists regularly in its catalog a farm engine of injection type and of as little as 3 in. bore. Also at least tolerable success must have been obtained in Germany by the Junkers engine, in France by the Bellem and the Bregeras and Caffort engines, and in England by the Blackstone engine, all using injection in one form or another. We all know that the large size injection engine is a complete success. When Mr. Ricardo announces that he has completed an aeronautical engine of 8 in. bore, operating successfully at 1350 r.p.m., it would seem to me that sizes have been reached where there ought to be little difficulty in applying the injection principle. C. A. NORMAN.

Disinterested Tests Preferred to Economy Contest

Editor AUTOMOTIVE INDUSTRIES:

In an editorial of one of your recent issues you suggested that it would be advisable, as a means of arousing public interest in fuel conservation, to arrange a public competition in which different makes of cars might participate. In the writer's opinion, such a competition might arouse public interest, but its results would be harmful rather than otherwise, in that the conclusions drawn by the public from the competition would almost certainly be wrong ones.

The relative showing made by an entrant in this competition would depend upon, first, the general efficiency of the car and motor design; second, the amount of special pains taken in getting this car and motor in better condition than the average car of the same make; third, the skill of the operator and his ability to make a better showing than would the average driver; fourth, points of special adaptation which are known to increase the fuel economy but are not practical for general use.

As instances of the second item, pistons might be used with more clearance than standard; special pains might be taken in running in motors and other parts; also special spring, tire and wheel bearing equipment. An instance of the third item would be the use of a carbureter adjustment much leaner than the average driver would tolerate, requiring the use of a choke or dash adjustment each time the throttle is opened; another would be the practice of throwing off the switch and throwing out the clutch every time the speed of the car is decreased. Item No. 4 would include various means of causing the engine to operate more nearly at full load conditions at all times, either by the use of a higher gear ratio or loading the car down to increase the effort required to pull it. A similar increase in economy could be made by raising the compression to a point where it would be unsafe to open the throttle wide.

Now it is evident that in a competition involving a number of different cars it would be impossible for the most competent engineer, and far beyond the general public, to analyze the showing of a car in respect to the different points just mentioned. It should also be borne in mind that the entrants from each factory would be more keen about the advertising value to be obtained from the test than the development of scientific knowledge and it is very probable that many special points of construction, along the lines referred to above, would be kept secret.

It would seem to the writer that the desired ends would be obtained to a much greater extent if experiments or public demonstrations were conducted by a *disinterested* research committee, on a *single car or motor*, showing the relative saving of fuel possible with different methods of driving, different conditions of motor and running gear, different fuels, different temperatures of intake manifolds, compressions, gear ratios, etc. In this way accurate comparisons could be made, there would be no question as to the correctness of the conclusions reached and there would be no danger of the experiment degenerating into a mere publicity and advertising contest. F. C. MOCK.

A MEMBER of the Society of Automotive Engineers who has been instrumental in furthering standardization of truck parts has recently received from George E. Roberts, vice-president of the National City Bank, a letter from which the following extract is taken:

"We have got to look to the engineer very largely for help in our industrial troubles; that is to say the most promising solution for our troubles is in greater efficiency in the organization and equipment of industry. The work that your organization is doing in standardizing automobile parts is of great significance, and if similar work is done throughout the industries we will make substantial gains."

What of the Safety and Personnel Departments?

The widespread elimination of safety and industrial relations departments indicates that they were established as temporary measures and are not viewed as of permanent operating value. Discussing matters with the workers is not a favor, but a matter of good business and production value.

By Harry Tipper

A SURVEY was made recently of the position of safety engineering as a special occupation in many of the large industries at the present time, as compared with its position in this respect a year or so ago.

Safety engineering developed to a very considerable degree just prior to the war and during the war. A number of men were engaged in specializing in this kind of work, and a great many improvements were secured, because of the exhaustive consideration of the matter and some understanding of its relation to efficiency in operation.

A rather large bibliography grew up around this and special publications were confined to its consideration. It is a little disturbing, therefore, to find that this work has been considered as such an outside matter, that the safety engineering department has been eliminated almost entirely in a number of cases. In other instances it has been cut down to such an extent that its effectiveness is lost and it will be a difficult matter to build the organization up again.

In one case, where a concern used forty-three safety engineers, with an extensive department created for the special study of safety work, all but three of those have been eliminated, and consequently practically all the research and most of the development work has been dropped. Some of the work in this establishment consisted in bringing the safety necessity home to the worker, making him understand his responsibility in connection with the matter.

The value of this kind of discussion does not end with the safety work, yet the department is ruthlessly cut even though the engineering departments are maintained with all the key-personnel remaining on the job. Something similar has happened to the industrial relations departments in a good many plants.

The elimination of these departments is not in itself so important. In both cases they are matters which should be a part of the training of every executive and a definite part of the quality and ability demanded of them. The practical elimination of these departments, however, indicates that they were not viewed as permanent necessities of analytical and operating value. This is the disturbing feature of the case.

It is not to be expected that such departments would remain full of men in a time of low industrial activity, but the fact that they have been practically wiped out in a number of cases indicates the attitude which has been taken toward them by the responsible executives in the establishments concerned. I have no brief for the erection of such departments in the first place, although it may be necessary to put specialists upon the studies of these matters, because of the general lack of intelligence among executives regarding them. It has been my firm opinion that nothing will be secured of great moment in the analysis of the human relations within a plant, until all executives who have charge of workers and who determine the policies are required to study the human side of the question.

It is evident that a good many of these departments of safety engineering and industrial relations have been created without a sufficient analysis of the matter and without a proper understanding of their functions or their value to the establishment. This has led to their acceptance because of temporary conditions, labor shortage, difficulty of meeting labor demands, and so forth, as an extra necessity on account of these conditions and not as a fundamental branch of the business, directed to the study of important matters.

Despite the existing evidence concerning the potential capacity of the human being, over and above the actual capacity which he puts into his work, there appears to be a general disbelief in the validity of humane methods of drawing out this potential power and putting it to work.

Most executives still think discussing matters with workers is an act of generosity, a sop to the workers or a matter of so-called welfare. Comparatively few of them have considered the matter as good business and necessary to the greatest production value. When mention is made of the results achieved in an establishment where these matters have been considered seriously, the first reaction is that such establishments are different, that other establishments were unsuccessful, or that the old way is best.

It is worth while repeating at this point, several of the fundamental reasons for the study of the human side and the fundamental values which can be expected from the proper kind of co-operative effort within the plant.

(a) The number of examples we secured during the war, when the general efficiency was decreasing, showed that it was possible to secure from 50 to 125 per cent increase in production capacity from the same workers with the same machinery and operations.

In some of these plants despite 100 per cent increase in wages the labor cost per unit of production had decreased a small percentage.

None of these things were due to improved machinery or any new system of development, but almost entirely to the discussion with the workers, the consideration of the workers and the feeling of co-operation which permeated the establishment.

(b) The studies of fatigue have shown that the mental factors of fatigue exercise a more important influence upon the production pace than the physical fatigue involved. In other words, the fatigue induced by the loss of interest and incentive translates itself into a greater physical effect than the fatigue directly resulting from the physical motions. This tends to establish a minimum pace and prevents the worker from putting forward his full power in the working operation.

(c) The rate of pay per hour doesn't have any very important bearing upon the possible cost per piece. Hours have been reduced without increasing the cost, and wages have been increased without increasing the cost per piece.

The relation which is presumed to exist in most of the discussions upon this subject is incorrect and leads to many false calculations, limiting the efficiency and destroying the value of the final observation. It is somewhat amazing that so little attention should have been paid to this matter and yet the presumption that a direct relation exists between wages paid and work done runs through 90 per cent of the discussion about wages that is going on at the present time.

(d) The industrial establishment is at present utterly divided in its outlook upon production, prices, reward of capital and other matters which intimately concern all parties engaged. There is a continual warfare between the groups in industry for the establishment of their own advantage and a continual disagreement which consumes an enormous amount of time, eliminates a very large amount of useful effort and adds to the cost of every operation which is conducted in the process of getting raw materials to the point of consumption.

These are practical items. They relate to costs; they relate to the limitation of the buying power; they show a large amount of waste effort, and they add to the burden which must be supported by industry and the consumer.

Yet these are the items which can be overcome only by a study of the human side of the question. The mathematics of industry are governed by the humanities of the case and not vice versa, as we seem to expect. These practical points are of sufficient importance in their effects upon industry and of sufficient volume in their relation to total costs to warrant the most careful examination and painstaking study. Yet, while the manufacturer retains his engineering department, almost intact in many cases, he has practically eliminated the industrial relations department, the welfare division and the safety engineering.

An old business philosopher said to me many years ago regarding the practical man who argues only from experience, "The man who is limited to what he can see and practice is the most impractical business man of the lot." Certainly this is true of the executive who shuts his eyes to the importance of the human side and the study of its fundamentals and its relations.

An Elevating Dump Body

(*Continued from page* 608)

position by the hydraulic hoist, which is controlled from the driver's seat in the usual way. The release hooks are engaged, as indicated by the hand lever resting in the forward position. To illustrate the method of operation, grasp a lead pencil between the thumb and fore-finger of the left hand, at about one-third the distance from one end, and hold it in a horizontal position. With the other hand press down on the short end. If an object representing the dump body were on the long end of the pencil, it would, of course, be elevated. The thumb and forefinger of the left hand represent the pivot shaft of the main elevating lever which is supported by the elevating frame. The forefinger of the right hand pressing down on the short end of the pencil represents the pull rods pulling down on the lower end of the main elevating lever.

If it is desired to dump without elevating—that is, in the ordinary position—the release hook lever is thrown toward the rear, thereby releasing the pull rods. The hoist is then operated in the usual manner. The body resting on the elevating frame, is raised at the front end only.

The body is made with a capacity of 80 cu. ft. for soft coal, and with less capacity for other materials. The height above ground of the bottom of the body when loaded is 6 ft. The hoist has a cylinder diameter of 6 in. The elevating frame is made of rolled steel channel 6 in. deep, weighing 10½ lbs. p. ft., well braced by ¼ in. thick cross members. The total weight of the body, hoist, elevating mechanism, telescoping chutes and bagging chute is 2950 lb.

British Government Assists Aviation

THE British Cabinet has approved (subject to Parliamentary sanction) the grant of a sum for the direct assistance of civil aviation. During the financial year 1921-22, payments under this grant will be limited to a maximum sum of £60,000 and will be made to British companies operating on approved aerial routes. They will be calculated, subject to the above limitation as regards the total sum available within the year, on the basis of 25 per cent. of the total ascertained gross revenue of each company—exclusive of the Government grant—earned by the carriage of passengers, mails or goods.

The routes at present approved are London to Paris, London to Brussels, and London to Amsterdam. Extensions to these routes and additional routes, such as England-Scandinavia, on which the possibilities of a service employing flying boats or amphibian machines, or a mixed service of sea and land aircraft, can be demonstrated, may be approved from time to time if satisfactory proposals are received by the Air Council. The maximum time allowed for journeys between London and Paris, between London and Brussels, and between London and Amsterdam will be four hours from aerodrome to aerodrome, or such other time limit as may be determined later by the Air Council.

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A. B. Swetland, General Manager
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Harry Tipper, Manager

EDITORIAL
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DETROIT OFFICE
J. Edward Schipper

WASHINGTON OFFICE
816 Fifteenth St., N. W.

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Government Helps for Business

MANY business men are holding the hope that with Herbert Hoover as Secretary of Commerce there will be a decided change for the better in the matter of appropriations for this department which means so much to the business world. Especially hopeful are those who are interested in export trade.

During consideration of the recent appropriations bill it was shown that the amount set aside for the Bureau of Foreign and Domestic Commerce was less than one-fiftieth of one per cent of the total appropriations for the Government. Secretary Hoover should be able to secure an increased proportion of the total to be voted in new appropriation bills. The business men of the country will certainly support him in such a request.

They appreciate the need for economy in government expenses, but are not committed to any policy which precludes expenditures, the results of which promise so much benefit as will result from a well-organized and intelligently operated Bureau of Foreign and Domestic Commerce.

Movable Track Automobiles

THE chain track principle was introduced in connection with heavy tractors that are required to pass over soft ground and through boggy places, the earliest application (or intended application) of this mechanism probably having been in connection with artillery haulage. During the war the chain track vehicle became widely known through its use for tanks and artillery tractors. In peaceful applications the outstanding feature of the chain track vehicle is that it can pass over soft, marshy ground where even a horse cannot obtain a footing, and where the use of ordinary wheeled vehicles would be entirely out of the question.

At the present time, a very large proportion of our road transportation is by motor vehicles, but there are two conditions of American country roads under which these vehicles are practically useless—when the roads are heavily covered with snow in winter and when they are deep with mud in February, March and April. It is quite possible that the movable track will help in overcoming this difficulty. Such a track for a light vehicle will probably have to be made of fabric belting, because a metal chain track would be too noisy, and if used in mud, would be subject to much wear. Naturally a vehicle equipped with such a track could not travel at the same speed as an ordinary wheeled vehicle on hard roads, but this would not be necessary. As both snow and mud are temporary conditions, it would not pay to build vehicles specially to run only on movable tracks, but the proposition of constructing tracks adaptable to standard automobiles looks promising. In a snow contest recently held in France, a car fitted with such a track was conspicuously successful, and a portable track for use on Ford cars has been developed in this country and is undergoing tests.

We have been building hard roads quite rapidly during the past ten years, but there is still an enormous mileage of roads in the country which are practically impassable for several months of the year. If some simple and relatively inexpensive attachment can be developed which will enable the ordinary automobile to negotiate any road at any time of the year, it will evidently add immensely to the practical value of cars which must in some way meet this condition.

The Elusive Saturation Point

EVIDENCE accumulates that ambitious statisticians are again turning to the problem of the "saturation point" of automotive vehicles. This is probably due to disappointment on the part of those who predicted evil days were ahead of the industry when the partial shutdown of automotive factories took place last fall. So many persons did not realize that factories making articles that had been regarded as necessities for years were also shut down—stockings, for instance. Now that the automotive indus-

try bids fair to be on high speed before some other industries, these prophets are seeking another basis for pointing out to our industry the exact location of its untimely grave.

Such prophets overlook the history of "saturation point" statistics. So many "saturation points" have been passed that they might be compared with the water that runs under the bridge. It does not appear to these persons that an automotive vehicle stands for transportation; that transportation is a part of civilization and that as long as civilization advances, transportation must advance with it. Railroad saturation probably will be reached first, because the automotive vehicle is an assistant to the railroad. Neither of these units of transportation will reach a saturation point until they are replaced by a better means of transportation.

There was a popular play in New York this winter called "Not So Long Ago." It was a violent reminder of how few years ago the "stationary bath tub" was the subject of discussion. This now more or less universal article of household equipment was then called "immoral" by some of its critics. At the same time the bicycle was making its appearance. How bitterly it was denounced! To-day the bath tub and bicycle industries are greater and more substantial than ever before. Both have a set place in every day life and scoffers of "not so long ago" must admit their error.

Passenger Car Body Standards

THE need for standardization of passenger car body parts would appear to be quite as important as similar work in connection with chassis parts, yet there seems to have been nothing accomplished in this direction in spite of the fact that great benefits have resulted from similar efforts relating to other parts of the car. This situation is, perhaps, due to the fact that body engineering has not kept pace with other branches of automotive engineering, while much body construction is still carried out according to old-fashioned methods used in carriage building.

Under these circumstances the first meeting of the Passenger Car Body Division of the S. A. E. Standards Committee held in New York last week can be regarded as marking a new epoch in the body industry. The new division does not, of course, expect to standardize any one design or group of body designs, nor does it plan or hope to fix dimensions that will limit initiative or prevent originality on the part of the designer. It may ultimately prove possible to agree upon certain dimensions that will facilitate in some measure interchangeability as between body and chassis of approximately the same size and type—as is already being planned by the Truck Division in connection with truck bodies—but for the present the committee plans to confine its work to standardization of body parts, hardware and materials, in some cases simply setting down for reference purposes practice which is now more or less generally followed.

Among the items which will probably receive consideration on the part of the division at an early date are: Top irons, window runways, size and thickness of glass, door handle square shank and hole, gage sizes for sheet metals, dimensions of stock shapes and mouldings, wire sizes for fender beading, nickel plating standard, door hinges (pressed and malleable), standards for leather and top materials. If the division is able to make progress in the development of these standards, that alone will amply justify its organization, yet these items represent only a very small part of what can and no doubt will finally be done.

The division as now constituted includes representatives of five body manufacturers, five car manufacturers who build their own bodies, one manufacturer who builds both bodies and chassis as well as bodies for other chassis builders (some of these being custom bodies), one body parts manufacturer and one consulting body engineer. Only six of the thirteen members attended the first meeting of the division. It is to be hoped that later meetings will be better attended, for the industry will watch the work of the division with interest and expect much from it. It should, and we believe it will receive the hearty support of all whose co-operation is sought.

Disrupting a Tax Policy

AN indication that the National Automobile Chamber of Commerce was wise in eliminating details from the tax program appears in a recent report of a ballot by the members of the Chamber of Commerce of the United States, which always carried its projects to the last possible detail.

One of the points of this ballot was a sales tax. The idea was defeated. Next came a ballot on the kinds of a sales tax. Even those persons who voted against the sales tax voted on this detail, and three sorts of sales tax had about equal support.

The hopelessness of developing a tax theory that will be supported by the membership of the Chamber after this division is evident. These are details that the N. A. C. C. plan will leave to the technical tax workers.

Ways and Means

DURING this period of readjustment when wage decreases are common, it is very interesting to follow the reaction of the workers in specific cases, and to attempt to analyze the reasons for that reaction in any given instance.

There are already numerous cases on record in which wage reductions have been met by a strike or by a strong protest of some kind. In a few cases, however, the readjustment has been made without difficulty, the employees shop committees even voluntarily making the reduction in one or two instances.

The way in which the management went about making the reductions undoubtedly had much to do with the reaction on the part of the workers. Those firms which have taken the trouble to consult, explain and reason have had by far the best success. No man can be expected to enjoy having his income decreased, but it is possible for him to be "sold" on the temporary necessity for it. And if he is to be retained as an employee he must be "sold" or his work will not be permanently efficient.

Ford Operating on Own Resources

Bank Loan Deferred, May Not Be Needed

Rapid Turnover of Surplus Cars and Inventory Helps Finance Factory Operation

DETROIT, March 14.—The Ford Motor Co. to-day is employing more than 20,000 men turning out around 3,000 cars a day, and is "going it alone" so far as finances are concerned. AUTOMOTIVE INDUSTRIES is able to say positively that Henry Ford is not seeking financial assistance, and for the time being at least, is operating successfully without it.

Just how long the company will be able to continue operation without financial help is a matter of conjecture, though it is reasonably certain that the company will ask for a bank loan about the middle of April when the thirty-day extension period granted the Ford Company by the Government for the payment of the first installment of taxes will have expired. That this money will be available without any delay or controversy also is certain.

The facts in the Ford financial situation are as follows: In January Henry Ford sent to New York for a representative of the New York bankers to come to Detroit to discuss finances. This representative came and the situation was gone over thoroughly. The banker suggested that Ford would need about $50,000,000. Edsel Ford, however, was of the opinion $75,000,000 would be required.

Ford Men Satisfactory

The hitch came when, as the climax of negotiations the banker set forth conditions upon which the loan would be made, among which was the stipulation that a treasurer must be installed to succeed F. L. Klingensmith, who would be satisfactory to the bankers. Henry Ford was asked to name three men which he did, one of whom was W. R. Campbell of the Canadian Ford plant. The bank representative scratched out the name of one man but announced that either Campbell or the third man would be all right. Campbell at that time came over to the Ford plant and remained for more than a month, and it was presumed he would be made treasurer, though he finally has determined not to join the organization.

With the matter of the treasurership settled, it looked as though the loan would be made, but Henry Ford balked at one other condition set forth and refused to accept the loan with this other stipulation included. He expressed the determination to go ahead with production without financial help, and the bank representative advised him that he felt confident Ford under the circumstances could do this successfully. The proposition of placing the plant under bank control, rumored as the stumbling block, was not touched upon.

Debt Reduced to $24,000,000

This advice was given in view of the fact that Ford had reduced his indebtedness to around $24,000,000 by the conversion of Liberty Bonds, which had been deposited as collateral to secure that loan. The further fact that Ford cars were selling steadily and that the company was reducing its inventories at a good rate, prompted the banker to offer his suggestion that it would be possible for Ford to operate without financial help at least until this bank indebtedness became due together with the Government taxes.

In other words, the proposition was put to Ford exactly this way: His obligations with the extension of time granted by the Government would not become due until the middle of April. It was possible for him to operate until that time without financial help. It was also possible that he might meanwhile, through extraordinary sales demand, be enabled to make whatever settlement became necessary the middle of April without asking for aid at that time. In the event, however, that bankers holding Ford notes insisted upon payment when those notes became due again at the same time the Government taxes were payable, Ford could have at his command as much money as he wanted from the banks on the condition they imposed. He could run until his last dollar but always had the knowledge that a telegram would bring him any money needed.

Interest at 8½ Per Cent

The loan sought in January and the loan that will be made in April—if it is made—was to be and will be at 8½ per cent gross, considered by bankers to be very reasonable. During the negotiations Henry Ford and his son Edsel agreed that they would not take any dividends pending the life of the loan, volunteering this to the banks' representative.

The bank indebtedness against the Ford Motor Co. represents notes upon which renewals have been asked five times, it is reported. It also is said with reasonable assurance that a sixth renewal on a majority of these notes will

(*Continued on page* 632)

Ford Treasurership Is Left Unfilled

Campbell Declines Position—To Continue with Canadian Company—Co-ordinate Work

DETROIT, March 11—Considerable interest has been aroused in the future of the Ford organization by the fact that W. R. Campbell of the Ford Motor Co. of Canada finally and definitely has refused to become associated with the American organization. Campbell was sent for by Henry Ford soon after the resignation of F. L. Klingensmith as general manager, and it is said Ford offered him the position vacated by Klingensmith. Campbell was reluctant to leave his Canadian post, but Ford urged him so strongly that Campbell remained at the Highland Park plant from the time of the reopening until last week virtually in charge of the organization there.

It was unofficially stated at Highland Park three weeks ago that Campbell had finally declined to become general manager, but would accept the office of treasurer. In fact, Campbell himself admitted he had finally refused to become general manager and virtually admitted he would accept the treasurership.

What developed to cause Campbell to change his mind is not known. Close friends quote him as saying he had seen too many bigger and better men than himself summarily dismissed or forced to resign for disagreement on company policy and did not "intend to go along with the procession."

At present Ford himself is said to be in active charge at Highland Park as well as the River Rouge plant, where tractor production was started two weeks ago. C. E. Sorensen, who has held the title of general manager of Henry Ford & Son, divides his time between River Rouge and Highland Park and virtually is looked upon as General Manager of Ford properties.

Kanzler Heads Production

Since the resignation of W. G. Knudsen, E. C. Kanzler has been in charge of production at Highland Park. However, the title of production manager has not been conferred on Kanzler, and Ford recently intimated it was his intention to eliminate titles and co-ordinate the work of the various departments with direct control of the big organization centered in the group of executives headed by himself and including Edsel, Sorensen, E. G. Liebolt, Ford's private secretary; W. A. Ryan, general manager; B. J. Craig, secretary; Fred Diehl, purchasing agent, and Kanzler.

Hoover Makes Foreign Trade Plans

Standardization Aim to Be Important One

Reduction of Wheel Sizes One of First Suggestions Expected—Stresses Economy

WASHINGTON, March 11—Standardization of automobile wheels will be suggested to the automotive industry by the Department of Commerce as part of a nation-wide movement toward standardization of manufactured products. In reorganizing the Department of Commerce for improved efficiency to business, Herbert C. Hoover, the new Secretary, contemplates extension of Government co-operation with trades and industry for the promotion of foreign trade against other competitors. The Government will in no way force regulation but will endeavor to accomplish its aim by proof of necessity and then by co-operation with industries.

Secretary Hoover is convinced that foreign governments are mobilizing the export trades, and in some cases the import, for militant commercial invasion. His studies abroad showed him that foreign merchants are obtaining support of their governments in pooling which will decrease manufacturing and distribution costs. This governmental assistance or even subsidy allows the European manufacturers to compete with American exporters at home and abroad.

In his first interview with Washington correspondents since assuming the Cabinet portfolio the Secretary cited automobile wheels as an instance where standardization would prove effective. He said that it was possible to cater to the needs of the automobile users by reducing the number of wheel sizes from 11 to 4. Secretary Hoover contended that this reduction in models would automatically reduce the expense of keeping rubber stocks by half. He asserted that the experiences of the war had demonstrated the necessity for standardization and its economies.

Lower Costs Imperative

American manufacturers must lessen production and distribution costs immediately if they are to preserve their standing on foreign markets, the Secretary says, because the tariff would only protect against invasion of domestic markets and have no effect on competition abroad. He contends that every ounce of efficiency is needed for American industry to recuperate and extend its markets abroad.

Hoover's interest in standardization of automobile wheels would indicate that he will encourage the research activities of the Bureau of Standards which is under his supervision. This Federal agency has made numerous investigations relating to standards in the automotive trade but failure of Congress to provide additional funds has somewhat checked its work. It is believed that with a national movement for standardization, it would be an easy matter for Secretary Hoover to obtain special or deficiency appropriations for whatever scientific inquiry the Bureau might undertake.

The question of economies of distribution will undoubtedly be stressed in all branches of business. It is here where the economies of highway transportation will be demonstrated, for shippers are desirous of relief from rail-hauls.

Statistical Division to Undergo Change

WASHINGTON, March 15—Automotive trade associations and individual exporters will be consulted shortly by a special committee appointed to-day by Secretary of Commerce Hoover, to reorganize and revise the methods used by the statistical division of the Bureau of Foreign and Domestic Commerce. Numerous complaints have been received as to discrepancies in export and import statistics and suggestions will be studied.

Exporters of automobiles, trucks and tires have manifested unusual interest in foreign trade statistics of late in order to gage the condition of foreign markets and the revival of competition. Manufacturers have complained to the secretary that there were numerous discrepancies in the figures prepared by the Bureau of Foreign and Domestic Commerce for August. Inquiry developed the fact that customs officials were overburdened and omitted certain items for that month. This error makes the official figures on all commodities open to question.

The committee, headed by William S. Rossiter of Concord, N. H., will conduct an inquiry into this mistake and revise the records.

The blunder in compiling official statistics sheds light on the failure of the Department of Commerce to publish data within a reasonable period. It is stated that errors are incidental to decoding and preparation for publication of reports from the collector of customs at New York.

Suggest New York Location

The small appropriation makes it impossible for the bureau here to furnish manufacturers with information and this import material is prepared by underpaid, and in many instances, inefficient clerks. It has been suggested that the statistical division have headquarters in New York.

Will Seek Enactment of Favorable Bills

Lower Rail Rates to Seaboard Important—Would Erect American Warehouses

WASHINGTON, March 15—Secretary of Commerce Hoover has indicated his intention to promote foreign trade in automotive products and other commodities on a gigantic scale. There is reason to believe that he will urge upon the new Congress legislative measures which will aid the movement and sale of American products on foreign markets. It is understood that he will recommend the liberalization of the Webb-Pomerene and Edge acts, lower freight rates to the seaboard and equitable ocean rates, establishment of American banking agencies abroad and erection of American warehouses at the principal foreign ports.

Business men, principally manufacturers, have complained to the new Secretary of Commerce that the rail traffic will not bear the present freight rates. He has been advised that the industrial centers of the country will be moved unless relief is accorded in transportation rates. Traffic experts believe that the commercial map will be changed by the removal of industries toward the seaboard, so that the rail haul will be relatively short. If the railroads do not lower their rates it is believed that shippers will turn to a more extensive use of trucks and waterways, which provide cheaper transportation.

The establishment of warehouses in foreign countries is regarded as essential to the success of American foreign trade. It is known that British and German traders own or control warehouses to-day in countries where American exporters are cultivating trade. Though American goods are stored in these places, it is known that the owners would naturally endeavor to dispose of goods manufactured in their countries which compete with American products.

Discrimination Hurts Trade

The Department of Commerce has a plan under consideration which would to a large extent prevent this discrimination against Americans. Warehouses constructed by the Government and in charge of consuls or other Federal agents would undoubtedly help American traders. There is also a proposal to extend branches of the Federal Reserve system at the principal ports.

In suggesting standardization of automobile wheels, Hoover made it clear that his proposals for standardization in all industries were made to allow more effective competition on foreign markets.

Durant-DuPont Deal Disclosed in Report

G. M. C. Holdings Taken Over for $23,790,600 in Cash and Stock Consideration

NEW YORK, March 14—Details, hitherto carefully concealed, of the spectacular financial transaction by which W. C. Durant retired almost over night as head of the General Motors Corp., are disclosed in the annual report of E. I. duPont de Nemours & Co. It shows that when Durant was unable to meet his obligations last November, the duPont Securities Corp. took over 2,504,273 shares of General Motors stock. He received for his holdings $23,790,600 in cash and 40,000 shares of the stock of the Securities corporation which was formed to buy his General Motors stock.

It is stated in the report that the taking over of the stock was at the request of Durant, who had informed the duPont interest that "he desired to resign and sell his interest in the corporation to liquidate his personal indebtedness, which was very large and pressing."

On the basis of the amount of money paid to Durant it is figured that he received $9.50 per share in cash for his General Motors holdings. The 40,000 shares of stock of the duPont Securities Corp., it is stated, have since been exchanged for 230,000 shares of General Motors common stock, which again gives him a substantial holding in the concern. If a value of $13 per share were placed on this amount of stock it would add $2,990,000 to what Durant received for his original holdings and would bring the amount up to about $10.70 a share.

At the time of the transaction there was much speculation in Wall Street as to just what amount was involved in the exchange. Estimates made at the time placed the amount at $27,000,000, but it was also gossiped around the Street that Durant received only between $7 and $9 a share.

Show Details of Financing

The financing of the transaction whereby the stock was taken, it was pointed out, was by the sale of $20,000,000 one-year 8 per cent collateral trust bonds of the duPont Securities Corp. through J. P. Morgan & Co. These bonds fall due on Nov. 22 of this year, but in consequence of this maturity the report states that the officers "are now working on plans for the permanent financing of this additional investment on the General Motors Corp., the details of which plan will be communicated to the stockholders as soon as completed."

In addition to the notes sold through the banking firm, the duPont American Industries Co., the stock of which is 100 per cent owned by the E. I. duPont de Nemours Co., paid into the treasury of the duPont Securities Co. $4,200,000 in cash and loaned 824,179 shares of General Motors, for which it received $4,200,000 in shares of the 8 per cent cumulative preferred stock and 36,000 shares of the non-voting common stock of the new company. The Chevrolet Co. paid $2,800,000 in cash and loaned $549,453 in shares of General Motors, receiving $2,800,000 preferred and 24,000 shares of the common stock of the duPont Securities Corp.

Obtained 4,000,000 Shares

By this method, it was also pointed out, the duPont Securities Corp. obtained $27,000,000 in cash and borrowed 1,373,632 shares of General Motors common stock. This stock, with the 2,626,368 shares taken over from Durant, gave the duPont Securities 4,000,000 shares of General Motors, which was pledged with the bankers for the $20,000,000 loan. It is also stated that the banking group received 20,000 shares of the common stock of the duPont Securities Co. as a commission for the loan. This was paid out of the 60,000 shares received by the duPont American Industries and the Chevrolet Co.

The report also states that under the same transaction with Durant the duPont Securities Corp. took over 122,095 shares of General Motors common from a syndicate consisting of the duPont, the Chevrolet companies and Durant. For this stock they paid $2,163,557 cash, which was the equivalent of $17.72 a share. This stock, however, has since been sold.

Durant Not Seeking Studebaker Control

NEW YORK, March 14—Formal denial has been made by W. C. Durant that he is seeking control of the Studebaker Corp. to make it the nucleus for Durant Motors, Inc. The reports became current when Durant bought a large amount of Studebaker stock in the market.

STUDENTS TO VISIT PLANTS

PHILADELPHIA, March 11—Twenty-seven seniors of the Mechanical Engineering School of the University of Pennsylvania have left here on an extensive tour through the Middle West. This will include a trip to the new factory building of the Cadillac Motor Car Co. of Detroit. The men are accompanied by Prof. R. H. Fernald, of the mechanical engineering department. They will inspect plants in Pittsburgh, Chicago and St. Louis.

PUBLICITY BRINGS BUYERS

DAVENPORT, IOWA, March 12—Automobile dealers in this community report a 50 per cent increase in trade within the last week. An early spring and an active publicity campaign which took the place of the usual automobile show were responsible for the revival, they said. No adequate exhibit room could be secured and the dealers went into an aggressive publicity campaign.

Indications are that the season will be a record one, some dealers said, and all of them have felt a business revival which has drawn expression of surprise.

Maxwell Defends Chalmers Merger

Asks Dismissal of Partition Suit Filed in Wilmington—Fixes Valuation

WILMINGTON, DEL., March 11—An answer has been filed in the United States District Court to the suit of Charles J. True against Maxwell Motor Co., Inc., by Carl Tucker the vice-president.

He claims numerous errors in the bill of complaint. Special stress is laid upon the fact that the book value of the stock of the defendant corporation, stated at $22,117,230.80 as of Dec. 2, 1920, is liable to deductions for reserves for depreciation, contingent liabilities aggregating $4,513,265.80, and furthermore that said book value, approximately $134 per share on the outstanding first preferred stock, is largely dependent on the defendant being a going concern.

Excepting the amount of the aggregate tangible assets of the Chalmers Motor Corp. these are asserted to have had the value on Dec. 2, 1920 of $4,519,722.57 and not $435,014.02 as alleged in the complaint.

It is admitted that a meeting of stockholders called to be held in this city on or about Oct. 19, 1920, has been adjourned from time to time, and has never been held, but proof is demanded that a properly accredited representative of the plaintiff was appointed to attend this meeting, and holds that the cause of the adjournment of the meeting was the failure of the defendant to receive a sufficient number of proxies to constitute a quorum.

It is admitted that the bill of complaint filed on Jan. 14, 1920, in the District Court for the southern district of Michigan, as well as others in Indiana and Ohio, was filed for the purpose of averting the danger of judgments, levies, etc., substantially all of the property of the defendant being located in these three states, the courts assuming jurisdiction and control of the assets.

It is denied that the equity in defendant's property is sufficient to provide for the full value of the plaintiff's stock and that of other first preferred creditors in case the property of the defendant is liquidated. The dismissal of the bill of complaint is asked.

A petition for leave to intervene in the suit has been filed by Robert W. Seaton of New York, owner of 200 shares of first preferred stock of Maxwell Motor Co.

ELECTRICAL SCHOOL FORMED

MILWAUKEE, March 14—The School of Automotive Electricity of Milwaukee has been incorporated with a capital stock of $100,000 as a development of the department established about two years ago by the School of Engineering of Milwaukee to train specialists in automotive electrical engineering.

Firestone Business Reaches 60 Per Cent.

Starts Second Shift on New Production Schedule—Surplus Nearly Exhausted

AKRON, March 12—Although directors of the Firestone Tire & Rubber Co. of Akron voted under date of March 15 to pass the common stock regular quarterly dividend due March 20, the company lists a surplus of approximately $33,000,000 and states that it has more than $7,500,000 in cash in bank.

The Firestone statement, issued in connection with the dividend action of directors, is one of the most optimistic issued by any rubber company in Akron since the beginning of the tire industry slump last May. The company is now producing about 7000 tires daily, and is operating five days a week with full eight-hour days. It is one of the first Akron tire concerns to reinstate the second shift, and is now operating two eight-hour shifts on tire production. The second and third shifts were dropped when the low ebb of the tire industry slump caused all Akron concerns to retrench and to reduce production to less than 25 per cent of normal.

Firestone reports that its surplus stock of tires is almost exhausted and that increased production is necessary to replenish these stocks, due to the rapid increase of tire sales. For the first ten days of March the company's business took a decided spurt, sufficient to warrant the official prediction by President H. S. Firestone that his company would do business in excess of $6,000,000 in March. The company's sales for the past fiscal year were $114,980,969, as compared to $91,078,513. Figuring on this basis, Firestone is now doing nearly 60 per cent of its average monthly business of last year. This is perhaps a higher percentage of respective normal business than is being done by any Akron tire company at the present time.

In addition to being one of the first to re-establish the second shift, Firestone is also the first Akron tire concern to begin re-employing men. During the past few days several hundred men have been taken on. Great care is being exercised by the employment division, however, in picking from the many applicants those formerly employed by the company, with preference shown to married men and to men on record as the company's former most efficient workers.

Miller Stocks Run Low

The Firestone prediction of a shortage of tires is strongly corroborated by recent action of the Miller Rubber Co. of Akron in calling in all available supplies of tires from districts where sales have been slow, in order to rush such stocks to points where sales are increasing rapidly. This action will preclude necessity, for the time being at least, of materially increasing production.

The Goodyear Tire & Rubber Co. has just increased production from 35,000 tires to 60,000 weekly, which is slightly less than one-third of peak production. Whether the company puts on any great number of men will depend largely upon the successful consummation of the company's refinancing program involving $85,000,000.

Business Renewals

Detroit—Property of Adrian Tractor Co. at Adrian, Mich., has been attached by several concerns holding claims for construction material. The Adrian Tractor Co. was formed last fall, and a sale of stock to secure funds for the construction and operation of a factory was begun but was stopped by the industrial depression.

Detroit—Columbia Body Co., which builds commercial bodies and truck cabs, has purchased a new plant containing 40,000 feet at Ford City, Mich. Increased business of the company and orders in prospect necessitated the expansion, officials say, and as quickly as the plant can be put into production, between 150 and 200 men will be employed.

Detroit—Erdman-Guider Co. officials announce receipt of an order for a large number of bodies for the Sheridan unit of the General Motors Corp. The bodies are constructed in Saginaw and painted and trimmed in the local plants. Company officials say indications are that the company would require an output of 5000 bodies this year.

Sheboygan Falls, Wis., March 14—The Falls Motors Corp. has increased its working force to nearly 400, and is now on a regular operating schedule of 9 hours a day, after running on a greatly reduced schedule since Oct. 1, 1920. The normal force is about 700 men. During the reduction of operations the engineering staff erected and equipped a new testing room with a capacity of 300 engines a day and otherwise improved the plant to increase efficiency to the utmost degree. The company builds 95 per cent of the parts entering into the construction of Falls motors.

TO BUILD HIGHWAY TRACTOR

FOND DU LAC, WIS., March 14—The Bull Dog Tractor Co., originally organized at Oshkosh, but later moved to Fond du Lac, has completed the first unit of its new plant. The company will build tractors for general purposes, but will specialize in machines designed especially for highway construction, and accordingly has named the machine the Hi-Way Locomotive. It has made excellent connections with concerns building road building apparatus without power units. The design also embodies a power operated from the driver's seat for stump-pulling, removing cumbersome obstructions, moving buildings, and many other uses where power is required.

Dunlop Production to Start April 15

Plant Will Employ 7000 Men by Jan. 1, 1922—Company's Finances Arranged

BUFFALO, March 14—Production of tires at the River Road plant of the Dunlop Tire & Rubber Corp. of America will be started April 15. Nearly 7000 men will be employed at the plant by Jan. 1, 1922, of whom 99 per cent will be from Buffalo.

R. W. Snow, legal advisor of the company, made the announcement to-day before Chairman Charles B. Hill, of the Up-state Public Service Commission, when the counsel for the tire company urged that the International Railway Co. should be allowed to extend its River Road tracks to give transportation to the men employed by the company.

P. D. Saylor, vice-president of the company, said that an office force had been organized and is at work and that a small working crew is on the job cleaning up and making ready for the resumption of activity.

It is planned to start manufacture this spring and to finish up the construction work. Saylor said that the key men of the organization have been retained and that all will be in readiness when the time comes for resumption.

Construction work at the Dunlop plant was suspended the first of the year and nearly the entire staff and corps of men which had been built up during 1920 was taken off. It is understood the company has now arranged its finances and is ready to start operations.

Public Fails to Buy Dunlop Stock Issue

(*By Cable to* AUTOMOTIVE INDUSTRIES)

LONDON, March 12—Underwriters of the new $15,000,000 issue of first debenture stock of the Dunlop Rubber Co., Ltd., have been left with 73½ per cent of the issue on their hands. The public subscription amounted to only $3,750,000. In spite of this result, however, Dunlop stock is quoted higher on the market.

Rolls-Royce will pay dividends of 10 per cent this year as compared with 15 per cent last year. The net earnings amounted to $963,885, or about the same as last year, but the directors decided to reduce the dividend rate because of conditions in the automotive industry.

CHARLES G. STODDARD DIES

NEW YORK, March 12—Charles G. Stoddard, who with his brother founded the Stoddard-Dayton Automobile Co. and later became vice-president of the United States Motors Co., died yesterday at Galveston, Texas, aged fifty-seven. He was born in Dayton, was graduated from Princeton, and retired from business recently because of ill health.

Rail Strike Threat Brings Truck Call

Council of National Defense Makes Plans for Mobilizing Motorized Transport

WASHINGTON, March 14—Serious thought is being given by the administration to the possibility of a general railroad strike as a result of the announcement by nearly all roads that the wages of all classes of employees will be drastically cut in the interest of economy and in the hope that lower freight rates can be given to stimulate business.

Unofficial but none the less authoritative information has reached the White House that if the pay of their members is reduced, the four great brotherhoods will advocate a strike in opposition to such a program. While it is the general belief that if there were such a strike it would be of brief duration, the Council of National Defense is preparing for a mobilization of the motorized transport to prevent suffering and economic disaster throughout the country. It is known that the council has devised a plan for the allocation of motor trucks. This program is based upon concrete data already in its possession and from State legislation lists.

The council will not assume control of highway transport unless it is evidenced that the railroads are unable to function properly. The council is dependent largely upon the co-operation of the State executives for the organization of volunteer motor truck associations at strategic points at centers of population.

In the last transport crisis when the brotherhoods threatened to quit, the Council of National Defense asked the various governors to obtain data as to the character, capacity, ownership and location of motor trucks throughout the State. The governors in turn addressed communications to the municipal authorities asking for their co-operation in obtaining pledge cars from direct owners in the local zones.

Congress Action Harmful

The failure of Congress to provide appropriations for the maintenance of the Council of National Defense has handicapped this organization in completing a survey of trucks and other forms of highway transportation, which they regarded as essential to the nation's safety. The council now maintains a skeleton organization for the purpose of rounding out its affairs before the end of the present fiscal year. In the event of a national crisis in transportation there is but little doubt that Congress would authorize additional expenditures in this direction.

Communicaions received from governors show that in the majority of States, at least, it will be an easy matter to organize an efficient transportation system over the highways. The Federal Government, however, is not prepared to render assistance in highway transportation in any such proportion as heretotofore. The depletion of War Department trucks through sales has been rapid during the past year.

According to Army officials there are 19,000 trucks which are available for army purposes. Out of this total 13,000 trucks are in active service with the military service. The other 6000 machines could be placed on the road for service on receipt of an order from the Secretary of War. The Secretary of War is the chairman of the Council of National Defense. The War Department had approximately 40,000 serviceable trucks and cars a year ago.

N.A.C.C. Starts Survey of Truck Mobilization

NEW YORK, March 12—A survey on the mobilization of motor trucks has been undertaken by the truck committee of the National Automobile Commercial Club. The information gathered will include the number of trucks operating in each city, their ton mileage and the type of service in which they are employed. This information is expected to enable manufacturers to estimate more accurately potential truck markets. The survey undertaken to determine the number of motor trucks on farms is about half completed.

Governor Miller of New York has announced his intention of appointing a highway transport committee. Its membership will include state officers whose duties include the development of good roads and citizens interested in the same subject.

Whittaker Takes Charge of Truck Sales Managers

DETROIT, March 14—Don F. Whittaker has been elected executive secretary of the National Association of Motor Truck Sales Managers and has assumed charge of the association affairs at headquarters, 1157 Book Building.

Whittaker has been in the motor truck business for several years with the Federal Motor Truck Co. and the Acason Motor Truck Co. He was a charter member of the association and has been active in its work.

Homer Hilton, who has been managing director of the association, has become vice-president and general sales manager of the Winther Motor Truck Co.

The next directors' meeting of the association will be held here March 25. Definite action will be taken toward furthering of plans for 1921 under Whittaker's jurisdiction.

JOHN D. DODGE WINS BEQUEST

DETROIT, March 15—Settlement out of court of the contest instituted by John Duval Dodge to break the will of his father, John F. Dodge, automobile manufacturer, was announced here today. Young Dodge, bequeathed an annuity of approximately $1,500, is to receive $2,000.000 of the estate, estimated at $80 000,000.

N. Y. Central Tries Truck Experiment

Special Equipment to Try Store-Door Delivery Plan in Western Cities

NEW YORK, March 12—An interesting experiment in the store-door delivery of express matter will be undertaken this week by the New York Central Railroad Co. in co-operation with the American Railway Express Co. The plan will be put in operation first in Chicago and Cleveland and standardized trucks will be used in its development.

A. H. Smith, president of the New York Central, has been much impressed with the possibilities of the motor truck as an auxiliary to the railroad. After careful consideration of the subject, his engineers recommended the construction of special express cars which would carry nine steel containers uniform in size which could be loaded from the trucks at the point of origin and unloaded to trucks at the destination.

The trucks will be driven to the point where the merchandise is to be loaded and then to the railroad yards, where the containers will be hoisted onto the specially constructed cars. When the destination is reached, cranes will lift the containers to the trucks and the merchandise will be delivered directly to the establishments of the consignees.

Each container will be 9 x 6 ft. and will have a capacity of 6000 lb. It is estimated that the cars which will carry them can be loaded and unloaded in 40 minutes. The New York Central is paying the expense of the experiment and is providing the standardized trucks which are to be used. If the plan proves as successful as is expected it will be extended to the main shipping points on the New York Central system.

RENEW TRUCK RATE REQUEST

NEW YORK, March 12—The traffic department of the National Automobile Chamber of Commerce has renewed its application to the Western Classification Committee for second class freight rates on motor trucks in carload lots and on chassis. The difference between first and second class rates on carload shipments of motor trucks to such western points as Denver, Kansas City, Omaha, and Dallas amounts to from $40 to $80 and more a car.

NEW ENGLAND GETS REOS

HARTFORD, March 15—Russell P. Taber, Inc., Hartford Reo distributor, finds business so good that it is necessary to receive cars by the trainload. There is now in transit from the Reo factory to the Hartford dealer a trainload of Reos made up as follows: 36 speed wagons, 34 touring cars, 10 roadsters, 8 sedans and four coupes. This big shipment is in addition to the regular February allotment of 50 cars which were all sold.

Urge Use of Trucks in Harbor Project

Engineers Would Cut Time and Expense from New York Development Cost

NEW YORK, March 12—The New York Chapter of the American Society of Mechanical Engineers has gone on record in favor of the use of motor trucks for the pretentious harbor development project undertaken by the New York and New Jersey Port and Harbor Commission. The alternative plan suggested by B. F. Cresson, chief engineer of the commission, is the construction of an electrically operated subway system extending all the way around the port through which loaded freight cars would be sent, with distribution points for rapid loading and unloading. It is estimated that such a subway would cost $280,000,000.

The engineers have taken the position that the same work could be done by motor trucks at only a fraction of the cost and no serious engineering difficulties would be involved in their use.

Motor truck interests are deeply interested in the project and their chief advocate is B. F. Fitch, president of the Motor Terminals Co. of Cleveland, Cincinnati and Chicago. Fitch also heads a similar company which has been incorporated in New York. His views on the subject were presented to the mechanical engineers and he now is seeking to win the support of the Harbor Commission, although Cresson is in disagreement with him.

It is the contention of Fitch that the use of motor trucks for such work would not be in any sense experimental and that development of the harbor in this way would consume only a fraction of the time required for the construction of a subway. He also asserts that the cost of operation would be considerably lighter. If the use of trucks is decided upon, thousands of them would be required for the work.

LA CROSSE GETS SITE OFFER

OSHKOSH, WIS., March 14—The industrial committee of the Oshkosh Association of Commerce has undertaken a campaign to secure the removal of the plant and headquarters of the LaCrosse Tractor Co., LaCrosse, Wis., to Oshkosh. It is proposed to organize a new corporation with $2,000,000 capital. The LaCrosse interests are said to be willing to invest one-half, and Oshkosh capital will absorb the remainder. A free site has been offered and arrangements made for the construction of a plant with a floor space of 80,000 sq. ft. A first year output of 3000 machines with a force of 750 to 800 workmen is planned.

The project has been under consideration for more than three months, it is stated, but no public announcement has been made until now, when Oshkosh bankers and business men have been definitely assured of adequate financing.

DELAWARE TRUCK BILL WOULD CHECK RATES

DOVER, DEL., March 14—There is pending before the Delaware legislature, now in session, a resolution the object of which is a nation-wide move to have State governments regulate motor truck freight rates. It was introduced a few days ago by Senator Bennett, who lives in the lower part of the state. After reciting the fact that every increase in railroad rates is likely to be followed by increased truck freight charges, it calls upon Governor Denney of Delaware to ask other governors to confer with him relative to the matter of having the states regulate rates.

The resolution has been referred to a committee, where it probably will lie until the time is considered ripe to bring it out and air it.

Car Makers Increase Demand for Engines

MILWAUKEE, March 12—Schedules have been released by the Wisconsin Motor Mfg. Co., manufacturer of the Wisconsin engine, to the extent of 25 engines a day, which, although a small percentage of the capacity of the plant, indicates the gradual trend toward normal conditions. The Liberty Motor Car Co., Detroit, has asked for immediate shipments and has released a very substantial schedule for the next ninety days. In addition there have been numerous small requisitions which will go to make up a decided improvement in the total output.

H. W. Schnetzky, president, and A. F. Milbrath, secretary and chief engineer of the company, have returned from an extensive trip through the west, surveying business conditions in general and calling on Wisconsin distributors. They report the business outlook favorable. The Earl P. Cooper Co. at Los Angeles, and the Chandler-Hudson Co. at Seattle, are optimistic over conditions and state that the west coast is fast recovering from the business depression.

OHIO SENSES TRUCK DEMAND

COLUMBUS, March 11—Prospects for an active demand for motor trucks within a short time are unusually bright in Columbus and central Ohio territory, according to leading agencies. During the past few months it has been rather quiet and a canvass of the situation shows that many truck users will soon come into the market for replacement of their truck equipment. It has been the custom during the past six months for the truck owners and users to make all repairs on their present equipment to keep them going. Now the time has arrived when their old equipment is in many cases just about worn out and they will be forced into the market.

Tractor Business Improves in South

Dealers Look to Normal Times for Restoration of Former Sales Volume

ATLANTA, March 14—Though it is the opinion among tractor distributers of the Atlanta territory that the crisis in this section has been passed so far as the tractor industry is concerned and that sales are experiencing a gradual improvement, the total volume of business is below the normal mark, and that condition appears likely to exist until the readjustment period has become a thing of the past.

One of the reasons distributers in this section are finding tractor sales rather few and far between is that many of the dealers, especially those in the smaller towns, have strained their credit almost to the breaking point. Fred Cameron, of the John Deere Plow Co.'s Atlanta branch, in a recent trip through south Georgia and the Carolinas, found that many of the smaller dealers were in severe straits. They were unable to make substantial payments on their accounts because they have not been selling enough tractors the past few months to even take care of incidental expenses.

Because of the declines in the prices of their products the farmers haven't the money with which to buy tractors now, and they are unable to obtain additional credit from their bankers in most cases because they are already under heavy obligations. This is the unfavorable condition against which the dealers are working in their efforts to sell tractors. Until that condition experiences material improvement the industry cannot get back to normal.

Cameron told of one dealer who started business a little over a year ago with $2,500 capital, and who now owes $37,500, with only $15,000 worth of notes to take care of it. While that dealer's condition is not typical, there are many experiencing troubles of a kindred nature.

In January the tractor business in the Southeast was really at a standstill, but during February a few sales were made. March has been about on a par with February, but a gradual increase in business is noted and there is a better feeling than for several months. During April and May they are anticipating a much larger volume.

WHARTON TO MAKE FULL LINE

DALLAS, TEXAS, March 12—The manufacture of a very extensive line of automotive apparatus is contemplated by the recently organized Wharton Motors Co., Inc. The line comprises three passenger car models, a four, a six and an eight, two trucks, one of 1 to 1½ tons capacity and the other of 2 to 2½ tons, and a combined tractor and cultivator. The four-cylinder model has a 3½ x 5 in. engine, the six-cylinder model a 3⅛x4½.

Car Design Lowers Rates on Insurance

Standard Frame Marking Secures 20 Per Cent Allowance—Locks Reduce Risks

NEW YORK, March 14—The insurance committee of the N. A. C. C. of which W. E. Metzger is chairman, has sent a bulletin to its members pointing out that insurance costs to the public are influenced by car design and urging members to study the schedule of fire hazards. The bulletin says:

"A very substantial item of expense in connection with ownership and operation of an automobile is insurance. The effect of the new plan of grouping cars by name instead of by list price is becoming better known and appreciated by buyers, and our Directors and Insurance Committee strongly urge that members carefully note the construction features which Underwriters consider as bearing directly on the risk attached to the various forms of insurance, not only for the purpose of having each car grouped as favorably as possible but because makers should aim to keep insurance costs to the public as low as possible.

"These features are listed in the schedule of hazards. The Underwriters believe that by means of theft retardents and positive identification marks, manufacturers can assist in reducing insurance losses. For standard marking of frame they offer 7½ per cent, for standard marking of engine block, 7½ per cent, and an additional 5 per cent for both, making 20 per cent when both frame and engine block are so marked.

"Deductions ranging from 12½ per cent to 20 per cent are allowed for built-in, or integral, approved locking devices; the transmission type secures the greatest reduction. It will be noted that the Manual grants an allowance of 20 per cent from theft rate on Paige-Detroit cars. This is because of their built-in transmission lock. In most cities and territories a 15 per cent reduction is made in theft insurance when the car owner buys a lock of an approved type and attaches it to his car; in many cities, if a car is not equipped with an approved lock a flat extra charge of $15 is made in the theft rate.

"Fire risk is influenced by location of gasoline tanks, their construction, the soundness of the feed system, proximity of carbureter to sparks, the tension and insulation of wiring, exposure of exhaust to drippings and general workmanship and stability."

STOCKHOLDERS RAISE $25,000

AKRON, March 12—Stockholders of the defunct Interlocking Cord Tire Co. of Akron and Mogadore, now in the hands of Elihu Harpham as receiver, and whose four former main officers are under criminal indictment for alleged violation of the Ohio Blue Sky Law, have raised $25,000 in an effort to reorganize and re-establish the company, it is announced by a special stockholders' committee. The committee also announces appointment of Edward R. Kohl as temporary president of the company, succeeding Walter Kline, who resigned following his indictment by the Summit County Grand Jury. R. E. Cartlidge, Akron industrial engineer, has been named treasurer of the new management of the company and C. A. Rukamp has been named secretary. The stockholders will elect a permanent president soon, it is announced.

U. S. C. C. Favors Revision in Contract Obligations

WASHINGTON, March 10—Six months' study of cancellations in representative industries convinced the fabricated production department of the Chamber of Commerce of the United States that this general repudiation of business agreements was largely responsible for the economic disturbances. The National Chamber has recommended that the business interests of the country take steps to prevent the spread of cancellation evil and insure confidence in the written and oral contractual relations.

The Chamber favors revisions in contracts which make the obligations of both seller and buyer equitable with provisions for arbitration; diligent inquiry into credit standing of applicants, report cases where parties cancelled their contracts and establish a "Golden Rule" policy in business. The Chamber recommended that merchants use the services of trade organizations in combating cancellations.

Germany to Open Gates to Light Tractor Test

DETROIT, March 14—Officials of the Ford Motor Co. are much gratified at the report from Berlin that the Reichstag committee on national economics has voted to recommend that the government permit the entry of four light weight American tractor plows for demonstration purposes. This action was taken in the face of strong opposition by German manufacturers.

It is the assumption here that the tractors in question are Fordsons. Negotiations for their entry into Germany have been pending since the visit here of B. F. Graetz several months ago. He expressed confidence that he would be able to get across the border several tractors which were furnished him. If the Reichstag adopts the recommendation of its committee it is believed it will presage the opening of an enormous new market for tractors.

POLICE GUARD TURIN PLANTS

NEW YORK, March 15—A dispatch from Turin, Italy, says the police have been stationed in the Michelin factories where the workers have been locked out. This action was taken because of acts of violence committed by the workers.

Insurance Companies Drop Full Coverage

Aetna to Make Insured Bear Initial Losses in Collisions—Urge Co-operation

NEW YORK, March 14—An important step toward reducing the number of automobile accidents and toward lessening insurance collision rates has been taken by the Aetna Life Insurance Co. and its affiliated companies, the Aetna Casualty & Surety Co. and the Automobile Insurance Co. of Hartford, in eliminating the sale of full coverage collision insurance from March 9 on. Under the new plan only that form of collision insurance which provides for the insured paying the first $50 or $100 of each collision loss will be sold.

This action has been taken individually by the companies and is designed to throw the burden of careless and negligent motor car operation upon the operator. Insurance brokers and agents have been notified of the company's action and the reasons for it. Their support has been particularly sought in a movement to eliminate full collision coverage insurance in the Greater New York zone because of the heavy traffic.

By making this change company officials expect to accomplish something more effective and constructive in the way of reducing preventable insurance accidents than the mere action of increasing rates. Decreased losses will be reflected in decreased rates, so that the main benefit will be to the public.

As part of the Aetna's present move to reduce preventable losses, the company is also advocating the equipping of cars with approved types of locks to lessen the danger of theft.

Safety Precautions to Win Lower Rates

MILWAUKEE, March 12—Wisconsin pioneered in workmen's compensation insurance covering accidents or fatalities, and since that time every manufacturer, or dealer, in any kind of industry or trade has paid the same premium rate for this state-enforced insurance as every other employer in his line.

Through the efforts of employers, including some of the automobile manufacturers, makers of parts and equipment and service plant owners, the Wisconsin law is now to be amended to give the employer who promotes safety in his establishment a lower premium rate and expense than the one who gives little or no attention to these items, regardless of class of enterprise.

The bill will be passed by the Wisconsin legislature, at least in its chief essential, and it is predicted that the move here will be followed by the other states having similar state-enforced insurance.

The new statute provides for individual experience rating, per establishment.

Industry Shows Gain While Others Slump

Cleveland Survey Shows Falling Employment in Other Lines —Look for Fair Year

CLEVELAND, March 15—The automobile industry is moving back toward normal conditions much more rapidly than are other lines of industry in this city, according to a survey made by the Industrial Relations Committee of the Cleveland Chamber of Commerce. The survey was made for the United States Department of Labor and the results were sent to Washington. Each month a similar survey will be made and the figures given to Washington, so that the labor department may keep an accurate line on developments here.

The report disclosed that there was an increase of 10 per cent in the number of employees in 18 plants engaged in making products for the automobile industry. In these 18 plants, 5542 men were employed on Jan. 31, while on the last day in February the number had increased to 6120. The plants in this group of 18 include all of the automobile making concerns in the city with the exception of one, as well as most of the factories in which automobile parts are made.

While the automotive industry was making this 10 per cent headway, other lines in the survey were going back 1.9 per cent from an employment standpoint. The committee sent out questionnaires to approximately 100 factories and 97 responded. In these 97 factories there were 58,116 men employed on the last day of January, while on Feb. 28, the number had decreased to 57,001. That is a loss of 1.9 per cent in the number of employees.

Here is what the survey disclosed:

Group—	No. of Employees Jan. 31	Feb. 28
Food	3,071	2,702
Textiles	5,928	6,045
Iron and steel	21,081	20,488
Lumber	1,119	1,163
Paper	1,170	1,100
Chemicals	3,242	3,141
Metal	869	747
Miscellaneous	16,088	15,495

At the automobile plants that were questioned it was brought out that orders were in February more than 10 per cent greater than they were in January, and this brought the prediction that more men would be employed in the present month. March has started off well.

Sixty per cent of the normal production or employment capacity of the 97 factories that responded in the survey is being used to-day, according to an estimate made at offices of the industrial relations committee. It is estimated that in normal times, the factories that were employing 57,001 persons on Feb. 28 would have on their payrolls approximately 100,000.

Predictions have been made that production for the year would be about 60 per cent of what it was in the boom days of the war.

Parts Makers to Push Service Station Plan

NEW YORK, March 16.—Representatives of some of the largest parts manufacturers in the country will meet here late this week for further discussion of the plan which has been in process of development for some time, for the establishment of major service stations and branches in all parts of the country. Better and more economical service for motor car owners by making constantly available to them complete stocks of major parts is the chief purpose of the plan. It is the purpose to carry at these stations the principal parts used in most of the assembled cars.

Many parts manufacturers are coming to the conclusion that if their products are to be properly serviced some such plan is necessary. It is not the purpose to come into competition with the dealer and garage men but rather to co-operate with them, except in the case of orphan cars and trucks. Supplies at these stations would be much more complete than any individual dealer could afford to handle.

Harvester and Case Lower Tractor Prices

CHICAGO, March 17—In anticipation of lower production costs, the International Harvester Co. has made the following reduction in tractor prices: Titan 10-20, reduced $200; International 8-16, reduced $150; International 15-30, reduced $350.

In addition, reductions ranging from 10 to 15 per cent of the wholesale price have been made on about one-third of the line of implements and machinery manufactured by this company.

A reduction of 15 per cent has been made by the J. I. Case Plow Works. This cut applies to all the products of this company, including tractors and other power farming machinery.

DORRIS PLANS EXPANSION

ST. LOUIS, March 16—At a special meeting called for March 21, stockholders of the Dorris Motor Car Co. will consider the proposition of forming a holding company to purchase all the property and improvements owned by the company, in this way permitting further manufacturing expansion by turning the fixed assets of the company into liquid assets. The company, according to its secretary, J. F. Culver, has been unable to expand and increase its output of cars to supply the demand on account of the lack of liquid capital. The holding company will be capitalized for at least $250,000.

Goodyear Meeting Is Again Deferred

Stockholder Ratification of Financing Plan Held Over to March 22

AKRON, March 15—The meeting of stockholders of the Goodyear Tire & Rubber Co. adjourned to to-day from March 4, for the purpose of finally ratifying the company's refinancing program which involves a loan of $85,000,000, was again adjourned to March 22 to-day upon request of special committees negotiating with creditors of the company. Announcement of the continued adjournment of the meeting came as a surprise to stockholders, as it had been announced officially by the company that stockholders proxies received showed more than a 75 per cent majority vote in favor of the refinancing and reorganization plans.

The eleventh hour hitch in proceedings leading to definite consummation of the refinancing program is said to have been with merchandise creditors. The special merchandise creditors committee has gained the assent of more than 80 per cent of merchandise creditors to the "plan of readjustment" included in the financing negotiations, but it is stated that practically unanimous assent of creditors is desired and is necessary. Creditors refusing to yield are holding out, it is said, in the hope that their claims will be settled either by Goodyear or by friendly interests.

Stadleman announced that progress was being made in winning over the merchandise creditors holding out, and that with continued gain of ground he expected that the stockholders meeting could be called soon.

Fisk Resumes Schedule at Reduced Wage Rate

CHICOPEE, MASS., March 14—The Fisk Rubber Co., which has been operating on a three-day schedule since Dec. 1, to-day resumed full time and a wage reduction on both day and piece work was put into effect, which amounts to an average of 10 per cent. About 1600 employees are affected. Increased overhead expenses under the shortened schedule makes the return to full time and wage reduction necessary, the company states.

RECEIVER NAMED FOR SUPREME

AKRON, March 12—Scott Kenfield, former Akron city solicitor, has been named receiver of the Supreme Cord Tire & Rubber Co. of Akron, on petition of Julia Nunamaker and A. C. Bender, representing the estate of Jefferson Nunamaker. The charge is made by the petitioning stockholders that the company's former fiscal agent absconded with $10,000 paid by the Nunamaker estate for 100 shares of stock, which, it is claimed, were never delivered. It is also charged that the firm is insolvent.

Studebaker Demand in Excess of 1920

Erskine Looks for New Production Mark—Earnings of $9,822,854 Reported

SOUTH BEND, IND., March 16—"If general conditions become no worse than they are now our business should almost certainly exceed that of last year," was the assertion made by A. R. Erskine, president of the Studebaker Corp. in presenting the annual report to the stockholders to-day. The report shows net profits of $9,822,054 after deductions of Federal taxes, depreciation and other fixed charges. This was equivalent to $15.18 a share on the $60,000,000 of common stock compared with $20.69 a share on the $45,000,000 of common stock outstanding at the close of 1919. Gross sales for 1920 exceeded any other year in the history of the company, having been $90,652,362, compared with $66,383,307 of 1919.

The income accounts for 1920 and 1919 follow:

	1920	1919
Net sales	$90,652,362	$66,383,307
Manuf. cost, depr., etc.	78,521,555	55,099,844
Operating profit	$12,130,807	$11,283,463
Other income	120,014	......
Total income	$12,250,821	$11,283,463
Interest, etc.	......	116,951
Federal taxes	2,428,767	1,854,229
Net profits	$9,822,054	$9,312,283
Preferred dividends	710,150	748,475
Common dividends	3,937,500	2,100,000
Surplus	$5,174,404	$6,463,808
Profit and loss surp.	*$13,467,047	$20,925,583

*After deduction of $15,000,000 stock dividend. $872,940 net losses actually sustained in 1920 or anticipated in completing final liquidation of wagon business, etc.

In his statement concerning the outlook for 1921, President Erskine said:

"The demand for Studebaker cars is quite heavy from all sections of the country, except in a few spots, and in a number of places is double and treble what it was last spring. March sales will probably exceed 5000 cars. Manufacturing schedules call for 5235 cars in March, 5440 in April, 7015 in May, and 7320 in June, with production proceeding nicely and under economic conditions."

Develop Scoutomobile Weighing 150 Pounds

BOSTON, March 14—A striking curiosity, a two passenger automobile said to weigh less than 150 lbs., has been developed by C. H. Martin of the Martin Rocking Fifth Wheel Co. in conjunction with C. R. Gurney, consulting engineer. The machine is claimed to have a maximum speed of 30 m.p.h. and to travel 75 miles on a gallon of gasoline. It seats two people side by side and can be completely housed in for protection in bad weather. There is a single front steering wheel which tracks with one of the rear wheels.

The car is made largely of aluminum-alloy and magnesium metal; it has a 5 h.p. opposed motor and sliding gear transmission, but no universal joints or differential. The wheel arrangement and spring suspension are said to be such that it will ride comfortably. One of the advantages claimed is that the car can be pushed through an ordinary doorway and stored in the front hall or office.

Martin says: "The machine will not be ready for the market for some time, but we are inviting criticism and suggestions from dealers and users. Before offering it to the public we propose subjecting it to months of tests. The selling price has not yet been fixed, but in view of the high priced light alloys extensively used in its construction it probably will be the highest priced automobile for its weight in the country."

Ford Is Operating on Own Resources

(*Continued from page* 624)

be possible, though there may be some banks unable to continue the loan and there may be others, which for various reasons, will refuse this sixth renewal. The personal taxes of Henry and Edsel Ford are declared to be negligible when taken in comparison with the other indebtedness.

The banking syndicate's representative at the meeting with the Fords and Alfred Lucking, the Ford attorney, expressed the sincere hope that the company would be able to weather the storm without financial help for the good effect it would have on the industry insofar as the attitude of the public is concerned. It was stated by the bank's representative that the depression had given rise in the public mind to a feeling that the automobile industry had gone to smash.

This naturally was accentuated by the reports that the Ford company was in financial straits. Successful operation of the big organization without help would be the best tonic that could be given the industry, it was urged. The New York bankers naturally are heavily involved in automobile financing and their representative stated frankly that they would be gratified if Ford could operate successfully on his own hook for the stimulus afforded the industry as a whole.

GIRL RE-ELECTED C. G. HEAD

KALAMAZOO, MICH., March 12—The first annual meeting of the C. G. Spring Co., held Friday, March 11, resulted in the re-election of Christian Girl as president for the ensuing year. J. G. Utz, consulting engineer of Detroit, was named as vice-president. Judson Clary is secretary and Charles Gettler, treasurer. These four and Fred R. Eaton comprise the board of directors.

The plant in Kalamazoo is operating on about 40 to 50 per cent basis. Two service stations, one in Chicago, the other in Detroit, have been established. C. C. Homan, one-time purchasing agent for Willys-Overland, is in charge of the Chicago branch.

Legislative Season Brings Many Bills

Revisions Upward in Licenses to Meet Road Costs Major Part of Burden

NEW YORK, March 15—Automobile legislation which has been introduced in the 40 State legislatures which began their sessions early this year is being sorted out and assimilated. Thirteen of the legislatures already have adjourned. It is estimated that approximately 1500 bills have been introduced in the 40 States. Almost the same number were introduced last year in less than half as many States.

Increases in registration fees have been proposed in 34 States. Generally speaking, they apply to commercial vehicles rather than passenger cars. In most States these fees are used for the maintenance of highways, but in a few cases it is proposed to expend them for actual building of roads. The increases proposed vary widely, but the industry has been gratified to note that in several States they follow closely the tax suggested in the proposed uniform motor vehicle law. Automotive interests are not disposed to combat seriously what they consider a reasonable increase on the theory that, while they will benefit directly through improved highways, all the taxpayers in the State will benefit indirectly. It is significant of the trend of legislation, however, that there is a tendency to increase fees each year.

Other subjects dealt with most generally in proposed legislation are size, weight and speed restrictions, obligatory equipment, indemnity bonds as a prerequisite to registration, stoppage at grade crossings, licensing of automobile mechanics, the classification of freight and passenger carrying motor lines as common carriers, and a tax on the consumption of gasoline.

As a general rule, gasoline taxes, indemnity bonds and grade crossing stops are not meeting with general favor. Gasoline taxes were proposed in 12 States, but already have been killed in four or five and have not much chance of passage in the others.

Measures providing for indemnity bonds have been introduced in 15 States, but have been killed in several and are making little progress in the others. Measures for the licensing of automobile mechanics have been introduced in 10 States, but have been killed in four.

TRAFFIC MANAGER KILLED

DETROIT, March 16—Roger Hurley, traffic manager of the Maxwell plant of the Maxwell-Chalmers Co., killed himself accidentally yesterday while examining the revolver of an acquaintance. Hurley was 46 years old. He was widely known as a traffic man, having been general agent of the Michigan Central and Cloverleaf railroads before he joined the Maxwell organization three years ago.

Congress Prepares to Halt Dumping

Tariff to Equalize Price Differences

Leaders Agreed on Tentative Program—Will Fix Duties by Valuation Here

WASHINGTON, March 16—Congressional leaders have adopted a tentative legislative program for the extra session which will include enactment of an anti-dumping bill with teeth in it. It will be designed to prevent unfair competition by foreigners and undoubtedly will be so phrased that it will put a serious crimp in the plans of Europeans who have proposed to sell in the American market many millions of dollars worth of American made motor vehicles and automotive equipment.

This material was sold by the War Department to the British and French governments with the understanding that it would not be sent back to the United States but it has since been sold to private individuals who propose to take advantage of the present laws and reimport it, duty free, to undersell the American market.

France alone has $65,000,000 worth of these materials. The Slough Trading Co. of England owns 10,000 American made motor vehicles and has begun their importation into this country. The Keystone Tire & Rubber Co. has bought up nearly all the American army tires in France. A French company also is shipping back American made trucks to be sold at auction. A Portuguese merchant has an option on $50,000,000 worth of automobile parts and accessories.

Leaders Committed to Action

The anti-dumping law which it is proposed to enact would at least require payment of duty on the difference between the purchase price of this material abroad and the market price in this country. Senator Penrose, and Chairman Fordney of the House Ways and Means Committee, already have committed themselves to such a measure.

The effects of the dumping law already have been discussed in AUTOMOTIVE INDUSTRIES which was informed two weeks ago by Senator Smoot that the bill passed by the House at the first session of the last Congress and amended materially in the Senate would cover the reimportation of motor vehicles.

Congressional leaders had little knowledge of the menace to American industry involved in the reimportation evil until their attention was called to it by the Washington bureau of the Class Journal Co. They grasped the situation quickly and their attitude has been entirely sympathetic.

While the anti-dumping bill may be re-introduced in its present form, several Senators and representatives stand ready to offer amendments from the floor. Senator Smoot believes it is essential to stop reimportations at prices less than production costs. It is possible the bill may specifically cover surplus army stocks sold abroad.

Amendment Adds Teeth

Senator Penrose and Chairman Fordney of the House Ways and Means committee will supplement the measure with an amendment to the tariff law assessing customs at American valuation. Effect of the revision of assessment policies as proposed by Senator Penrose upon the automotive industry is easily noted. For instance, it is reported by the Federal Trade Commission in its report on farm implement trade, that mail order houses have been selling spare parts for automotive products at prices which defy dealer competition.

It is known that certain large mail order houses have their agents operating among foreign manufacturers. These American importers find it possible to obtain prices which, with ocean-freight and duty added, remain below production costs here. The valuation is made at port of shipment and the customs officials abroad have little chance to contest the figures as the manufacturers would have their instructions in this respect. With American valuation restored to the books, importers would be assessed on the wholesale prices of the goods in this country instead of abroad.

A committee comprised of C. C. Hanch, vice-president of the N. A. C. C. and chairman of the taxation committee; R. A. Branigan, counsel, and Pyke Johnson, manager of the Washington office, conferred with legislative leaders here this week on the taxation question. They found a sharp division of opinion as to tax proposals and much uncertainty as to what plan should be considered first.

The committee ascertained that State officials had advised their congressional representatives to consider the effect that a national levy on automobiles would have on State revenues and highway programs. With the various States insisting on State rights and jealously guarding their sources of revenue, it is expected that the Houston proposals for a horse-power tax on automobiles will meet strong opposition in Congress.

May Try Canadian Tax Plan

Few legislators would commit themselves to the proposed increase in excise taxes. Senate and House committee leaders are split over the sales tax levy. The Hanch committee was advised that the Canadian two-point tax, which hit the manufacturer and wholesaler, was under consideration.

Washington Amused at Barrett Attack

Farmer Representative's Charges of "Assistant Government" Fall Short of Mark

WASHINGTON, March 15—Official Washington evinced little surprise at the attack of Charles S. Barrett, president of the National Farmers' Union, against local representatives of the National Automobile Chamber of Commerce, the American Automobile Association and other large organizations. The contention that these representatives were "a new and powerful 'assistant' government" fell short of its mark because Barrett has been haled before special committees of Congress investigating the activities of professional farmer-lobbyists.

Barrett did not give details as to the activities of the Washington office of the N. A. C. C. though he did cite the real achievements of the A. A. A. He contended that "automobile owners have not neglected an opportunity to assist the government in making laws which are designed to make more pleasant and perhaps more profitable, the business in which they are engaged. Under the name of the American Automobile Association, the owners have established themselves in a big office building and have placed A. G. Batchelder, a former newspaper man, in charge. This organization was largely instrumental in securing the passage of the bill providing for Federal aid in road building and many hundreds of millions of dollars have already been expended for this work."

No Pleaders for Industry

Batchelder, executive secretary of the A. A. A., like all other individuals mentioned by Barrett declined to take him seriously. He pointed out that in the promotion of good roads and Federal aid the farmer had been the greatest beneficiary.

Pyke Johnson of the N. A. C. C. explained that Barrett had been misinformed as the Washington office was purely an information bureau maintained for the automotive industry. He declared that no special pleaders were employed and that legislative committees selected from the membership spoke for the industry and not salaried men.

Senators and Congressmen who have investigated have found that the entire membership of the National Board of Farm Organizations, represents less than one per cent of the registered farmers, yet presume to speak for the agricultural industry.

Larsen Plane Tests Show Instability

Army Air Service Condemns Control and Pilot's Seat—Fire Hazards Eliminated

WASHINGTON, March 11—Summary of results of the official performance tests conducted by the Army Air Service with Junker airplanes sheds light on the numerous and baffling accidents which resulted in casualties to air mail pilots. The reports submitted to-day after a series of flights show that the airplane is spirally unstable, due to the large fin area toward the tail, causing a lifting of the rear of the fuselage in the event of a side slip.

The pilots reported that the flying qualities of the Junker planes appear new and different when originally flown by pilots familiar with conventional types. The rudder and elevator of the JL planes appear and feel too small. The Army test pilots agree in part with the Post Office Department as to the fact that the JL planes are economical and efficient and have features of construction having valuable possibilities.

The aviators have little criticism to offer for the engine, but the arrangement of the controls and pilot's seat are condemned. The pilots suggested the abolishment of the notched push-rod type of throttle and the substitution of a standard engine throttle. The oiling system is regarded as adequate, but the shutter control works poorly. The Army test pilots eliminated fire hazards to a large extent by installing air intake pipes leading from the tank under the crankcase to the outside of the plane below the engine, thus directing backfires outside the fuselage.

The airplane tested was of the commercial type with an engine developing 1445 r.p.m. on a mixture of half benzol and half gasoline. The Postal Service has suspended use of these planes pending further tests.

Canada Plane Barrier to Be Effective May 1

NEW YORK, March 12—The Manufacturers' Aircraft Association has been informed that the Canadian Air Board has set May 1 as the time limit in which American army and navy pilots may fly over Dominion territory. Civilian aircraft and pilots from the United States are barred. The action was taken under the terms of the International Air Convention, which provides that pilots of aircraft entering other countries must be registered and licensed in their own country.

All the powers have subscribed to the convention, including the United States, and all governments excepting that of the United States have established departments with jurisdiction over aviation. At the request of the American State Department the Canadian authorities permitted army and navy fliers to enter Federal machines on official business only "pending the organizing of a body in the United States having authority to issue civilian aviation certificates and licenses in accordance wth the internatonal air convention." It evidently is the expectation that such a body will be created before May 1.

Higher Operating Cost Causes Goodrich Deficit

NEW YORK, March 15—Despite sales by the B. F. Goodrich Co. for 1920 of $150,007,345, a new high record, there was a deficit of $921,248 before payment of taxes, inventory depreciation and dividends. After payment of dividends on the common and preferred stock the deficit was $5,371,792, compared with a surplus after dividends of $12,657,813 in 1919.

A comparison of the income account for 1920 and 1919 follows:

	1920	1919
Net sales	$150,007,345	$141,343,419
Mfg. expenses, etc.	142,250,719	121,579,265
Balance	7,756,626	19,764,154
Total income	8,732,972	20,340,214
Depreciation, etc.	6,021,686	3,035,401
Net profits	2,711,286	17,304,813
Preferred dividends	2,688,840	2,247,000
Balance	22,446	15,057,813
Common dividends	3,604,200	2,400,000
Deficit	3,581,754	*12,657,813
Prev. sur.-adj.	41,203,046	33,894,923
Total surplus	37,621,292	46,552,736
Final surplus after reserve, etc.	22,706,498	41,203,046

*Surplus.

B. G. Worth, president of the company, in his remarks to stockholders, said in part:

"In view of the decline in the market values of crude rubber and fabrics, directors have deemed it advisable to appropriate out of surplus the sum of $8,000,000 which added to the reserve for contingencies of $2,000,000 provided out of profits in prior years, leaves a total reserve on Dec. 31, 1920, of $10,000,000 to cover possible losses on future commitments and contingencies.

"Directors feel that, taking into consideration the depression in the rubber industry during the last half of 1920, operating results shown are satisfactory and the financial position is excellent.

"Plants are in a thoroughly efficient working condition, prepared for any emergency, and it should therefore not be necessary to incur any further expenditures during current year for additional expansion of fixed properties."

FORM NEW FINANCE COMPANY

OTTAWA, March 12—The Canadian Metropolitan Securities Corp. has been formed with a capital of $1,250,000 divided into $500,000 8 per cent preference cumulative shares and $750,000 common shares, both $10 par value. The new company will act in connection with the Confederative Investment Corp., Ltd., the latter being fiscal agents for the new company. The Ritter Commercial Trust of Cleveland has guaranteed the preferred dividend for ten years.

Modified Contract Urged in Georgia

Dealers Solidify Sentiment Looking Toward More Equitable Terms From Factory

ATLANTA, March 14—Contending that the contracts under which the dealers operate are arbitrary with regard to the rights of manufacturers, but that they show slight regard for the interests of the dealers, the Georgia Automotive Dealers' Association has inaugurated an intensive campaign that has as its objective an improvement in this condition of affairs. The association is co-operating with the national organization in this movement.

Within the past month four sectional meetings have been held in various parts of the State, together with a meeting of the State body in Atlanta, March 10, at which time the contract matter was thoroughly discussed and resolutions adopted advocating the five important items as objectives in the national campaign. These items are outlined as follows:

First: For the automatic renewal of contracts on the basis of fair and faithful representation of the manufacturers by the dealers.

Second: For contracts binding both parties whether the manufacturers be one of the parties directly participating or through distribution.

Third: For the termination and cancellation of contracts upon a just cause only.

Fourth: For concession of the right to the dealer to order and receive automobiles as he needs them only and to refuse acceptance of all automobiles not so ordered by him.

Fifth: For cessation of contract deposits required of dealers by manufacturers.

An increase in the discounts now allowed dealers by the manufacturers was also advocated at the various sectional meetings and at the State meeting in Atlanta.

Liberty and Chandler to Finance Dealers

NEW YORK, March 15—To a greater extent than ever before motor car manufacturers are having impressed upon them the necessity of financing their dealers, especially in the smaller towns, either directly or through automobile financing companies. The list of those which have undertaken this work is steadily expanding.

Among the latest to go into this field is the Liberty Motor Car Co. of Detroit, which has begun the financing of its dealers on what is known as the floor plan.

The Chandler Motor Car Co. recently entered into an agreement with the Continental Guaranty Co. of Chicago to finance its dealers and a similar arrangement was made several months ago by Dodge Bros. with the Bankers Commercial Security Co. of this city.

The Maxwell Motors Co. has been financing dealers for two or three months

INDUSTRIAL NOTES

Times Square Auto Supply Co., Inc., will change its name to Consolidated Distributors, Inc.

Gardiner Motor Co. has re-elected all directors and officers at the annual stockholder and organization meetings.

Deere & Co. has reduced production in its wagon factory in Moline, Ill., because of stagnant buying tendencies.

Chappelow Advertising Co. has leased 10,000 feet of floor space for the location of a modern advertising office in St. Louis.

Masters Motors Co. has moved its Indianapolis plant and office equipment to Lafayette, Ind., where it will combine its forces.

Green Bay Drive Calk Co., Green Bay, Wis., has started work on a forge shop and storage building to replace buildings destroyed by fire.

Kelly-Springfield Tire Co. has re-elected all retiring stockholders, with the exception of Van H. Cartmell, who is succeeded by Theodore G. Smith, a vice-president of the Central Union Trust Co.

Standley Skid Chain Co. has made arrangements with Mattauch & Strong Co. of Des Moines for the manufacture and marketing of the Strong transmission band adjuster.

Skelton Motors Name Changed by New Owner

ST. LOUIS, March 12—W. F. Traves, head of the Talbott Reel Mfg. Co. and an official of the American Knockdown Bottle Case Co., Kansas City companies, has taken over the interests in the Skelton Motors Corp. which he purchased from Dr. L. S. Skelton shortly before the latter's death.

The general offices of the Skelton company have been moved so that they now share quarters with the Premier distributor, and the Murphy Machinery & Equipment Co. Both retail and wholesale work will be done there. The name of the producing company has been changed to the Traves Motors Co., Successor to the Skelton Motors Corp.

Mr. Traves states that the former officials will be retained including W. A. Chapman, general manager; J. A. Schroeder, chief engineer; and George Sherwood, production manager. The name of the product, Skelton, will be retained for the present.

Wharton Motors Builds Combination Tractor

DALLAS, TEXAS, March 11—A two plow tractor that can also be used as a cultivator and which is to sell at about $1800 is being manufactured by the Wharton Motor Co., Inc., of this city. The outstanding feature of the machine is that it is a three-wheel type with drive on all wheels. The tractor has a rating of 12-20 h.p. and is equipped with a four cylinder Gray engine of 3¾ in. bore by 5 in. stroke, running at 1000 r.p.m. Lubrication is by a gear pump and ignition by an Eisemann Magneto. The carburetor is a Kingston 1¼ in. Gasoline is recommended for fuel but kerosene can be used. The fuel tank has two compartments, of 15 and 3 gal. capacity, respectively. The cooling water is circulated by pump and a fan is mounted back of the radiator.

The belt pulley measures 10 in. in diameter by 7 in. face and its shaft is mounted on roller bearings. The clutch is a Borg & Beck, while the transmission is of the Wharton Company's own design and manufacture. Three forward speeds are obtained, the reductions being 152, 109 and 77 to 1, respectively. The three speeds given by the above reduction ratios in combination with the 60 in. driving wheels are 1½, 2½ and 4 m.p.h. respectively. The final drive is through worm and wheel and bull gear and pinion. This tractor has a wheelbase of 82 in. and turns in a 7 ft. radius Its minimum clearance is 24 in. and its total weight, dry, 3800 lb. The rear driving wheels are adjustable on the axle, which enables the operator to cultivate rows of any spacing from 30 to 48 in.

G. M. C. Directors Board to Act on Dividends

NEW YORK, March 16—Directors of the General Motors Corp. are expected to take dividend action the latter part of this month. There is no intimation whether or not the dividend will be paid but it is expected to depend largely on the showing made in the next two weeks. If there are indications that the present upward trend in business will continue permanently the payment probably will be made.

It is not probable immediate action will be taken by the corporation on the proposal to fund its bank loans of approximately $75,000,000 through the issuance of new securities although the plan has not been abandoned definitely. The position of the company has been materially improved by the large reduction made in its inventory. It can be stated positively that no large additions or improvements to any of the General Motors plants are contemplated.

Renard, Ballot Driver, Killed in Collision

PARIS, Feb. 27—(*Special Correspondence*)—Fernand Renard, Ballot race driver, and mechanician to René Thomas in the last Indianapolis race, was killed instantly to-day when he collided with an automobile truck in the suburbs of Paris. Renard, who was entered to drive a Ballot car in the next French Grand Prix, was carrying out carburetor tests in company with the chief engineer of the Zenith Carbureter Company when the driver of the truck suddenly swung across the road. The racing car was little damaged, but Renard struck his head against the body overhang of the truck and was decapitated.

BRIDGEPORT RECEIVER NAMED

BRIDGEPORT, CONN., March 16—Edward K. Nickolson has been appointed receiver for the Bridgeport Motor Truck Co. His bond has been fixed at $25,000.

METAL MARKETS

WHATEVER improvement is making itself felt in the automotive industries is eagerly seized upon to generate a more optimistic atmosphere in the iron and steel markets. A Cincinnati pig iron interest, whose market letters since the beginning of the year have been dyed in the most sombre hue of unrestrained pessimism, says in its report for this week:

"It is especially encouraging to realize that a revival in the automobile industry is apparent. Several well-known manufacturers of passenger cars in Michigan have resumed operations. Some are back to 50 per cent of their normal output. The cars have been sold and are being shipped out as made. This allows the foundrymen to liquidate stocks of castings which have been held in storage for many months, and in turn affords them the opportunity to specify more liberally for shipments against their contracts for pig iron and coke. Thus blast furnaces will be given some relief from the heavy burdens they are carrying for the benefit of their customers."

The steel market may be said to have entered upon a new phase. Heretofore we have had steady declines in the prices named by "independents," whereas now we have unprecedented irregularity in quotations, some of the producers, convinced that the tide has turned, being unwilling to cut prices further, while others appear to be anxious for every ton of steel they can get on their order books. The latter incline to the belief that, when Judge Gary returns from his vacation, which will be next month, the Corporation's price policy will undergo readjustment. By that time, it is expected, the preliminaries for changing from the twelve-hour to the eight-hour day in the Corporation's mills will be out of the way, and it will be seen whether, as a result of this rearrangement, it will be possible to avoid complications with labor and at the same time readjust production costs on a lower level.

In the non-ferrous metals, of chief concern to the automotive industries, the outstanding feature is that aluminum prices are expected to reflect more and more from now on the growing certainty of the passage of an emergency tariff measure.

Pig Iron.—Although occasionally transactions in resale iron would make it appear as though the market was still on the toboggan, automotive castings manufacturers are specifying much more freely against old contracts, and, with merchant furnace output at the lowest in many years, the supply of bargains is likely to lessen.

Steel.—Mills catering especially to the automotive trade, such as those specializing in cold-rolled strip steel and cold-finished steel bars, report more activity all around. Releases against old orders are gratifying and new inquiries and orders on the increase. New price levels, however, are still in a formative stage and await the placing of more representative business. Cold-finished bars will likely sell at 3c. Finished sheets for automobile use have been selling at 5.85c. So far as can be learned, the 1000-ton sheet order which a Detroit automotive interest is asking bids on has not yet been placed. No. 28 black sheets have been sold at as low as 3.85c. by Valley mills, although the sheet market generally is at 3c.

Aluminum.—One- or two-passenger car builders have begun to sound the market. The sole American producer continues to quote 28.50c. for virgin ingots. Importers are somewhat firmer in their price views.

FINANCIAL NOTES

Lee Tire & Rubber Co. reports net profits, after all charges and Federal taxes, of $326,-638 for the year ended December 31. This is equivalent to $2.11 a share earned on the 150,000 shares of common stock of no par value, and compares with $471,805, or $3.14 a share, earned in the preceding year. Assets of the company totaled $5,934,118, of which $362,123 is cash and $3,101,870 inventories. The surplus of the company is shown as $652,335.

International Motor Co.'s report for 1920 shows gross sales of $34,071,365 and net profits of $4,583,151 before write-off for inventory depreciation. After inventory deduction and tax reserves the profit available for dividends is $2,644,013, equal to $5.32 a share on the common stock. The regular quarterly dividends of 1¾ per cent on preferred stocks will be paid April 1.

Peerless Truck & Motor Corp., for the year ended Dec. 31, shows net profits of $1,063,306 after all charges, including Federal taxes. This is equal to $5.31 a share on the 200,000 shares of common stock (par $50) outstanding. In 1919 the company earned $872.154, or $4.36 a share. Net sales for 1920 were $14,919,065, compared with $12,928,601 in 1919.

Republic Rubber Corp. is negotiating for additional funds, and for that reason has deferred the presentation of its annual report. The annual meeting of the company has been postponed until April 14, at which time stockholders will be asked to approve financing plans arranged.

Stewart-Warner Speedometer Corp. reports net income for 1920 as $3,092,383, which compares with $3,161,634 in 1919. Surplus after dividends for 1920 is $615,928, which compares with $1,063,575 in 1919. The profit and loss surplus totals $8,041,938, as compared with $7,514,455.

Simms Magneto Co. reports net income for 1920 as $71,661. This compares with $94,998 earned in 1919 and $74,414 in 1918. The balance after deductions for preferred dividends was $1.661, as compared with $22,748 in 1919.

Badger Foundry Co. of Racine, Wis., which specializes in automotive and agricultural implement castings, has increased its capital stock from $100,000 to $200,000 to handle a larger volume of business.

Auto Body Co., in a balance sheet as of Dec. 31, shows total assets of $2,674,906, of which $32,863 is cash and $1,232,648 inventories. The surplus is $48,035.

Mason Tire & Rubber Co. reports a 10 per cent increase in sales for February, 1921, over the same month 1920. The entire plant is again on a 24-hour basis.

Hupp Motor Car Corp. will pay a quarterly dividend of 1¾ per cent on the 7 per cent cumulative preferred stock on April 1.

Gardner Motor Co., Inc., has had listed on the Boston Stock Exchange 155,000 shares of no par common stock.

Timken-Detroit Axle Co. has passed its common dividend, due March 15, to conserve its cash resources.

PATTERSON EXTENDS HOLDINGS

GRAND RAPIDS, MICH., March 16—E. C. Patterson, president of the Patterson-Warner Co. of Chicago, has acquired a substantial interest in the Auto Indicator Co. of this city, and has been made one of the directors in the company. The Chicago company was organized four years ago by Patterson and A. P. Warner of Beloit, Wis., originator of the Warner speedometer, to manufacture and sell the Warner-Lenz.

The capital stock has been increased to $1,500,000, which will provide for the company being financed on a basis to handle the increased business of the company resulting from the sales and advertising policies shortly to be put into effect. The board of directors has been increased to seven, the additional member being C. B. Hamilton of the Brearly-Hamilton Co. of this city. The present officers of the company are Joseph Renihen, president; R. W. Brown, vice-president and V. I. Gilley, secretary-treasurer.

Immel Reorganization Approved by Creditors

COLUMBUS, March 12—The preferred stockholders' committee of the Immel Co., of Columbus, makers of closed automobile bodies, which has been in the hands of a receiver for several months, has prepared a plan of reorganization which is receiving the sanction of the creditors. The creditors hold claims of approximately $450,000 against the company. It is proposed to organize a new company and purchase the property, including the plant, and pay 50 per cent of the claims in cash, giving first mortgage notes bearing 8 per cent interest for the remainder of the claims.

It is proposed to issue $250 000 second mortgage 8 per cent notes, payable in three years, to furnish capital for operation. All preferred stockholders are asked to agree to the plan and aid in the reorganization which will maintain the plant as a going concern. Replies received both from preferred stockholders and creditors show that the plan is being approved generally.

CLEVELAND RE-ELECTS OFFICERS

CLEVELAND, Mar. 13—At the annual meeting of the Cleveland Automobile Co. the same board and officers were re-elected, as follows: F. C. Chandler, chairman of the executive committee; Samuel Regar, chairman of the finance committee; J. V. Whitbeck, president; Sid Black, vice-president; J. I. Krall, secretary and treasurer. Although no statement was given out, Krall said profits for the first full year were satisfactory from the time operations started in August, 1919, up to Dec. 31, 1920. The company has manufactured 19,000 cars, of which 16,000 were made during 1920. Present production is rather light, but it was stated that it is the aim of the company to resume normal production in a few months. Last August the company retired 5 per cent of its $1,400,000 8 per cent preferred stock.

NEW BRITAIN ON FULL WEEK

NEW BRITAIN, CONN., March 15—The New Britain Machine Co. is now operating the tractor division on a 55-hour week schedule. Indications point to an early increase in the working force and overtime operation in order to meet the production requirements.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, March 17—In spite of the fact that March 15 is one of the biggest days in the routine of the United States Treasury, the shifting of funds incident thereto had little outstanding effect on the money and security markets last week. On that date about $500,000,000 of certificates of indebtedness matured, and there was due $76,-000,000 interest on the Third Liberty Loan, and, in addition, there will be payments of $200,000,000 due the railroads at about the same time, under the provisions of the Winslow Act.

Moreover, the Treasury has announced the issuance of approximately $400,000,-000 of new certificates of indebtedness at rates fractionally lower than has been the case in the recent past. It had been variously estimated that the tax receipts on that date would amount to from $300,-000,000 to $700,000,000, the new Secretary of the Treasury's estimate being near the maximum. The only assured thing about the tax receipts is, however, that they will undoubtedly be much smaller than for the corresponding date a year ago.

There was a slightly firmer tone in the local money market last week. Offerings of call money were fewer, at rates ranging from 6 per cent to 7 per cent, and with a ruling rate of 7 per cent. Time money, the greatest demand for which was for the shorter maturities, advanced to 7 per cent for sixty and ninety days, and four months' paper, and 6¾ per cent to 7 per cent for five and six months' paper.

The Federal Reserve System continued the improvement of its position which has, with only one interruption, steadily become stronger all the year. The same factors which have been chiefly responsible for the improved reserve ratio again were the main elements in the betterment in the past week; that is, gold reserves increased $24,816,000, and the Federal Reserve notes in circulation decreased $36,771,000. In spite of an increase in net deposits of $68,392,000, and substantial increases in total earning assets and total bills on hand, the ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against net deposits, increased from 59.3 per cent to 59.9 per cent.

GRIGGS SELLS TRAILER STOCK

DETROIT, March 16—J. B. Mansfield heads a syndicate which has purchased a controlling interest in the Detroit Trailer Co. from S. A. Griggs. Plans are announced for an addition to the plant, 55 x 135 ft., which will be completed May 1. The new structure will house show rooms and finished stock. At the annual meeting, Mansfield was elected president; Griggs, vice-president; E. B. Newton, treasurer, and F. L. Tully, secretary.

Men of the Industry

David F. Edwards, formerly assistant general manager of the Chrysler plant of the Willys Corp. at Elizabeth, N. J., has been elected vice-president and treasurer of the LaFayette Motors Co. at Indianapolis. Edwards, who was graduated from Harvard, became an instructor in the Graduate School of Business Administration at Harvard University, specializing in industrial organization. In 1911 he came to Detroit as one of two assistants to the president of General Motors and became comptroller and later vice-president of Olds Motor Works at Lansing. Leaving the Olds organization, he joined the Gier Pressed Steel Co. of Lansing and remained with that concern until joining the Willys organization.

R. W. Schuette, for many years Rolls-Royce distributor for the United States and of late New York branch manager, has resigned with the object of taking an extended trip through Europe, to be gone several months. J. S. Inskip, formerly of the sales department of the New York branch, Locomobile company, has been appointed New York manager, succeeding Schuette. J. Roy Hiltz, for a number of years with the Locomobile and recently with Hare's Motors of New England, has resigned and accepted a position on special sales work, making his headquarters at the American Works, Springfield.

Sir Dugald Clerk, the noted British gas engine expert, will come to this country in May and will deliver an address on, "The Internal Combustion Engine for Motor Cars," before the Society of Automotive Engineers at its summer meeting. Sir Dugald has long taken an interest in gas matters, and will discuss matters of thermal efficiency with leading American gas engineers. He is also chairman of the Conjoint Board of the Scientific Societies' Committee on Water Power in the British Empire and will look up matters connected with the water powers of the United States and Canada.

Fred P. Steele, for many years associated with the automobile industry, has joined the Stutz Motor Car Co. of America, Inc., and will represent the factory in the Atlantic Coast district. Homer R. Horsfall, formerly identified with the automobile business in St. Louis and for the past five years with the Overland, is now connected with the Stutz Motor Car Co. of America, Inc., with sales supervision over the Western and Pacific Coast territories. Fred Wilson is now located with the Stutz Motor Car Co. of America, Inc., in the capacity of assistant sales manager.

H. Y. Grassl has been appointed director of service of the Republic Truck Sales Corp. and will be in charge of the company's comprehensive system. He has been connected with the service department of the Republic company and supervised the installation of standard service records. Practically all of Grassl's business career has been devoted to the mechanical and engineering field. Before joining the Republic organization, he was with the Master Truck Co. for two years and supervised the production of its first truck model.

George E. Bruner, manager of the service department of the Goodyear Tire & Rubber Co., has been announced as successor to Robert S. Wilson as truck tire manager. E. J. Samuels, manager of the organization division, will go to New York to become manager of inside sales. Bruner has been with Goodyear for over five years. He will be succeeded as manager of the service department by W. H. Sorn, at present assistant manager. Samuels has been with Goodyear since 1911.

George H. Strout has been appointed manager of the Eastern department of the Apperson Bros. Automobile Co. Strout has been in the Apperson family for many years. He has complete charge of the territory comprising the New England States, Eastern New York State and Northern New Jersey. Strout is also, and has been for some time, in complete charge of export business.

James T. Aubrey, western manager for the *Cosmopolitan Magazine* with headquarters in Chicago, has been selected to succeed H. H. Holmes as advertising manager of the Packard Motor Car Co. and will assume his duties April 1. He has had long experience in the advertising field and joined the Cosmopolitan staff upon his discharge from the army.

Lincoln T. Kauffmann has organized a company to act as selling representative for manufacturers of automotive equipment. Associated with him is Lewis M. Schwartz, who for ten years was advertising and sales manager for the Emil Grossman Mfg. Corp. of Brooklyn.

Alfred Reeves, general manager of the N. A. C. C., addressed a meeting of New England dealers at Boston, Tuesday night, on business prospects for 1921. He spoke before the Buffalo Rotary Club at noon to-day and will address the Buffalo Dealers' Association to-night.

Homer Hilton has been elected vice-president and general sales manager of the Winther Motor Truck Co., Kenosha, Wis. Hilton up to this time has been managing director of the National Association of Motor Truck Sales Managers.

J. C. Johnson has resigned his position in the purchasing department of the Maxwell Motor Co. Johnson formerly was in the purchasing department of the Briscoe Mfg. Co. in this city. He has not announced future plans.

R. W. Stanley has been engaged by the receivers of the Owen Magnetic Motor Car Corp. as production engineer in charge of the Wilkes-Barre plant. He was formerly connected with General Electric Co.

James C. Griven has recently joined the forces of the Miller Rubber Co. as special Eastern representative, with headquarters in New York. Griven's connection with the rubber business dates from 1909.

R. F. Ohmer, sales manager of the Recording & Computing Machines Co., Dayton, Ohio, manufacturers of Ohmer Ignition, has organized a distributing sales company, with headquarters at Dayton.

Ralph Leavenworth, advertising manager of the Standard Parts Co., Cleveland, left that connection, March 15, to take the position of director of personnel with S. L. Weedon & Co., Cleveland.

Robert W. Boys has resigned as superintendent of the Goodyear Mills, Inc., subsidiary of the Goodyear Tire & Rubber Co., to accept a similar position with the Manhasset Mfg. Co., Putnam, Conn.

E. J. Herrmann has been appointed sales manager for the territory handled from the Indianapolis plant of the Martin-Parry Corp. Mark E. Hamer has been appointed advertising manager.

George E. Merryweather, president of the Motch & Merryweather Machinery Co., has become a member of the board of directors of the Davenport Machine Tool Co., Inc., Rochester.

L. J. Kramer has joined the sales force of the United States Motor Truck Co., Cincinnati. He has been connected with the truck business for some years, serving with Master and Republic.

George W. Ellis of the Supplee-Biddle Hardware Co., Philadelphia, has been appointed chairman of the Automobile Accessories Branch of the National Hardware Association.

Herman Alperin, formerly with the Cyphers Incubator Co. at Buffalo, has been made sales manager of the King Motor Car Co., recently purchased by C. A. Finnegan and his associates.

A. C. Immel, former superintendent of construction for Ford Motor Co., has joined the Columbia Body Co. of Detroit in the same capacity.

J. A. Cowles has severed his connection with the McVicker Engineering Co., Minneapolis.

S. Gordon Hyde has resigned as advertising manager of the Buda Co., Harvey, Ill.

Chicago Finds Sales Very Brisk in City

CHICAGO, March 11.—The number of actual deliveries of new cars sold at retail during the first two months of this year was equal to that for the same period a year ago, and there appears to be no let-up in the demand for new cars by city buyers. The same condition does not hold in the wholesale trade—cars sold by the distributors to country dealers. There is little trade in the country and little hope of improvement until the farmers get to work.

But trade in the city is so good that dealers are asking if it is going to last—whether it does not constitute in a measure the business left over when the slump came last August. There were many prospects at that time in the mood for buying who were frightened off by general conditions and who, with the cut in Ford prices the following month, felt that they might as well wait a while to see how far prices would be cut.

The used car market is good; probably as good as it was in the first two months of last year.

The truck market is not good. Chicago profited slightly from the good roads show, but until business conditions throughout the city show a more appreciable improvement truck distributors do not see that there will be any forward movement in their lines.

SELLS 30 TRUCKS IN OHIO

DETROIT, March 16—Substantiating optimistic reports of improvement in the truck industry, the Commerce Motor Car Co. reports that one roadman brought in this week orders for 30 trucks from the Ohio territory, including 13 from Cleveland, nine from Columbus and six from Toledo. Factory production schedules are being increased daily and officers of the company declare prospects are bright for restoration of a normal pre-war business by May 1.

Calendar

SHOWS

Mar. 19-26—Detroit, Annual Automobile Show, Detroit Automobile Dealers' Ass'n, Morgan-Wright Building.

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

FOREIGN SHOWS

Mar. 22-28—Witwatersrand Agricultural Show including machinery and motors sections.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

Apr. 20 - May 5 — Mexico City, Mexican Automobile Show, National Theatre Bldg.

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland. Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais. Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

May 24-28 — West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

Oct. 12-14, 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 24—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Buffalo section—April 19—Paper on "Carbureter Performance," by F. C. Mock.

Dayton section — March 22 — Symposium on Post War Aeronautical Progress.

Dayton section—May 3.

Detroit section—March 25—Discussion of "The Relation Between the Industry and the Department of Engineering Research of the University of Michigan," by Prof. E. A. White. Detroit Board of Commerce.

Metropolitan section—April 14—Paper on "Low Grade Fuel Carburetion," by A. H. Beach.

Minneapolis section — April 6 — Discussion of repair equipment.

Washington section—April 1—Aeronautical Engineering Session.

Obregon Takes Position as Mexican Show Head

NEW YORK, March 14—The presidency of the forthcoming automotive show in Mexico City, which will be held in the new National Theater from April 20 to May 5, has been accepted by General Obregon, president of the Mexican Republic. General Obregon, in accepting the honor, came out strongly in favor of the good roads movement which is being inaugurated by the dealers and automotive interests of Mexico.

Information reaching New York, both from Mexico City and from the manufacturers of automotive equipment in the United States, lends weight to the belief that the exhibition will be satisfactory from every standpoint. Many manufacturers of cars, trucks, tractors, accessories and equipment, have signified their intentions of being represented and in the last few days a number of special exhibits for the show have gone forward.

The importance of the show is twofold. Mexico at this time is one of the few foreign countries which has not suffered seriously in the present business depression. Secondly, the Mexican show is among the first in the Spanish-American countries in which the manufacturers of North America have co-operated strongly. Several other showings have been held in South America but they have received but scant attention from manufacturers.

To Make Special Survey of Bethlehem Affairs

NEW YORK, March 16—Edward F. McGuire, vice-president of George W. Goethals & Co., an experienced automobile and industrial organizer, has been appointed to make a fresh survey of the affairs of the Bethlehem Motors Corp. He will act with Clinton E. Wood, the receiver. If McGuire deems it advisable he will undertake a vigorous selling policy looking toward the liquidation of the trucks on hand within the next three months and will report back to the creditors his conclusions as to the most advantageous course to pursue in reference to the future conduct of the company.

A committee of Bethlehem Motors stockholders, headed by B. W. Jones, has sent a letter to stockholders urging them to deposit their stock under a protective agreement in the hope that if conditions in the industry show a marked change for the better in the near future and that if adequate working capital can be obtained, a reorganization or adjustment will improve materially the present situation of the stockholders.

Mid-West Section S. A. E. Studies Ansted Engine

CHICAGO, March 12—At the meeting of the Mid-West Section of the S. A. E., Chester S. Ricker and John Moore, consulting engineer and chief engineer, respectively, for the Lexington Motor Car Co., presented a paper on the design of valve gear and engine design as applied to the new Ansted engine used exclusively in the Lexington car. The paper was supplemented with moving pictures showing the unique production methods used in the construction of the engine. The "rocking chair" valve motion for the operation of the overhead valves was explained by the use of an animated moving picture.

The results of a complete set of tests on the road and re-run on the dynamometer under duplicated road conditions were also presented with the aid of graphic charts. One consideration, the presence of several humps in the vacuum lines showing manifold depressions, was the cause of a long discussion. Mr. Purdy of the Rayfield Carbureter Co., proposed several possible reasons, but by a series of illustrative examples showed that these reasons were without grounding, and therefore valueless.

The meeting was one of the best attended that the Mid-West section has ever had, about 125 members and their friends being present.

Wood Accepts Challenge for Motor Boat Cup Race

DETROIT, March 15—"Gar" Wood has accepted the challenge cabled by the Royal Motor Yacht Club for the Harmsworth Trophy. This guarantees the holding of the foremost motor boat racing fixture during the coming season. For the first time in the history of international motor boat racing the contest will be held on inland waters, as the Motor Boat Club of America, the recognized club in the United States governing B. I. T. matters, has awarded the contest to the Detroit Yacht Club. The race will be held in the protected waters of Lake St. Clair or on the Detroit River on Sept. 3, 5 and 6.

The British International Trophy event will follow the American Power Boat Association's race for the Gold Cup and One Mile Championships of North America, which will be held on Aug. 27, 29, 30 and 31. At the same time will be held the first of the new Wood-Fisher Trophy races for displacement boats under 32 feet in length equipped with any type of motor of a piston displacement not exceeding 2150 cubic inches.

Atlanta Show Brings Southern Sales Spurt

ATLANTA, March 12—At least 150 sales were made in Atlanta this week, many of which resulted directly from the automobile show. Of this number about 50 were retail sales while many of the others were sales to new dealers secured throughout the southeastern territory by Atlanta distributors exhibiting at the show. The most important feature of the show lies in the fact that it has brought the dealers back to optimism not only because of the actual sales that were made, but because the public displayed real interest for the first time in months and hundreds of prospects were obtained. Hundreds of dealers from the smaller towns visiting the show left imbued with greater enthusiasm.

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Things To Consider If You Would Sell Trucks

There is much more to the selling of trucks than the mere obtaining of dealers, sending salesmen to see prospects, and getting the name on the dotted line. There still remains the huge problem of establishing a motor transportation industry.

A MAN who has given more than 20 years of a busy life to the study of the motor truck and its problems said recently:

"It is my belief that 75 per cent of the motor truck sales to-day have been misfits."

Rather startling comment!

It might be well to follow this motor truck student in his reasoning:

"Salesmanship has so far been based upon the motor. Every manufacturer, and consequently his salesmen, have been anxious to place their motors in the hands of the men who can use them. This desire has been so overmastering that little thought has been given to the methods.

"In recent years some salesmen have studied the problems that the trucks were called upon to do, but still they have considered that problem almost entirely from the view of the motor.

"It is my thought that the truck user should be sold on the body, or in other words, on the economy and convenience of handling his particular merchandise problem. Once the salesman sells him on this problem, the buyer will not care much about the motor, except to be assured that it is a worthy piece of machinery and is suitable to move the bodies that he needs to handle his freight."

The above is condensed from the beginning of a conversation that ran well into an entire evening. It ran into the difficulties of the very large trucks, the danger of taxing heavy trucks off of the road, the misuse of trucks generally and finally an agreement of all concerned that the solution of congestion, heavy wheel load and numerous kindred problems lies in putting the heavy loads on more wheels, just as the railroads have solved the same problem.

This solution, of course, lies in the trailer or the semi-trailer. The latter was greatly favored by the persons engaged in this entirely informal conference.

Another thing agreed upon was this:

> **The greatest handicap the truck has today is the waste caused by the misfit sales. Owing to the fact that the truck does not fit the job it is intended for, it is not giving the efficient service that it should. Every truck that is not giving this efficient service, is blocking the sale of other trucks.**

These things were all discussed a few days before Alfred Smith, former governor of New York and later Chairman of the Board of the United States Trucking Corp., spoke before the National Automobile Chamber of Commerce. Smith was invited to tell to the men who make the trucks the troubles of his company. It was interesting to note that he said most of the things that entered into the conversation referred to, and then he said some more. Smith outlined for the truck manufacturers a good many things

that he thought they would have to do before the truck becomes a truly economic transportation medium in New York. He might have added, but he didn't, that the problems of the country are simply intensified in New York and when all of the New York wrinkles are ironed out, then the truck industry will be ready to go ahead with assurance.

A waste of truck time and ability is the great inefficiency Smith saw in trucks under present conditions in New York. He said that in most traffic in lower New York, the horse is more economical than the truck, because of the congestion. It is a lot less expensive for a horse and wagon than for a truck to wait for a shipment at a pier.

He said that it costs his company about $20 a day to operate a motor truck and that under ordinary conditions this truck loses three hours or more a day waiting, so that the charge necessary is not in keeping with the service rendered.

The remedy, as Smith sees it, is for all business to urge the adoption of the store door delivery plan. This plan, he said, would permit the efficient use of trucks. Trailers of the proper variety can be placed upon the piers and loaded at night, so that in the morning each motor can go to the pier, pick up a capacity load and depart on its errand without a loss of time. Under the present plan, he said, it is often the case that the piers are so jammed with trucks and horses, each outfit calling to obtain a small shipment, that each is in the way of some other vehicle and not 50 per cent of them leave the piers with a full load.

Why the Opposition

He said that the opposition to the store door delivery plan is now confined to mercantile establishments that maintain fleets of trucks bearing the name of the establishment for advertising purposes, and that for this reason the owners want these trucks to handle all of the work. Smith did not say, but he let it be inferred that he considers this advertising entirely too expensive and that the motor truck industry is bearing a good deal of the expense in the reflection that the truck is not efficient.

The former Governor said that he had been a good deal impressed by accounts of the freight handling job in Cincinnati, where, by use of interchangeable bodies, trucks are rendering a highly efficient service. Just what the reasonable radius of a truck haul is, he said, could not be measured until there is efficiency in handling the freight. No one would dispute the efficiency of the truck in the measure of covering ground as against the horse. Nor would any one argue the expense of maintaining idle equipment in dull times. He said that during the recent dull weeks his company had been maintaining between 400 and 500 idle horses. When he saw the feed bills, he earnestly wished that the entire equipment had been motorized, but when traffic demands are strong again, he would be thankful, because of the congestion in the streets, that he had horses.

After his talk Smith was asked what the reduction of traffic would be under the store door plan. The questioner said that he had been informed that store door delivery in Philadelphia would mean the elimination of half of the trucks engaged in this service. Smith answered that he believed that the store door plan would eliminate at least half of the traffic in the streets of lower New York.

The man who asked this question is one of the enthusiasts for store door delivery. He realizes that the greatest handicaps to the sale of his trucks to-day is the lack of efficiency of service due to conditions over which the purchaser of the truck has no control.

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The points of view quoted in this article are those of men who have given thought to the future of the truck and are convinced that there is much more before the manufacturers as a group to prepare the way for proper selling of trucks.

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Just at this point in the writing of this article there came to the desk a booklet entitled "Vocational Selling as Applied to the Motor Truck Industry," published by the Duplex Truck Company. In this book are many ideas that point to a new way of selling trucks. Indeed, the idea as a whole is newer than many will realize.

In the ten years of development of motor transportation a lot of men have been bribed by money and promises to enter the truck selling field because they had successfully sold something else. In the main these men have not been examined fully as to their fitness as truck salesmen. Some few companies—the Pierce-Arrow is an example—have made an earnest endeavor to educate their salesmen up to a standard. But even the promoters of these educational plans will admit freely that they have not reached their ideal.

Idea Not Always Working

Some companies have adopted the transportation and even the vocational idea in the selling of trucks. It is no criticism of this idea of selling trucks to state that a salesman for one of the companies that is pioneering in this idea has within the last few days lost a sale to a rival because he tried to sell the truck as a machine, while the salesman for a much less widely known truck put in his equipment on the transportation basis.

But to get back to this booklet on Vocational Selling. Some paragraphs can very well be quoted here:

"We have spent too much time telling about spark plugs, axles, transmissions, etc., instead of showing the buyer the real results to be obtained by the proper use of the motor truck."

Especially the PROPER part of it.

It is the improper use of motor trucks that has hurt. Too many men have not realized the heavy losses that would come to them as a result of congestion over which they have no control. Not being warned on this, they have attempted to make an entirely improper use of the motor truck; they have lost money and have become adherents of the horse-drawn vehicle—condemning the motor truck utterly.

Right here, let it be added that it is worse than foolish to sell a truck where it does not belong. In a recent conversation with a motor truck sales manager, the development of the TEC truck was referred to. This is a combination industrial and street truck. It is on the lines of the well known electric truck that is so much used in large plants and warehouses. The freight is loaded on a platform, the surface of which is only 27 in. from the ground. The truck backs under this platform and carries it and the freight to the destination and sets it down perhaps in the storage warehouse, without rehandling. There is nothing radically different about this truck from other industrial trucks except the size—5000 lb. freight capacity—and the wheels equipped for street use.

The sales manager referred to, markets road trucks. He hailed the new type as a much needed piece of equipment. He said that it would relieve his trucks of a great amount of unprofitable work. He cited this example. In New York there is a large amount of heavy traffic

for short distances. Aside from the combined warehouse and street problem, he pointed to the fact that in New York bricks are unloaded on the bank of the Hudson. Many of them are used within a mile or so of the dock. Road trucks have been used uneconomically for this haulage. There are several points involved: first, the loading of heavy material on a high truck platform; second, the necessity of the truck standing while it is loaded and unloaded; third, the congestion that delays the large equipment that would not so seriously check a smaller vehicle.

The important point is this: The truck salesman welcomed this innovation in truck transportation because it would relieve his trucks of business that is likely to create prejudice against them.

Again quoting from the booklet:

"You know that any method of selling must benefit both the seller and the buyer if it is to be a long-lived method."

That is very important but too obvious for discussion. It has not been the basis of many truck sales.

Frequently the booklet calls attention to the fact that transportation problems differ and the information that put one man right will not always serve for another. It tells salesmen that in the home office are many transportation analyses and that some of these will doubtless fit the case the salesman has in mind **IF HE WILL WRITE AN ACCURATE DESCRIPTION OF THE PROBLEM.**

Then follows a grouping of all known truck uses into their general classification, a valuable and interesting document. Forty-four body types for special uses are also named.

The solicitation, visitation and use of catalogues and other pertinent subjects are discussed. It is always kept in mind that it is not the chassis alone that is being sold.

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Marketing Not Well Planned

To properly consider the details entering into this problem would require a book—a big one. Just a few general remarks in conclusion.

It is the history of industry that manufacturers frequently give much attention to the building they occupy, even greater attention to the design of the article they will make and that they will get the best advice on financing, and then they will pick a stranger to them and their product for the marketing job.

Frankly, between a good truck and an ordinary marketing department and an ordinary truck and an excellent marketing department, the writer would choose the latter combination. The best truck in the world is not much benefit to humanity or to business, if it is not properly sold.

Look over the truck list and draw conclusions as to why certain trucks and companies have succeeded.

Truck marketing—in the main—has been done very poorly. Truck advertising has been entirely uneconomical—perhaps crude.

In two recent monthly magazines there was an example of this:

One magazine, which has absolutely no interest in trucking and which is read largely by society folk, readers of good literature and admirers of well-printed pictures, carried four full-page advertisements of trucks at say $300 a page.

Another magazine, with a circulation that goes practically 100 per cent to truck users—some of them owners of large fleets—had only seven pages of advertisements for eight trucks at $60 a page. The subscribers of the latter paper average about 10 trucks each in actual ownership.

Think of the truck purchasing power of these two bodies of readers.

One of the most popular of truck advertising mediums asserts that its two largest classes of readers are lawyers and doctors!

Other Important Factors

From time to time there have been printed in AUTOMOTIVE INDUSTRIES articles prepared on the vocational basis, reflecting the inquiries of business papers among their subscribers. These would appear to have a very direct bearing on the proper marketing of trucks.

As to the life of the truck and service—these are important topics in themselves. Such studies as "The First Fifty" by the Pierce-Arrow Motor Car Co. and the "Roll Call" figures by The White Co. should have a great influence in the arguments made for worthy trucks. There are many other companies that can tell a similar story of their early vehicles.

Recently an engine builder in discussing service said that his company was forced to enter this field to protect their engines in "orphan trucks" and trucks that were not properly serviced.

Just the other day a notice was sent out that a factory service manager had been "promoted" to sales manager. It would seem that this was turning the thing around. Certainly a man with a sales experience should better realize the need of service than any one else around the factory, and certainly the man with the responsibility on his shoulders for all of the trucks the company had ever made should be more important to the organization than the man whose obligation rests with current production—as do the obligations of many sales managers.

Cam Design

CAMS are rotating or oscillating pieces of mechanism having specially formed surfaces against which a follower slides or rolls and thus receives a reciprocating or intermittent motion such as cannot be generally obtained by gear wheel or link motions. Cams are a familiar form of mechanism in the automobile industry, but there are probably few automotive engineers who realize the great variety of cams. Prof. Franklin De Ronde Furman in his Cams, Elementary and Advanced (John Wiley & Sons, Inc.) distinguishes between the following types: Radial or disk cams, side or cylindrical cams, conical cams, spherical cams, periphery cams, plate cams, heart cams, frog cams, mushroom cams, plate groove cams, wiper cams and rolling cams. The book referred to contains eight sections of which the first five were printed four years ago under the title Elementary Cams. Displacement, velocity and acceleration diagrams are given for a large variety of cams applicable to internal combustion engines, together with outlines of the cams giving these curves. Much of the material, however, applies to cams for other classes of work. The processes of design illustrated are mostly graphical and are readily followed by practical shopmen and draftsmen, as well as by technical students.

To Produce New Eight-Cylinder Engine for Use in Oldsmobile Chassis

Engine will be produced in quantity, using new tool equipment especially designed for the purpose. Cylinders will have rolled finish in place of ground surface. Blocks and heads to be interchangeable. Pressure lubrication and high speed, two- bearing crankshaft among features.

By J. Edward Schipper

FROM the engineering and production standpoints the new eight-cylinder Oldsmobile, known as Model 47, contains a number of interesting features. As this car is to be the quantity job of the Olds factory, and the engine is to be turned out in a plant specially tooled up for the purpose, it will undoubtedly be produced under conditions of unusual economy. More than $1,500,000 was spent on new tool equipment for the engine.

The chassis is practically identical with that of the four-cylinder model, but the new engine has features making for low labor cost. The price of the chassis equipped with touring body will be $1,695. Considering that the car is equipped with a four-passenger sport body with genuine leather upholstery, this price should certainly make a strong appeal to the buyer.

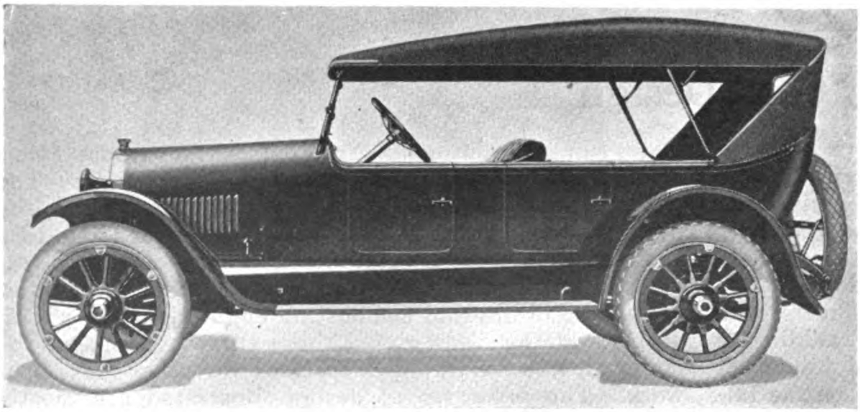
The engine is of conventional V type, the angle between the blocks being 90 deg. The cylinders are cast in groups of four, with removable cylinder heads, the major portion of the manifolds being integral. With cylinder dimensions of 2⅞ by 4½ in., the total displacement is 233.7 cu. in. The S. A. E. horsepower rating is 26.45, but the horsepower actually developed is 57 at 2600 r.p.m. The engine has three point suspension.

The valve passages are so arranged as to allow of a valve inclination of 6 deg. 17½ min. toward the cylinder axis, the object being to reduce the wall surface of the combustion chamber. Another noteworthy feature of the cylinder block is the integral intake manifold. Considerable study has been given to gas distribution, the intake being notable for the absence of abrupt bends. The diameter of the intake is 1 9/32 in. Exhaust passages are in line with the intake, sweeping around in an easy curve and allowing the exhaust to be carried away through a manifold bolted on top of the cylinder block.

The exhaust passages lie directly over and cross the intake passages, thus heating the intake. Cooling water circulates all around the cylinder bores and also around the intake and exhaust manifolds. Water from the pumps enters the jacket through tubes cast as part of the cylinder blocks. These tubes have five outlets, three being directly opposite the spaces between the cylinder barrels. Bosses are cast on the outside of the tube opposite the three center outlets, and holes are drilled through the bosses and the opposite wall of the tube, the holes through the bosses being afterward plugged. This is done to insure an even supply of water to all parts of the jacket. At each end of the cylinder block a wall is carried out, these two walls, with the inspection plate, entirely enclosing the valves.

Cylinder Bores Rolled to Size

Probably the most interesting feature of the cylinder block, however, is its manufacture. The cylinders are not finished by grinding in the usual manner, but are rolled to their finished diameter. By this method of rolling the bores, the metal inside the cylinder is slightly compressed, giving a hard, glassy surface. The rolls surround a central spindle, the assembly thus resembling a roller bearing; each single roller in the tool is carefully gaged so that the entire assembly generates an absolutely true cylinder. This is made to the true size of the cylinder bore. In a previous machining operation from 0.0005 to 0.001 in. metal is left on the diameter to be compressed by rolling. The roll, which works in oil against the cylinder surface, compresses the metal and the process is said to give greater smoothness of surface and greater resistance to wear than can be obtained otherwise.



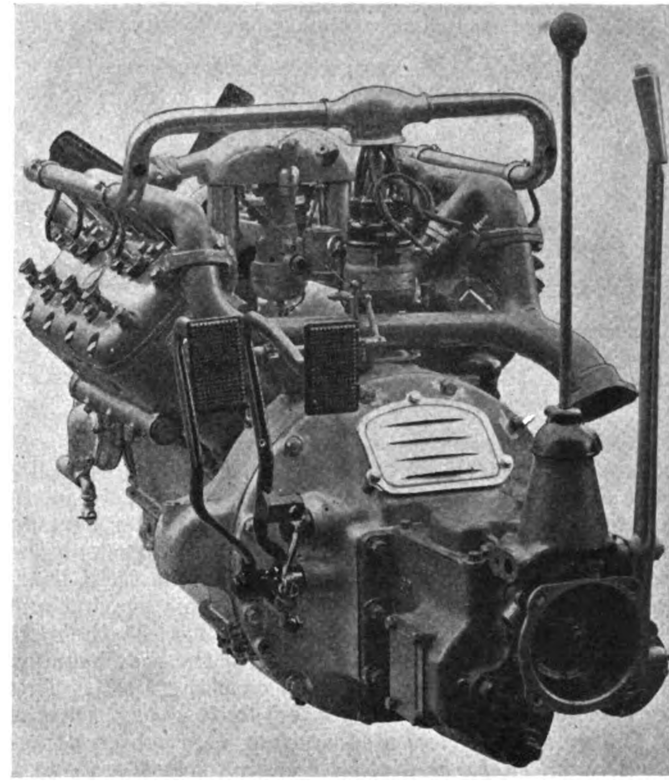
New Model 47 Oldsmobile

The two cylinder blocks are interchangeable, in spite of the fact that one block is set slightly ahead of the other. Semi-steel is employed for the cylinder head, which contains the combustion chambers. The heads for the four cylinders are a single casting, with combustion spaces of regular form. Bosses are cast on this head, to receive the compression cocks located in the cylinder axes, so that it is an easy matter to check the timing. The spark plugs are placed in the head directly over the intake valves, so that the inrushing gas will tend to keep the plugs clean and cool. The head is secured to the cylinder by fourteen 7/16-in.

cap screws, so located that all will be subjected to substantially equal strain by the explosion pressure. The right and the left cylinder heads are interchangeable.

The piston is a cast iron, three-ring type with a plain skirt, the third ring groove being beveled on the lower surface and holes drilled at 45 deg. to drain the oil back to the crankcase. The weight of this piston is 15 oz., and in assembling the pistons are selected so all eight in one engine vary but slightly from a fixed standard. The piston is fitted with a hollow piston pin of 21/32 in. diameter, locked in the boss by a tapered, pointed locking pin which is itself locked against looseness. The rings are 3/16 in. wide and are fitted closely in the grooves. The minimum clearance between the piston and cylinder bore is 0.002 in. and the maximum .0025 in. These pistons and the light rods used in connection with them are designed to make possible speeds as high as 3500 r.p.m., although the engine develops maximum power at 2600 r.p.m. A special fixture is used for line reaming the piston bosses square with the barrel of the piston, and both ends of the connecting rods are machined, so there is no possibility of misalignment.

I-beam section connecting rods are employed, the section being constant throughout the length, measuring 13/16 in. in depth, ⅝ in. in width and 3/32 in. in thickness. The upper end of the rod is bushed. The rods are of high carbon steel and are heat-treated to a Brinell reading of 180 to 215.



Three-quarter rear view of powerplant

Two-Bearing Crankshaft Used

The crankshaft is forged of 1045 S. A. E. steel and is of the two-bearing type. Owing to the small bore and the use of block cylinders the crankshaft is unusually compact, allowing a stiff shaft, although only two main bearings are employed. Tests indicate that the shaft is free from whip up to 3500 r.p.m. Counterbalances are welded solidly to the shaft and the finished shaft is put in both static and running balance. When the crankshaft is being balanced the oil holes of the shaft are filled with oil, and the oil pipes, which are curved on the cheeks of the crank, are in place. This means that the crankshaft is balanced under running conditions, and by this method it has been possible to eliminate perceptible periodic vibrations throughout the speed range of the engine. At the rear end of the crankshaft are three spiral grooves leading from the oil thrower, to turn back any oil which would otherwise tend to work out at this point.

Forward of the timing gear pinion is a helical gear which operates the two water pumps through a cross-shaft. To the forward end of the crankshaft is keyed a pulley which furnishes the drive for both the fan and the generator. The section of the crankshaft webs increases progressively from the pins to the axis of the shaft. The curved oil pipes secured to the webs carry the oil from No. 1 to No. 2 throw on one side of the shaft, and from No. 3 to No. 4 throw on the other side. This arrangement overcomes interference with oil flow due to centrifugal action and it also obviates the necessity for drilling the cheeks. The oil holes feeding the connecting rod bearings are drilled on the inside surfaces of the crankpins, so that the centrifugal force will cause the oil to pass over the entire surface of the bearing. It is claimed that when the oil hole is on the outside of the crankpin, the oil is whirled directly out of the bearing and into the cylinder bores, where it is picked up by the pistons and much of it needlessly burned or oxidized. This is said to be one of the factors tending toward oil economy in these engines.

The rear main bearing measures 2⅛ x 3 5/16 in., the front, 2⅛ x 2 27/32 in. The bearings are of the babbitt-lined, bronze back type, the specification for the lining metal being 90 to 92 per cent tin, 4 to 5 per cent antimony, 4 to 5 per cent copper, and 0.20 per cent maximum lead. The connecting rod bearings are 2⅛ in. in diameter by 2 11/32 in. in length.

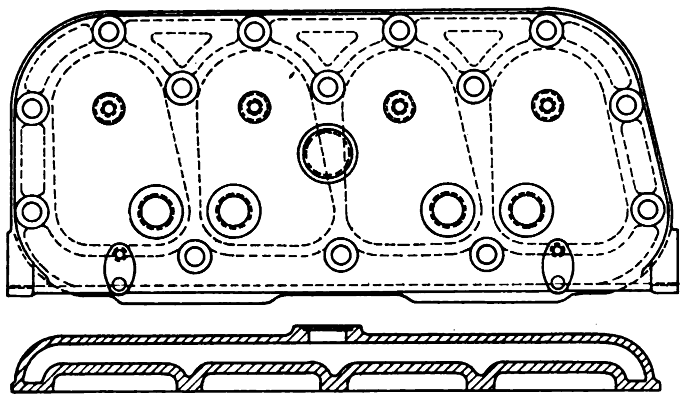
High tungsten steel is used for the exhaust valves and low tungsten for the inlet. These valves are tulip shaped, to reduce the resistance to gas flow. The valves have 1 7/16 in. diameter heads and 9/32 in. diameter stems. The clear diameter of opening is 1 9/32 in. Roller cam followers are fitted to the valve tappets. Each valve is operated by an independent cam, this being made possible by setting one block slightly forward of the other.

Valve Details

The valve springs have ten live coils and exert against the cams when the valve is closed a pressure of 66 lb., which is sufficient to cause the valves to follow the cam contour at maximum speed. The valve springs are 63/64 in. outside diameter and are tested by compressing from a free length of 3¼ in. to a closed length of 1¾ in. The spring must allow of this compression without taking a permanent set. The valve spring is held in place by a retainer which rests on a split collar fitted into a recess on the valve stem. This collar is hardened to 90 points scleroscope and forms an efficient locking device. The valve tappets are 9/16 in. in diameter by 2⅝ in. in length and work in a guide which forms a bearing from the center line of the roller right to the end of the tappet. Nickel steel is the material used for the tappet, and it is heat-treated to 50 to 55 scleroscope.

The valve adjusting screw is ⅜ in. in diameter and is heat-treated to glass hardness. The cam roller is ¾ in. in diameter by ¼ in. wide and is hardened to 75 to 85 scleroscope. The pin on which this roller runs is driven into the valve tappet and is also hardened.

The camshaft, with its sixteen integral cams, is a very interesting drop forging. The cams are of the constant acceleration and deceleration type and have a base line



Cylinder head

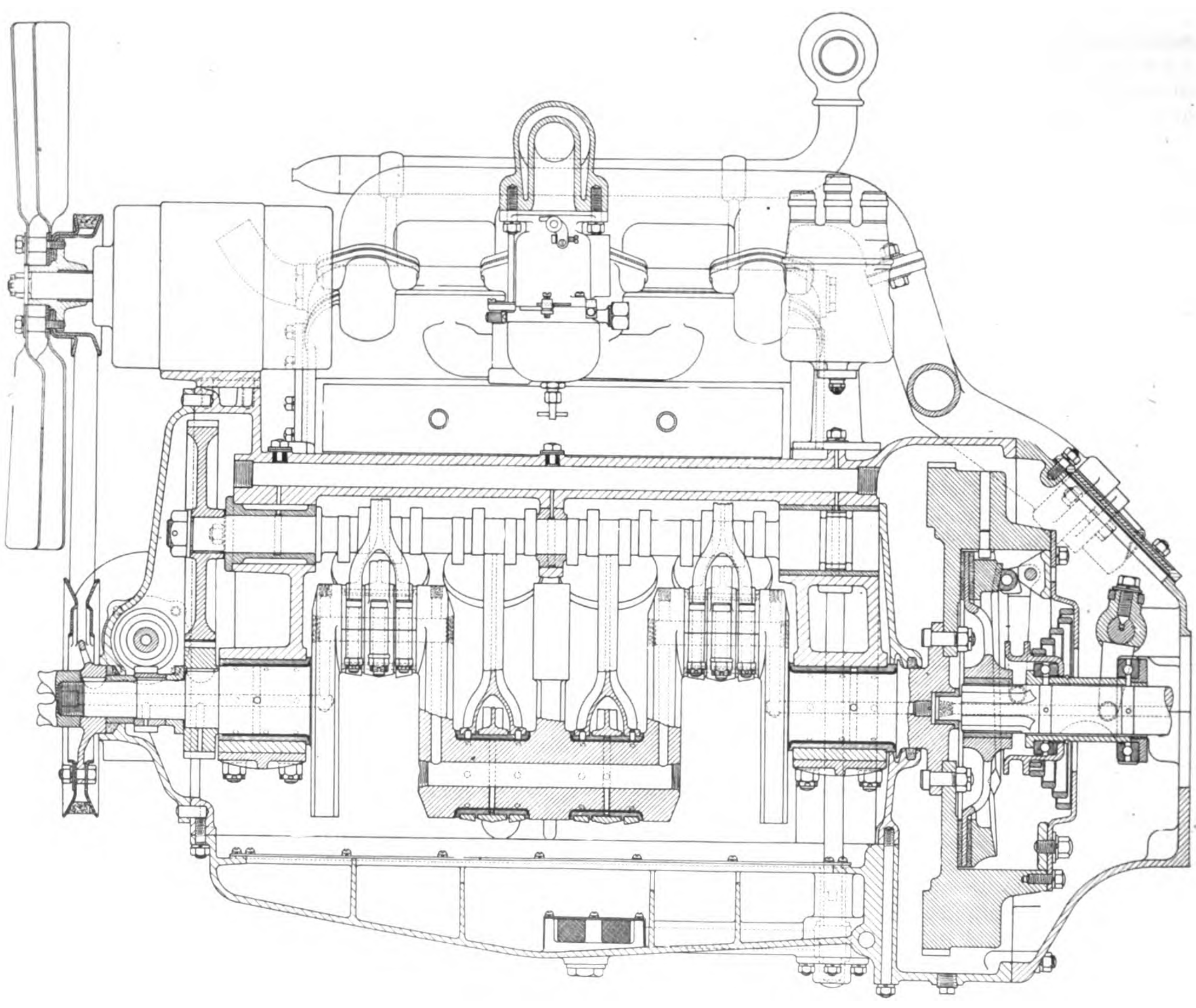
clearance of 0.006 in. on both exhaust and inlet. The lift of the cams is 0.2928 in. The camshaft is 1 1/16 in. in diameter and runs in three bearings, the center bearing being split to permit easy assembly. The thrust on the camshaft is taken up at opposite ends of the front bearing, a flange being on the inside end of this bearing and the timing gear hub on the opposite end. At the rear end of the camshaft, near the center of the rear bearing, a 15-tooth helical gear is pressed onto the shaft. This gear meshes with the distributor shaft gear. On the distributor shaft is mounted another gear which drives the oil pump shaft, also at half engine speed.

The timing of this engine is as follows: Inlet opens 4½ deg. after top dead center and closes 42 deg. after lower dead center; exhaust opens 45 deg. before lower and closes 3½ deg. after upper dead center.

The oil pump is located in the base of the oil pan and is of the conventional gear type. Both gears have eleven teeth, 10 pitch, and have a face 1 in. wide. These gears are straight spur type, whereas the driving gears are of the helical type and have fifteen teeth of 14 pitch with a 20 deg. angle. The timing gear on the crankshaft is of the helical type and has thirty-two teeth of 10 diam. pitch, with a 22 deg. 30 min. angle of helix. The timing gear, which is mounted on the camshaft, has sixty-four teeth.

The crankcase is made of aluminum, its sides extending down 4¼ in. below the center line of the crankshaft. These sides are ribbed and form a bridgework. The cylinder blocks are bolted to the crankcase by ten 7/16-in. studs each. The camshaft bearings are located directly above the crankshaft bearings. A cast oil passage ¾ in. in diameter extends the whole length of the crankcase, its function being that of an oil cooler. The main bearings are supported by box section ribs and the caps are bolted to the bearings by means of four 7/16-in. studs. The oil pan is also of aluminum.

The two water pumps are carried on the front gear cover and they are so located as to line up with the particular block which they supply. They are driven at crankshaft speed and their impellers are of the inclosed



Longitudinal section through engine and clutch

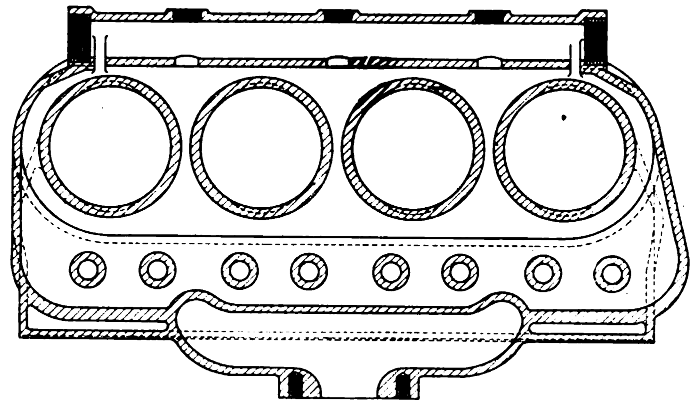
vane type which eliminate wall friction in the pumps.

Oiling is by pressure feed. The oil is first strained through a large, fine-mesh screen into the oil pan; from there it passes through the oil pump which is located in the base of the oil pan toward the rear, and is then delivered through a pipe in the bell housing to the top main oil-way cast in the crankcase. Here some of the oil branches off to the rear main bearing, while the main stream passes along the top of the crankcase and then down a drilled hole to the front main bearing. Here it enters the hollow crankshaft and flows along the center of the shaft and up through the web to No. 1 bearing. Thence it is carried through an arc-shaped pipe concentric with the crank axis to No. 2 bearing. At No. 2 bearing the smaller stream which comes in at the rear bearing is met. At the rear bearing there is a relief valve discharging to the crankcase. A small hole in the crankshaft supplies the front pump gears and timing gears with oil, and the rear camshaft bearing is similarly supplied from the top main oil channel.

The weight of the second unit power plant turned out in regular production is 714 lb. This includes the engine with generator, starter, carbureter, wires and header, fan, clutch, transmission, pedals, 5 qt. oil in motor and oil in transmission.

Motor minus clutch and transmission weighs..	606 lb.
Transmission filled with oil weighs...........	82 lb.
Borg & Beck clutch weighs..................	26 lb.
Motor alone without oil weighs..............	597½ lb.

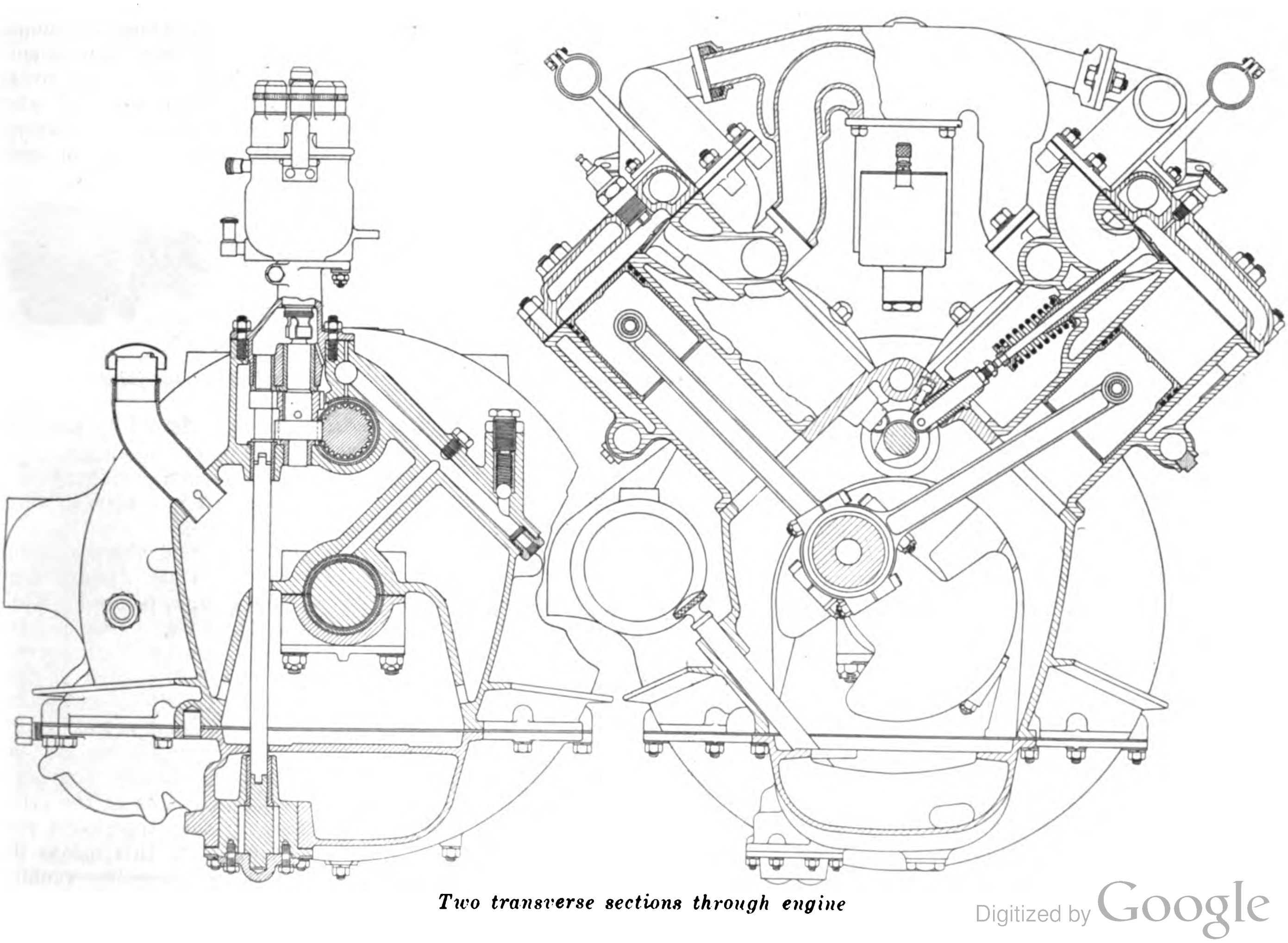
The clutch used is a Borg & Beck 10-in. The gearset is of the selective type and has three speeds forward and one reverse. The second speed ratio is 1.736 to 1; the first speed, 3.525 to 1, and the reverse, 3.966 to 1, with a 4 2/3 to 1 reduction on the rear axle. The gears are of 6-8 pitch. The drive from the transmission is taken through a Spicer universal joint encased in a ball housing connected to the end of the torque tube.



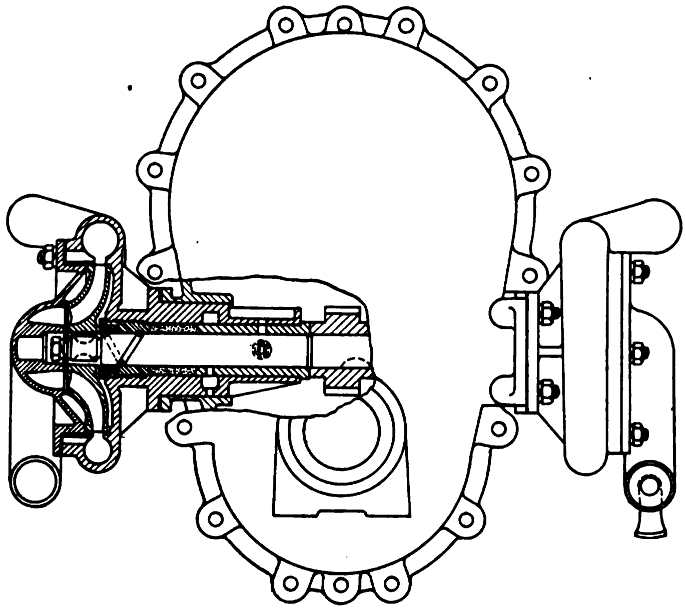
Horizontal section through cylinder block, showing water inlets and inlet manifold

The rear axle is of the three-quarter floating type and is of Oldsmobile design and manufacture. The axle pinion shaft is carried on ball bearings of liberal size. A Hyatt roller and a thrust bearing are fitted on both sides of the differential. The end bearings on this shaft are of the regular Hyatt type.

The front axle is of I section and the wheels are carried on radial ball bearings. The king-bolts are 1 in. diameter. There are oil cups on the king bolts and Alemite grease connections are fitted to the tie rod bolts. The front springs are 2 in. wide by 36 in. long and have 8 plates. The rear springs are semi-elliptic, underslung, 2¼ in. wide by 54 in. long and have 9 plates.



Two transverse sections through engine



Assembly, gear cover, water pump and shaft

Both front and rear springs are so designed as to be flat under the rated load of the car.

A split nut, semi-reversible type steering gear is fitted. The steering column, mounted on the left side, is nickel finished and rigidly braced to the instrument board. A corrugated walnut steering wheel is used, the diameter being 18 in.

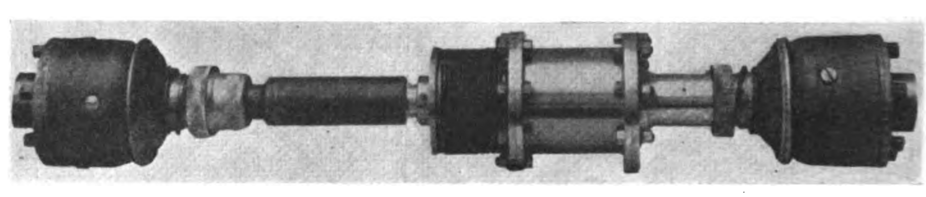
The seats on the "Pacemaker" four-passenger are amply wide. The dimensions of the front cushions are as follows: Depth, 18½ in.; width, 38 in.; thickness, 5½ in. rear and 6½ in. front. The rear cushion has a depth of 19½ in.; width, 40 in.; thickness, 8 in. front and 6 in. rear. These cushions have the conventional springs and are covered with fine grained, bright finish, black leather, French plaited. They are stuffed with a No. 1 4-oz. cotton batt. The upholstery on the rear seat back is about 9 in. deep, and on the front about 6 in. The cushions are kept in place by smoothly finished, black enameled, round edged retainers.

All open cars will be fitted with straight side 32 by 4-in. tires, the rear tires being nonskid, while on the closed cars 32 by 4-in. cord tires are used. The weights of the four-passenger car with 14 gal. of gasoline, 1½ gal. of oil, water and one spare cord tire is 2970 lb., of which 1360 lb. is at the front and 1605 at the rear.

A Shock Compensator for Shaft Drives

A SHOCK compensator designed by Richard T. Cooke, for insertion in the propeller shaft, to relieve the shocks coming on the mechanism of an automobile or motor truck when the clutch takes hold too rapidly, is to be manufactured by the Hartford Automotive Parts Co. The device consists of a cylinder filled with oil, in which there is a shaft having two paddles or vanes formed integral with it. There are also within the cylinder two partition walls dividing the cylindrical chamber into two compartments. There are two passages in each of these partitions, one a very restricted one through which the oil can flow in both directions, but only at a comparatively slow rate; the other controlled by a check valve, so that oil can flow through it only in one direction, but quite rapidly. The paddle shaft is the driving member and the housing the driven member.

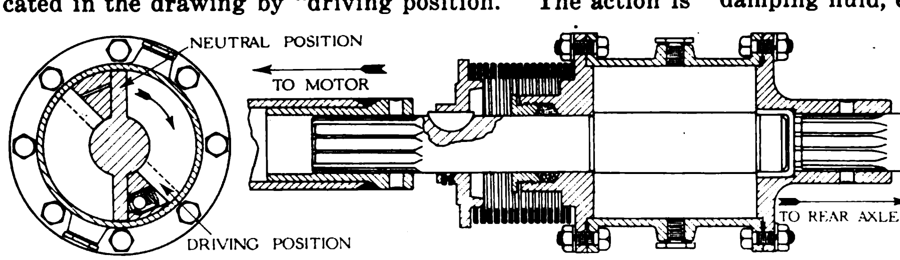
When the clutch is disengaged a coiled spring between the housing and the flange on the driving shaft keeps the paddle and the housing in the relative position indicated by "neutral position" in the cross sectional view, there being then no torque transmitted through the device. When power is applied by letting in the clutch, the torsional force of the spring will be overcome and the oil will be forced through the fine passage from one compartment of the housing to the other, thus causing the paddle shaft and housing to gradually assume the relative position indicated in the drawing by "driving position." The action is similar to that of a door check. Angular motion of about three-eighths of a turn in the propeller shaft, or from three-eighths to two turns of the engine, depending upon the gear reduction in the transmission, occurs before the drive is positive. During this period a marked cushioning effect is said to take place. A device of this kind should prove particularly valuable on heavy motor trucks, owing to the great inertia of the mass to be accelerated when changing to a higher speed. The device is said to prevent axle and other driving part breakage due to sudden application of power. It is claimed that the flexibility provided in the drive by the device makes gear changing, as in traffic, much less frequent and that, when desired, even a truck of medium weight can be started in second or third gear without undue clutch slippage.



Assembly of compensator, propeller shaft and universal joints

A fluid, the viscosity of which does not change to any great extent with ordinary changes in atmospheric temperature, can be used in the compensator if desired. While the fluid chamber is so packed as to prevent leakage of the damping fluid, even the loss of all the fluid will not prevent operation of the car, though in that case the cushioning effect, except for that due to return spring, will be lost.

It will be seen from the cut that the shaft is well supported in long bearings in the flanged ends of the cylindrical casing so that transverse play is inappreciable. By this means the possibility of the assembly running out of true is virtually eliminated.



Sectional views of shock compensator

British Light Car Becoming Increasingly Popular Because of Its Economy

The high grade four seater with an engine of about 100 cu. in. displacement selling at about $3,000 is now recognized as a permanent and practical type—one making a wider appeal to British buyers than any other type. First cost less important than economy. Owners soon learn to change gear frequently and almost unconsciously.

By M. W. Bourdon

SINCE the Olympia Show of 1919 the light car in Great Britain has developed very appreciably. It is no longer only a two-seated runabout with an engine of about 60-70 cu. in. displacement, but has become also a practical four-passenger vehicle with an engine of 90-100 cu. in. The two-seater is still very popular, but its limitations in certain directions have been eliminated and only in a few instances has it the cramped accommodation of a year ago.

As it is growing in chassis and engine dimensions so is the light car increasing in popularity and scope. It is generally admitted that the feature of the recent London Show was the light four-seated car, and it is safe to say that no British maker of this type having a standing in the industry is other than satisfied with prospects for 1921. There were approximately 50 firms exhibiting light cars of various sizes, but the type which is making the widest appeal is restricted to about half that number.

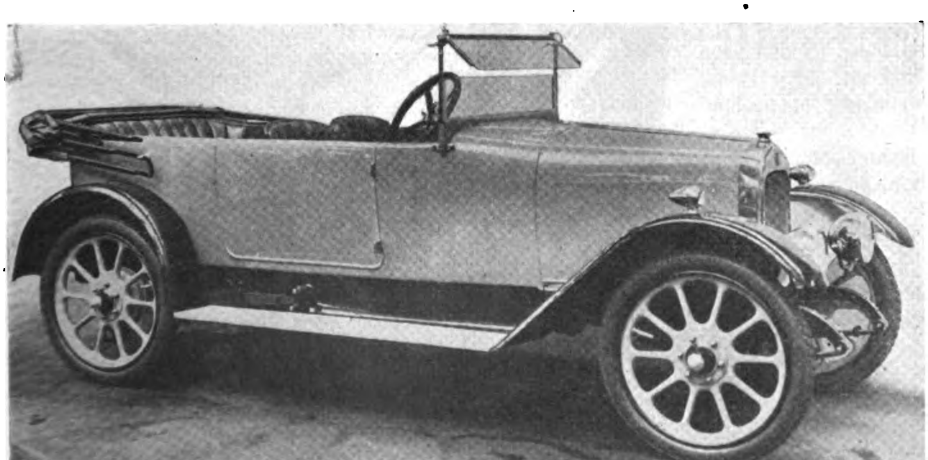
It is very difficult to generalize on the technical side of the light car, for the range of the type is so wide. That is to say, the term "light car" is very indefinite and is applied simultaneously to the four-seater weighing 1800 to 2200 lb. and to miniature two-seaters with motor cycle practice written all over them. The latter are cycle cars in all respects except name. Between these two extremes there are the two-cylinder horizontally opposed or Vee air-cooled two-seaters of about 8 hp. Of this section there probably is none so good or at all events so popular as the little Rover at anything like the price ($800); it was at one time turned out as fast as the makers could get bodies built, about 40 per week.

Next comes the section with four-cylinder water-cooled engines of 60-70 cu. in. capacity, the original of the general type. In this class are the 10-hp. Wolseley, Singer Calthorpe, A. C., and others which have or have not yet established their reputations. Finally, there is the section with which this article is primarily concerned. It is usually looked upon as a new type, but actually it was represented even in 1914 by the 10-hp. Humber with an engine capacity of approximately 100 cu. in.

It is in this last section where development is most observed. After being looked upon as an overgrown and overloaded miniature car, it is now recognized as a permanent and practical type and as one making a wider appeal to buyers than any other size of car.

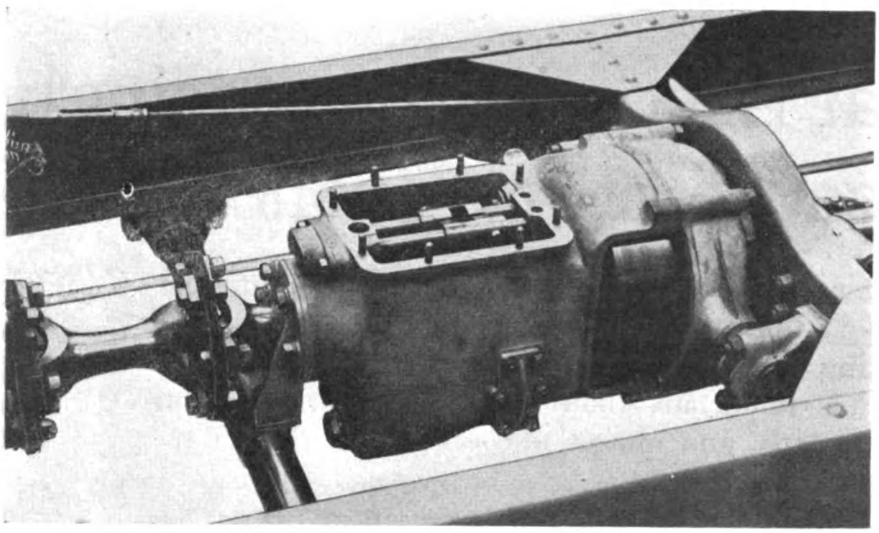
The light four-seater is a term which better describes it than "light car," for although the chassis is quite as often fitted with a "two-seated" body the latter generally has accommodation for two extra passengers in a more or less roomy folding rear seat. At all events, the chassis is designed to carry four passengers, which the original and still existing light car chassis was not.

A general idea of the type in question can be obtained from a knowledge of the engineering details of two of the best examples, wherein design varies widely without affecting the result in performance. These two are the new 12-hp. Standard and the small (so-called 10-hp.) Humber. There is little to choose between them.



Enfield Allday, a good example of the British light four-seater. The four-cylinder engine has 2½-in. bore and 4⅝-in. stroke. The transmission is a separate unit. One wide door on each side affords access to either front or rear seats, the former having folding backs and being hinged to tilt forward.

The 12-hp. Standard has a four-cylinder 68 x 110 mm. (2 11/16 x 4 5/16 in., 97.5 cu. in.) overhead valve engine with push rod operation; detachable head; block cast cylinders mounted on an aluminum crankcase; thermo-syphon water circulation; magneto ignition; hollow shaft lubrication carried up to the wrist pins and valve rocker shaft; dry single disc clutch; separate three-speed gear-set with right-handed control lever; open propeller shaft with fabric disc joints; overhead worm gear, 3.83 to 1 ratio; 32 x 3½ in. tires on all-metal hollow spoked wheels and brakes on transmission and wheel drums. The wheelbase is 108 in., track 48 in. and weight 2000 lb. Electric lighting and starter are fitted and with four-passenger body it sells at $3,200.



The Enfield Allday three-speed gearset has three-point suspension and is extended at the rear to enclose an expanding transmission brake. Two flexible disc couplings are used between clutch and gearbox

r.p.m., but speeds higher than that, in some cases 3000 r.p.m. and over, are reached and maintained — on the lower gears especially—for quite long periods at full throttle. They are unquestionably high-speed engines, and the power falls off rapidly below 1300-1400 r.p.m. As a result, the gear shift is frequently in use and this as much as anything accounts for their fuel efficiency without detracting seriously from the approval of users.

It must not be assumed that this type of car is appealing only to those buyers who are men, or women, of strictly limited means, though these were the class of people for whom it was originally designed. The light four-seater, with either a tonneau or a folding rear seat for two of the passengers, is being bought in increasing numbers by people of social and financial standing, who have been hard hit by the excessive income tax and cost of living generally. As they are reducing their domestic staffs, so they are turning to far smaller cars than those with which they at one time would have been satisfied. They are people who in 1914 would have derided any neighbor who rode in a car of less than 25 to 30 hp.; yet now they take pride in the running and appearance of their little 10 or 12-hp. four-seaters.

Even if this class of man does not buy a small car for constant or sole use, he probably very considerably restricts the mileage of his larger car (which quite possibly is a Rolls-Royce) and uses the small one for short journeys for economy's sake. His wife and daughter actually prefer the light car for driving themselves; they find it handier and easier to drive than a large one and quite large and presentable enough for shopping and social calls.

But the small car makes an even more forcible appeal to the man of no particular social standing and of somewhat limited means. He uses it quite successfully for touring and week-end runs. He can carry 3 friends with light luggage and cover 200-250 miles per day at an average speed of 20 to 22 m.p.h. exclusive of stops. The car will climb any hill on low gear; does not overheat; and with its well-upholstered and well-finished body is almost as comfortable as the 30-hp. six-cylinder car. The shorter

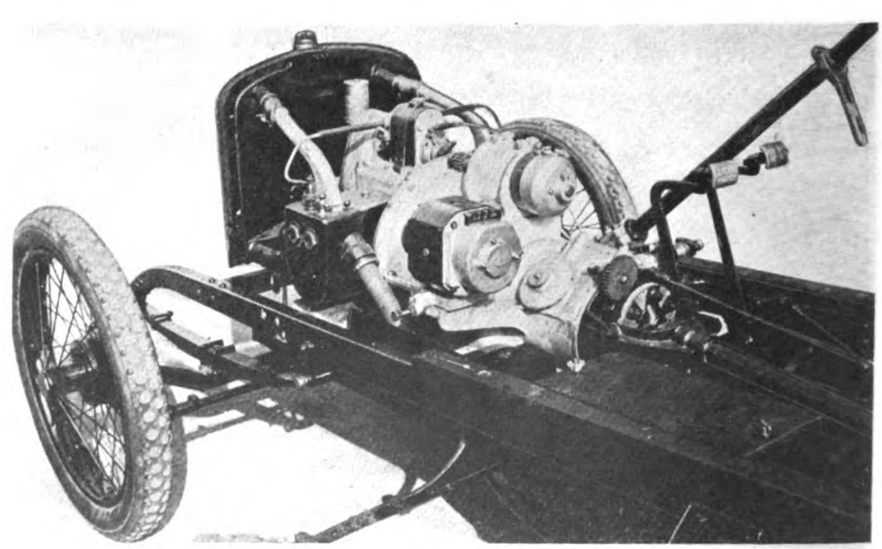
The Humber has a unit power plant with a four-cylinder block cast detachable L head engine, 65 x 120 mm. (2.56 x 4.73) or 97.2 cu. in. displacement. The cylinder block is cast as a unit with the top half of the crankcase. Trough and splash lubrication, magneto ignition and thermo-syphon water circulation are used. The inverted cone clutch is enclosed, leather-faced and has provision for running in oil. The gear-set has four speeds with the control lever on the right; open propeller shaft with disk and sliding block joints; straight bevel gear 4.33 to 1, 34 x 3½ in. tires on hollow spoke wheels; transmission and wheel brakes, a wheelbase of 106 in., a track of 55 in. and weighs 2200 lb. With full electric equipment and four-passenger body it sells at $3,400.

Another example is the 10-hp. Wolseley, but this is usually fitted with a two-seated body, though a standard model is a four-seater with a narrow (34-in.) rear seat, wide enough for two small-sized adults or two children; it hardly comes into the Standard and Humber class, having a smaller engine (2 9/16 x 3¾ in., approximately 76.8 cu. in.) and is very much overloaded with four full-sized passengers. Nevertheless, it makes a big appeal at $2,600 in the two-seater model, for with its overhead camshaft the engine efficiency is fairly high. The three-speed gear-set is on the back axle, which embodies worm drive with a ratio of 5.1 to 1. It is one of the best if not the best sprung of its class, having quarter elliptic springs fore and aft, as against the semi-elliptics all around on the Standard and Humber.

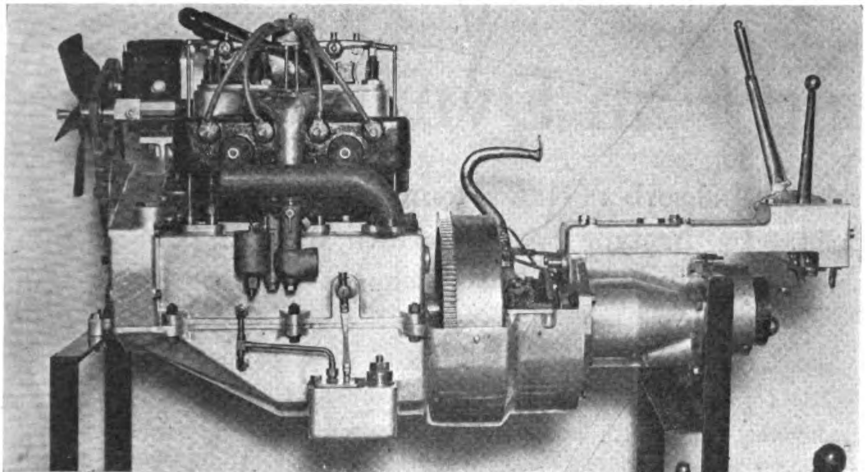
From the prices quoted it will be realized that these are not cheap cars as regards first cost. They are very well finished mechanically and otherwise.

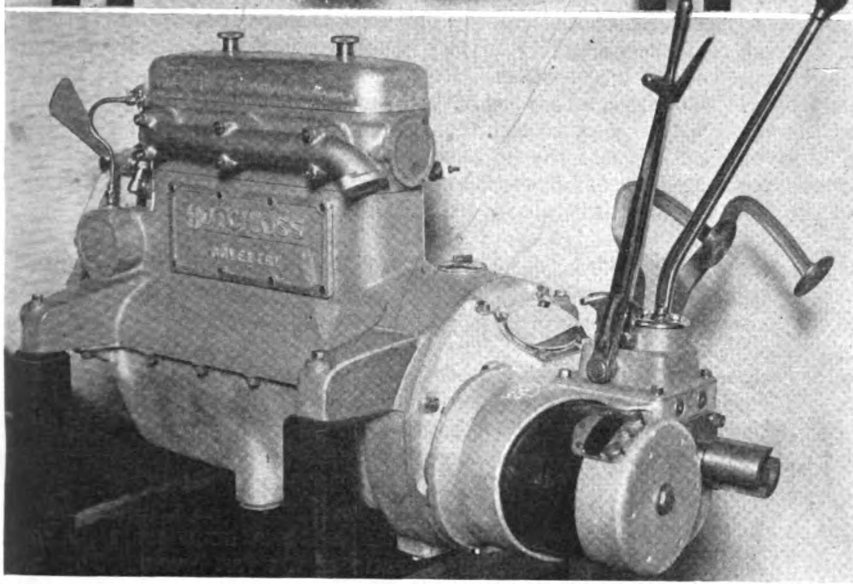
Where the light four-seater makes its appeal is in respect of economy in running, ease of maneuvre and "handiness." It runs on an average 29 to 33 miles to the gallon of fuel, when driven at moderate speeds. On high gear and level roads it has a maximum speed in the neighborhood of 50 m.p.h. Oil is 1500 to 2000 miles per gallon and the average life of a set of tires is 10,000 to 12,000 miles.

The engine efficiency is fairly high. The normal speed of rotation is 2000 to 2200



The unit powerplant of one of the lighter type cars built by the manufacturer of the Douglas motorcycle. The double opposed engine is only 3⅝ by 3⅝ in. but has electric starting and lighting generator and magneto ignition





Above—The Lagonda four-cylinder 2¾ by 3¾ in. engine is one of the few British engines with superimposed valves. Note construction of unit powerplant with open top casing for flywheel and clutch

Below—The English Hotchkiss powerplant, used by at least one British light car manufacturer. Note method of mounting the starting motor

wheelbase and the lighter weight do not enable the car to run as smoothly on rough roads as a bigger car *if the same average speeds are attempted.* If the road speed is reduced proportionately to the car size there is very little to choose between one and the other.

But the majority of buyers of the light four-seater want a well-finished car, and do not mind paying a comparatively high initial price so long as it runs economically, quietly and without pronounced engine vibration. They would prefer, no doubt, to run more on high, but they have no great objection to changing gear. They soon find that they are compelled to use the gear shift very frequently; they dislike it at first, but within a month they change gear almost as unconsciously as they operate the accelerator; and usually with similar quietude.

An original drawback to these little cars was their susceptibility to carbon deposit; they have quite a reasonable compression—from 70 to 80 lb. per square inch when new—and yet they were at one time prone to "pink" badly after quite a small mileage. But this fault has been overcome to a large extent by the experienced makers by the use of scraper rings and less haphazard lubrication, and these cars will now run 3000 to 4000 miles without decarbonizing. Local overheating was another cause of trouble. Running as they do for long periods at high rates of speed with full or nearly full throttle, the spark plug points are liable to become incandescent and cause pre-ignition and back-firing. The plug boss in the cylinder must therefore be in fairly intimate contact with the cooling water and care is essential to eliminate pockets in the water jackets where steam can generate. On the new Standard this pocketing has been overcome by a subsidiary water outlet (with an internal diameter of ½ in.), from the front end of the head to the radiator, the main outlet being at the side of the head. The detachable L-head design is quite satisfactory in these small sizes, and the spark plug difficulty has not occurred in this type. Where it has been most pronounced is in cyclinders in which the plug screws into a valve cap. Failing other remedies the plug adopted is made with external radiating fins and very heavy electrodes—what is sold as a "racing" plug.

Another original difficulty was due to rapid wear of crankshaft journals and big-ends. Hollow shaft lubrication has been adopted with some success in eliminating these troubles, and, although troughs for the big ends have frequently been retained, direct leads are now nearly always taken to the journals. Two-bearing crankshafts are normal, as are light cast iron pistons and H-section connecting rods. Obviously the balancing of reciprocating or rotating parts is an important consideration, though counter-weighted crankshafts are not used.

Generally speaking, the developed type is a high grade car in miniature, though, as may be expected, there are not a few examples of poor design, bad workmanship and unsuitable materials among the chassis and bodies turned out by small firms trying to make their own components—as the majority of them do.

It must be said that there are no dividing lines between the true light car (with 60-70 cu. in. engine), the light four seater (90-100 cu. in.) and the next size above. The latter comprises the Bean (110 cu. in.) and others of similar size; but they are accounted out of the light car class, although termed 12 hp. The four-cylinder Rover is also rated at 12 hp. with an engine capacity of 136 cu. in., but both it and the Bean are a heavier type of car, although in seating capacity there is little to choose between them and the 10 hp. Humber. Further, the Bean sells at $2,700 as against the Humber $3,400; but the better finish of the latter has enabled its makers to be fairly well assured of a market.

It is to be noted that British makers have by no means a monopoly in the type of chassis under discussion. Fiat, Citroen, Peugeot, and other Continental plants are turning out chassis for light four-seated bodies of similar size and selling them at approximately the same price in England as British cars, the import duty being counteracted by the rate of exchange between Italy or France and England. The Fiat model has an engine of 65 x 110 mm. (approximately 89 cu. in.). It need hardly be said that these also are high-grade cars in miniature; they have the same characteristics as to engine speed, weight, and gear ratios as the British productions, but at present the latter are not feeling this foreign competition.

There are indications that the development of the type is not yet complete, and one of the best known makers has

(*Continued on page* 651)

A Variable Speed Fan Dynamometer

The ordinary type of fan brake will absorb a given amount of power only when running at a fixed speed. In the type here described the fan is inclosed and load can be varied by changing area of discharge opening.

By Karl D. Wood*

FAN brakes are widely used as absorption dynamometers in testing internal-combustion engines because they are comparatively simple, inexpensive and flexible. They have, however, the disadvantage that a given fan will run at only one speed when the engine is delivering full power, that speed being determined by the size, proportions and environment of the fan and the density of the air. In order to be able to vary the speed at which a given power will be absorbed, English manufacturers have for some time been using a cylindrical housing around the fan with one or two variable openings in the periphery. They are not known, however, to have published any information showing the range of speed control available. Hence, these experiments were undertaken with a view to answering the following two questions:

(1) What range of speed control is obtainable with a fan brake?

(2) Given the rated horsepower and speed of an engine, what is the diameter of fan brake necessary in order to obtain complete tests of power vs. speed?

The general procedure of the experimental work was to mount a two-bladed paddle-wheel fan on a small electric dynamometer, build a cylindrical housing around it, the inlet and outlet of which were of controllable area, and measure simultaneous values of speed and horsepower with different sizes of inlet and outlet. This gave sufficient data to determine the speed and power ratios obtainable by opening and closing the outlet, and the size of inlet for maximum speed control.

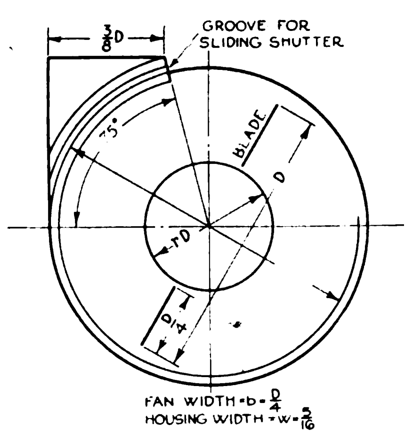


Fig. 1—Section through fan blades

The fan consisted of two square pieces of 1/8-in. sheet aluminum about 11 in. on each side, bolted to a steel arm 3/8 x 3 in. by means of steel angles. The diameter of the fan measured from tip to tip of the blades (the nominal diameter) was 44 in. The proportions of the fan brake are shown in Fig. 1, which is a section through the fan blades looking toward the inlet end of the brake. The two ends of the housing were sawed out of slabs of cleated tongue and groove pine and an 18-in. strip of galvanized iron nailed around the periphery of the ends completed the fan brake except for the sliding shutter. The estimated maximum cost of such a fan brake in January, 1920, labor included, is $25.00.

The fan brake was mounted on a 50-hp. Sprague electric dynamometer. Data for horsepower-speed curves were taken with inlet diameters of 26, 20 and 16 in. respectively and with inlet closed, the circumferential outlet opening being changed by steps of 2 in. up to 30 in. open for each setting of the inlet. The outlet uncovered about 75 deg. of the periphery of the housing when the circumferential opening was 30 in. Readings of static air pressure in the housing and air velocity through the outlet were also taken with a view to establishing a reasonable basis for the computation of the horsepower necessary to drive a fan brake of different proportions from the one tested, but no satisfactory formulas were obtained.

Fig. 2 shows the horsepower-speed curves for the fan brake tested, plotted on the same sheet with a horsepower-speed curve of the fan in free air and curves of three well-known engines. The observed points are shown in circles and dotted lines indicate extrapolation. The slope of the lines is 3.0; this differs from some other observers' results by as much as 0.1. The horizontal distance between curves *B* and *C*, measured with a logarithmic scale, is the speed ratio of the fan brake. For the brake tested the speed ratio was 1.7. The horizontal distance between curves *A* and *C* gives the maximum speed ratio that could be obtained by any improvements in the design of the fan brake. It will be noticed that *A* cuts the 1000 r.p.m. line about the same horsepower that *C* cuts the 2000 r.p.m. line, so the maximum speed ratio obtainable is 2 to 1. The vertical distance between the two lines gives the power ratio of the fan brake, and is naturally the cube of the speed ratio, or 5 to 1. Since the lines are parallel, the speed ratio is independent of the speed at which the fan is run. This means, of course, that the *speed* range is greater at higher speeds. At 300 hp. a speed range of 1600 r.p.m. is available, which is more than enough to take a complete full-throttle run on a 300-hp. Hispano-Suiza engine. At 18 hp. speed a range of only 650 r.p.m. is available, and this is not quite as great a speed range as is usually required in running tests on Ford engines. Curve *D* is a typical full-throttle Ford engine curve. While the characteristics of a fan brake give it greater speed range at high speed than at low, it must be very carefully built in order to be run with safety at speeds over 1500 r.p.m. Fig. 3 shows in full lines the curves of horsepower at 1000 r.p.m. against fan diameter for Sturtevant Steel Plate blowers plotted from data given in their catalog No. 234. These curves indicate that for fans of different diameter having other dimensions proportional to the diameters, the power absorbed by the fan varies about as the fifth power of the diameter, since the slopes of the curves are 5.3 and 5.1 respectively. The fact that the lines for Sturtevant blowers open and closed are parallel shows that the speed

*Technical note prepared under the supervision of the Automotive Power Plant Section of the Bureau of Standards, and submitted through the Subcommittee on Power Plants for Aircraft to the National Advisory Committee for Aeronautics for publication condensed.

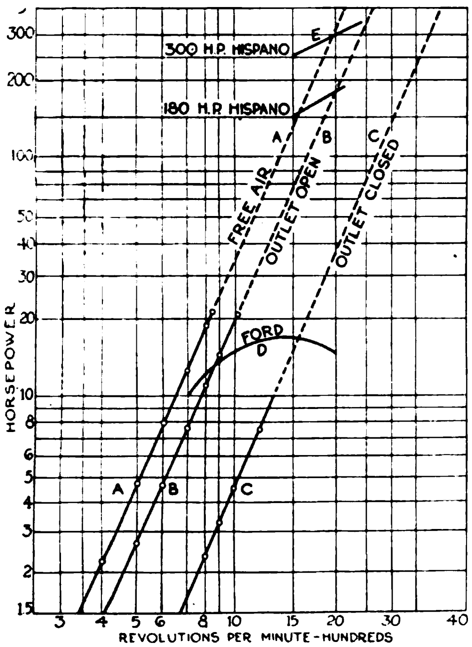


Fig. 2

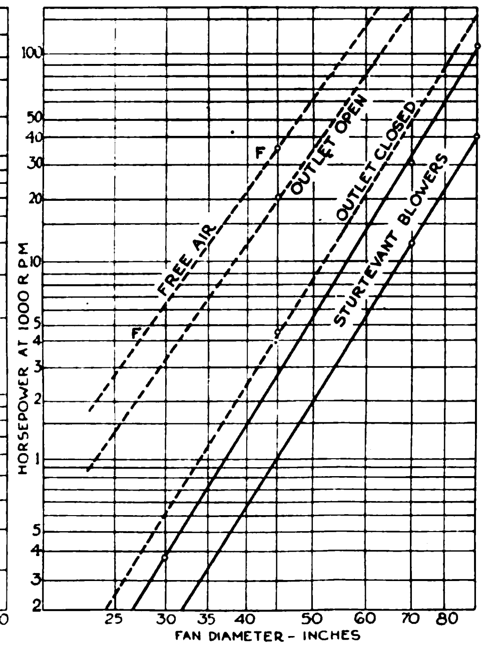


Fig. 3

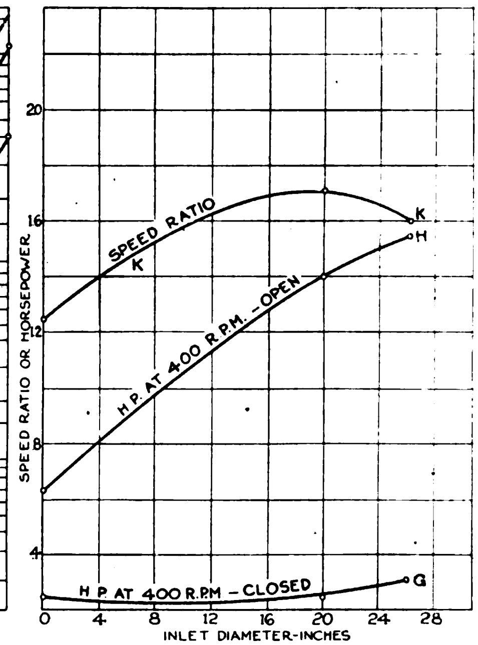


Fig. 4

and power ratios are independent of size of fan, and it is assumed for the purposes of this work that this is also true for fan brakes. The dotted lines are for the type of fan brake shown in Fig. 1. Each is drawn through one observed point with a slope of 5 to 1. They can be used to determine the size of fan required to run a test on a given engine provided an approximate horsepower-speed curve for the engine is known, but a fan built with the nominal diameter indicated on the curve may absorb as much as 10 per cent *more* or 10 per cent *less* power than indicated on the curve.

Fig. 4 shows how the diameter of the inlet affects the power absorbed by the fan and the speed ratio. Curve *H* shows that the power absorbed by the fan with outlet open varies almost directly as the inlet diameter, and curve *G* shows that the power absorbed with the outlet closed remains constant until the inlet diameter becomes greater than the inside diameter of the blades, when it increases. The ratio of any two ordinates on the curve gives the power ratio, which is the cube of the speed ratio, and the speed ratio is plotted as curve *K* to the same numerical scale as the horsepower curves. Curve *K* shows that if the diameter of inlet is *rD* (where *D* is fan diameter), the best value for *r* is about ½, which makes the inlet diameter just equal to the inside diameter of the fan blades. It might be possible to get a greater speed ratio if the blades were made oblong instead of square, with the axial length greater than the radial depth.

The conclusions of this investigation are, briefly:

(1) A fan brake can be made to give a power ratio of 5 to 1 or speed ratio of 1.7 to 1, by means of a variable shuttered housing.

(2) Performance of a fan brake of the same proportions as the one tested but of different diameter can be predetermined within about 20 per cent (i. e., ± 10 per cent from nominal) by means of the curves given. For accurate work a means of measuring torque must be used in conjunction with the fan brake.

British Light Car Movement Extending

(*Continued from page* 649)

confided to the writer his intention to add another 10 cubic inches or so to the capacity of his engine (now just under 100 cu. in.) without varying the chassis or price. This may reduce fuel economy, other things being equal, but it will improve high gear performance and make the chassis less overloaded when fitted with a sedan body—for which quite an appreciable number of buyers are asking, but, again, of high-grade.

Then, Morris, who has a good name and one of the biggest outputs of light cars in England, has put out a six-cylinder engine of the same bore and stroke as his four-cylinder model (2¾ x 4 in.) which, incidentally, has the unit power plant made by the English Hotchkiss Co. But this six-cylinder engine is only a "feeler" in an endeavor to sound the market to find out whether there is likely to be a sale for a super-grade light car.

The writer considers it is doubtful. His opinion is that buyers generally do not want anything bigger than 110 cu. in. for a larger capacity would diminish the economy feature and bring the car into another class altogether.

DURING the war the production of aluminum developed enormously, and many things which formerly were made of other metals are now made of aluminum. At the same time the processes of production have been materially improved. According to the German periodical *Prometheus*, 176,200 tons were produced in 1917, as compared with 84,800 tons in 1914. The United States led with 90,700 tons, followed by France (20,000 tons), Norway, Switzerland and Canada. Germany is compelled to import most of her aluminum or to produce it from foreign bauxites. During the war the German consumption rose from 10,000 to 40,000 tons, and in the near future it will probably reach 70,000 tons.

Refinements in Body Design to Be Seen on Many 1921 Models

Even the moderate priced closed cars use materials equal to those employed in the more expensive cars, this being necessary to insure durability. Still much to be desired in the matter of comfortable seating. Higher backs with better contour will add to comfort of users.

By George J. Mercer

CLOSED cars are quite uniform this year in the matter of interior design, appointments and material. Dealers who supply fabrics say that manufacturers of very moderate priced cars use materials for trimming that are the equal of those used in the more expensive cars. The reason for this is that a car must not only look well when new, but it must look well after service. Consequently the cheaper cotton velours that were used during the past year when materials were hard to obtain, have on account of their poor wearing quality been discarded. They have, however, temporarily hurt the sale of the mohairs, because while they look like them they do not wear the same, and besides there are more cars with a fine grade of wool fabric having a semi-smooth finish for trimming than usual.

It is a fact that real service and comfort have not in the past been such important elements in connection with body parts as they have become of late. Interior appointments such as lights, door and regulator handles and vanity cases must of course be uniform in design. The buyer may not have the requisite knowledge to understand cloth fabrics and painting, but if he is to remain sold, the cloth must not show a mark each time it is sat upon and the paint must not lose its luster in a short time.

There is still much to be desired in regard to comfort in seating and this will come in time. It can only be gained by having the cushion and back fit the human anatomy. The average cushion is generally most to blame in its relation to the height of the seat side. As a rule the springs are fairly good, but the backs are not comfortable on most open cars and the front seat back on closed cars is seldom right.

We have had a long era of the plain pleat. This type is readily adapted to quantity work and is easily kept clean, but too often the shape is a rounded contour from top to cushion, whereas a decided improvement would result if one row of buttons were placed at the height of the shoulders. This would draw the trimming in at that point and hold the bulge out below to fit the back below the shoulders. Providing there is sufficient slope to the back, the appearance made in this way appeals to the eye as being right. It is actually more comfortable in service. Sufficient height is also necessary in the case of the front seats of both open and closed bodies. This height is not sufficient for comfort in many cases, but it is not easy to gain more height as bodies are now designed. The rear seat can and should be 20 to 21 in. above the cushion, measured along a line parallel to the back from the cushion before it is depressed.

As will be seen from the accompanying photographs, mohair trimming is used for the Cadillac coupe, a conspicuous pattern being employed on the seats and plain material above. The LaFayette has a very inconspicuous pattern and plain material for sides and roof. The Cadillac coupe uses arm rails on the folding seat. The LaFayette limousine has an enclosure for the folding seats with locker space above.

In the Locomobile limousine the doors are paneled with carpet at the bottom. On all closed bodies the doors are without pockets. On this body arm holders are used. There are two dome lights and no corner light. The tendency to increase the power of the dome light and dispense with corner lights is growing.

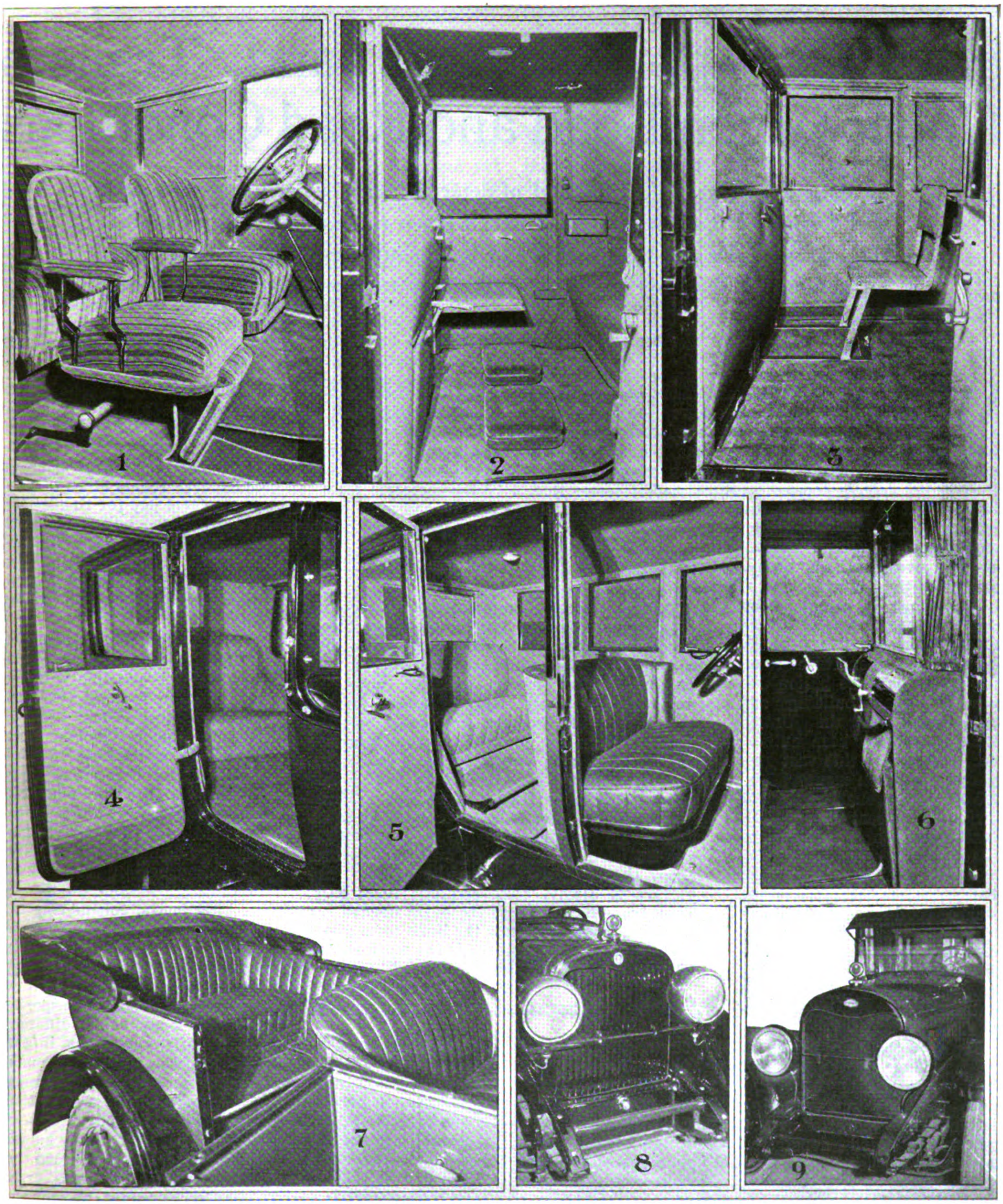
The Packard sedan is also a cloth trimmed body, but leather covering is used on the driver's seat. The back of this seat is higher than usual and more comfortable looking. The doors are plain and there is one dome light.

The Pierce cabriolet is a good example of a high class town car and is trimmed in broadcloth. In the Lincoln limousine cloth trimming is employed and the doors have carpet at the lower edge. The folding seats are of the flush floor type.

The Lincoln touring body is a good example of comfortable seating arrangement. The backs are high and well sloped and the cushions low and well proportioned.

The radiators of the LaFayette and the Lincoln are good examples of the tendency to abandon straight lines for the inner contour of the shell. Practically all the new radiators have departed from the old practice of using a straight line at the top, and now that the tendency also is to have rounded lines on the outer contour, the new inner lines are in keeping and a pleasing contrast to the style just passing out where the use of straight angular lines was somewhat overdone.

THE Midvale Steel Co. had an educational exhibit at the recent Columbus Tractor show intended to convince the tractor engineer that it pays to use rolled gear blanks in tractors in preference to cast iron blanks. A standard cast iron gear was shown on which a weight of 200 lb. had been dropped from a height of 6 ft., the gear being broken into four pieces by the first blow. A rolled steel gear subjected to the same test showed no serious effect after 20 blows. Gears were also shown out of which teeth had been broken in a testing machine and the force necessary to break the teeth measured. Two teeth in the cast iron gear had broken under pressures of 7515 and 5360 lb. respectively. With rolled steel gears without any special treatment it took 32,000 to 34,000 lb. to bend the teeth over. The teeth of the heat-treated gear required pressures of 40,000 to 42,000 lb. to break them.



(1) Interior of Cadillac coupe. Mohair trimmings are used, that on the seats having a pronounced stripe, while the other trimming is plain. The folding seat has folding arm rails. (2) Interior view of Pierce-Arrow cabriolet, trimmed in broadcloth. (3) The folding seats used in the Lincoln limousine are of the flush floor type. (4) On the Locomobile limousine a panel of carpet is fitted at the bottom of the door. (5) Packard sedan has leather covering on driver's seat, but other interior trim is cloth. (6) The Lafayette limousine is provided with lockers above the space into which the folding seats disappear. (7) The Lincoln touring body has high, well sloped seat backs which, together with low, well proportioned cushions, make for comfortable seating. (8 and 9) The Lincoln and Lafayette radiator shells are good examples of the practice now becoming popular of using curved inner as well as curved outer contour lines.

How to Apply Trucks and Trailers Under Given Load and Road Conditions

Explanation of graphical method of determining how much a given truck and trailer equipment can haul over a given route under various conditions as to grades and road surfaces to be encountered. Method can also be applied in selecting the best equipment to meet given conditions.

By Marius C. Krarup

WHILE trailers and semi-trailers are being employed in increasing measure, the large appropriations now made for road improvements in many States make it probable that the use of these auxiliaries in transportation will leap ahead at an unprecedented rate in the near future, and it seems that a development of this nature, provided it proves itself justified, may cast into the shadow, by its sheer economical importance, any other feature in the evolution of motive power for the highways.

According to recent statements by the Good Roads Board of the American Automobile Association, expenditures totalling more than one billion dollars for road building and maintenance in the United States have now been authorized, and out of this vast sum of real American money $550,000,000 will probably be spent during the current year of 1921. Practically the appropriations of four years are available for 1921 and 1922, as so far very little work has been done on the basis of bond issues of 1918 and 1919, owing to high prices for materials and labor as well as shortage in the flatcar rolling stock required for hauling road materials to their destinations by rail.

Figuring the cost as high as $10,000 per mile, which is the maximum allowed in California, for example, there is thus an immediate prospect of having 10,000 additional miles of highly improved highways in the United States within a few years. A vast amount of hauling is done over existing roads, done at whatever cost, because necessary in the ever expanding work of upbuilding and cementing the material elements of civilization in a resistlessly prospering country where all backward waves are of short duration. But this work is done in streaks. It is estimated in Illinois that in that State about 90 per cent of the hauling is done over 10 per cent of the improved roads, and those the roads so well improved and located that motor trucks and trailers can be operated over them with maximum profits without question. So great is the competitive economical pressure in the price of hauling that the march of enterprise and improvements naturally follows the lines of smallest transportation cost. The figures may be rough, but the reasoning is tried and sound, and the 10,000 miles of new and highly improved roads become an augury of a tremendous wave of new productive business activity. A most extraordinary amount of business transportation work can be done over 10,000 miles of good roads, and must be done to make them pay for themselves. Located where they are most needed, they will create work and business which would not be done without them. The transportation work will go to those who can afford the lowest bid.

EIGHT truck manufacturers recently wrote answers to the question "How Much Can a Truck Trail?" and, while they differed in viewpoints, all agreed on emphasizing that every instance must be analyzed separately. In the present article the author shows how any case may be analyzed in a few minutes. Anyone who can specify his roads somewhat as a small portion of a route is specified in Fig. 5 can answer his own trailer questions. Those who know their roads less well must be satisfied with a less definite answer. The method can be used backward as well as forward. Draw the desired work on the graph. The picture is always four straight lines only. Then trace backward to the outfit needed for realizing them. Or draw the lines for a given outfit on the graph and see if the work shown by the lines is suitable.

If all that is claimed for trailers and semi-trailers can be verified, it is possible with the aid of them to haul two tons almost at the normal price of hauling one by motor truck alone. It is possible in most cases to haul four cubic yards of merchandise in one trip where the motor truck alone, with its more limited volume-capacity, could transport little more than half of this bulk in practically the same number of working hours, considering especially that a working day is a unit which cannot always be lengthened or shortened to suit the work at hand. And it is possible to handle transportation over a number of different routes with close reference to daily variations in the requirements for each route. Railway trains are made long or short on the same principle, an ideal roadbed being at disposal to permit it. It is proved to the satisfaction of many that trailer service involves these advantages if the conditions are favorable, but it is not yet widely known just how favorable the conditions must be, how good the roads, how suitable the motive power and the gears, or to what extent trailer service may be extended to common roads without running up against uncertainties similar to those which hampered motor truck service in bygone days, and even during the recent war when extraordinary conditions were encountered.

These questions are almost identical with an inquiry about the utility of trailer service in conjunction with any ordinary installation of motor trucks operated with little reference to road conditions, taking them as they come,

but with a keen eye to a given set of business requirements, and the questions are therefore doubly interesting and timely. The answers as usually given involve terms and ideas with which the consumer is not quite familiar. Drawbar pull is figured by formula from engine specifications and "mean effective pressures." The application to any particular instance follows through a little series of arithmetical operations, simple enough for engineers who habitually reason in mathematical channels and have faith in the outcome, but forbidding to most laymen and not quick enough for executives. At the first technical knot in the thread of the demonstration they quit following. At the second they make up their minds that they will have to fight it all out with experience anyway, preferably with other people's experience. And so they decide to go slow, perhaps too slow. It is attempted in the following to sketch a method of investigation which is correct enough, can be easily amplified and which will remain alive and useful when passed on to the numerous actual and prospective consumers interested in deciding to what extent trailers and semi-trailers can be used advantageously under different conditions.

Table I shows the drawbar pulls obtainable at vehicle speeds from 1 to 20 miles per hour when certain net horsepowers are delivered at the rims of the driving wheels. Net horsepowers such as 15, 20 and 30, it is safe enough to figure, can be obtained from engines whose brake-horsepowers are rated 22½, 30 and 45, respectively, the efficiency of the transmission mechanism of the vehicle being taken as ⅔ or 67 per cent. This is a low rating for purely mechanical efficiency, but perhaps not too low for rough service when no other allowance is made for possible maladjustment of carburetors and cooling systems. At all events, the estimate can be suited to circumstances, the point at issue being the net horsepower delivered at the wheel rims. When the net horsepowers available for traction are taken as the starting point, questions of maximum engine speed and of cylinder dimensions are eliminated from the problem of ascertaining what can be done with trailers. It might be a comfort, however, if makers of trucks and tractors, who are in the best possible position for testing out the efficiency of their transmission gears, would generally adopt the practice of mentioning the maximum drawbar pull for each gear speed and a given diameter of driving wheels. And, if the engine is adapted for more than one fuel, the drawbar pulls for each of the fuels would make interesting reading for users.

The schedule of Table I can, of course, be expanded to include all net horsepowers of interest. The figures are obtained as follows: One horsepower overcomes a resistance of almost exactly 375 pounds at the rate of one mile per hour. From this figure all the drawbar pull figures are readily derived, being proportionate to power and inversely proportionate to speed. The column of speed figures in feet per second is given only to help in realizing what the different speeds mean in visible motion, as it is sensed by an onlooker. The table proves useful for the two main purposes, (1) to decide what can be done with trailers in conjunction with the trucks or tractors one has on hand, and (2) to decide what powers and gears would be preferable in trucks, tractors or tractor-trucks for the work one has on hand, the latter element including consideration of the local roads, maximum loads, and of the desired vehicle speeds. Drawbar pull in this connection is not, of course, understood to be the pull a motor vehicle can exert in addition to that required for moving itself, as sometimes applied in the case of traction by horses or traction engines, but includes the whole pull that can be developed by the motor unit. In all cases the drawbar pull has to overcome the whole traction resistance of the whole weight moved, and it is convenient to look upon this resistance as a percentage of the weight moved and as composed of two elements, one due to road grade, which is constant for a given route, and one due to road surface, which is nearly constant on the best roads, but highly variable, through the influence of weather and poor drainage, on poor roads.

A limitation to the increase of drawbar pull by gear reduction is imposed by the possibility of slip which occurs when the frictional resistance to spinning the driving wheels is smaller than the resistance to traction. The slip factor on hard and dry roads usually exceeds 60 per cent and permits a traction resistance not exceeding 60 per cent of that portion of the whole weight which rests over the driving wheels. On roads of looser structure the slip factor may drop below 40 per cent, and on roads made slippery by rain or snow to a much lower figure, which is, moreover, so variable from one spot to another that calculation is useless. The remedy is either to make the percentage of weight carried over the driving wheels high, as is done in motor trucks with large overhang and more radically in fourwheel-drive trucks, or to raise the slip factor by the well known means of traction rims on the wheels, traction chains or blocks, and to a certain degree by knobs on tires. The first method has the advantage of not raising the traction resistance but is not effective in extreme cases and not readily adapted to trailer service, in which it is the first principle to trail rather than to carry the load in order to secure large load space and other advantages. By the second method troublesome and incalculable slip is transformed into a not very objectionable increase of traction resistance accompanied by a dependable slip factor permitting the use of strong drawbar pulls.

When all the elements in truck and trailer operation here mentioned are made directly visible on a chart, it becomes possible to tell at a glance, almost, what may be done over a wide range of different circumstances. The matter of time consumed will be seen to depend largely on a favorable selection of gears.

Fig. 1 represents road conditions, including road grades up to 20 per cent and road surfaces causing traction resistances up to 20 per cent of the weight moved. The grades are scaled

Table I—Drawbar Pull Obtainable at Speeds From 1 to 20 Miles Per Hour From Net Horsepower Available at Rims of Driving Wheels

Miles per Hour	Feet per Second	Net Horsepower Available at Rims of Driving Wheels														
		1	5	10	12	14	16	18	20	22	24	26	28	30	35	40
1	1.47	375	1875	3750	4500	5250	6000	6750	7500	8250	9000	9750	10500	11250	13125	15000
2	2.93	187	937	1875	2250	2625	3000	3375	3750	4125	4500	4875	5250	5625	6562	7500
3	4.40	125	621	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4375	5000
4	5.86	94	468	937	1125	1312	1500	1687	1875	2062	2250	2437	2625	2812	3281	3750
5	7.35	75	375	750	900	1050	1200	1350	1500	1650	1800	1950	2100	2250	2625	3000
6	8.80	62	311	625	750	875	1000	1125	1250	1375	1500	1625	1750	1875	2187	2500
7	10.26	53	268	536	643	750	857	964	1071	1178	1285	1392	1499	1607	1875	2143
8	11.72	47	234	468	562	656	750	843	937	1031	1125	1219	1312	1406	1640	1875
9	13.29	42	208	416	500	583	666	750	833	916	1000	1083	1166	1250	1458	1666
10	14.67	37	187	375	450	525	600	675	750	825	900	975	1050	1125	1312	1500
11	16.13	34	170	341	409	458	545	613	682	750	818	886	954	1022	1175	1363
12	17.60	31	156	312	375	437	500	562	625	687	750	812	875	937	1093	1250
13	19.07	28	144	281	346	404	461	519	578	634	692	750	807	865	1009	1154
14	20.53	27	134	268	321	375	428	482	536	589	642	696	750	803	937	1071
15	22.00	25	125	250	300	350	400	450	500	550	600	650	700	750	875	1000
16	23.47	23	117	234	281	328	375	421	469	515	562	610	656	703	820	937
17	24.93	22	110	220	264	308	353	397	441	485	529	573	618	662	772	882
18	26.40	21	104	208	250	291	333	375	416	458	500	541	583	625	729	833
19	27.86	20	98	197	236	276	316	355	394	434	473	513	552	592	691	789
20	29.33	19	94	187	225	262	300	337	375	412	450	482	525	562	651	750

Net horsepower available at rims of driving wheels may be taken as ⅔ of engine's brake horsepower.

vertically and the surface conditions horizontally. A small area at the lower left corner of the graph represents highly improved roads. The adjacent area in lighter shading represents inferior road conditions, including the steepest grades and poorest surfaces likely to form more than a negligible portion of the mileage in any territory where the commercial demand for haulage would justify regular motor truck or trailer service. All the rest of the area represents conditions which are met only sporadically and for very short distances, so that they do not appreciably affect the time consumed in covering a route, even if low gear must be employed in overcoming them.

The grade scale stands for the usual "per cent grades." Fig. 2 shows that this scale is not strictly proportionate to the drawbar pulls required for hauling loads. The line *AC* is the 20 per cent grade, but the line *BC* is the grade demanding a drawbar pull twenty times stronger (apart from the traction resistance of the surface in both cases) than that required for a 1 per cent grade. *AE* is the 10 per cent grade, and varies so slightly that the difference can scarcely be illustrated, from the grade over which the distance travelled is exactly ten times the rise of the road, making the needed pull just ten times smaller than the weight hauled. The discrepancy grows progressively as the grade gets steeper but is unimportant and not even sufficient to balance against another small discrepancy arising from the fact that the low gears required for the steeper grades nearly always are slightly less efficient than

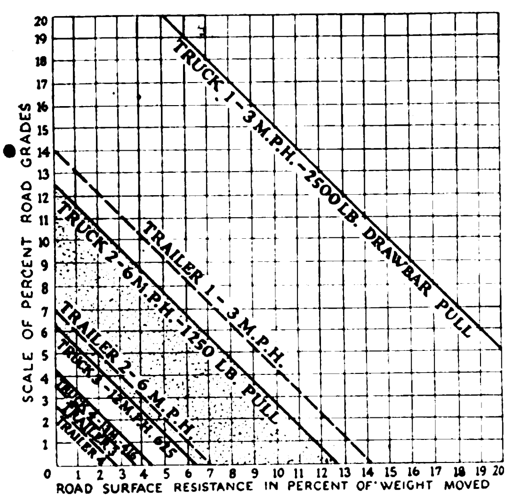


Fig. 1—Graph of resistances to vehicle movements due to grades and irregular or soft road surfaces Each square represents a total resistance determined by its vertical and horizontal distance from the zero point at the lower left corner. The light area at this corner therefore represents good roads having light grades and favorable surfaces. The adjoining area in shading represents common roads, and the rest of the squares difficult and unusual conditions increasing in severity toward the upper right corner. The oblique lines show the total resistance which can be overcome on each of the four gear speeds of a loaded truck and by the same truck when pulling a loaded trailer

the higher gears. These matters, while worth watching to avoid serious errors, sink into insignificance compared to the looseness in estimates of grades, surface resistances and distribution of weight and loads which can never be avoided in practice.

The scale of surface resistance in the graph, Fig. 1, is based, like that of grades, on an addition to the traction resistance equal to 1 per cent of the weight moved for each higher numerical unit on the scale. Only a small portion of it, up to about 5, represents normal surface resistances

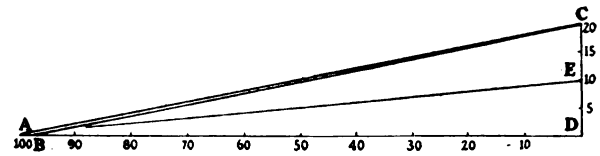


Fig. 2—Illustrates the small difference between a "20 per cent grade," AC, and the grade BC on which that portion of the resistance to traction which is due to grade alone, exactly equals 20 per cent of the weight moved. In the case of the "10 per cent grade," AE, the difference is too small to be shown, the two lines almost coinciding. The grade BC equals AD in length

of those roads on which something like 90 per cent of truck and trailer traffic is carried on at present. Paved and macadamized roads usually make less than 2 per cent of resistance on level stretches. Old brick, asphalt or wood blocks often raise the resistance to about 3 per cent before repairs are made. A macadam road considerably broken up easily reaches a resistance of 5. The average earth road, when dry and fairly hard, is rated at 2 to 6. Wet and rutty it may defy all estimate, being so variable, but this condition is rarely combined with steep grades, except in clay on mountainsides. It may be slippery, too, requiring an additional rating for the use of traction devices to avoid slip. Loose gravel is supposed to raise the resistance to as high as 15. Plowed land or sand may bring it to 20 or higher. There is nothing firm or final about the ratings, and the graph gives only the division on a percentage basis. All have to guess more or less as to what percentage of resistance a poor road surface offers. Only good roads are uniform.

There is shown on the graph the scope of road conditions that a loaded 2½-ton truck, weighing five tons, can cope with on each of its four gears, having an engine delivering 20 net horsepower at the wheel rims and carrying from two-thirds to seven-eighths of the total weight over the driving wheels. The gear speeds are taken to be 3, 6, 12 and 18 miles per hour. These are hurry gears for a truck of this size, but it is the object to pick an example rather unfavorable for trailer service, thereby bringing out more strongly what the effect of a great addition to the good-roads mileage is likely to be, such roads being shown to permit heavy trailer service at fair speeds even with unfavorable proportions of the gears of the motive power. Other power, gear and load combinations can be tried out in a few minutes by the reader with the aid of Table I and a sheet of paper ruled in squares.

For the truck selected, the oblique lines marked "Truck 1," "Truck 2," "Truck 3," "Truck 4," cut off to the left of them all the road conditions that can be negotiated in each case. As shown in Table I, the low gear gives a drawbar pull of 2500 lb., and this will admit of climbing a grade of 25 per cent, as 2500 lb. is 25 per cent of 10,000 lb., the total weight. But grades above 20 per cent need not be considered. So the line is drawn from the point in the graph denoting a 20 per cent grade combined with a 5 per cent surface resistance to the point representing a 5 per cent grade with a 20 per cent surface resistance. At all intermediate points along the line the sum of the grade resistance, shown on the ordinate (vertical), and the surface resistance, shown on the abscissa (horizontal), is 35. At all points to the left of the line the sum is smaller, denoting easier road conditions.

On the second speed, giving 6 miles per hour, the truck can negotiate grades up to 12½ on the best roads, or it can climb grades up to 2½ on roads giving the enormous surface resistance of 10 per cent, as the graph shows, the second line being laid down on the same principle as the line for the low gear.

The line for the third speed, or 12 miles per hour, takes in all roads that may be designated as good, having no grades above 4 per cent and no surface resistances above 3 per cent. And in addition it takes in well-surfaced roads up to 6 per cent grades and poorly surfaced roads with grades from 0 to 4.

The high speed, 18 miles per hour, will, of course, not ordinarily be employed with full load, but the graph shows that it can be employed on the majority of good roads. Usually the engine will be throttled to reduce the speed, with some loss in fuel efficiency.

Now let the trailer loaded with another 2½ tons of merchandise be hitched to the truck. Such a trailer may weigh about 1½ tons, making the addition to the weight hauled 4 tons and the total 9 tons, or 18,000 lb. The drawbar pull figures remain unchanged, and the load on the driving wheels is also the same as before. To get the lines showing what roads can be negotiated, it is only necessary to figure the new percentages of the total weight which the drawbar pulls now represent. If 2500 lb. is 25 per cent of 10,000 lb., what percentage is it of 18,000? Multiply by 10 and divide by 18. This gives a shade below 14. The line marked "Trailer 1" is drawn accordingly to show what truck and trailer with a combined load of 5 tons and a weight of 9 tons can do on low gear. Proceeding by the same method, one sees that the drawbar pull of 1250 lb. on second speed represents 7 per cent of the total weight, and the line drawn accordingly, from 7 grade to 7 surface resistance, takes in practically all good roads and a majority of common roads at 6 miles per hour. The third speed with trailer takes in the larger portion of good roads at 12 miles per hour. And in most cases much of the larger portion, perhaps usually as much as seven-eighths of the mileage of a route lies over roads of this character, so that little time is lost in comparison with the truck alone, which on the same roads often must be held down to about the same speed for reasons of prudence, maintenance cost and legal rules for heavy traffic. On high gear, at 18 miles per hour, the trailer outfit takes in grades or road resistances up to 2.3 per cent.

In all cases a slip factor (traction coefficient) of 40 per cent is sufficient to secure the hauling of the trailer, as the minimum load at the contacts of the driving wheels with the road is 6667 lb., and for trucks of the overhang type more than 8000 lb., while the maximum drawbar pull is 2500 lb.

Special resistances may arise. The use of traction devices to overcome temporary slipperiness may be considered as normal and included in the scope of the graph, justifying an increased rating of the surface resistance by 1 to 2 per cent, and allowance may likewise be made for the additional resistance encountered on curves and especially at sharp turns, due to misdirection of the drawbar pull. Starting with the wheels in a hole may cause difficulty which the driver cannot always avoid. At the top of a hill, with the trailer still on the slope, a similar increase in resistance occurs. The graph shows that the low gear will take care of these factors, even all combined, unless the otherwise existing road condition calls for low gear and nearly exhausts its capacity. If a route contemplated for trailer service presents possibilities like those mentioned, provision should, of course, preferably be made for them in laying down the low gear line and selecting motive power, gears and loads in such manner that the required low gear line can be realized.

There is need of a good scale of surface resistances. Some experienced road specialists may have the data, but there is a difficulty in designating the different materials and qualities by such terms that anybody can identify them with the actual condition of an actual road which he has in mind from personal observation or which has been carefully described to him. Some data on the effect of wheel diameters also remain to be collected, as large semi-trailer wheels, for example, meet smaller surface resistance than ordinary truck and trailer wheels, yet not always in inverse proportion to diameters. Hauling is not meticulous laboratory work, however. With a few fixed surface data, distributed along the scale from 0 to 15 per cent and well authenticated, one who estimates a given route should have no trouble in assigning the proper per cent value to intermediate road qualities not specified on the scale. Experience in distinguishing sharply between grade and surface resistances is perhaps the main personal requirement. At worst the low gear will take care of many errors, so far as muddling through is concerned. A determined call for the best surface resistance scale, well phrased and possibly illustrated, might elicit something of great interest in this connection, as well as in other directions.

The method which has now been outlined permits a good deal of experimenting and demonstrating to be done handily on paper, and it may be turned to account for good salesmanship and for securing the best utilization of any fleet of motor trucks and trailers operated over a number of routes. At one point of some importance Fig. 1 is lacking, however. It fails to visualize or suggest the time factor, because a square representing a bad road condition, of which there may be a fraction of a mile, is just as large and prominent on the graph as another square representing a road condition of which there may be twenty miles. Trailer time often comes near equalling

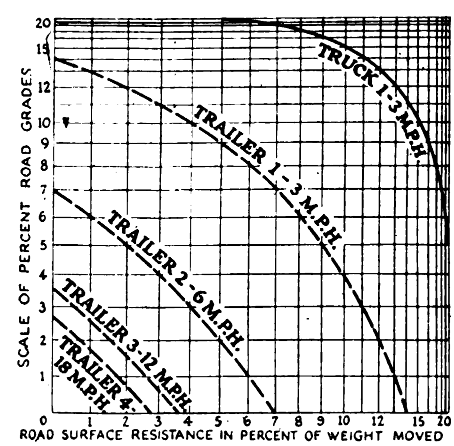


Fig 3—Graph picturing road conditions somewhat in proportion to their prevalence, each square or rectangle representing a certain total resistance to traction by its location, and the probable frequency or mileage by its area. The curves represent the same truck and trailer as the oblique lines on Fig. 1, the whole area to the left of them denoting roughly the share of all road conditions which can be negotiated in each case

truck time, because those bad or steep stretches are very short, which call for a lower gear with the trailer than with the truck alone. As no two routes are quite alike, the running time can be figured closely only by means of specifications or charts for each route, but a general idea of distances, difficulties and time consumption can be conveyed by means of a graph like Fig. 3 and the tell-tale gear lines laid down in such a graph. It may be used in the same manner as Fig. 1, and the lines shown in this case are the low gear line for the same truck as in Fig. 1 and all the lines for the trailer outfit from Fig. 1. These lines here become curves. This graph is shown here not because it is believed to be thoroughly practical with reference to trailers. It sacrifices simplicity too much for this

purpose and is not specific enough. It illustrates a situation but does not give figured values for distances and time. But it is presented because it may be found particularly useful for choosing, examining and demonstrating the capacities of trucks and tractors whose relations to their work are judged on a plan of generous allowances in matters of power and weight for the overcoming of exceptional difficulties when the need arises.

Each of the small squares or rectangles in Fig. 3 pictures by its comparative area the probable frequency or mileage of the road condition, or working condition, which is designated by its location in the graph. So far as roads are concerned, as all roads are intended for removing difficulties in transportation, it is a fair assumption that frequency or mileage of a given road feature is in inverse proportion, on any given route, to the difficulty or road resistance it presents. The nature of the graph is based on this assumption, which may be extended to tractor work with some modifications, and should be useful for estimating the required types and specifications of vehicles, with the time factor easily if not accurately included in the considerations. But this interest is largely professional.

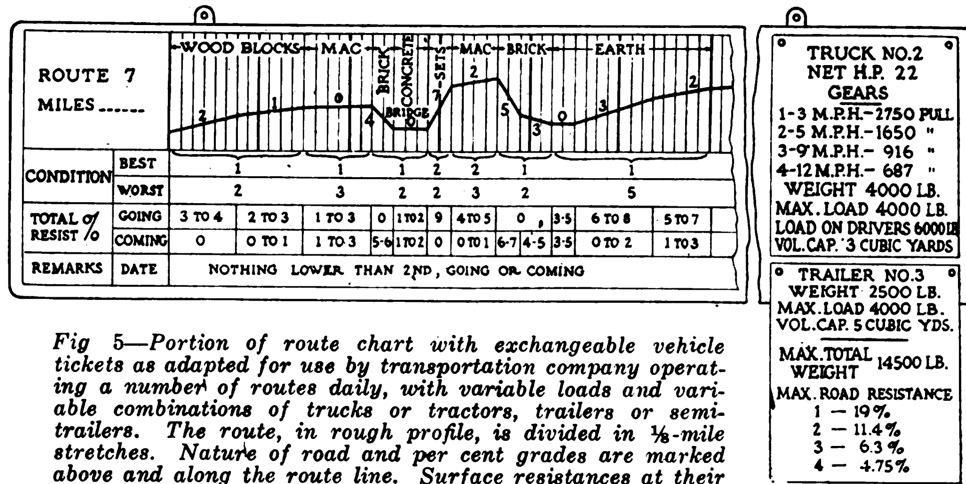


Fig 5—Portion of route chart with exchangeable vehicle tickets as adapted for use by transportation company operating a number of routes daily, with variable loads and variable combinations of trucks or tractors, trailers or semi-trailers. The route, in rough profile, is divided in 1/8-mile stretches. Nature of road and per cent grades are marked above and along the route line. Surface resistances at their best and worst are marked below. Total road resistances are footed up, subject to whatever changes may occur in the road condition from day to day. In practice, only the doubtful stretches should be considered, and these mainly when unusual loads require an unusual combination of the vehicles

With closer reference to trailer work and the timing for routes whose peculiarities are known and may be charted, one reverts to the simpler type of graph. Fig. 4 shows one way in which the normal resistances of a route may be marked with their corresponding mileage upon those squares in the graph which represent the various resistances concerned. Gear speed lines for available transportation units and desired loads may be laid down, and it may then be observed to what extent the marked squares come inside or outside (left or right) of the respective speed lines. Time can then readily be figured, and the method is not laborious when Table I and graph blanks are at hand.

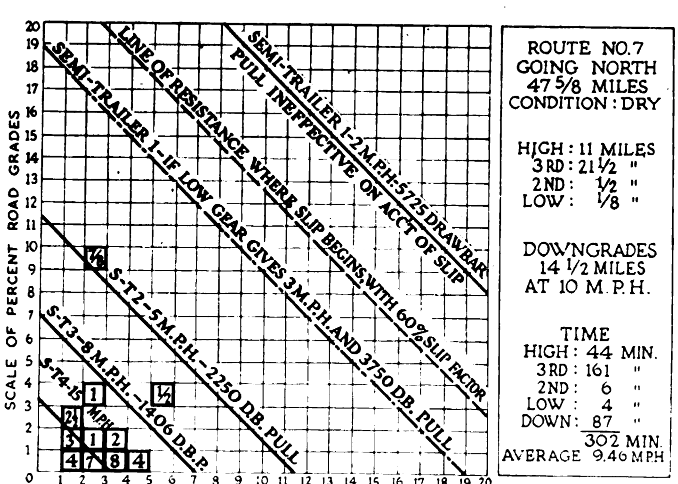


Fig. 4—Graph on the same plan as Fig. 1 and showing the work and working limitations of a semi-trailer outfit. Without connection herewith, there is indicated on the graph, by marked squares and figures in the same representing mileage, a system for viewing the road conditions of any given route in relation to the hauling capacity of a transportation outfit, including timing of work over the route

Fig. 4 shows the lines for a tractor-truck with semi-trailer in addition to the markings for a supposed route. The following data are assumed for the semi-trailer outfit: Horsepower 30 at the driving wheels, gears 2, 5, 8 and 15, weight of tractor-truck 2½ tons, weight of semi-trailer 1½ ton, payload 6 tons, weight on drivers 3¾ tons, weight on trailer wheels 4¾ tons, total weight 10 tons. It will be noticed on the graph that in this case the low gear cannot be made useful up to the power limit without the use of special traction devices for raising the slip factor.

Traction resistance on downgrades need rarely be considered, and the timing for downgrades may be estimated somewhat according to the degree of caution desired of the driver. If heavy surface resistance occurs on a light downgrade the net resistance can, if necessary for completeness, be marked under the base line of the graph. To illustrate the possibilities, the writer remembers one serpentine downgrade six miles long and averaging 13.2 per cent on which the pull of the grade was not everywhere sufficient for overcoming the drag of the sandy roadbed. And a great deal of trailing had been done over it, not by motor truck, but by 20-mule teams.

Fig. 5 shows a plan for a separate route chart that may be pieced up in sections—since routes, too, may vary from day to day—and pictures the road data for both directions of travel. It can probably be much improved in the hands of skilled fleet operators, as by eliminating all detail of features which present no difficulties.

While the method described in the foregoing for tracing the requirements in horsepowers and gears are applicable to ordinary motor truck work as well as to trailers, something of this order is no doubt more widely needed in connection with trailer equipments, as these are very low powered transportation units for their loads and cannot possibly be as independent of road conditions as trucks must be in order to be saleable, while, on the other hand, they exhibit ample justification over a wide range of conditions and circumstances, partly by moving loads too heavy for trucks of general utility and perhaps even more by large volume capacity and great flexibility in their adaptation to varying demands. In this article the only aim has been to indicate an easy way to estimate with some degree of accuracy the ton-load and ton-mile capacities that are compatible with any set of road conditions, in which estimate the X may be on either side of the equation.

A Commercial Monoplane Designed to Carry Pilot and Six Passengers

Clean design with minimum parasite resistance and efficient wing curve said to result in excellent performance. Wings externally braced. Both passengers and crew have clear vision downward.

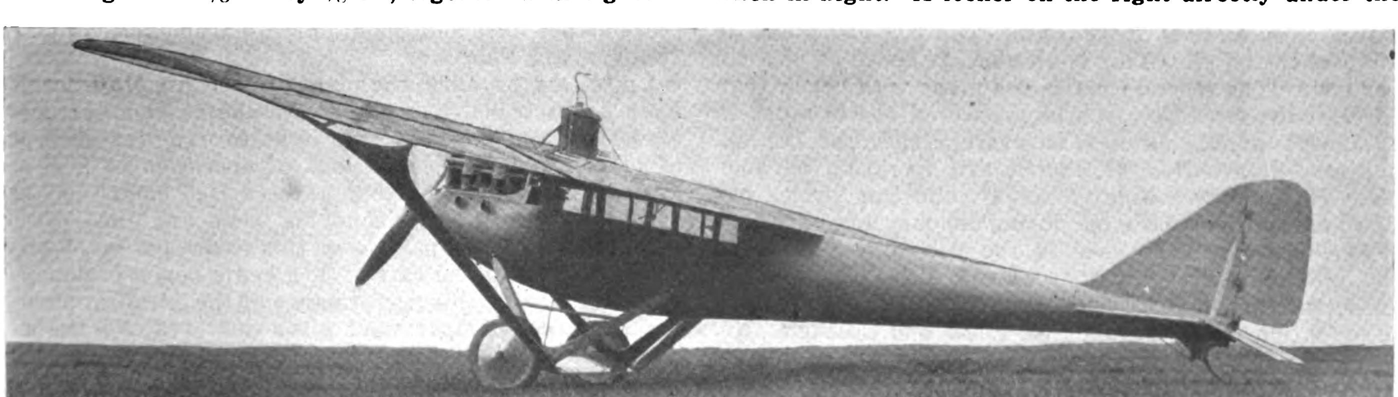
THE monoplane shown in the accompanying photographs was built expressly for passenger carrying purposes and with the object in view of providing a strictly commercial ship embodying efficiency and comfort.

An externally braced monoplane is used to make possible a thin wing section with consequent high efficiency at high speeds. The wings taper in plan from the fuselage to the tips and are constructed of wood and fabric. The webs and beams used are said to be of more liberal design than those used in standard biplane wings of equal dimensions. There are, besides the usual two beams, twelve auxiliary strips linking the webs together and adding greatly to the strength of the wings. The wings are braced by Y-shaped struts which pass from a tie rod just back of the landing wheels to a point about two-thirds out on the wing, the strut dividing and fastening directly onto each beam. The planes themselves have a small dihedral. Large ailerons are cut into the trailing edge of the wings and are actuated by a strong and positive system of tubes and cranks which connect them with the dual stick control.

The landing gear has its two wheels spaced with a 7-ft. tread, which makes it easy to avoid tipping when landing. The wheels are of the wire-spoke extra strong type and carry 750 x 125 mm. tires. They are mounted upon a 2-in. tubular axle. Streamlining between this axle and the tie-rod holding the wing struts is in the form of an airfoil, the axle being the leading edge and the rod the trailing edge. Landing shocks are absorbed by rubber cords, which allow the axle to rise against stops 6 in., the leading edge of the small airfoil rising with it and the rest of the airfoil remaining in place.

The design embodies unusually clean lines. The fuselage merges directly into the center section, the roof of the passenger compartment being ply-wood and conforming to the wing curve. The fuselage is made up of six main longerons 1⅝ in. by ⅞ in., together with eighteen longitudinal ribs ⅞ in. by ⅜ in., all of which are supported by fourteen ply-wood bulkheads and inclosed in a laminated covering ¼ in. thick, thus forming a rigid structure. The fuselage terminates at its rear in an aluminum casting in which the rudder and elevators turn. The passengers are accommodated in three seats arranged in tandem. The first seat accommodates two people, either of whom may pilot the plane or, with one stick removed, one may pilot and the other be a passenger. The second seat holds three people and the rear one two. Entrance is through a door on the left side and at the front of the compartment, a portion of the first and second seats hinging to enable easy access to the rear seat. The windows which reach the entire length of the passenger compartment, are placed in a portion of the fuselage which slopes inward at the bottom, thus an excellent view downward is obtained. There is a dome light in the roof of the cabin. The fuselage looks small for its capacity. Head-room is provided by utilizing what would ordinarily be the interior of the center section of the wing.

The rudder is controlled by two sets of pedals, all of which are interlocked and work in unison, being connected to the rudder by cables entirely within the fuselage. The pilots have good forward vision through windshields provided with large openings at the side, making it easy to remove any moisture which accumulates on the glass. Side vision is obtained through the windows already mentioned. There is a mahogany instrument board mounting an air-speed indicator, altimeter, motometer, revolution counter, ignition switch and oil pressure gage. The spark and throttle are controlled by levers centrally located within easy reach of either front seat. There are fuel shut-off cocks within easy reach of the pilot with which he can cut out either or both of the fuel tanks. Small levers within convenient reach of the operator give the radiator shutter any desired setting when in flight. A locker on the right directly under the



The Jacuzzi commercial monoplane, carrying seven persons

instrument board contains the storage battery while a similar locker on the left is available for tools, etc.

The engine used is a Hall-Scott L-6 capable of developing over 200 hp. but in this airplane it is said to require an average output of about 100 hp. at the average flying speed of 100 m.p.h., thus providing ample reserve power, which when all used is said to increase the speed to over 125 m.p.h. Delco ignition and two Stromberg carbureters are used. The engine is mounted in the forward end of the fuselage and turns a propeller 8 ft. 2 in. in diameter.

Precaution is taken against fire by allowing practically no chance for an accumulation of gas or oil vapors in the fuselage. Overflow from the carbureters is led away through pipes. The carbureters receive their air through scoops cut through the side of the fuselage, thus eliminating practically all back-fire hazard. The fuel is carried in two gravity tanks made of copper and mounted in the wings at either side of the fuselage. Fan-driven pumps deliver all fuel in these tanks to their highest point, thus maintaining a constant gravity head at all fuel levels. The portion of the fuselage immediately under the engine is provided with a large number of ventilation holes.

Cooling is by a radiator mounted in unobstructed position and provided with a heavy canvas shutter which when entirely open is rolled up at one side of the radiator. As previously stated, this shutter can be given any desired setting while in flight. The venturi tube of the air-speed indicator is mounted high above the radiator out of the propeller slip-stream and all air disturbances set up by the plane.

The following specifications and performance data are furnished by the manufacturer, Jacuzzi Bros., Inc.:

Length over all	29 ft.
Span	52 ft.
Height (top of radiator)	10 ft. 6 in.
Wing area (with center section)	400 sq. ft.
Weight empty	1,800 lbs.
Weight fully loaded	3,400 lbs.
Fuel capacity	80 gal.
Oil capacity (outside engine)	4 gal.
Fuel consumption per hour	8 to 9 gal.
Radius of action	900 to 1,000 mi.
Speed, half throttle	100 mi. per hr.
Speed, three-quarter throttle	125 mi. per hr.
Minimum landing speed, full load	45 mi. per hr.
Minimum landing speed, half load	38 mi. per hr.
Approximate ceiling	22,000 ft.

According to the builders, the plane handles exceptionally well, the rudder being markedly effective in taxying. The wings are notably rigid in flight due no doubt largely to their great depth near the fuselage and the special interior construction. A landing sufficiently bad to collapse one wheel and bend the axle is said to have failed to indicate weakness in the design or construction of the rest of the landing gear. The performance of this plane is attributed to the unusually clean design in which parasite resistance has been reduced as much as possible, while at the same time a wing section of high efficiency is employed.

One and a Half Million Miles Flown by Air Mail Planes

MORE than one and a half million miles flown by the planes in the Air Mail Service shows that 21 of these planes have traveled more than the distance around the earth at the Equator. The prize plane of these veterans of the air was D. H. Plane No. 76, which flew 38,348 miles in 407 hours and 8 minutes before it went out of service on Oct. 16, 1920. The average speed of this plane was 94.4 mi. per hr. The plane with the next greatest record was D. H. Plane No. 74, which flew 38,381 miles in 420 hours and 15 minutes, and is still going strong across the Sierra Nevada Mountains from Reno to San Francisco. It is one of the planes that the Air Mail mechanics expect to see make a record of 50,000 miles or better. Its average speed has been 89.1 mi. per hr. through the entire period of its activities. This plane added 3443 miles to its record during the months of January and February. Four other De Haviland planes have each exceeded 30,000 miles of operation.

Next to these top-notchers in the mail service stand the two Curtiss R-4 planes. Of these, No. 31 had a record at the close in 1920 of 33,644 miles in 378 hours and 49 minutes in the air. This is an average speed of 88.8 mi. per hour. The second Curtiss R-4 plane with better than 30,000 miles was No. 35, which covered 30,948 miles in 397 hours and 25 minutes, an average speed of 77.9 mi. per hr. Planes Nos. 31 and 35 are operating between New York and Washington to-day, and the former has flown an additional 6885 mi. during January and February.

The first airplanes used in the Air Mail Service on the date of its inauguration, May 15, 1918, were Curtiss JN-4 training planes, Nos. 11 and 12. Both of these are in operation to-day between St. Louis and Chicago. No. 11 has flown 31,208 mi. and No. 12 30,090 mi.

The first planes purchased by the Post Office Department were 8 machines manufactured by the Standard Aircraft Corporation of Elizabeth, N. J., which was in business only during the war. Seven of these eight planes are still in existence, two of them flying daily between Chicago and St. Louis. Their record is 15,781 mi. and 10,256 mi. respectively.

Two of the Glenn L. Martin twin motor mail planes put into service in the winter of 1919 have exceeded 25,000 miles of service. Plane No. 201 of this type has flown 27,757 mi. at an average speed of 75.3 mi. per hr. Plane No. 202 has seen 25,593 mi. of service at an average speed of 89.2 mi. per hr. Both of these two planes are being repaired and overhauled and give promise of getting into the 40,000 to 50,000 miles class.

The Junker all-metal monoplanes are the latest planes put into the Air Mail Service. They have not had the mileage that should have been obtained from them, owing to the fact that they had serious engineering defects in their fuel system and engine installation. One of these planes covered 7677 miles between August and Dec. 31, at an average speed of 81.1 mi. per hr. A second of the all-metal monoplanes has flown 6159 miles. Both of these planes have additional mileage accumulated during January and February.

Up to Dec. 31, 1920, the planes in the Air Mail Service have flown 18,806 hours and 37 minutes and have covered 1,572,450½ miles. This is an average for all types of planes under all conditions of operation of 83.6 mi. per hr. In that period they have carried more than 49,000,000 letters. The mechanics' time and the cost of airplane and repair parts over this entire period of service have been at the rate of 30.5 cents per mile flown.

In announcing this performance of the Air Mail planes, the Post Office Department gives due credit to the mechanics who are keeping them in condition for the daily flights, and the pilots who have handled them with daring and judgment under most trying and adverse conditions of weather.

A Labor Dispute Which Was Settled by Frankness

The following article describes how an Eastern manufacturer succeeded in coming out of labor trouble with more good will from his employees than when he went in. The accomplishment was due to the simple expedient of laying all the cards face up on the table.

IT is possible for an employer to come out of a labor difficulty with more good will from his workmen than when he went it. One executive recently "got together" with his workmen and solved mutual difficulties merely by laying all the facts on the table, even when the difficulties had gone so far as to result in a strike affecting an important "keystone" department. The details of the settlement are of interest to the many other manufacturers who are, unfortunately, meeting similar situations with only too great regularity.

About 1500 men are employed in this plant, which is located in a town of about 15,000 inhabitants. Ever since the establishment of the concern in 1898, it has been the custom of the management to adjust all differences with workers through a committee elected by the employees to represent them. An open shop has been maintained.

Union agents have attempted to organize the plant, but had met with little success over a period of years. Finally, however, they did manage to organize the foundry. Shortly after, a strike was threatened, the demands being for a reduction of the working day from ten to nine hours, maintenance of the present wage scale, and recognition of the union. The management refused to deal with the union agents, but was willing to discuss the wages and hours demand through the usual representative channels.

This status continued for a day or so, when the foundrymen finally did walk out. The next day the management urged the rest of the workers to remain loyal and to choose their representatives for conference so that the actual facts surrounding the demands and the possibility of granting them might be threshed out. One or two men in a certain department were known to be among the ultra-radical group. The management urged that they be elected in the committee representing the workers. One of these men in particular had been putting forth many heated and radical arguments. He was chosen as a member of the shop committee.

When the committee met in conference with the general manager, the latter put the following facts before them:

1. He showed the committee actual charts prepared from production records which proved that since 1914 the production of the plant per man per hour had decreased about 33 1/3 per cent.
2. He showed them similar charts from the foundry production record for the last two years which showed on the graph a very sharp and steady decrease since 1916. the percentage being much greater than for the rest of the plant.
3. He told the committee that he knew the men were loafing; that it was proved by these records. He said that he knew they could produce as much in nine hours as they were now in ten—if they would; they could do it even in seven hours, if they tried.
4. He told them he had known of this condition for a long time, but had said nothing in the belief that after the war things would settle down and conditions would return to normal; but that present conditions could not continue if the plant was to go on operating successfully.
5. He explained to them that local conditions had much to do with the number of working hours. In this town no workman lives more than a mile from the plant, most of them within five minutes' walk. Thus they have as much time at home as the man in New York City who actually works only eight hours.

When these facts had been presented, a lively discussion followed in which nearly every member of the committee took part. Objections were brought up and were answered by the general manager. One of the outgrowths of the discussion being that the radical member of the committee was unable to successfully defend in open forum and in the face of true facts laid on the table the views he had been disseminating. This very man, in fact, got up and finally said:

"We *have* been loafing on the job. I know it and you know it. We have the facts here, and the thing for us to do is to go out there and really begin to produce something."

The management then proposed to try a nine-and-one-half hour day temporarily with the same rate of pay as for ten hours, with a promise of readjustment later if it seemed justified. This proposal was agreed to.

In the meantime, of course, the foundrymen were on strike. The committee members after this meeting went out and talked with the striking men, told them they could come back—if they came at once without recognition of the union—and that they would be better off to do so. The next morning all the strikers were on deck.

The immediate trouble was thus settled—a desirable but by no means an ultimate end. Frequently employers have been able to break a strike in one way or another and get the men back to work, but too often the resulting ill-feeling that has been aroused reflects very definitely in even more greatly decreased production and discontent. In this case, however, the strike was taken as an opportunity to give the workmen true facts in regard to the entire situation. By laying all the cards on the table, and then frankly inviting discussion, this management came out of a strike with a greater feeling of good will and co-operation on the part of its workers than at the start. That is the unusual feature of this experience.

Proof of this is shown in production records since that time. Production in every department of the plant has risen, especially that in the foundry.

This settlement illustrates strikingly the possibilities presented to the management which, with a really honest purpose, is willing to put the facts before their employees. The name of the concern is withheld merely because the story is a rather intimate one, while the facts are applicable in one place as well as another.

Where Is the Motorcycle Going?

The general status of the industry, together with the relation between foreign and domestic business, was discussed last week. This article takes up the more detailed problems of overcoming prejudice, over-emphasis of racing, the size of the future motorcycle, and the field for future development. Vital necessity for cooperative effort by manufacturers is indicated.

By Norman G. Shidle

IT may be admitted that so far as the opinion of the general public is concerned, the motorcycle has a distinct prejudice to overcome. The automobile once had the same difficulty, but the automobile succeeded in overcoming it; the motorcycle has not yet done so.

In seeking the best means by which this prejudice may be overcome, the necessity for co-operative effort among the manufacturers becomes apparent. In an industry composed of so few units, it should not be difficult to get together to boost the industry in general for the good of each individual. This is necessary if any real progress is to be made. The chief necessity for the motorcycle in the domestic field is the widening of the potential sales market. No real progress will be made while the manufacturers content themselves with fighting over the business available in the present market, which seems to have grown smaller—certainly not larger—during recent years.

Why Not Study England?

The situation in England presents a field for study in this connection. The motorcycle is undoubtedly popular there and American manufacturers might gain by attempting to analyze thoroughly the reasons for this fact with the idea of adapting them to American merchandising conditions. Some interesting material was recently presented by M. Olley, chief engineer of the Rolls Royce Co. of America in this connection. He said in part:

"The motorcycle is becoming an institution in England and is used by old and young, and by both sexes almost equally.

"On English roads and in English weather, it is the perfection of motoring as distinct from mere luxurious riding. The machine amounts to nothing in itself, weighs only 150 lb., is no bigger than an ordinary bicycle, travels 100 miles on a gallon of gas, yet transports you anywhere at 30 miles an hour average and 60 miles an hour maximum speed.

"It can never lose its place in the affection of the British motorists, probably 80 per cent of whom have served their apprenticeship on motorcycles. It is a fine training for driving a car.

"Design in England is affected greatly by the essential democracy of its inhabitants or perhaps by the fact that there the car is not the standard of the man.

"Here a man will buy a car of cost proportioned accurately to his income or his pretensions.

"There a cabinet minister or railroad president will own a Ford sedan, or will take pride in the possession of a miniature vehicle peculiar to the country, called a 'light car' or voiturette, and resembling a traveling bathtub. His social status is not governed by the car he drives, or by his income, but rather by the particular accent with which he speaks the English language."

It is obvious that as general prejudice to the motorcycle is lessened the sales field will widen. One way in which co-operative effort may be effective is in a definite attempt to break down this barrier of prejudice. A co-operative publicity campaign, conducted along broad and intelligent lines, in a conservative and dignified manner, would go far toward accomplishing this end.

No single manufacturer, naturally, wishes to undertake such an effort alone, since the benefits would be shared by the others without cost. But the general benefit to the industry from such a campaign will be great. It is, in fact, the understanding of the writer that such a movement is practically under way. It will be to the lasting benefit of the industry.

This is merely a single instance, however, of the way in which active co-operation is needed among the manufacturers. The industry as a whole cannot grow unless all of its units are willing to bury their small grievances against one another and fight shoulder to shoulder for a common end.

Outsiders cannot be expected to have much respect for the various manufacturers if they have but little for each other. In every possible manner co-operative effort for the boosting of the motorcycle in general should be fostered by the motorcycle manufacturers. Along this line lie some of the best possibilities for the future progress of the motorcycle.

The motorcycle has been merchandised chiefly as a sporting proposition. It has appealed almost entirely to the young man with a love of speed and hard riding; the young man who likes a thrill, and who gets real joy from dashing over open stretches of roads as fast as his machine will carry him.

To this group the motorcycle still appeals and will always appeal. The sales in this field are so great as to constitute an overwhelming percentage of the entire motorcycle sales in the United States. Since this is the backbone of the motorcycle trade, it is obviously necessary that every effort should be made to sell to this field and to develop it to its fullest. The manufacturers are accomplishing this with a large degree of success.

But this field is obviously limited in scope, and if the motorcycle confines itself within these limits, the end of its development is not far distant. Other fields must be opened up if progress is to be made. And the overemphasis of this sporting phase in both publicity and interest among dealers and manufacturers is likely to hinder that further development.

Racing, for instance, is an extremely expensive form of advertising. The cost of financing riders and equipment, of manufacturing and developing special engines for racing work, etc., constitute an enormous expense. One factory advertising manager recently said something like this in regard to racing:

"It's great, we all admit; but, lands sakes, how it costs! If you have your doubts about the cost, just ask some of the dealers who footed the racing bills last season. It puts some nick in our advertising budget and the annual cost runs into six figures. . . . For the factory to attempt to support a third or one-half of all the races would load an excessive and unfair cost on the retail price of stock machines and side-cars."

Racing as an aid to sales is scarcely of value in proportion to the financial burden which it imposes. It has a favorable influence only with a limited class of prospects, and its influence on the more intelligent of this class of speed and sport lovers is probably not as great as is generally imagined. Any sensible motorcycle purchaser knows that the machine he buys is nothing like the machine of the same name which has won the various races and that fundamentally the two have little in common except that they were made by the same manufacturer.

Certain types of racing, moreover, have a definitely bad influence on outside persons, who might otherwise be favorably inclined toward the motorcycle and thus become prospective purchasers. The establishment of road records, for example, has caused a great deal of unfavorable criticism for the motorcycle. So strong was this criticism, in fact, that the chief manufacturers have practically discontinued this form of racing altogether. This was a definite step in the right direction.

Probably no single factor ever brought the motorcycle into disrepute so strongly as the motordromes which were established in various parts of the country several years ago. The numerous injuries and deaths gained wide publicity, while the excessive noise created in the vicinity of the motordrome caused hundreds of people to gain a permanent and constant grudge against the vehicle. These were discontinued after a short time.

But all of these things have had their part in building up prejudice and consequently sales resistance for the motorcycle outside of its narrow sporting field. This resistance, however, must be broken down if the industry is to permanently progress.

Racing is a strong tradition with the motorcycle industry, and like many other traditions has survived in full vigor long after its former usefulness has passed. One reason for this may be found, perhaps, in the fact that more than one manufacturing executive has been very close to the thrills and joys of racing himself, and his memories of the exciting times of his old racing days are so pleasant and strong as to somewhat warp his perspective when attempting to view the industry from a purely business and merchandising point of view.

This is not an argument for the elimination of motorcycle racing. Motorcycle racing has and always will have a definite place. But it is getting far more than its fair share of attention and is the cause of more expense than its merchandising value warrants.

All of the factors thus far presented are recognized more or less by nearly everyone connected with the industry. Some of those who have thought most along these lines have some definite suggestions to offer. One point that is pertinent to any such discussion is that of the mechanical phases of the American motorcycle.

Let it be granted in the first place that the American motorcycle of to-day is a carefully built, quality machine, very powerful and rugged, capable of very high speed and of taking hills of nearly any variety, that there is a definite place for such a machine in this country where many roads are bad and where the rugged qualities are necessary. The very fact that there are 234,000 motorcycles in the United States shows that there is a definite market for machines of the powerful type, but the fact that the number is not increasing would indicate that the demand has been met.

The big manufacturers appear to have some similar thought, as is indicated by the introduction of middleweight machines by both Hendee and Harley-Davidson, while both of these makers now have on the market a single cylinder, though not a light weight machine, adapted to commercial use.

Only a limited number of persons in any country need or desire a machine capable of going seventy miles an hour, and the opportunity for the utilization of the power of these big machines is also extremely limited.

If the field of the motorcycle is to be extended, it must be through the development of a machine more suited to the use of a greater number of persons. The heavy 15 to 19 hp. machines can not be operated with comfort by anyone except an athlete, while their initial cost and operating cost is comparatively large if they are to be used merely as a sporting proposition.

If a man desires a vehicle chiefly to take him from one place to another, he has no use for the high power and speed of the big machine and is not likely to pay the high price charged for it.

One of the chief executives of one of the principal concerns said recently, "Frankly, this big machine is too hard to handle. I can't ride it myself any more."

In the mind of at least one concern is the idea that the future development of the motorcycle lies along the increasing use of the so-called middleweight machine. One of the executives of this concern stated that he believed the sale of this type of machine could be increased very greatly, especially among persons hitherto shy of the big machine. He thinks that the sale can be increased so greatly as to render real quantity production possible, with a consequent decrease in price, thus widening the market still further.

This view looks more nearly toward the direction in which the future development of the motorcycle is likely to be.

But even the so-called middleweight machines are good-sized motorcycles and sell at a price only slightly lower than the big machines. Thus the price is still high enough to make the motorcycle compete to some extent with the smaller automobiles. It is not a machine that is within the means of the man unable to buy a small car, who still desires a rapid means of individual transportation for himself.

There are three fields for development of the motorcycle outside of the sporting field:

1. Police and municipal work of various kinds.
2. Utility work, such as delivery for stores, etc.
3. Personal utility work: a vehicle for taking a man to and from work; to the store and back; and for short pleasure rides.

The first field is being cultivated intelligently and intensively by the manufacturers. Several large sales in this field were announced recently by one of the big companies and more will probably follow.

Some effort by individual dealers has been made in the second direction, but this field will bear more attention

than it has been given in the past. For certain reasons, however, it has definite limitations.

The third field is almost entirely undeveloped, although it probably constitutes the one great outlet for the progress of the American motorcycle industry. The potential field which it presents cannot be definitely calculated, but it is large.

For the first two limited purposes, as well as for sport, the present type of big and middle-sized machine is suitable. But for this last and very wide field, it is not suitable both because of its size and its cost.

Manufacturers are wont to object that the light motorcycle is not feasible in this country because of the bad roads and because of the demand among our riders for speed and power. An analysis of the situation does not seem to validate this criticism.

There is a demand among present riders for speed and power. But the whole point of this discussion tends to show that the very trouble with the motorcycle industry is its failure to develop and recognize the potential demands of a different class of possible riders. It must go forward into the development of this group or stagnate as a power and speed sporting proposition.

And the riders in this third class are largely those who could get great efficiency and usefulness from their machine, scarcely ever leaving a paved street or an improved road. It includes thousands of potential municipal buyers and of small town buyers who care a great deal for steady, constant individual transportation and not a tinker's darn for high speed and excessive power.

Some very definite opinions were expressed recently by a man who has been closely connected with the motorcycle industry since 1902, who is still connected with it and who has some rather frank statements to make in regard to its present and future status. While the writer does not specially wish to endorse these opinions, they undoubtedly contain much real food for thought and present an angle worthy of serious consideration and analysis by manufacturing executives coming as they do from one thoroughly familiar with conditions past and present. A part of what this man says is as follows:

". . . The fact is, the motorcycle business is very sick. A few million folks want a motorcycle, but not the kind factories insist on building. Those, and a few thousands more, who would take one of the present types, won't pay the price the factories demand.

"There will be nothing doing in a cut. The factories are going to stand pat and force the dealers to put it over at to-day's market. The dealers won't and can't.

"I've been in the game since 1902, and believe that I know some of the things that are wrong with it. I have gotten factory men to admit them, but they won't see the light and break away from customs.

"The crying need of the motorcycle industry is and always has been distribution. . . . this limited and fluctuating distribution is due to two things:

1. Refusal of manufacturers to produce a popular type of machine in volume.
2. The slow progress made, either in educating the low grade type dealer who predominates in the retail field or in replacing him with a better type of merchant.

"The motorcycle business needs a Ford or a Dodge; someone who appreciates the one model, volume and low price. They don't know the meaning of the word volume when they are content with 25,000 machines a year as a maximum; nor of the term 'popular price,' when they are charging $490 and $650. They don't know the meaning of the word 'standardization' when the big fellows are trying to build models to please everybody and get the other fellow's share as well as their own.

"The first necessity is a radical change in manufacturing policies, but I am convinced that this will not come from within the industry. It will have to be an outsider who comes in with an open mind, disregards the past and starts production on the type of machine the public wants, at a price which will appeal."

This from a man who has been in contact with the industry for 19 years as a department head in a large factory, as a member of a dealer organization, and as a constant motorcycle rider. It contains much that is worth thinking about.

The man who made these statements is wrong in implying that the present manufacturers do not have an open mind. There is probably no group of men who are striving more diligently toward the goal of achievement than the executives of the various motorcycle companies. It is with the idea of presenting some frank criticism to this open-minded group that this article has been written. To a group of any other kind, such criticism would be useless.

An analysis of the entire situation, however, would lead to the belief that there is a call in the United States for a lighter, cheaper motorcycle, merchandised in a progressive and intelligent manner, the bad traditions of the industry being ruthlessly thrown away and the good traditions carried forward with renewed vigor. A summary brings out several important needs for the immediate future developments of the motorcycle industry:

1. A careful, open-minded analysis of the broader possibilities for permanent progress.
2. Active co-operative effort on the part of all manufacturers together for the betterment and promotion of the industry as a whole.
3. Definite and immediate action in regard to raising dealer personnel, radical if necessary.
4. Intensive effort in the development of new sales fields, and care not to allow the traditional sporting and racing features of the industry to overshadow possibilities for future development in a manner out of proportion to their true importance.
5. A serious consideration of sales possibilities of a light-weight machine for general personal transportation purposes; and the production of a machine at a cost low enough to appeal to the man desiring such transportation but not financially able to pay for either a Ford or the present heavy or middleweight motorcycle.
6. The encouragement by manufacturers of frank constructive criticism by the motorcycle trade press; thus allowing the various companies to gain the benefit of candid suggestions from those in a position to view the industry as a whole.

This article has consciously refrained from discussing in detail the many good features of the motorcycle industry and the numerous constructive efforts which are being made within the industry for its betterment. These things are present in abundance. The article has assumed this and constitutes merely a friendly attempt to examine from an outside, though related, viewpoint the interested onlooker's analysis of the present status of the motorcycle industry. The purpose has been to criticize in a helpful way, but not to disparage in any sense the many constructive agencies now at work within the industry.

ONE of the speakers on tractor subjects at the recent Columbus show said that a life of 7½ years of 45 working days can be conservatively figured on in connection with farm tractors, making the total active life of the tractor 337 days. The annual depreciation charge, therefore, is about 14 per cent of the cost price. In addition 4 per cent should be allowed for repairs.

The FORUM

Kinship of Aircraft and Automotive Industries

Editor AUTOMOTIVE INDUSTRIES:

I think all of us who attend meetings of the S. A. E. are always vividly impressed while attending them with the close inter-relationship between all branches of the automotive industry. I also fear that as the memory of these gatherings becomes more dim that very important impression does likewise. Therefore, I think that a good technical publication like AUTOMOTIVE INDUSTRIES is doing a real favor to all of us when it comes around with a reminder that we all belong in the internal combustion family.

At last winter's session there were a few of these impressions that I determined not to forget. One was that I am interested in fuel, that I wanted to attend the fuel session, that I could not attend it because of simultaneous meetings on other subjects, and that I must read the proceedings of the fuel session. I also was equally impressed with the fact that fuel men should attend the aeronautical session and if simultaneous meetings made it impracticable they should read what we did. To further illustrate this inter-relationship, let me recall the statement of a well known automobile engineer who sat next to me during the general meeting. "Of course I am interested in aeronautics, especially in the engines," he said. "The designers of aviation engines are doing things all the time that I ought to know about, and I am equally sure that a lot of the research work going on in the other branches of the industry would be of real value to the designers of aircraft engines. The same is true of airplane engineers and chassis and body builders—not that a body builder can work directly from a plane design, but there is a lot of detail research work which should be of real use to him." Another engineer, who was listening to the above conversation, remarked that he was attending the aeronautic session because some day he might be building aviation engines himself, and it is a fact that it is the belief of some of the best engineering minds in the world that co-operative thought will lead to the best development and that there is every reason to think that the automobile industry itself may be very directly affected to its advantage by the development of aircraft, especially along commercial lines.

Later on, outside, we discussed this same question and the consensus seemed to be that many members of the S.A.E. hardly realize the really intimate relation between flying and the automobile. Aircraft will never take the place of the automobile, but there will grow to be a more and more intimate relation as time goes on and it is certainly to be hoped that the automobile engineers as they go back to their own work will not forget all about the youngest member of the family, because some day they may have to go into partnership with him. Builders of automotive apparatus are very short-sighted if they do not realize that the time will come, and that sooner than many of them think, when there will be a great passenger and fast express service by lighter or heavier than aircraft. As an analogy, one famous builder of carriage bodies has said that as early as 1898 he began to work on designs for automobile bodies and he certainly profited by his farsightedness. In the same way we all know how some of the great bicycle manufacturers were interested in the automobile game and one at least of these men devoted a great deal of his time and energy to good roads campaigns, not only on account of his bicycle business, but also because of his farsightedness in looking ahead to the time when the automobile's popularity would depend on good roads. Many men at that time, and some of them even own up to it now, thought that these manufacturers were almost insane when they began to play with what was thought to be at that time a toy—"the horseless carriage." Yet to-day the proportion of carriage bodies built is very small indeed compared with the automobile bodies turned out. Those who remember far enough back can trace the development of some of the great automobile concerns of to-day from the experiments of those early pioneers in the bicycle business.

A great number of automobile concerns became interested in aeronautics during the war, but almost all of these have at the present time apparently dropped all thought of aeronautics, and, while no one can believe that aviation is the panacea for all transportation evils, still the automobile engineer whose thoughts trend along aeronautic lines and who keeps in touch with the game as it is to-day, and who goes further than that and does a certain amount of research and perhaps experimentation is laying the foundation for the future which will well repay his foresight.

The great basic difficulty now is the lack of any Federal control of construction and of flying in the United States. There are no great number of real landing fields, but given the proper legislation to prevent freaks from injuring the development of the industry and unsound fliers from injuring themselves and others, landing fields will come and the aeronautical industry will develop like a plant in good soil which is properly cared for. The automotive industry at large can be of the utmost assistance to aeronautics by lending its powerful influence to the solving of the basic problem of legislation, and to quite as great an extent by giving its thought toward the solution of the many technical problems which confront the art to-day. Many of these technical problems could have real light thrown on them by their being attacked from the entirely outside and fresh viewpoint of men who have not been so close to the industry that they have difficulty in viewing the matter as a whole. Experimental work may be considered too great an expense. If so, an automotive concern might do two things: (1) conduct the experimental work on paper, or (2) induce the Government to bear the expense. In several instances (all too few as a matter of fact), the Government has let contracts to the automotive industry to build experimental jobs, though most work of this type is conducted at McCook Field in Dayton. With the entire industry interested in aeronautics more of this work undoubtedly would be placed with the industry. The automotive industry had, before this country got into the war, a few men who were farsighted enough to see the tremendous benefit this industry could be to aircraft as a whole should the emergency arise and when

this country did get into the war it had to call on the whole industry. If it had not been for the automotive industry this country would have been in a particularly helpless condition, so far as aircraft went, and although it is to be definitely hoped that should we have to go to war again the aeronautical industry will be sufficiently on its feet to give a good account of itself, undoubtedly more or less help would have to be obtained from the great automobile and body building plants.

Therefore it behooves the industry at large to keep an eye on aeronautics and to keep itself in a position where, if the emergency arose, there could be an instant response which would give this country a strength potentially and actually which it could not otherwise have.

This whole thought goes back fundamentally to the basic idea of the industry—the whole automotive industry is one family—the internal combustion group, and, while it is impossible to tell at the present time where the family is going to, it is certainly on its way.

JOHN R. CAUTLEY.

Passenger Car Displacement Per Ton-Foot Basis

Editor AUTOMOTIVE INDUSTRIES:

Your article in the March 3rd issue of the AUTOMOTIVE INDUSTRIES is the best exposition of the subject that has ever been presented and, covering as it does practically all passenger cars, is of very great importance and enables a fair comparison to be made of the ability and merits of all the cars.

In the classification that appeared in your Statistical Number, and which also was very complete as regards the details generally, there was lacking the total weight and the pay load or live load that are necessary for making a comparison of the merits of the various cars, and you have now worked these out on a basis fair to all the makers and in a form that can be seen at a glance.

Might I suggest that a similar procedure be followed with reference to the classification of gasoline trucks that also appear in your Statistical Number, so that similar knowledge can be gained with regard to the motor trucks? There are so many of these (over 500), I appreciate this may be quite a task, but this condition might be met in part by taking say, 100 to 200 of the leading makes and comparing these, as they would probably represent the entire number, most of which are in small production.

In this connection, also, the live load or **rated pay load** should be given for each truck, and the displacement per ton-foot should also be given on the basis of **pay load** as this is what is wanted in the final analysis. There is no other means of knowing whether the pay load is 20 or 50 per cent of the total weight. This pay load varies greatly in the various trucks, and in a tabulation comprising 219 trucks, which was recently shown me, the pay load ran from 18 to 50 per cent and therefore the user had no means of knowing whether he was carrying around 5 pounds of dead load to one pound of pay load or 2 pounds of dead load to 1 pound of pay load (which greatly affects the efficiency of the trucks).

Reverting now to the table on page 495, the final analysis should be on the pay load or live load and based on the 150 lbs. per passenger that you have assumed. The first car given in your list carries only 4 passengers or 600 lbs. pay load for 4670 lbs. total weight or, say, 12.9 per cent pay load; therefore, the cubic inch displacement per ton-foot pay load becomes 192; further, for the last car in your table, Piedmont 4-30, carrying 34 per cent pay load, it becomes 138, and, similarly, for the Ford, carrying 31.8 per cent pay load, it becomes 110. Of course, I recognize that it is not quite fair to compare the lightest and the heaviest cars, and in order to make a fair comparison these cars, which are generally spoken of as light, medium or heavy, should be compared in their various classes and as a basis of comparison it is suggested that these might be classified on their loaded weights as follows:

Light	Medium	Heavy
Under 3000 lbs.	3001-4400 lbs.	4401-8800 lbs.

On this basis we get the following results:

LIGHT WEIGHT CARS

Name	Cubic Inch Displacement Per Ton-Foot	Per Cent Pay Load	Displacement Per Ton-Foot Pay Load	Index Figure*
Seneca	28.5	25.5	112	1.02
Harroun	29.7	25.0	119	1.08
Nelson	30.2	20.0	150	1.37
Overland	31.0	28.3	110	1.00
Ford	34.6	31.7	110	1.00
Leach	34.9	28.0	124	1.13
Piedmont	47.0	34.0	138	1.26

MEDIUM WEIGHT CARS

Name	Cubic Inch Displacement Per Ton-Foot	Per Cent Pay Load	Displacement Per Ton-Foot Pay Load	Index Figure*
Monroe	24.7	23.0	108	1.00
Norwalk	25.1	18.0	140	1.30
Friend Four	25.8	23.5	110	1.02
———	26.0	21.5	121	1.13
Reo	28.0	19.0	147	1.36
Liberty	28.5	21.8	130	1.20
Tulsa	28.8	20.5	141	1.31
Lexington	28.8	24.5	118	1.09
Essex	28.9	21.8	132	1.22
Saxon	29.0	21.5	135	1.25
Cleveland	29.2	21.6	135	1.25
Briscoe	29.6	23.3	127	1.17
Templar	29.6	17.3	172	1.60
Commonwealth	29.7	23.5	126	1.17
Kline Car	29.8	20.8	136	1.26
Skelton	30.7	23.6	130	1.20
———	30.7	20.3	150	1.39
Noma	30.9	19.4	158	1.46
Buick	30.9	20.0	154	1.43
Hatfield	31.2	21.8	147	1.36
Hupmobile	31.3	22.2	142	1.31
Dixie Flyer	31.4	22.0	143	1.32
Allen	31.5	22.2	142	1.31
Paterson	31.6	20.4	155	1.44
Scripps-Booth	31.7	23.0	138	1.28
American	31.8	17.8	178	1.67
Elcar	32.0	20.5	156	1.45
Oldsmobile	32.0	21.5	149	1.38
Grant Six	32.1	21.8	147	1.36
Globe Four	32.2	23.0	140	1.30
Gardner	32.4	23.3	139	1.28
Dodge	32.5	23.0	141	1.305
Lorraine	32.8	23.0	142	1.31
Wescott	32.8	19.0	173	1.62
Auburn	33.2	20.25	164	1.52
Holmes	33.3	25.2	132	1.22
Moon	33.3	20.0	166	1.54
———	33.4	20.0	167	1.55
Jordan	33.6	20.2	167	1.55
Maibohm	34.0	24.30	140	1.30
Nash	34.0	19.6	173	1.62
Piedmont 6-40	34.5	21.5	160	1.48
Pilot	34.8	19.5	178	1.67
Sayers Six	34.8	21.2	164	1.52
Paige G	35.2	19.4	180	1.68
Metz Master Six	35.5	20.6	172	1.60
Elgin	36.9	21.5	171	1.59
Chandler	37.0	25.0	148	1.37
Meteor	37.5	14.1	265	2.55
Crawford	38.9	18.2	213	1.98
Bour Davis	40.4	19.2	210	1.95
Davis	41.7	20.5	203	1.89
Franklin	42.2	23.5	179	1.65
Severin	42.6	20.0	214	1.98

*This index figure is obtained by dividing the corresponding figure under displacement per ton-foot pay load by the lowest figure under the same head in same weight class.

HEAVY WEIGHT CARS

Name	Cubic Inch Displacement Per Ton-Foot	Per Cent Pay Load	Displacement Per Ton-Foot Pay Load	Index Figure
———	24.6	12.9	192	1.57
Stephens	28.2	23.2	122	1.00
Dorris	28.6	20.6	139	1.14
Cadillac	29.0	20.5	142	1.16
Brewster*	29.2	17.0	188	1.54
Marmon	29.9	21.25	140	1.15
National	30.2	21.5	141	1.155
Daniels	30.3	17.2	176	1.45
Rock Falls	31.2	21.3	147	1.20
Roamer	31.9	17.0	188	1.54
Porter	32.0	19.8	162	1.33
———	32.4	17.8	181	1.49
Standard	32.6	21.2	154	1.27
Winton	32.7	20.2	162	1.33
Apperson	33.2	22.2	150	1.23
Hudson	33.2	22.0	151	1.24
———	33.3	17.2	193	1.58
Ferris	33.6	20.5	164	1.34
———	34.4	16.25	212	194
Case	35.2	22.3	159	1.30
Cunningham	35.5	18.8	189	1.76
Lincoln	36.0	14.6	245	2.02
Page L.	36.4	21.8	166	1.37
King	36.6	23.3	158	1.30
Peerless	36.7	21.2	168	1.38
Cole	37.0	21.7	170	1.40
Lafayette	37.2	15.4	242	1.99
McFarlan	38.1	17.2	222	1.82
Stevens-Duryea	38.8	18.6	210	1.72

*Correction: In figuring the original table from which this tabulation is made the displacement of the Brewster engine was given as 376.5 instead of 276.5 cu. in. the correct figure, due to a typographical error. This makes the displacement per ton-ft. 29.2 cu. in. instead of 39.4 the figure originally given.—Editor.

By taking the highest efficiency in each class as unity (1.00) the relative efficiencies can at once be compared and the importance of the percentage of live load becomes apparent and generally the higher this pay load percentage the more economical the car, but it does not always work out that the lightest car is the most economical.

As regards the cubic in displacement per ton foot, no account is taken of the relative economies of the different engines, and this result may be attained very much more economically in one car than in the other, so that the real economy in gasoline per mile may be very much different than that indicated in your table. Take the Franklin car, for instance, which is at the very top of your table; it is claimed, and presumably admitted, that this car gives a very high mileage per gallon of gasoline and in the above table giving the relative economies it does not work out very well and shows 179 per foot-ton of pay load although its weight is quite low.

With reference to your comparison with the small Fiat car, is it exactly fair to compare this with the average American car? This car is lighter than the Ford and really belongs in the light car class, but as regards cubic inch displacement per ton-foot it does not show up as well as the first two at the head of your list. You do not state the number of passengers carried but I understand this car is designed for four passengers or 600 lbs. and on this assumption the pay load is 28 per cent, giving an efficiency of 98 as compared with 110 for the Ford.

In making all the comparisons it must be borne in mind that in all the larger and refined cars weight per se is not the consideration but riding and other qualities.

Medium Weight Cars: The weight given for the Buick car is wrong and should be 3750 lbs. and not 2700 lbs. The weight of the Oldsmobile car is 3450 lbs. and not 3900 lbs.

Heavy Weight Cars: The weight of the Brewster car is 4450 lbs. and not 4850 lbs. as given in your table.

W. J. P. MOORE.

In determining the cu. in. piston displacement per ton-ft. for the different makes of passenger cars we did not intend it as a figure of merit or of efficiency, because as applied to automobiles these terms have a very vague meaning. The index figures given in Mr. Moore's table are not correctly termed relative efficiency. They are the ratios obtained by dividing the displacement per ton-ft. pay load of each car by the lowest displacement per ton-ft. pay load of any car in the same weight class.

Our object in preparing the original table was to show what is being done by engineers in powering their cars or in making a compromise between the requirement of fuel economy on the one hand and high acceleration on the other.

While the ratio of pay load to total load has a great influence on the economy of a car on the passenger-mile cost basis, combining this figure with the cu. in. per ton-ft. confounds two quite different things. Of course, the economy of the car as a transportation unit should bear a close relation to the index figure calculated by Mr. Moore.

We doubt whether there would be much value in a table showing the cu. in. displacement per pay ton-ft. of different trucks, for the reason that the rated load capacity of a truck is an arbitrary figure. To illustrate what we mean, let us say that a certain truck has been sold for a number of years as a 2-ton. Now competition becomes exceedingly keen and the manufacturer believes he can "get away with" a 2½ ton rating, so he announces the truck as a 2½ ton model. This would greatly increase Mr. Moore's efficiency figure for the truck but it would not add one iota to its real merit.

In making the comparison with the Fiat small car it was not our idea to show that this car was superior to American cars generally. We reasoned that inasmuch as gasoline is exceedingly expensive in Italy and this is a very small car and therefore undoubtedly designed for economical operation, the powering (that is, the cu. in. per ton-ft.) is probably as low as considered possible in a practical machine by the designers, and that the figure arrived at for this car therefore constitutes apparently the limit beyond which it is impractical to go in seeking for economy.

The weight figures were those given us by the manufacturers with the passenger weight added by us. We requested the manufacturers to give us the weight of the car in running condition with tanks full. As long as the displacement figure is reduced to 4, the unit of total weight of car and load, it makes very little difference whether the passenger weight is assumed to be 150 or 200 lbs.—Editor.

IN a review of the recently issued volume, "How to Keep Invention Records," in AUTOMOTIVE INDUSTRIES for Jan. 27, the name of the author was inadvertently omitted. The book was written by Harry A. Toulmin, Jr., J.D., Litt.D., a patent attorney. The introduction is by James T. Newton, former U. S. Commissioner of Patents. The volume is published by D. Appleton & Co.

IN a recent paper read before the graduates section of the Institution of Automobile Engineers the statement was made that it was quite useless to drill the oil scoops at the bottom of the connecting rods, as the centrifugal force was so much greater than the inertia force that no oil could possibly be thrown up on to the pin from the scoop. The scoop was to create an oil mist.

Exported Cars Are Making Market for Parts and Equipment

Increased trade, due to pioneer sales, is making itself apparent in the monthly reports of sales to the various countries of the world. The January figures illustrate this point by totals that run well over previous figures. Increased business in both pneumatic and solid tires. British hope to regain New Zealand motor trade.

THE thousands of automotive vehicles—cars, trucks and tractors—exported from the United States in 1920, as well as those of previous years, are making excellent markets for equipment and accessories in all countries of the world. That is nowhere more strikingly shown than by the export figures from this country for the month of January, the last for which official totals are obtainable. These show that the foreign shipments for that month were 136 per cent of the monthly averages for 1920 and 208 per cent of the business that was done in the same lines in January, 1920. The respective figures are:

Parts and equipment exports in January, 1921	$9,679,295
Parts and equipment exports in January, 1920	4,649,192
Parts and equipment exports monthly average twelve months of 1920	7,113,507

The significance of this to the manufacturer and exporter is that the cars and trucks sold last year are needing equipment. These cars, as in the United States, were put to work when they were sold in Asia, Africa, Latin-America, Australia, Europe and elsewhere. When the business depression came, they were not scrapped, regardless of what may have happened to the saie of new vehicles. They were kept running and to-day they are in need of spark plugs, windshields, magnetos, covers, pistons, piston rings, horns, lamps, batteries and all that class of automotive parts which must be replaced from time to time.

Tires make up another item which should be included in this list. They are not, however, shown in the tabulation just given. But exporters and tire manufacturers report increased business on both pneumatics and solids. This is natural, when it is remembered that more than 142,500 passenger cars and 29,000 motor trucks (as well as 24,000 motor cycles) were shipped from the United States to various foreign countries last year and that, in addition, thousands of other cars and trucks were built during the year in the branches maintained by Henry Ford in Canada, Argentina, Brazil, England, Spain, France and Denmark which do not show in the export statistics but which require American equipment.

A tabulation of the leading countries in the January parts exports, not including tires and engines, shows the following to have been the leading countries:

England	$2,617,307	Australia	$194,819
Argentina	1,610,061	Brazil	170,069
Denmark	844,353	New Zealand	130,031
France	758,624	Philippines	109,550
Canada	729,706	British South Africa	87,588
Spain	370,393	Chile	62,677
Mexico	243,597	Uruguay	61,396
Dutch East Indies	239,372	Peru	53,751
Cuba	222,546		

New Zealand Problems

THE Wellington, New Zealand, correspondent of the London *Times*, in a lengthy survey of the local motor trade, discusses factors that are handicapping the development of the trade. Summarized these factors are:

Reduced price for wool, uncertainty in trade generally, unfavorable attitude of the banks toward the motor trade in particular—apparently the bankers regard the trade as almost wholly a pleasure giving, joy riding business—and the unfavorable rate of exchange. He thinks that the British and the European car makers are likely to recover the market, but points out that manufacturers who wish to increase their standing in this market will need to be familiar with the character and varying conditions of New Zealand roads, and that gasoline is not only dear but at times scarce. In effect these two conditions emphasize the need for gasoline economy, a light tare and big tires.

Another point noted by the New Zealand writer is that the trend is toward heavier and larger capacity motor trucks, which are found to stand up better under the road and local usage conditions.

Suggestions As To India

THE British Trade Commissioner in India, T. M. Ainscough, recently offered the following suggestions to the British motor trade for working the Indian market. He advised that branches be opened in Calcutta, Bombay, Madras and Lahore, each furnished with a stock of chassis and spare parts and a well equipped garage and workshop for the execution of all repairs and body-building. Each depot should be staffed by an experienced sales manager, three or four European mechanics, trained in the home factory, and two good touring salesmen. In addition agents should be appointed in Cawnpore, Allahabad, Rawalpindi, Peshawar, Delhi, Bangalore, Nagpur and Rangoon.

An alternative method recommended is the nomination of one of the well-known motor importers as representative in India, or the appointment of a good house in each center. The maker should also send out a few salesmen and half a dozen mechanics.

With regard to the types of vehicle for which there is likely to be an increasing sale, trucks merit first attention. Light trucks for merchandise service in and around cities are in demand, and would sell in greater numbers if transport companies were organized. Their use for mail collection is likely to grow.

Of heavy trucks, the prospects for sales are considered excellent. Their use in transport between the plains and the hill stations is growing, and municipalities are large

buyers. On the cotton plantations trucks are replacing the bullock cart. It is thought that they will be brought into extended use as feeders for the railways and may supersede the light line.

Notes On Swedish Trade

IN an article contributed to a recent number of the *Swedish-American Trade Journal*, S. A. G. Swenson contributes some very interesting facts concerning the trade in Scandinavia. Swenson, according to an identification note, has been active in establishing dealer outlets for American cars in Northern Europe.

He reviews briefly the boom in the automotive trade following the armistice and says that the orderly progress of this trade was somewhat interfered with because the Germans offered some cars and trucks there at low prices. Then he says:

"Several companies in Scandinavia are now under 're-construction.' However, the old established real dealers and a few new ones who knew the business and stuck to it have not been much affected by the present readjustment; they are well established, have good lines to sell, and know how to market them. Some dealers, though, have heavy stocks being carried over the winter and naturally do not want to contract for this year.

"Sweden imported 9061 automobiles, valued at 54,200,000 kronor, from all countries during January-November, 1920. In the corresponding period of 1919 the number was 2440, valued at 12,500,000 krona. The United States exported during the eleven months of 1920 5294 cars to Sweden, valued at $6,643,617, while Norway and Denmark took 3182 and 1074 respectively."

Swenson then lists 51 American passenger cars that he knows were being sold in Sweden with 24 European cars. As to Swedish made vehicles he says:

"The Scania-Vabis, made by the Scania-Vabis Co., is a Swedish product. This company, however, specializes more in high-grade motor trucks. Another Swedish car, the T. V., in the light class, is manufactured by the Thulin Works, with a present output of one car per day. This company also planned to produce the T. V. motorcycle."

In discussing trade methods, Swenson says:

"With regard to export houses, it is true that a manufacturer can have advantage of operating through such a distributor, as he should thus be assured of immediate payment and relieved of a great deal of responsibility in connection with service, and furthermore, one can expect that the export house should be better posted on foreign conditions by having representatives stationed abroad, but unless the export house has a financial interest in the foreign firm the method is impractical, and it is evident that dealers on the other side have become skeptical of export middlemen and prefer direct factory connections.

"The Swedish territory is in some cases handled from Copenhagen or Christiania. With due respect to the Danish and Norwegian merchant it must be said that it is not wise to place an agency for Sweden with a dealer domiciled in either city. Scandinavia is a name for three separate states and Sweden is, by the way, the largest and uses the most motor cars.

"As an example we may mention that the Norwegian, Swedish and Finnish agency for a well-known French car was given to a firm in Christiania. The reverse procedure is not entirely satisfactory either. For example, a light American car is handled for the whole of Scandinavia by a dealer in a provincial town in Northern Sweden. Most of the large dealers have as much as they can handle, and it is good business ethics to help the small dealers, but it would be better for the manufacturers to have such agents act as dealers for their respective countries. Arrangements of this kind have sometimes been made because the manufacturer did not find better connections, but in the majority of cases he was ignorant of the market, or did not care because his ability to deliver cars was limited.

"The Norwegian market is smaller than that of Sweden, but it is a fact that Norway is more aggressive than Sweden in the matter of good American products. The cars one sees in Christiania are practically all American. It is interesting to compare the automobile lines introduced in Sweden with those in Norway and Denmark. There are approximately 50 American and 25 European lines in Sweden, of which about 26 American and 3 European are also represented in Norway, and 33 and 10 respectively in Denmark. On the other hand, Norway and Denmark have certain lines that are not handled by Swedish dealers, namely Norway 15 American and 7 European, and Denmark 10 American and as many as 35 European."

Spark Plugs In Argentine

AN estimate is made by Vice Consul Harold C. Waters, of Buenos Aires, that 600,000 spark plugs are sold annually in the Argentine Republic, and he believes that at least 75 per cent of them are of American manufacture. This coincides with an estimate of 75 per cent, by Consul Ezra M. Lawton, of Sao Paulo, Brazil, as being the percentage of American made plugs sold in Brazil.

The Argentine market, however, is being entered by an increasingly large number of European manufacturers, who have recently brought in the following brands: German, Bosch; English, Lodge and Hobson; French, Oleo-Magneto, Pognon, Apollo, and Hauquaire. The foreign brands are made only in metric dimensions, whereas many American makers sell both the standard American and the metric sizes. Both Consul Waters and Consul Lawton agree that the more satisfactory manner of packing is to have each plug in a separate cardboard box.

Foreign Trade Financing Fund

WITH regard to the effort being made to finance The Foreign Trade Financing Corp., automotive manufacturers should always keep in mind that it is the intention of the heads of this corporation to assign this money to use according to the source. Thus, if the automotive industry is a large subscriber to the stock of the corporation it will have a large share of the available funds placed at its disposal. The sale of stock is said to be progressing at a satisfactory rate.

Red Sea District

THE possibilities of automobile sales in the Red Sea commercial district, of which Aden, Arabia, is the center, is discussed by Addison E. Southard, American consul at Aden, in the Feb. 21 report of the Bureau of Foreign and Domestic Commerce. "The Aden Red Sea district may be considered as having immediate possibilities as a limited market for motor vehicles," the Consul declares.

Tractor Future In Australia

AN Australian correspondent in an article emphasizing the need for suitable settlers in Australia chiefly as a measure of protecting the British Empire, states that of 200,000,000 acres of arable land, only 12,500,000 are being cultivated. The fact suggests an immense scope for tractors and power farming plant, which Great Britain cannot possibly meet under present conditions of tractor enterprise; the Austin and Fordson outputs being the only ones of any numerical value.

The Trend Toward Decentralization in Organization

The trend toward decentralization may become as much of a fetish as did centralization some years ago. The minimum amount of system necessary to prevent confusion is probably the ideal. Upon the intelligence of the individual depends largely the amount of system necessary.

By Harry Tipper

SOME of the industrial engineers who have been engaged upon meeting the problems arising out of production in a good many different lines of industry are beginning to talk of the necessity of decentralizing in the large industrial organizations, in order to secure the progress in effective work which must be secured in the future. They contend that we have established so many special departments for the general standardization of system within the plant, and so much overhead organization has been created through this development, that too much responsibility has been taken away from the foreman and the sub-foreman. We have attempted to reduce the necessity for the individual judgment of the foreman in order to provide a system which would facilitate mass operation without confusion.

In doing this some of the engineers contend that we have gone too far in that direction, and that we should give the foreman a larger opportunity to control his own department. By these means they expect to render the system more flexible, to improve the executive capacity of the foreman and to reduce the overhead by simplifying the special departmental requirements.

The value of this contention cannot be practically determined at the present time, because experiments in decentralizing have not been carried sufficiently far to make any conclusions permissible. It is quite possible, however, to centralize so much in the hands of special departments that the efficiency is not increased by the increase in specialization. There may be a drop in efficiency due to the tendency for all such departments to enlarge their own technique and their own technical detail, without any thorough understanding of the value of that technique to the general establishment.

We are wise enough to know that the possibility of human error requires a tolerance allowance in the actual production work, but we do not always follow the same precedent in dealing with system and methods of operation.

Not long ago I was consulted about a proposed change in the system of operating one of the special departments of a fair-sized plant. It seemed that some errors were discovered in the operation of the system and the changes were intended to remove those errors. A little examination showed that the total number of errors discovered represented less than one per cent in proportion to the total operations of the department. The changes in the system meant an addition of five people to the personnel of the department.

Five more people meant an additional possibility of the human error, because every new motion necessary in the conduct of the system added a new possibility of error in each motion to be made. Unless the new checks and balances would remove a large proportion of the original errors established, the addition of more system could be expected to lessen the efficiency, because it increased the number of places where error could creep in and the number of motions where a mistake could be made.

Under the circumstances, my judgment was that the changes in the system were unwarranted by the conditions; that they would bring no observable improvement in accuracy; and that they would probably lead to a decrease in accuracy due to the larger possibility of human failure.

In an establishment with which I was well acquainted some years ago, the manager of one of the special departments became so interested in securing accuracy of records and conditions, that his department was enlarged with great rapidity in order to analyze the items, check the conditions and balance the results. After a number of years, a change was made in the management of that department. The new manager operated with 50 per cent of the personnel and the observable errors were not increased by this reduction of the system.

The first manager had become so interested in securing accuracy for the sake of securing it, he had forgotten that an unusual degree of analysis in his department could not have any bearing upon the total result because the extra accuracy secured in that department was lost in the relative approximation required in the work of other branches of the operation.

We are constantly referring to the red tape which surrounds the governmental departments, which makes it so difficult to do business with any satisfaction. These governmental departments are limited by the laws, precedents and rules which have been established from time to time for the protection of the public, for the definition of responsibility or for the extension of the system. While it is not visible to the same degree, there is a tendency for the system in its detailed technique to evolve a lot of unnecessary motions in many of the special departments in the large industrial establishments in this country. This leads to a bureaucratic condition, within the departments themselves, and the elevation of a rule to a principle so that it cannot be disturbed and must travel its accustomed way, whether that method answers the purpose most effectively or not.

Some of these things had been observed by intelligent engineers in their study of plans under different conditions and with different operations, and they have led to the talk about decentralization which threatens to become as much of a fetish as centralization did some years ago.

The minimum amount of system necessary to prevent confusion is probably the ideal amount of system. The practical amount of system is dependent upon the measure of intelligent understanding possessed by all supervisors. If we are willing to spend the necessary time and effort to educate supervisors, instead of obliging them to educate themselves in the inefficient and fragmentary way in which this education must be secured, we will be able to give all supervisors a larger measure of responsibility, simplify the work of the special departments without losing any of the required standardization.

The present tendency to inflexible routine in the special departments would be eliminated or reduced, because it would be checked constantly by the practical understanding of the supervisor who was permitted to exercise his responsibility in connection with it. Mostly, the human errors are due to lack of interest and misunderstanding, and no system based upon these deficiencies will eliminate the errors. Systems, which run wild in their accumulation of technical detail for the purpose of eliminating error, are quite likely to enlarge it and to add to the cost burden under which the establishment labors.

For a considerable time we have paid some attention to training the skilled worker in his job, and a lot of time and thought has been given to the education of the salesman and the office force. It will pay us to spend some time on the education of the men responsible for production, and we should be able to eliminate a lot of cumbersome special systems when we have been at that work for a reasonable period.

The development of theoretical education along with practical education for the foreman, which has been taking place in the last year or two, is an excellent sign. No development is more greatly needed in the improvement of production efficiency. It will be accelerated if we study the systems we at present employ, find out from the foreman and the other supervisors the difficulties and troubles which arise out of these systems and take into serious consideration the question of simplifying them by permitting the supervisors a larger degree of responsibility in connection with them.

Instincts and Incentives

THERE are various instincts which make men work. There is often a more or less direct relation between the instinct which motivates the worker and the quality and quantity of work produced. This fact should be more generally recognized, since its importance increases directly in proportion to the length of time over which it operates.

In other words, fear of losing his job may drive a man to extended effort for a short period of time, but if no other incentive to work is ever provided, other instincts, such as hate and distrustfulness, come into play and are almost sure to overcome the fear of losing his job. The growth of these other instincts among many individuals combine to produce industrial inefficiency and in the long run industrial chaos.

What little data is available as the result of experiments tends to show that men urged by the better instincts of pride in workmanship, ambition and desire for service, as well as by desire for money and fear of unemployment, will produce work of greater quality and quantity over any considerable period of time.

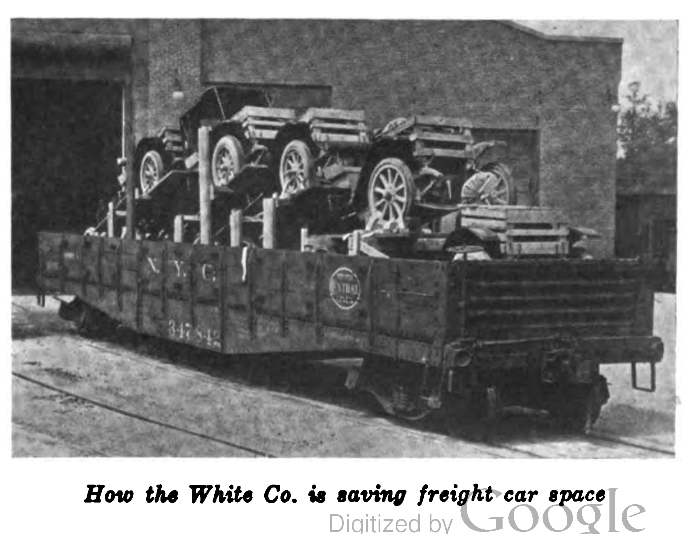
All these factors should be considered when discussing the matter of better workmanship and the providing of incentives. A recent pamphlet published by the Cleveland Chamber of Commerce entitled "Employees' Incentive Plans in Cleveland Industries" divides the plans discussed into four classifications: profit sharing plans, limited profit sharing plans, bonus plans and stock sales plans.

Examination of this classification brings out the fact that every one of these incentives appeals to a single instinct, the instinct for monetary gain. It is undoubtedly true that an appeal to this instinct is likely to play an important part in many successful incentive plans. But it is significant that all the plans noted appeal almost entirely to this instinct. The term "incentive plan" must be supposed to have a very narrow definition if it is to refer only to money incentives.

A broader interpretation of the term is necessary and a wider group of instincts need to be considered if permanent progress is to be made along these lines. And it is very desirable that the study necessary to such progress be pushed forward as rapidly as conditions permit.

Commercial Vehicles of Great Britain

A COPY of the second edition of a book of specifications of British commercial motor vehicles, published by the B. F. Goodrich Co., Ltd., of London, under date of 1920, has just come to hand. Specifications of forty-four different makes of vehicles are given, including trucks, tractors and sight-seeing buses as well as vehicles of all three motive powers. There are articles on A Standard System for Recording the Operating Costs of Commercial Vehicles, Lengthening the Life of a Motor Vehicle and Relation of Tire Equipment to Cost of Maintenance of Commercial Motor Vehicles. Besides the book contains useful information on British tire standards, British commercial vehicle associations, etc.



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Government and Business

THE announced theme of the Ninth Annual Meeting of the Chamber of Commerce of the United States indicates that the meeting will be an interesting and profitable one. The theme is:

"In the public interest; more business methods in business, less government management of business."

The advance notice of this meeting states that all questions to be brought before the meeting will be approached as they relate to the general theme. If this program is carefully and intelligently followed, the gathering of business men at Atlantic City April 27 to 29 should do much to solve many of the minor, but perplexing troubles of business. There is and must be such an intimate connection between government and business, especially while heavy taxes are necessary to clear up the war expenses, that almost any new undertaking is considered from this point of view.

Many business men are hopeful that the present administration will take long steps toward injecting the business idea into government. This hope has been increased by the news that Secretary of Commerce Hoover is consulting frequently and frankly with business men. He is hearing the views of men who are successful in private business and is letting them pass on his ideas. It goes without saying that these men will reach a common idea in these meetings, for both sides are approaching the questions with a view of being mutually helpful. The annual meeting of the Chamber of Commerce should do much to promote the work that Secretary Hoover is endeavoring to carry out.

Then, too, if the business men and the government departments can agree on a few fundamentals, and each is led to see the troubles of the other, there will be less antagonism over details.

Annual Working Days of Farm Tractors

MANY of the farmers who purchase tractors do not at once dispose of the number of horses that the tractor should be able to displace. The tractor is something new to them, largely of the nature of an experiment, and they decide that they will feel their way slowly and not take any unnecessary risks. The loss of any considerable part of his crop is a serious matter to the average farmer, and as he is not quite sure of his tractor and of himself as a tractor operator he holds onto most of his horses for the first year at least. The result is that the tractor does not prove as economical as it otherwise would.

For some classes of work the tractor is so obviously superior to the horse that most or all of it is done with it right away. This applies particularly to plowing. After a farmer has once plowed at the rate of 8 acres or more a day, the old rate of 2 to 2½ acres seems exceedingly slow. But for other lines of work the tractor is not visibly better than the horse, and as long as horses are kept on the farm in any numbers they will be used for this work. To judge from a report recently issued by the U. S. Department of Agriculture, this applies particularly to haying, for whereas 85 per cent of all the plowing on the farms covered by the report was done by the tractors, only 15 per cent of the hay loading and hauling was so done. The low efficiency the tractor showed in hauling hay on wagons is readily understood, because in drawing a load of hay the tractor is giving only a small fraction of its maximum useful output. But in order to make the tractor an economical investment, all of the work for which horses are usually required should be done by motor power so that horses can be dispensed with.

It is rather remarkable that the investigation, which covered 286 farms in Ohio, Indiana and Illinois with an average area of 258 acres, showed an average annual use of only 30.8 full days per tractor. Some years ago it was figured that the average number of days use per year was close to 50, while at the Columbus tractor show one of the speakers mentioned 45 days. It would seem that on the farms in-

vestigated there was altogether too much equipment for the work to be done, which cut down the amount of work for the tractor, and hence its economy.

In making this statement we are not finding fault with the report, the natural object of which was to present conditions as they actually existed. The trouble is that, for one reason or another, the farmers found it impossible to dispense with a considerable number of horses and that owing to the existence of both the horse and the power equipment the annual working time of both was undoubtedly very low.

It is rather remarkable that only 2.7 full days of belt work was done annually by each tractor. It ought to be an easy matter to find much more belt work than this. The solution of the power farming problem lies in rendering the equipment adaptable for the multitudinous classes of work that require to be done on the farm, thus eliminating the cost of horse maintenance and reducing the periods of idleness of the expensive power equipment.

Better Springs for Light Loads

ONE factor frequently commented upon in connection with passenger-carrying vehicles relates to the fact that they are almost universally hard riding under light loads. It is necessary, of course, to fit to any such vehicle springs having sufficient capacity to carry a full complement of passengers, even under adverse road conditions, with the result that when the same vehicle is only partly loaded the riding qualities are much less satisfactory. This is espepecially noticeable in the case of a bus when such vehicle carries only a few of the total number of passengers for which seats are provided, particularly when, as is usually the case, rather poor cushion springs are provided.

During the past few years many unconventional types of springs have been suggested which are designed to overcome this fault, but so far as we recall none of these have proved sufficiently satisfactory from every standpoint to see any extensive commercial application. So the problem is still with us.

Spring suspension is one feature of chassis design which has perhaps received more study than any other one item outside the engine and its accessories, yet there is still room for great improvement. The theory of spring action is well developed, but it still remains to design springs which are entirely satisfactory under all conditions of service. The problem is not an easy one, but the reward for its solution should be great enough to encourage those who are sufficiently persistent in work to this end.

Highway Transportation

UNTIL the many industries that use the highways, either in the transportation over them of their raw material, partly manufactured or finished products, realize the relationship of their industry to the highway problem it is not to be expected that transportation development will go ahead as it should.

The highway problem to-day is more than one of road construction and maintenance, it is one of the proper use of the highway and streets of our cities; it involves not only the highway but our railway and waterway termini in relation to these highways and the most efficient methods of handling commodities over these highways.

Our highway problem is one that must be looked squarely in the face not only by motor car and motor truck manufacturers, but by railway executives, city governments, suburban trolley interests, waterway executives and every other executive with whom transportation is a problem. It is only by the broad consideration of it by all of these parties concerned that economic results will follow. The movement cannot be pushed by any one industry to the detriment of others. The broad policy of rendering to the railroads that which economically belongs to the railroads and to the highways that which economically belongs to highways, must be applied throughout to waterways, trolleys and, in time, to airways.

In the bringing together of these several interests, the Federal Highway Council has accomplished commendatory service. For the first time in the history of highway transportation large railway executives, large express company executives and large trolley and waterway executives have met with highway executives and traffic executives to work together in untangling the highway problem. Some disinterested organization of this character is the only kind in which all interests will agree to come together. It is to be hoped that the work already accomplished by these varying interests, meeting under the guidance of the Federal Highway Council, in connection with store door delivery will continue and that, when this needed movement is accomplished, the problem of the short haul will be as fearlessly considered by all parties concerned as has the store door delivery. No other organization, without strings tying it to some particular industry, is so well qualified to handle this work. There is every year a growing need for such a citizen organization. It is free from government domination. It is not obliged to answer any particular industry. It works with but one end in view, namely, the economics of highway transportation, construction and maintenance.

Floatless Carbureters

SOME engineers are of the opinion that the next step in carbureter development will be the elimination of the float mechanism. Several carbureters of this type are being marketed in Europe, and a few are offered by American manufacturers. Some of these have means for vacuum feed and thus make it unnecessary to use a separate vacuum tank or pressure fuel feeding system. There is thus eliminated in some cases two float mechanisms, which, though they are the cause of relatively little trouble in themselves, add extra parts which advocates of the floatless vacuum feed type maintain are superfluous, and therefore involve a needless expense. A device of some kind must, of course, be substituted for the float, and whether this will involve moving parts that are less reliable and less expensive than the float mechanism remains to be seen.

Unit Parts Makers in Service Plan

Stations Proposed to Cover Country

Complete Stocks for Assembled Cars to be Carried Within Easy Reach

DETROIT, March 22—Rapid progress has been made in the past few days by some of the leading unit parts manufacturers for the establishment of a nation-wide distribution system for parts for assembled cars and trucks. The plan is said to have the approval of some of the leading vehicle assemblers. Plans are rapidly being brought into workable form and a definite announcement is expected in the near future.

The entire subject was considered at a conference in New York last Friday, but many details remain to be worked out. Thirty major stations where standard unit parts can be obtained by distributers and dealers are in operation, but the plan calls for twice this number of major stations and as many sub-stations as may be needed to cover the country in such a way that no service shop will be more than six hours distant from the nearest parts depot.

The idea took nebular form in the minds of various parts and car manufacturers at about the same time, and was in recognition of the need for better servicing of automotive vehicles. There were differences of opinion as to how it should be worked out, and it was necessary to reconcile these opinions. This resulted in many informal meetings and in much missionary work. One of the leading engine manufacturers was the prime mover, and he now has associated with him some of the most prominent unit parts makers.

Consideration was given to the subject at a recent meeting in Chicago of the Motor Truck Manufacturers Association and there will be a conference here next week between committees representing the parts makers and the Motor Truck Sales Managers Association.

Will Carry $5,000,000 Stock

The depots will carry ultimately stocks of parts of eight unit manufacturers. It is estimated $5,000,000 will be invested when the system is in complete operation.

A nation-wide advertising campaign announcing the sale of genuine parts at prices which will eliminate the pirate is planned to stimulate demand for genuine parts and to acquaint the owner with the fact that they can be obtained at the same price or less from the depot maintained under the new system. The genuine replacement parts will bear the trade mark of the unit manufacturer.

There is a wide divergence of opinion among passenger car and truck manufacturers in regard to the merits of such a system. Some of them are in hearty accord with the movement and others are bitterly opposed to it.

Promotors of the venture contend that under this system it would be much less expensive to carry an adequate stock of parts and that it would give a tremendous stimulus to the sale of assembled vehicles. There is no idea of preventing manufacturers, distributers and dealers from carrying a stock of parts if they so desire.

Would Avoid Duplication

In behalf of the plan it is pointed out that under the present system many duplicate stocks are carried in each city, but in the case of smaller car and truck stations these stocks are often inadequate. Then, too, the lack of uniformity in profit percentages and charges, and varying distances between assembling factories and service stocks, results in wide divergence in prices on the same part in the same city. The aggregate stock carried in some of the cities is so large, yet so spread out, that it does not meet the real needs of many of the stations, and had proved so expensive that the overhead more than absorbs the profit, even when this profit seems to be unduly high.

The result is that pirate parts manufacturers and dealers can quite easily sell these parts for a mere fraction of the price asked by the dealer with the contract. Under the new plan, distribution would be unified so that a complete stock would be carried in one central

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SOVIET GOVERNMENT BUYS SLOUGH TRUCKS

LONDON, March 21 (*Special Correspondence*) — The Russian Soviet Government is understood to have contracted with the Slough Trading Co. for the purchase of a large number of reconditioned trucks now stored at Slough. A very large proportion of these trucks are of American make and were sold by the War Department at the close of the war. It is reported that the Russian Government wants to buy several hundred, and since the trade agreement between Russia and Great Britain has been signed it is not expected any obstacles will be placed in the way of the transaction. The sale will help trade renewal and will stabilize the market value of several classes of motor trucks.

Importers Organize in Mexican Capital

Will Seek to Improve Methods of Car Importation, Distribution and Sale

NEW ORLEANS, March 21—Spanish newspapers of the city of Mexico received here to-day tell of the organization in the capital of the southern republic of the Mexican Association of Automobile Importers, embracing as active members all the firms engaged in this line in Mexico City, and as associate members about 78 per cent of the firms similarly engaged outside the capital. There are about a score of these firms in Mexico City, but the number in the other large cities of the country are not mentioned.

In its statement to the press, the "Associacion Mexicana de Importadores de Automoviles," to be known briefly as the "A. M. I. A.," gives the purposes of its organization as "to procure unity, harmony and better relations, both business and social, among the automobile importers of Mexico; to represent its members in all necessary action to obtain commercial advantages and legal protection; to improve methods of importation, distribution and sale of automobiles throughout Mexico, and to assist in the establishment of good roads in all parts of the republic."

Apparently the native newspapers of Mexico City are largely responsible for the organization of the association, as the first meeting was held in the offices of one of the papers, and was attended not only by all the automobile importers, but by the publishers of all the newspapers in Mexico City, and in several surrounding cities as well. Entrance fees of $250 (gold) for active members,

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SEES CHEAP AIRPLANES SOON

BOSTON, March 18—Airplanes as cheap as automobiles were predicted by M. Luckiesh, director of applied science at the Nela Research Laboratory in Cleveland, who spoke at the Engineers' Club under the auspices of the American Institute of Electrical Engineers. He said this ought to come in five years.

PREPARE TO BUILD FORD DAM

TROY, N. Y., March 21—Engineers having in charge preliminary arrangements for the erection of Henry Ford's great tractor plant at the United States dam across the Hudson River here have arrived in this city and will begin active work excavating for the power plant as soon as the high water recedes.

Business Continues Upward Trend

General Conditions Show Improvement

National Response to Better Business Extends—Spring Weather Brings Cheer

NEW YORK, March 21—Reports from various sections of the country indicate a slow but gradual improvement in trade and industrial conditions in general. Excellent spring weather has broadened sales demand, both at wholesale and retail. The early spring has had much to do with the upward trend in automobile sales and it is partly seasonal.

Good weather has brought increased activity in farm work and plowing and planting are moving rapidly northward. This should improve the spirits of the farmers and make them a little more willing to buy. It probably is responsible for reports of better trade prospects in Kentucky, Minnesota, Missouri, Iowa and Texas. There are few districts, in fact, which report wholesale or retail trade as dull. In most sections it is classed as "fair."

It must be conceded, however, that while conditions are steadily improving, especially in the automotive trade, industry as a whole is lagging and that while unemployment is less widely diffused there are millions of workers who are idle. In this connection it is encouraging to note that unemployment is decreasing in the South and that several thousand men have gone back to work in Chattanooga, Louisville, New Orleans, Memphis, St. Louis and Atlanta.

It has been said that when the break in sales resistance came in the Northwest the worst would be over. The indications are that this condition soon is coming if it has not already arrived. Any sign of improvement in the South is significant for it has been felt it would take this section longest to go through the readjustment process. Although conditions there are getting better, it is too early to look for heavy sales. In this connection the Atlanta correspondent of AUTOMOTIVE INDUSTRIES says:

All Lines Found Improved

"Business is gradually getting back to normal in all lines but it has not yet recovered from the long period of depression. An intensive merchandising and sales campaign at this time doubtless would produce some results but postponement of that effort until conditions are more favorable, probably would be advisable. The condition of the cotton market always has much to do with the financial situation in the South. The present price still hovers around 10 cents a pound and with thousands of farmers holding last year's crop for higher prices they haven't the money with which to buy anything. Caution is advisable until it is known just how much the cotton acreage will be reduced this year. If there is a material cut it probably would be safe to make a hard drive for sales as higher priced cotton will be the inevitable result."

The central west seems to offer good sales opportunities at this time. The Milwaukee correspondent of AUTOMOTIVE INDUSTRIES wires:

Central West Reviving

"Knitting mills are running full time. Other factors in the clothing and dry goods business show rapid improvement. Further slight revival is noted in the steel industries. Merchants find money easier to get and a marked improvement is expected at once, with the income tax paying period past. Hotels report a revival of business, the first since December, and used car advertising brings a much improved response. Altogether the outlook is distinctly encouraging."

Taken as a whole there has been something of a general industrial revival in Ohio and Indiana and there has been a considerable increase in the sale of cars.

The outlook in New England is not so encouraging as it was a few weeks ago when renewal of operations by textile mills and boot and shoes factories was general. It was found that the orders which resulted in the opening of plants were largely to complete depleted stocks.

R. A. Stranahan Predicts Car Shortage in June

ATLANTA, March 18—R. A. Stranahan, president of the Champion Spark Plug Co., and of the National Automotive Equipment Jobbers' Association, predicted that there would exist a shortage of motor cars in the United States by May and June of this year, in an address before the Southern Automotive Equipment Jobbers' Association, which held its annual convention in Atlanta, March 11 and 12.

Stranahan declared that Champion business during January and February of this year compared very favorably with the same months in 1920, while advance specifications from dealers and jobbers were better for March of this year than the same month in 1920, and for April of the present year were more than 100 per cent greater than April, 1920. Orders, however, he stated, were still low, not more than one-third or one-half as great as during the same period in 1920. In the sale of manufacturers' equipment, he declared that 1921 would fall considerably below the record of 1920, but expressed the belief that the accessory and equipment business as a whole for 1921 would surpass 1920.

Kansas City Finds Sales Volume Rising

City Buying in Good Volume—Farmers Returning to Market Slowly

KANSAS CITY, March 21—Steady increase in retail trade is reported in Kansas City and the larger cities of the territory. Established dealers with a good car of reputation, with service departments actually helping to keep cars running—this class of dealers is getting really first class volume. Cars not so well known and cars handled by dealers who for one reason or another have not maintained service, are not selling so well at retail; the shortage in movement reduces the average of passenger car sales to about 80 per cent of normal in the city.

After two weeks of brisk movement of carloads from Kansas City distributors to country dealers, this phase of the business has settled down to a steady outgo of single cars, usually driven out by or for the country dealer. The dealer in the small town is having difficulty financing his stock purchases; the farmer, his chief source of volume business, is not buying yet, and the small-town business men do not offer a wide market. Dealers are taking from distributors, therefore, only as they sell. But this volume is increasing steadily, as farmers become reconciled to new conditions.

The chief factor now operating to increase sales is the restoration of confidence in the minds of the salaried man. Until this month men on salary were hanging onto their money fearful of possible financial catastrophe (either personal or national). They now see that the world is moving calmly along; that business is being transacted in most lines on a level about 75 per cent of normal (in some lines 100 per cent) and that they are going to keep on earning and getting salaries.

Used car sales are said to be increasing faster than new car sales. Several dealers report that while they were getting fair results even in fall and winter and better this spring on new cars, they had not moved any used cars until the past few weeks.

HANSON REDUCES PRICES

ATLANTA, March 18—Prices on Hanson open models will be reduced at once. The 5-passenger and roadster models will be sold for $2,185, and the 4-passenger model at $2,285. The former prices were $2,365 and $2,465 respectively. The price on the sedan will continue at $3,165.

Pence Company Buys Trainload of Buicks

Half-Million Order Indicates Sales Resumption in Northwest—Ford Branch Starts

MINNEAPOLIS, March 18 — While generally speaking there is only a slight lifting of the sales cloud situation, one optimistic note is struck in the receipt by the Pence Automobile Co., which buys Buicks for a large territory and distributes on its own account, of a trainload of cars, the first time this train has moved its wheels for four months.

The Pence company owns two trains and this one was composed of 76 cars, four automobiles to a car, which cost the firm just $411,139.20. Upon arrival of the train the company had just thirty cars left in the house. It is the opinion of this firm that the savings banks' increased deposits show that the people have the money to buy automobiles. This firm's retail sales have looked up. However, generally speaking, the country situation does not seem much improved from a financial viewpoint, as to motor car purchases.

In the Twin Cities retail sales have improved some with the mild weather, but a large percentage of these are from car owners and involving trades. The new business does not seem to be appreciable. In trucks there promises to be a better business. In fact inquiry is good, but the basis of the hope for better business is the quantity of trucks that will be required by contractors who get their bids accepted for road construction under the Babcock law, adopted by popular vote at the general election in Minnesota.

Another note of interest is the resumption of operation by the Minneapolis assembling plant of the Ford Co. The rate of assembly reached this week is 250 cars per day. The branch reports 3500 orders of cars for March delivery in Minnesota, northern Wisconsin and eastern South Dakota. For April this is 6000 cars. These are larger than a year ago. Dealers' stocks are said to be about cleaned up.

Buick and Dort Plants Increase Operations

DETROIT, March 18—Further improvement in the industry is shown in the step-up in production within the last three weeks in factories throughout Michigan. Practically every manufacturer outlined increased schedules for March production, but in many cases the brisk demand noticeable since the first of the month had resulted in revision of those schedules upward. This is true particularly in Flint, which was hard hit by the depression.

The Buick plant now is turning out around 250 cars daily, the output for the last ten days ranging from 240 to 260. The Buick plant capacity in finished cars is 600 daily. During last year's peak Buick was employing 22,000 men. There are approximately 12,000 employed now working about 60 per cent normal time. Sales demand, Buick officials say, is better than was expected, necessitating the sharp upward trend in production. The plant built approximately 200 cars a day in February.

Dort Motor Car Co., which produced about 700 cars in February, now is turning out an average of 60 each day with 500 of the normal force of 1500 men working full time. The new Dort model, officials say, rapidly is winning its way with automobile lovers, and actual sales and prospects they say will necessitate another step-up in production by the end of March.

Dodge Resumes Work with 4000 Employees

DETROIT, March 21—About 4000 of the normal force of 22,000 employed at Dodge Brothers resumed work to-day on a schedule conforming with sales requirements which is expected to be steadily increased.

Arthur T. Waterfall, general manager, said that the company would make no statement regarding the actual number of men to be employed at the start nor the probable production. The report that the company would put on a night shift was denied by officials, who declared they were just feeling their way and that future activities would depend entirely on demand.

Canaday Forms Company to Handle Willys Ads

TOLEDO, March 21—The formation of the United States Advertising Corp. by Ward M. Canaday, formerly advertising manager of the Willys-Overland Co., was announced this week. The move indicated a further trend toward economy in the Overland administration.

Practically the entire management of the Willys advertising staff goes over into the new company, which will handle the Overland contract and the Mather Spring Co. advertising. Canaday is president of the company. He has been with the Willys-Overland company for five years. The company is capitalized at $50,000. It will have charge of Overland service publications as well as all advertising. The Overland contract was held for many years by the Martin V. Kelley Co.

DECLINE NINE HOUR WORK DAY

YOUNGSTOWN, OHIO, March 19—Operations at the Salem plant of the Mullins Body Corp. have been suspended following the refusal of employees to work nine hours a day at the same pay they received for eight hours. The men asked for a reduction of 10 per cent and that the eight hour schedule be continued. The 10 per cent reduction has been made in the wages of executives, office workers, foremen, engineers, watchmen and other employees as well as piece and premium workers.

Overland Factories Extending Schedules

Plan Centralization of Production Control and Development of Quality Standards

TOLEDO, March 21—With the return of Overland officials from the Boston automobile show yesterday, indications appeared to point to gradual increase in production at the Toledo plant of the Willys-Overland Co. Vice-President Charles B. Wilson and Sales Manager A. C. Barber attended the show at Boston and met with the Willys New England dealers while there.

It was the first opportunity the dealers have had to get acquainted with the new factory heads and also put the factory men in touch with the Eastern markets. The officials expressed themselves as pleased with the results of the show.

On Thursday the first issue of the Willys News, the factory employees' paper, since the change in management and since the "closed for inventory" period last November, was put out.

Employees are being added to the payroll and the production of Willys-Knight cars is increasing. The plant schedule is now running between 25 and 40 cars daily. The output varies with the demands from dealers.

Much of the work at the plant for several weeks has been directed toward increasing the quality of Overland products. All parts on hand have been rigidly inspected and the officials have ordered more attention to all details in the production end.

A new production system is being installed at the plant under the supervision of Wilson. The general plan has the goal of centralization of production control and development of quality in the product. J. A. Sheldon, production manager, will have direct factory supervision of the production plan, and Ernest Smith, will have direction of the executive work.

A central planning office is being organized and co-ordinated with it will be production booths in each department of the factory. The amount of work to be done daily will be laid out at the central office and the part each department will do will be indicated at its own production booth. Each booth manager will know the amount of work to be done in his section and the time of its arrival and departure.

To Decide Changes in Models

An important part of the general program being lined up is the naming of a committee to pass on proposed changes and improvements in the Overland models. There are eleven men on the committee, including some of the oldest employees of the company.

"These men will be expected to keep our cars in the vanguard," said Vice-President Wilson. "Any suggestion that any man in the factory makes will be considered by this committee."

Chevrolet Refund Offered to Buyers

Will Return $70 to $100 a Car if Sales Aggregate 50,000 Vehicles by July 31

NEW YORK, March 21—As a special inducement to prospective buyers to come into the market at once, the Chevrolet Motor Co. has announced a refund of from $70 to $100 on its several models, providing sales between Jan. 1 and July 31 equal the 50,000 production schedule which the company has outlined for this period.

List prices of models and the amount of reduction under the proposed plan are:

Roadster and touring, $795, refund $70; light delivery wagon, $820, refund $70; chassis, $770, refund $70; coupe, $1325, refund $100; sedan, $1375, refund $100.

According to the announcement the refund represents savings in material prices under present readjusted conditions, which savings can be made provided Chevrolet factories continue to operate on the estimated average quantity production basis. It is in keeping with the Chevrolet policy, it declares, to make the price of its product as low as quality manufacture on a large scale will permit.

Fifty thousand cars is the minimum, the company says, which its engineers estimate will secure substantial savings in cost in manufacture. Purchasers under the plan will receive a certificate from dealers which will be redeemed as indicated on its face. Production results will be announced by August 10.

Goodyear Coordinates Sales Departments

AKRON, March 21—With the appointment of R. S. Wilson, truck tire manager, as manager of the Western division of the Goodyear Tire & Rubber Co., with headquarters in Chicago, several changes in personnel have been announced coincidentally with a readjustment of the Goodyear sales service, so as to improve the company's method of stimulating sales service throughout the entire country.

Wilson, as Western division manager, will supervise a territory embracing twelve States. He succeeds H. P. Ziegler. G. E. Brunner, manager of the service department, has been announced as successor to Wilson as truck tire manager at Akron.

Brunner's promotion leads to a change in the functioning of the service and of the sales promotion departments, under which C. W. Santee, who has been manager of the sales promotion department, becomes manager of sales service.

Responsible to Santee will be R. W. Clark, manager of sales promotion; W. H. Sorn, manager of the service department; P. R. Baugh, manager of the dealer development division; H. H. Tolman, manager of the government sales division; C. A. Reed, manager of the stock clearance division, and A. R. Kroh, farm lecturer and field worker.

The new arrangement which closely co-ordinates the work of various departments directly related to sales, is expected to increase the scope of Goodyear sales service. Santee, now director of the plant has been with Goodyear since 1919. He was first attached to the office of sales manager L. C. Rockhill, later becoming manager of the sales promotion department in charge of the work of centralizing promotional work on all products.

Brunner, the new manager of the truck tire department, has been with Goodyear since 1914. He is a former faculty member of Mercersburg Academy. He became manager of the service department in 1917.

Goodyear Meeting Adjourned

AKRON, March 21—The special meeting of the stockholders of the Goodyear Tire & Rubber Co., set for to-morrow, to act upon the reorganization program, has been adjourned to March 29. This is the second postponement, but President Seiberling declares satisfactory progress is being made by the committees negotiating with merchandise creditors, although a little more time will be needed to adjust the situation satisfactorily.

Ford Plant Increases Production of Benzol

DETROIT, March 18—The first of a number of benzol stations to be operated by the Ford Motor Co. has been started here. Heretofore the sale of benzol has been confined to three Ford stations near the Rouge and Dearborn plants, outside of Detroit. With production increasing at the blast furnaces, the company plans to maintain stations throughout Detroit.

The fuel is a by-product extracted from the gas produced when coal is decomposed into coke at the Rouge ovens. The 5000 gal. produced daily is mixed with an equal amount of gasoline to make impossible the thickening of the by-product in cold weather, and a 12 per cent mileage increase is guaranteed. The fact that the benzol is sold cheaper than gasoline naturally is an inducement to drivers.

KENWORTHY REORGANIZED

SOUTH BEND, IND., March 21—The Kenworthy Motors Co has been reorganized and the majority of the board of directors now consists of officers of the Dodge Mfg. Co. The new directors are F. T. Howlett, general purchasing agent; Walter E. Rowe, chief engineer; Frederick S. Willett, comptroller, and Temple Williams, assistant to M. W. Mix, president of the Dodge company. The Kenworthy plant is being operated under the direction of Rowe. The books are being brought up to date as rapidly as possible and an investigation is being made to determine the possibility of continuing operations.

C. C. Hanch Joins Advertising Firm

Former Maxwell-Chalmers Executive Will Be Counsel to McKee Company

INDIANAPOLIS, March 21—Charles C. Hanch, vice-president of the National Automobile Chamber of Commerce, widely known in the administrative activities of the automobile industry, has become associated with the Homer McKee Advertising Co., Inc., of Indianapolis. Hanch has long been associated with the automobile industry,—nineteen years as treasurer of Nordyke & Marmon Co. of Indianapolis, four years as treasurer of the Studebaker Corp. and later as general manager of the Maxwell-Chalmers interests.

In entering the advertising and merchandising business with the McKee organization Hanch will be able to continue his close contact with the automotive industry, through his work as general business counsel of the McKee company. Hanch believes conditions have brought about a new alignment in American business in which scientific distribution of goods based upon sound engineering, production and finance is the crying need in the transformation through which the automobile industry is passing. He points out that manufacturers have reached the peak on production economies and now must concentrate upon distribution economies which heretofore have been permitted to run wild.

Hanch is chairman of the Taxation and Patents committees of the National Automobile Chamber of Commerce and was one of the prime movers in the organization of the national body of automobile manufacturers. He had been in Washington lately in conference with the government's taxation experts relative to tax revision in impending legislation. During the war he was Chief of the Automotive Products Section of the War Industries Board at Washington and following the armistice he was sent abroad by the Bureau of Foreign and Domestic Commerce of the U. S. Department of Commerce to study and report commercial and industrial conditions in England, Belgium, France and Italy.

One of Hanch's accomplishments in the automobile industry was the initiating of the movement and serving as chairman of the committee that effected the cross-licensing patent agreement among American automobile manufacturers.

PERFECTION PAYS CREDITORS

MILWAUKEE, March 21—Creditors of the Perfection Engine Co. have accepted the offer of a 50 per cent composition of all claims, which are being liquidated by special loans made by two principal stockholders in the corporation. It probably will continue operations. Upon involuntary bankruptcy proceedings, schedules were filed admitting liabilities of $16,306.76 and claiming assets of $27,273.56.

Continental Nears 70 Per Cent Basis

Will Reach New Production Mark by April 1—Truck Demand Remains Slow

DETROIT, March 21—Steady improvement in the passenger car end of the automotive industry is demonstrated in the constantly increasing production at the Detroit plant of the Continental Motors Corp. Officials said to-day the plant would be on a 70 per cent production basis April 1.

While there has been no marked increase in production of truck engines at the Muskegon plant, that end, they say, is showing signs of improvement. With the start of roadway repair and construction, and building operations throughout the country during the next few weeks, the demand for trucks is expected to take a spurt. Continental officials, however, do not look for greatly increased production in the truck end for 60 days.

Renewed activity in the passenger car division is not confined to any car or group of cars, but reflects conditions throughout the industry, officials say. It is significant that with the increased production Continental at present is employing only about 45 per cent of the normal force. The normal mark, insofar as production is concerned, officials say, will be maintained with less than 75 per cent of the usual force.

Toledo Commutator on Full Production

TOLEDO, March 21—The Toledo Standard Commutator Co. has gone on a full time production basis this week. The company has several contracts with automobile factories and has begun receiving orders for the production drive getting under way.

At the annual meeting of stockholders this week the officers were re-elected. Charles A. VanDeusen is president; Eugene Rheinfrank, vice-president; E. B. Moon, secretary-treasurer. D. O. Kershaw, for many years with the Electric Auto-Lite Corp., has associated himself with the company as vice-president and general manager.

W. S. HUDSON TO BUILD TRUCKS

PHILADELPHIA, March 21—William S. Hudson, president of the Hudson Motor Specialties Co. and inventor of the Hudford truck attachment, is forming a company to build a 3-ton truck which will embody in its construction many of Hudson's patented features. The vehicle will be named the Hudson truck and it will be produced by the Hudson Motor Specialties Co. The control will be in the hands of Hudson who is said to have evolved entirely new methods of distribution. J. H. Malone, who was advertising director of the Chilton publications, will be vice-president.

SOUTHEAST EXPRESS MOTORIZES DELIVERY

ATLANTA, March 21—The Southeastern Express Co., organized some weeks ago to take over the business of the Southern Railway lines, has standardized on White trucks and placed a large order for equipment. When delivery is completed the fleet operating for the Southeastern Express Co. will be one of the largest truck fleets in the South. The order was placed through the White Atlanta branch by J. R. Hockaday, president of the new express company.

Baxter New President of Holt Manufacturing

STOCKTON, CAL., March 19—Thomas F. Baxter has been elected president of the Holt Mfg. Co. to succeed the late Benjamin Holt. Baxter has served as general manager since 1914. Alfred B. Holt, elder son of the founder of the company, has been elected a vice-president, and C. Parker Holt is treasurer. William E. Shepherd has been made manager of the Western end of the business, and J. A. Hymer, sales manager of the Western territory, succeeding Thomas H. Luke who becomes director of sales. R. S. Springer remains as vice-president and factory manager, and M. M. Baker as vice-president and manager of the Peoria plant.

The company reports that there is a satisfactory sale West of the Rocky Mountains of the 5-ton model of the caterpillar tractor, which was offered in that territory for the first time only a few months ago. This model, which was used by the American army during the war, is offered in standard type for general farm and road work, and a special low seat design has been made for orchard work.

Velie Speeds Output to Thirty Cars Daily

MOLINE, ILL., March 21—Production of the Velie Motors Corp. has jumped to 30 cars a day and next week is expected to go to 35 daily. The plant has gone on a 9-hour shift to meet the production schedule and this working hours increase, officers say, has been effected without decrease of wages.

Lee Hazard, production manager, says Velie orders within the last few weeks required the increased production and he does not foresee any early let up.

HAYNES PASSES 60 PER CENT

KOKOMO, IND., March 21—The Haynes Automobile Co. is gradually returning to normal production schedules. With the addition of a considerable number of employees the factory is now turning out cars at more than 60 per cent of its capacity. It is expected this figure will be raised to 75 per cent in April.

Winton Production Normal by May 1

Changes in Executives Witness Return of Alexander Winton to Active Role

CLEVELAND, March 21—An increase in sales of cars that set in on Jan. 1 and has continued to the present, led to the statement to-day at the plant of the Winton company that the factory probably would be operated on maximum production capacity by the first of May. The capacity is ten cars a day.

At the same time, the announcement was made that C. W. Churchill, who for a number of years had been general manager of the corporation, has resigned. Churchill retains a monetary interest in the corporation. Several years ago he came to the local plant from the New York branch of the corporation to act as sales manager. Later he was made general manager.

The position vacated by Churchill has not been filled and for the present his duties will be discharged by executive officers of the corporation. In the last few weeks, Alexander Winton, whose business capacity and knowledge of the automobile industry were responsible largely for the upbuilding of the corporation, has been taking a more and more active part in directing affairs.

Another change of executives was made in the sales department where J. C. Miller was made manager of sales, succeeding O. F. Baughman, who had occupied the position for a number of years. Miller left the New York branch to take up his new position.

Charles Mears, advertising manager, resigned, effective April 1, to engage in the advertising business in this city. He will handle the account of the Winton company in connection with his business.

INDUSTRY'S PAY-ROLLS GROW

WASHINGTON, March 18—Study of employment in selected industries during February as conducted by the Bureau of Labor Statistics of the Department of Labor shows the per capita earnings in the automobile trade were 16.2 per cent greater than in January. This increase is found despite cuts of 15 per cent in one establishment and five per cent in another. There was an increase of 1.3 per cent in the number on the payrolls of 40 reporting automobile plants. and an increase of 17.8 per cent in the amount of the payroll.

GRAND PRIX DATE, JULY 25

PARIS, March 1—(*Special Correspondence*)—Monday, July 25, has been definitely fixed as the date of the French Grand Prix 3-liter race at Le Mans. The Motorcycle Grand Prix will be held on the previous day over the same course. This change has been made in order to attract the popular crowd, which only has Sundays free, to the race for two-wheel machines.

Amarillo Becomes Big Tractor Center

Farm Machinery Sales in 1920 Total $20,000,000—Transform Former Cattle Ranches

AMARILLO, TEX., March 21—Amarillo bids fair to be the chief distributing point for tractors, power farm machinery and road building machinery of the entire Southwest in the next few years. This is indicated by the number of big distributing concerns located here now and the amount of business done during the past year. The motorized farm machinery business grew from an insignificant figure in 1915 to $20,000,000 in 1920.

This is considered phenomenal by the machinery houses of Texas and the big cities of the North and East when it is taken into consideration that the farm implement business in the Panhandle of Texas and New Mexico is really in its infancy. It is considered more remarkable because Amarillo is the only city of 16,000 in the United States which did that amount of farm machinery business during the last year.

Machinery men believe Amarillo will become the greatest distributing point in the country because the vast stretches of rolling prairies, once great cattle ranches, are rapidly being made into grain farms of vast acreages. The tractor and the other motor implements of the farm are being installed on every ranch which is subdivided into farms. A ranch which formerly contained 50,000 acres—and there are hundreds of them—means from 50 to 100 tractors, a score of binders and a bunch of threshers.

In a few years the vast plains of west Texas will be waving fields of grain and other crops, and as this is developed the sales of motor farm machinery will be increased, the machinery men say. In addition to the hundreds of thousands of acres of land being converted into farms in the Panhandle of Texas, like numbers of acres are turning to growing crops in New Mexico and parts of Oklahoma which are supplied by the implement houses in this city.

Nine Houses Now Open

At present there are nine big implement houses located here. They employ several hundred persons and have an annual payroll of several hundred thousand dollars. These nine houses did $20,000,000 worth of business in implements last year, and they report that despite the fact that money appears more stringent, the business for 1921 will increase from $5,000,000 to $10,000,000.

The big concerns located in Amarillo now are: Case with C. E. Kiser as manager, Avery with H. M. Hunter as manager, the Emerson-Brantingham with G. W. Davidson as manager, Dempster with R. T. Emmett as manager, Harvester with W. A. Frisk as manager, Roberts-Troxell with George Roberts as manager, Twin City with R. B. George as manager (Mr. George also handles the Oliver lines), Advance-Rumely with J. G. Wells as manager, Allis-Chalmers with J. D. Ingram as manager, and Kibbe Tractor & Implement with P. F. Kibbe as manager. The Minneapolis Threshing Machine Co. also has a branch here with G. C. Small as manager.

In many cases district managers of the really big concerns are handling lines of farm implements not carried by their own concerns. In that way anything from a plow point to one of the biggest tractors or most modern binders or threshing machines can be had in Amarillo without waiting for orders from the main houses. Every branch house here carries a stock of from $50,000 to $100,000 worth of machinery and implements all the year around. Some of them handle auto trucks, and the farmers are buying them rapidly.

Higher Taxes Hamper Car Sales in Japan

SEATTLE, WASH., March 21—Imposition of increased taxes is hampering the development of Japan as an automobile market, according to representatives of the American automotive industry returning from the Orient. Illustrative of the manner in which burdens are being heaped on motorists in the Nipponese Empire is a recent decision of the Yokohama Municipal Office to raise the schedule of motor car taxes about 30 per cent over the taxes formerly in effect.

Cars operated privately will be taxed from 85 yen (yen 50 cents United States money) a year upward, depending upon the seating capacity. The minimum of 85 yen a year is for cars with a capacity of three persons or less. For four passenger cars the tax will be 105 yen and 20 yen is added for each additional seat. A seven-passenger car, for example, will be taxed 165 yen a year.

Passenger motor cars in public service will be taxed at the rate of 65 yen for three-passenger capacity; 75 yen for four-passenger capacity, and 90 yen for five-passenger capacity, and 15 yen for each additional seat above five. Trucks of one, one and one-half and two tons are provided for, the taxes respectively being 50 yen, 55 yen and 65 yen.

MILES ON EUROPEAN TRIP

NEW YORK, March 23—S. A. Miles, manager of the New York and Chicago Shows for the National Automobile Chamber of Commerce, sailed for Europe on the Aquitania, Tuesday. While abroad Miles will investigate the European automobile situation for the Export Department of the N. A. C. C. He will be abroad about two months. Besides Mrs. Miles, the veteran show manager will be accompanied by William G. Stirm and Charles E. Ellias. They have been associated with him for years in arranging shows and will be his guests on the trip.

Banker Finds Cars Safer Than Stocks

President of Gotham Bank Finds Losses Rare—Declares Stock Most Liquid

NEW YORK, March 18—Henry Bizallion, president of the Gotham National Bank, told Reo dealers of the New York territory in convention here to-day, that they could use two arguments to convince their bankers that their businesses were entitled to loans:

1—There is no other class of merchants whose stock is so liquid.

2—Cases of loss by bankers who have financed dealers in stocking cars are so rare as to attract wide attention.

The banker said that his wide experience in handling automobile paper had shown that the average dealer's loan on any particular car was usually liquidated in two months in this territory. He said a bank could more safely loan on cars as security up to 90 per cent of their value than on stocks.

Bizallion said that his bank advanced money to dealers on mortgages or bills of sale covering cars at the legal rate of 6 per cent plus a charge for drawing up the necessary documents, which never exceeded $2.

The banker said that in the long experience of his institution with automobile financing it had never lost a dollar except in one case of fraud, which he said might happen in any business.

A. M. Welch, assistant manager of the Reo Motor Car Co. of New York, presided at the convention luncheon. R. C. Rueschaw, general sales manager of the Reo company, talked along sales lines and congratulated the dealers on their part of the work, which he said had enabled the factory to operate at full tilt without warehousing cars or trucks.

ARMY FIXES SALES DATES

WASHINGTON, March 19—Sales of surplus army automotive material will be held at Camp Jessup, Atlanta, the week beginning April 4; at Camp Normoylen, San Antonio, Texas, April 11; at El Paso, Texas, April 18; at Jeffersonville, Ind., April 25, and at Schenectady, N. Y., May 1. These dates are tentative and subject to revision.

The sales will be similar to the one held at Camp Holabird, Baltimore, at which a large number of unserviceable vehicles, as well as parts were sold.

TO SELL OBERBERGER STOCK

MILWAUKEE, March 19—Foreclosure sale of 1260 shares of the capital stock of the John Obenberger Forge Co. owned by President John Obenberger and held by the First Wisconsin National Bank as collateral security for loans, will be held March 21 at the courthouse in Milwaukee at the instance of the bank. The financial affairs of the Obenberger company for some time have been in the hands of a committee of creditors.

South Africa Finds Business Improved

Tractor Representatives Make Bid for Market—Passenger Cars Find Buyers

JOHANNESBURG, SOUTH AFRICA, Feb. 4—(Special Correspondence)—The trade position in January has been quite satisfactory taking into consideration the general tendency to slackness in trade generally. The firms interested in the motor trade are reporting a general improvement; although this is only slight, it shows that the industry in South Africa is on a solid footing.

Tractors are being pushed out here and the Holt people recently held a demonstration near Johannesburg. The Titan agents have also been in the field in this direction. General Motors Export Co. are out to place the Samson tractor on the market and an expert is due to leave the States this month. He will be attached to the Johannesburg office, from which all distribution is made. Karrier and Guy Motors South Africa, Limited, have commenced operations in Johannesburg.

These English trucks have come to stay and it is noticeable that more trucks are being placed in commission in the commercial centers of the Union every month. Steam trucks are finding favor, but the internal combustion engine continues to do very well. Commercial houses are finding that the truck speeds up work and in consequence are buying them. There are now several firms in Johannesburg who have fleets of trucks for work of all descriptions and it is a matter of some difficulty to get fixed up in a hurry by them.

Consignments of Briscoe cars that were received a few weeks ago are reported to be all sold and other makes give similar results. The English Belsize has arrived. The four gear system is installed and because of this hill climbing is not as easy without changing, as is the case with most American cars.

Light Cars Meet Favor

Among the light cars that are new arrivals are the Spacke and the Morris Oxford. The former needs no comment, as it is manufactured in the United States. This little car has been at Cape Town for some time, but the first model to come to Johannesburg only arrived a few weeks ago. The Morris Oxford is a light English proposition and is a car in every sense of the word. It is well finished and fitted with all the modern conveniences that are expected in a modern automobile. It is one of the few English cars that have come out here that is fitted with the three gear system. The latest model is very fine and has caused much comment all round. The Arrol-Johnston model (1921) has arrived and is fitted with disk wheels as standard equipment.

There has been no shortage of fuel during the past month and there is every indication at present that the supply will be maintained. South Africa is in a peculiar position. It is an important and fast developing country and requires all the assistance possible from the products of modern manufacture. The supply of petrol is a vital factor in a young country, as will be seen from the following. The railroad system of this country is very comprehensive, but it has to serve large tracts of fruitful land. At present there are no adequate feeders to the railroad system and in time regular truck services will be organized to feed the railways.

Plenty of Work for Trucks

This is a recognized fact and the internal combustion engined truck is going to come in for a great deal of the work of developing the country. The fuel supply will, therefore, have to be clearly adequate before any such schemes can possibly be undertaken. At the present there is no guarantee that supplies will be adequate to fill the demand that will be made as the country develops. Special efforts are being made by both American and English manufacturers to place large quantities of trucks and tractors on the market in addition to passenger cars, and for this to be successfully accomplished there are two factors to be reckoned with. Fuel and service are essential in a country where long distances have to be covered and when these two problems are solved there is no reason why a large market should not be opened up.

Tires have seldom got a square deal in South Africa, owing to both lack of knowledge and bad roads, but the tire companies have opened campaigns bringing to the notice of the user the necessity of looking after their tires. Cords are becoming more popular, especially among motorists who do a good deal of country traveling.

SOUTH AFRICA BUYS TOOLS

WASHINGTON, March 18—Trade in garage tools and equipment is growing rapidly in South Africa. Johannesburg alone now has over 150 motor-repairing and overhauling establishments, the whole of South Africa has over 1000, all of which, besides carrying stocks of spares and accessories, are constant purchasers of the tools peculiar to their business, according to a report received by the Bureau of Foreign and Domestic Commerce. Especially is there a demand for tire-levers, wrenches, bearing scrapers, sheet rubber, spanners, ordinary and snub-nosed pliers and similar appliances.

INDIA INCREASES DUTIES

WASHINGTON, March 21—Duties on automobiles imported into India were increased from 7½ per cent ad valorem to 20 per cent as of March 1, according to a cablegram received by the Bureau of Foreign and Domestic Commerce from Consul General A. W. Weddell of Calcutta.

High Fuel Prices Hurt French Trade

Industry Threatened by Continued High Costs — Seek Abolition of Taxes

(By Cable to AUTOMOTIVE INDUSTRIES)

PARIS, March 21—Vigorous efforts to bring down the cost of gasoline will be made in France because of the realization that the life of the automotive industries is threatened by the present high price. Gasoline now is selling in France at 2 francs 45 centimes per litre compared with 92 centimes per litre in America at the present exchange rate. A syndicate of French manufacturers and representatives of various societies made up of persons using gasoline have united for concerted action. An attempt will be made to bring about abolition of Government taxes on gasoline and close study is being given to a proposal for the purchase by automobile manufacturers of large quantities of gasoline in Galicia to be thrown on the French market.

French dealers are preparing a petition to be presented to the Government for the abolition of the 10 per cent retail sales tax on all cars of not more than 15 horsepower. It is asserted that this tax is highly detrimental.

There was an increase of 854 per cent in French automobile exports for the year 1920 as compared with 1919. The value of the export business was 1,188,000,000 francs. Imports decreased 45 per cent.

Jules Goux has entered a Peugeot in the Indianapolis sweepstakes, nominating Howard Wilcox as the driver. Jean Chassagne is expected to enter a second Peugeot.

Germany announces that its first post-war automobile show will be in the fall.

Because of French competition, all the British aviation companies operating lines between London and Paris suspended their service but have resumed upon the promise of the British government to increase subsidies. The rates charged by the French companies for passenger service between Paris and London are practically the same as railroad rates.

The Belgian Minister of Finance has introduced a bill calling for a 20 per cent ad valorem import duty on cars.

SPAIN TO REDUCE TARIFFS

WASHINGTON, March 21—The import duties on automobiles and possibly tires into Spain probably will be lowered by Royal Decree on March 20 or shortly thereafter. This information was contained in a cablegram from Commercial Attache Cunningham at Madrid to the Bureau of Foreign and Domestic Commerce. Cunningham advises that shipments for delivery after that date should be made subject to the new duty which is expected to be higher on such items as steel products, hardware supplies, textiles and others but lower on automobiles.

British Sales Show 1921 Light Car Year

Buying Tendency Ascribed to Excessive Large Car Costs—Factories Hard Hit

LONDON, March 10—(*Special Correspondence*)—Early indications that 1921 would be pre-eminently a light car year are being strengthened by developments. Application of the term is being widened and it seems to include everything up to 15 horsepower rating. Ultimately, however, the deciding factor in determining what is a light car will be either weight alone or weight and power rating up to some limit suggesting a correct ratio of power and weight.

Elastic use of the term "light car" is not without its dangers. One of them is that recently makers of genuine light cars have been fitting four seater bodies on short chassis, thereby reducing comfort and piling on weight. In one or two instances this has upset the balance of the car.

The main reason for this trend toward light cars is the present excessive price of the larger vehicles. The British light car now is priced at from $2,500 to $3,000 (normal exchange) which was the cost before the war of a medium grade full size British car. It should not be forgotten, however, that the buyers of $3,000 cars cannot afford it as well now as they could a larger car at the same figure before the war.

The big problem, therefore, is in determining how far it will be possible to cut the cost of a medium grade car and thereby eliminate the light car which is almost as expensive to build. This situation is working in favor of the "full bodied" American car.

As a means of reducing prices, there is a possibility of starters being eliminated from the standard light car equipment and of the magneto being superseded by a dynamo combined with an igniter.

Leyland Business Shaken

The Leyland company, the largest British motor truck builder, proposes to bring out a light car in the near future to take the place of the straight line "luxury 8" shown at Olympia. This announcement indicates that the company senses the trend of demand. The balance sheet of the Leyland company shows a sharp falling off in business. This reduction makes it impossible to pay a dividend on the ordinary stock although the dividends will be continued on the preference shares.

Crossley Report Disappoints

The report of Crossley Motors, Ltd., following close on the comparatively good showing of the first year's Willys-Overland-Crossley business, is disappointing as the figures include the substantial sum paid the Crossley stockholders by the Willys-Overland British interests for the Crossley aircraft factory at Heaton Chapel, Manchester.

Unless the company has a large inventory on hand it is difficult to see how it can hope to meet the expected revival in trade as it has a surplus of only $50,345. Apparently importing and assembling Overland cars, in spite of the 33 per cent tariff and the adverse exchange situation, is more profitable than the manufacture of expensive cars of the Crossley type. There recently have been reports that the Crossley company intended to bring out a "40" for the Indian and Colonial markets.

To Wind Up Sanderson

The Joseph Sankey Co., manufacturers of metal wheels used on the Angus Sanderson cars, has taken judgment against Angus Sanderson & Co. for $75,000 and has obtained an order in the high court for the compulsory winding up of the company. This follows a recent decision of the bank creditors to continue operations. The financial difficulties of the company are considered unfortunate because the car is good value and has passed successfully through the development stages. The design is good and with certain modifications should lend itself to mass production, which was the original intention of the promoters.

Trading Company in Difficulty

Following financial difficulties in the affairs of the makers of Bean cars, similar trouble is being experienced by the British Motor Trading Corp., the selling organization for these cars and for Glasgow agricultural tractors. The corporation has also very widely handled Crossley cars and Vulcan trucks. As a first result of these troubles, it is stated that the makers of the Glasgow tractors have taken over the selling organization.

Sizaire Berwick Hit by Strike

The business of the Sizaire Berwick Co. now is being carried on by an administrator appointed by the creditors but it is understood the prospects are favorable and that the present output of 6 cars a week may be increased soon to 18 a week. The company suffered a long delay in getting into production because of the molders' strike which lasted 15 weeks. The present price of the chassis is $7,500.

Price Guarantees in Effect

There is a widespread movement among British manufacturers to fall in with the arrangement first planned a short while ago by a few small makers to guarantee to refund to purchasers of their cars any payment made in excess of the lowest current price between now and a specified date in the future. This date is usually about July 1 next, though in one or two cases it is extended to August or until the end of the year. The following are among the prominent makers who have adopted this principle publicly: Albert, June 30; Crossley, July 1; Cubitt, July 1; Riley, July 31; Rover, June 30; Ruston Hornsby, June 30; Singer, June 1; Star, July 31; Sunbeam, June 30; Swift, June 1; Vauxhall, August 1. In addition a similar guarantee is issued by the British agents for certain American cars.

Tractor Subsidies Proposed by French

Army Experts Suggest Way to Advance Agriculture and Protect Military Needs

PARIS March 11—(*Special correspondence*)—French agriculture can be put into a flourishing condition, and the military interests of France can be safeguarded, if the agricultural tractor is made suitable for military operations as well as for work on land, declares General Castelnau. Before the war France had 16,000,000 acres of land under wheat cultivation, compared with 9,800,000 at the present time. To get the best results out of the land, French farmers ought to put 2500 tractors in service each year until a total of 25,000 is reached.

General Castelnau believes that the best way to accomplish this is by giving subsidies to farmers who own tractors which can be used, if necessary, for military purposes, and which the army could call up for service in case of war. The arrangement proposed is similar to that existing for trucks before the war, when France had an approved type of commercial truck suitable for military service. The army requisitioned 5000 of these trucks in 1914, and by the end of the war had increased the number of military trucks to between 80,000 and 100,000.

It is suggested that the same arrangement should be made for tractors, farmers being encouraged to purchase these semi-military types, which would be examined at intervals, in order to see that they were maintained in good mechanical condition and for which the Government would pay an annual subsidy.

TO OPERATE TRUCK LINES

WASHINGTON, March 22—A concession has been granted to an Argentine company for the operation of three lines of motor trucks for passengers and cargo, the lines to run from Paraguari to Ita via intervening points, according to the Bureau of Foreign and Domestic Commerce. Considerable interest is aroused among agriculturists and Government officials in this proposed line.

DENLINGER PARTS RESTRAINED

MERIDEN, CONN., March 21—The Connecticut Telephone & Electric Co. has been granted a permanent injunction restraining the Denlinger Lamp & Ignition Co. of Rochester from the sale of ignition parts alleged to have been made in imitation of the Connecticut patents.

OLD TIMER DIRECTORS CALLED

DETROIT, March 21—Albert Champion, president of the Old Timers Club, has issued a call to the directors of the organization who were elected at the meeting in Chicago during the automobile show, to meet at the Hotel Durant, Flint, Michigan, April 2 and 3.

Chamber Proposes Changes in Overhead

Would Eliminate Rigidity of Present Systems and Allow for Better Distribution

WASHINGTON, March 21—Manufacturers throughout the country have been advised by the Chamber of Commerce of the United States that to adjust overhead charges on the basis of the normal year is to take a forward step to better times. Inquiry shows the plan to be feasible in practice, though there are many business men who regard it as novel and daring, an idea which must be demonstrated more fully. Many cost accountants insist that our cost systems are far too rigid because overhead expenses are spread too thin in times of forced production and massed too heavily in period of slight demand and production.

The fabricated production department of the National Chamber contends that cost systems should recognize the continuity of time wherein any single year or month may or may not typify and represent normal production and demand. It is pointed out that certain expenses accrue regardless of operation of plants and often bear no relation to output. Cost systems should provide that these expenses, known as overhead, should be absorbed and pro-rated on the basis of a normal year.

This practice would allow absorption of overhead in costs, and create a surplus of overhead cost to take care of those years when output is reduced below normal and overhead charges are not fully taken up in the costs of the year. The chamber tells us that this method would assure the business man a reward for his efforts in speeding-up; eliminate the needless throttling of business by the practical attempt to load semi-normal production with greater charges than can be borne or should be borne.

What Is the Normal Year?

The question naturally arises, "What is the normal year?" The standard year is indeed difficult to determine. The Chamber of Commerce believes that "the normal year does not remain on a dead level, but should probably curve upward gradually and conservatively with the growth of population and markets. To do otherwise would indicate industrial stagnation." In the establishment of normal unit overhead charges, the normal overhead expenses for the various departments of the business and normal production must be considered and divided to obtain the normal unit overhead charge. Accidental expenses of the previous years should be wiped out and an effort made to anticipate and allow for trend of expense for the coming year.

According to the chamber, "there is nothing conclusive, final or binding about this estimate of normal expenses. Each month your cost system gives the estimated overhead expenses and the actual expenses. If there is an increase of the actual over the estimated, and upon analysis that increase is found to be a real increase, due to unanticipated increase of salaries or insurance rates, etc., and not inflation arising from reduced production, an adjustment upward can immediately be made in the unit overhead charges. Each concern will establish for itself a safety zone, below or above which decreases or increases in real costs will be reflected and taken up in the selling price." Warning is sounded against placing the normal production at high figures reached only in exceptional years.

National Underwriters to Approve Bumpers

NEW YORK, March 22—The National Automobile Underwriters Conference has authorized a reduction of 5 per cent in collision insurance rate on commercial cars and trucks equipped with either a radiator guard or a bumper, or both, provided such device or devices have been listed as standard by Underwriters Laboratories. This is contingent on there being at least two truck bumpers and two radiator guards listed prior to July 1, the ruling to take effect on that date.

This announcement is accompanied by the statement that manufacturers of guards, or truck companies which make their own guards, may desire to place their product before the Laboratories for examination in advance of July. On receipt of request from any manufacturer the procedure will be outlined.

Passenger cars now get an allowance for approved front bumper of 10 per cent, rear bumper 2½ per cent, and both front and rear 12½ per cent. This percentage is higher for passenger cars because the damage or loss is greater than in truck collision.

TO LOWER COLLISION RATES

MILWAUKEE, March 18—Lower collision insurance premium rates for new drivers with new cars, and also for experienced drivers with new cars, in comparison with older passenger cars, is the novel plan to be followed by a mutual insurance company just organized in Milwaukee. Incorporation was granted on March 21 to this company, as the Federal Mutual of Milwaukee. J. J. Helby, president of a casualty company, and who will be elected president of the automobile insurance company, is the author of the new plan in making rates. He says that careful investigation shows that new drivers, and older drivers with new cars, are much more careful.

SAMSON PRICE REDUCED

JANESVILLE, WIS., March 19—J. A. Craig, president of the Samson Tractor Co., a subsidiary of the General Motors Corp., has announced a 20 per cent reduction in the price of tractors and a 10 per cent cut in the price of power harrows and plows.

Unit Parts Makers Have Service Plan

Abolition of Private Parts Maker Important—Credit Demands to Be Higher

(*Continued from page* 674)

station in every important city. Dealers could carry small stocks of parts in the greatest demand and could rely on the parts establishment for less frequently called for articles. The capital tied up in parts would thereby be reduced.

One of the chief advantages would be elimination of the pirate. The parts manufacturers assert the public does not realize the great quantity and variety of inferior parts on the market, and that the average buyer does not comprehend the risk he takes in purchasing parts of this type.

All branches of the automotive industry are in agreement in the belief that the problem of service is one of major importance and that the company which provides the best service will corral the largest number of sales. Sponsors of the nation-wide parts station plan contend that it will give the maker of an assembled vehicle the advantage over manufacturers who build the greater part of their product. Better results are promised with a smaller investment of capital. It also is asserted that with the problem of a parts stock solved for them, dealers in assembled vehicles could devote all their time and capital to original car sales.

Another proposal for stabilization of the industry by the parts makers is denial of credit to the promotor of a vehicle factory who cannot demonstrate he has the capital to reasonably insure success. This would hit the wild-catter who is in to-day and out to-morrow, leaving owners of his vehicles with orphans on their hands and at the mercy of parts pirates.

The advantages of the parts station venture are summarized in this way by one of its enthusiastic sponsors:

It would eliminate investment in parts by the manufacturers, his distributers and dealers, enabling them to use the money which would otherwise be tied up in parts in the development of sales.

It would familiarize the public with the actual value offered in the assembler's products.

Would Make Prices Reasonable

It would enable manufacturers, distributers and dealers to obtain genuine parts at reasonable prices upon short notice in any part of the United States and in foreign countries.

It would eliminate the use of inferior parts furnished by pirate manufacturers.

It would benefit manufacturers by assuring them of adequate service.

It would not interfere with the operations of repair shops, garages or service stations, but would permit them to do business with a smaller investment.

Hawkins Goes with General Motors

Serves as Advisor on Sales Service

Former Ford Sales Manager Makes New Connection—Widely Known Figure

DETROIT, March 23—Norval A. Hawkins, formerly general sales manager for the Ford Motor Co., will join the General Motors Corp. on April 1 and will be a member of the advisory staff, located at Detroit, handling subjects pertaining to sales, advertising and service.

Hawkins is one of the most widely known sales executives in the industry and the success of the Ford Co. in its early days is regarded as due in large measure to his efforts. Since leaving the Ford Co. he has devoted his time to several enterprises and now is head of Hawkins, Gies & Co., accountants, with offices here. Rumors about Hawkins' future activities have been numerous in the last few months. They have connected him with General Motors, the new W. C. Durant enterprise and the new venture of F. L. Klingensmith.

Since the retirement of Hawkins from the Ford organization there has been much speculation as to his future connections because it was assumed he would remain in the automotive industry. He opened a set of books for Ford in 1903 and for three years served as auditor. He then became sales manager and continued in that capacity for 12 years until January 1919. Besides being president of Hawkins, Gies & Co., he is president of the Sturgis Steel Gocart Co. of Sturgis, Mich., and a director in several other concerns.

Acceptance Corporation Reorganizes Personnel

NEW YORK, March 24—Curtis C. Cooper was elected president of the General Motors Acceptance Corp. at a meeting this afternoon. He was named after a meeting of the stockholders at which these directors were elected: C. C. Cooper, Rlbert L. Deane, Irenee duPont, Lamot du Pont, Pierre S. du Pont, Paul Fitzpatrick, J. Armory Haskell, John J. Raskob, John J. Schumann, r., and Alfred H. Swayne.

Besides making Cooper president, and Swayne chairman of the board, the directors elected the following officers' Vice-presidents, Deane, Schumann, Donald M. Staidal and James H. McMahon; treasurer, Reune Martin; secretary, George H. Bartholomew; auditor, F. Stanley Parson; counsel, Livingston L. Short.

Haskell remains as a director but retired as president because of his other duties as vice-president of the General Motors Corp. in charge of operations. Fitzpatrick also remains on the board but retires as vice-president because of his recent election as vice-president of the General Motors Export Corp. McMahon, who was made one of the vice-presidents of the Acceptance Corporation, was promoted in recognition of his constructive work in credit department.

FORD COMPANY SELLS LAST OF SURPLUS CARS

DETROIT, March 21—The Ford Motor Co. started operations this week on a six-day basis for the first time since Christmas. The company is now producing almost 3000 cars a day and according to officials orders are catching up rapidly with production. All the surplus cars on hand when the plant closed Dec. 24 have been sold.

Service Stations Send Call for Mechanics

NEW YORK, March 22—Service stations in this city have in the last week been getting more work than they have in the past three months. Some of the shops have lately been so slack that forces of mechanics have been cut down to the very limit, one shop ordinarily employing eighteen men being reduced to the service manager and one mechanic. The sudden rush of service work has found most of these shops unprepared to take care of orders with the reduced forces and the calls for mechanics are many. Among the shops reporting greatly increased business are Overland, Marmon, Master Truck, Automotive Service Corp., and Chevrolet.

GRAY EXTENDS ENGINE WORKS

DETROIT, March 19—Announcement is made that under the reorganization of the Gray Motor Co. which will produce a $1500 motor car in the early fall, separate plant units will be organized for its marine and other motor business but they will remain under the same management. The Gray Motor Co. is one of the oldest motor manufacturers in the United States and has nearly 60,000 Gray motors in operation in all parts of the world. It is announced that a new 40 h.p. 4 cylinder overhead valve unit plant will be ready for production and delivery July 1. Marine and other motors will be distributed from the assembling plants which will be established in all parts of the world to handle the new motor car.

Assert Present Fees Ample in New York

Organizations Declare Funds for Maintenance Now Realized—Oppose Construction Uses

ALBANY, N. Y., March 23—The Lowman bill was passed in the Senate to-day after a sharp attack by Senator Lusk upon automobile clubs, which, he declared, were banded together to keep the State from raising through motor vehicle fees the money necessary for the maintenance of its good roads system.

Increases in passenger car registration fees range from $2.50 on low powered cars to $6 on high powered cars of more costly make. On motor trucks the increases range from 35 per cent on the lighter models to 50 per cent on those above 5-ton capacity, and as high as 100 per cent on trucks of 10-ton capacity or over.

ALBANY, N. Y., March 21—Insisting that existing license fees were ample to meet State needs for maintenance and repair of main highways, representatives of forty New York State automobile organizations at a conference here drew up a declaration of opposition to the proposed increased fees and submitted this to the legislative committee in charge. Pending formal action by the legislature, the organizations will get in personal touch with legislators and request support of their position.

Represented at the hearing were the National Automobile Chamber of Commerce, Motor Truck Association of America, Automobile Dealers Association of New York, New York State Automobile Association, New York State Motor Federation, Central New York Warehousemen's Club, New York Furniture & Warehousemen's Association, Van Owners Association of Greater New York, and many individual clubs of car and truck owners.

The principle that registration fees should be devoted to repair and maintenance of highways only, and that motor vehicle owners should not be burdened with costs of construction or reconstruction, was set forth in plain terms. That returns now from vehicle registration were ample for this purpose was shown.

UNITED BODY MOVES OFFICES

CLEVELAND, March 21—What is regarded as an important development in automobile circles is seen in the announcement that executive offices of the United Automotive Body Co. have been removed from Springboro, Pa., to this city.

Congress Outlines Definite Program

Emergency Tariff, Anti-Dumping Tariff and Internal Revenues, Order of Business

WASHINGTON, March 23—With five sub-committees of the House Ways and Means Committee actually engaged in drafting a permanent tariff schedule, there is evidence of a real effort on the part of Congress to settle the chaotic condition of business and industry through a definite legislative program. Analysis of this program indicates quite strongly that it will be mid-summer before the automotive industry will know what it must contribute to the national exchequer through taxation. The Senate Finance Committee will, however, begin hearings on the internal revenue measures on or before the convening of the extraordinary session April 11.

According to the program outlined by Senator Penrose, chairman of Senate Finance committee, and Chairman Fordney of the House Committee on Ways and Means, the emergency tariff confined to agricultural products, will have the right of way on the calendar. It has been a political boomerang for several months, and Congressional leaders have agreed to pass the original bill without amendment in order to clear the track for other important legislative measures.

President Harding and well-informed leaders favored an emergency tariff confined to high staples but on inquiry found it would never pass with a few items on the list. In order to obtain sufficient Democratic votes for cloture rule, it was found necessary to consent to sectional demands and include 26 agricultural products. The ten months period written in the original bill will be reduced to six months because leaders feel that this period will be adequate. They expect to have the permanent tariff enacted before the expiration of this period.

To Write Automobile Schedules

Chairman Fordney announced to-day that Congressmen Tilson of Connecticut, Luther Mott of New York and Timberlake of Colorado, would write the schedule for metals and manufactures thereof. The tariff item includes automobiles and automotive products. The sub-committees to handle the free list have not been organized. These sub-committees are expected to report their schedules to the full committee early in the session as the tariff will precede the internal revenue legislation in the House.

That the Senate Finance committee will not call witnesses for tax hearings until next month is indicated in the announcement that Chairman Penrose will be away for several days. It is apparent that these hearings will be brief and representatives of the automotive industry must present clear and concise arguments in the few minutes allotted. If the industry is to oppose the proposed tax levies, it will be necessary to convince the committee of the inequities of the Treasury and other plans, for it must be remembered that this committee will be swamped with suggestions as to sources of revenue and will have little time for study.

Copies of the arguments presented at the hearings will be turned over to the House Ways and Means committee for its guidance in framing tax bills. With an estimate of the yield from the new permanent tariff at hand, the House committee must design internal revenue measures to bring the balance required into the Treasury. The Senate will use the measures originating in the House as a guide for re-drafting or amendments.

It has been tentatively agreed to consider the emergency tariff first, followed by the anti-dumping measure, passage of a bill or amendment providing for assessment of import duties upon the basis of American and not foreign valuation, the permanent tariff and finally the internal revenue bill. Senator Penrose hopes to clean the slate by Aug. 1, although this prediction may be regarded as unduly optimistic in view of the tremendous amount of work at hand.

Contingency Reserves Reduce Case Surplus

CHICAGO, March 21—Net income of the J. I. Case Threshing Machine Co. in the year ended Dec. 31, 1920, amounted to $2,936,962, as compared with $4,305,211 in 1919. From this was deducted $1,000,000 as contingent reserve, increased dividends on the common and preferred stocks, which left a surplus for the year of only $156,962, compared with $2,843,961 the preceding year.

The income account for the last year compares as follows:

	1920	1919
Gr. sales	$34,547,321	$32,342,653
Net earns	4,791,942	6,021,607
Bal. aft. int., dpr., Fd. txs.	2,936,963	4,305,211
Contg. res	1,000,000	......
Bd. prm., etc	......	143,761
Extra chgs	......	*1,261,968
Net profit	1,936 693	2,909,482
Bal. aft. pfd. divs	1,026,963	2,029,232
Sur. aft. com. divs	156.963	1,448.232
†Earn. per com. share	$7.90	$15.61

*European assets written off.

†Based on $13,000.000 common stock outstanding Dec. 31, 1920. A stock dividend of 39,000 shares was paid Dec. 15, 1920.

S. A. E. NOMINATES OFFICERS

NEW YORK, March 22—The nominating committee of the Metropolitan Section of the Society of Automotive Engineers, consisting of H. G. McComb, chairman, Norman Bell and C. F. Scott has named the following ticket for officers of the Section for the year 1921-22: For chairman, H. W. Slauson; for treasurer, Ethelbert Favery; for secretary, F. E. McKone; for members of governing board, P. M. Heldt, C. T. Myers and W. E. Kemp. A. M. Wolf, the retiring chairman, becomes vice-chairman, in accordance with the by-laws of the Section.

New York Engineers Study Brake Action

Metropolitan Section S. A. E. Hears Interesting Discussions at March Meeting

NEW YORK, March 18—The regular monthly meeting of the Society of Automotive Engineers' Metropolitan Section, held here this evening, was devoted to discussion of brakes and clutches. The principal paper was read by H. G. Farwell, chief engineer of the Raybestos Co., who recently returned from Europe, where he has been making a study of practice in reference to brakes and clutches used on British and continental cars.

He said that most of these brakes are of the expanding type, and that more attention is given to their design and construction than is as a rule given to brakes on American cars. Many metal linings are used in spite of the fact that their coefficient of friction is only about half that of good asbestos linings. Cone clutches are still the predominant type, both leather and fabric being employed for facing, but many plate and multiple disk types are also employed. Four-wheel brakes are seeing wider application and are favorably regarded.

A second paper, presented by W. D. Reese of the Fifth Avenue Coach Co., described the brakes used on the 'buses operated by this company. Since these vehicles are continually used in traffic where frequent and very certain stops are necessary, the brakes must be extremely rugged and very certain in action. Carefully made tests have shown that the buses in question are capable of a deceleration rate of about 3.75 m.p.h. per sec. on dry smooth asphalt paving. It is estimated that the aggregate number of stops per year made by the buses of this company is 36,000,000. Some 10,000 ft. of brake lining materials per year is required.

R. W. Hastings, chief engineer of the Parker Axle & Products Corp., described the multiple disk type of brake used in axles produced by his company. These brakes closely resemble in design the multiple disk type of clutch, but are applied by toggle linkage.

Hydraulic Brake Described

A representative of the Four Wheel Hydraulic Brake Co. described the four wheel braking system put out by this company, while A. A. Rost, a dealer in Delage cars, recited experiences with the four wheel braking system used on cars of this make.

In the discussion which followed the paper Clarence Carson, consulting engineer of the H. W. Johns-Manville Co., described the efforts being made by one division of the Standards Committee, in cooperation with the Motor Transport Division of the Quartermaster Corps and the Bureau of Standards, to standardize a method of testing brake linings for durability.

INDUSTRIAL NOTES

North Star Mfg. Co., Chicago, has taken over the business of the S. & M. Mfg. Co., maker of the North Star glare shield.

Ekern-Turk Mfg. Co., Pipestone, Minn., upon expiration of its contract with H. G. Paro Co., Chicago, will handle all its products through jobbers direct.

Perfection Heater & Mfg. Co. has closed a contract with Sheridan Motors Co. whereby Perfection heaters will be standard equipment on all Sheridan closed cars.

R. C. Smith Tool & Mfg. Co., Newark, N. J., has moved into a larger factory in that city, where it will extend the variety of its machine-tool line and its production capacity.

Motor Car Supply Co. has been organized in Charleston, W. Va., to do an exclusive jobbing business. The company will have a capital of $150,000. Officers are H. F. Shepherd, president; W. D. Harold, vice-president, and George D. Cochrane, secretary and treasurer.

Precision Stud & Bolt Co., a new Milwaukee corporation, organized with $20,000 capital, has taken over a factory building and after making alterations will install equipment and tools for manufacturing studs, bolts, screws, nuts and other similar mechanical specialties and supplies.

Robeson Preservo Co. of Port Huron, Mich., which for 20 years has been manufacturing canvas waterproofing for other lines, has entered the automotive field. The company, according to Carl F. Adams, president, will make a special waterproofing for automobile tops and truck covers.

Schoeffler-Graham Mfg. Co., Milwaukee, recently incorporated with $50,000 capital to take over the machine shop business of Schoeffler & Graham, will hereafter concentrate on a patented horizontal hoist for dump body motor trucks. It has leased considerable floor space to increase the capacity about 100 per cent.

Utility Hoist & Mfg. Co., Milwaukee, has accepted the offer of the business men's club at Prairie du Sac, Wis., to relocate the plant and offices in that city. Prairie du Sac is a rapidly growing industrial community, due largely to the abundance of cheap current from mammoth hydroelectric generating plants on the Wisconsin River at this point.

FILE RED DIAMOND PETITION

ATLANTA, March 21—An involuntary petition in bankruptcy has been filed in the United States District Court here against the Red Diamond Motors Co., Inc., of Athens, Ga., a company incorporated some months ago with $5,000,000 capital to establish a plant at Athens for the manufacture of a newly invented engine. Stockholders of the corporation are scattered throughout this country and Mexico. No statement of liabilities and assets has yet been filed.

FEDERAL SHOWS NEW MODELS

DETROIT, March 21—Federal Motor Truck Co. is showing a new 5-ton model at the automobile show, priced at $5,350. The new truck is equipped with a specially designed Continental 4-cylinder engine, 4¾ by 6, and is geared to permit extra high speed adding materially to the efficiency of the truck.

Federal also is showing a new dump body mounted on a 2-ton truck. The truck is so equipped that the front end can be elevated for dumping into manholes or cellars, or the entire body can be elevated to a height six feet above the truck and the front end then raised slightly to permit of dumping across a sidewalk or into window or doorway above the walk. This equipment also makes possible the use of two or three smaller trucks for loading, the body hoisting attachment permitting the dumping into the bed of the heavy truck.

Bearings Service Pays Bonus to Employees

DETROIT, March 21—The Bearings Service Co., which acts as service department for the Timken Roller Bearing Co., the Hyatt Roller Bearing Co., and the New Departure Mfg. Co., will divide approximately 2 per cent of the net sales for the year 1920 as a bonus fund. All employees who served continuously six months or more participate. The bonus plan provides for a trust fund which pays the participant interest at the rate of 6 per cent a year. The participant is privileged to draw 20 per cent of his bonus each year or he may elect to receive payment in full at the end of five years together with a proportionate share of all forfeitures and excess earnings. Participants are divided into four groups according to length of service and personal efficiency rating. The plan applies to all employees, both in the general office here and in the company's 33 branches.

Romer Forms Company to Make Passenger Car

BOSTON, March 21—The Romer Motors Corp. has been organized by Albert J. Romer, designer of the Northway passenger car and formerly chief engineer of the Murray Motor Car Co. in association with Frank C. Gilbert, formerly of the Northway Motor Sales Corp. Offices have been opened at 43-57 Cornhill Street in this city, and a factory site of 16 acres has been purchased at Danvers, Mass.

Plans for a factory building are being prepared. The first unit will be a one-story structure 100 x 500 ft. Designs have been completed for passenger car bodies and chassis, and it is expected the first cars will be on the road by June 1.

TO FORM AVIATION COMPANY

CINCINNATI, March 22—Definite steps to co-operate with the Cincinnati Aero Club in forming a co-operative aviation company to be known as the Commercial Aviation Co. have been taken by the Aviation Committee of the Cincinnati Chamber of Commerce. The aero club is to erect a hangar on Reading Road, this city, and to construct a flying field and furnish instruction in operating machines as well as for commercial purposes. It will be capitalized at $100,000.

METAL MARKETS

CAUTION on the part of automotive purchasing agents continues to be the outstanding feature of the iron, steel and non-ferrous metal markets. The tonnage involved in inquiries is much greater than that actually ordered. No better proof that the market is still a buyers' affair is needed than that it is possible to sound producers on 500 tons and meet with no objection on their part when a contract for 100 or 200 tons is offered on the basis of the 500-ton quotation. On the whole, however, new steel orders from automotive concerns are still light, the bulk of shipments from mills consisting of previously suspended orders that have recently been reinstated. In those commodities for which there is a relatively light but, for all that, steadily growing demand, such as pig iron and sheets, values continue flexible, and to that extent the market may be characterized as still unsettled. Each transaction is a law unto itself, price depending upon the individual buyer's skill as a negotiator and the desirability of his business. Influences from outside of the automotive industries make for considerably quickened eagerness on the part of pig iron interests for orders from automotive foundries. In spite of the curtailment of pig iron production to what is very close to the irreducible minimum, much difficulty is encountered in finding consuming outlets for this output, due to the continued idleness of the building industry and lack of railroad demand. As a result of this condition, automotive consumption is receiving far more attention than it formerly did, and every pig iron market letter stresses the resumption of automotive buying as a market prop. The truth of the matter is that, with structural steel operations on a basis of 14 per cent of capacity, railroads and shipbuilders out of the market, and miscellaneous demand very light, the automotive industries are not only the largest but almost the only representative buyers in the market, and this in spite of the fact that automotive production has not yet attained anything like its normal stride. That automotive purchasing agents, in full consciousness of their orders furnishing the stop-gap in this period of transition for the iron and steel industry, proceed with prudent regard for this condition is only natural.

Pig Iron.—Middle West automotive foundries, because of improved labor conditions, are ordering somewhat more iron forward. The Ford Motor Co. is offering pig from its River Rouge furnace to those who hold contracts for Ford castings. About the best way to describe the market for No. 2 foundry is to say that bids of $25, valley, are being listened to.

Steel.—Somewhat more activity in automobile sheets is noted. Four cents as the basis for No. 28 black is chiefly used as a level from which to make reductions in order to compete for what business offers. Shipments of cold-finished steel bars and cold-rolled strip steel consist largely of reinstated orders. No representative new business has been placed so far.

Aluminum.—Buyers appear still to be holding off.

Copper.—Producers contemplate further reduction in output.

Tin.—Speculation in London and, to some extent, in New York makes up the sole activity.

Lead.—The "outside" market is now fully ¼c. higher than the chief interests' New York quotation.

Zinc.—Continuingly dull.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, March 24—There was scarcely any trace of last week's shifting of funds incident to the income and excess profits tax payments in the week-end bank statements, nor was there any outstanding feature in the money market which could be ascribed to the operations on March 15. On the other hand, there was an easier tone in the money market, especially after the first two days of the week. Call money ranged from 6 per cent to 7 per cent with 7 per cent as the renewal rate all week, but with the bulk of the business in the latter part of the week done at 6 per cent. On Monday of this week the renewal rate dropped to 6½ per cent, the lowest renewal rate since the latter part of January. While there was a relaxation in time money rates the supply was not plentiful. Rates dropped to 6½ per cent to 7 per cent for all maturities up to 5 months, and 6½ per cent to 6¾ per cent for 6 months' paper. The shorter maturities were in greatest demand. The return of funds to the banks following the tax payments is said to have been partially responsible for the easing of rates.

The improvement made in the reserve ratio of the Federal Reserve Banks as a whole is greater than the figures show in view of the new method used in calculating the deposits. The ratio of total reserves to net deposits and Federal Reserve note liabilities combined increased from 50.9 per cent to 51 per cent (on the old basis of figuring this 51 per cent would be about 52½ per cent). The ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against net deposits, increased from 59.9 per cent to 60.6 per cent. These increases were caused largely by a decline in net deposits of $180,905,000 and a decline in Federal Reserve note circulation of $42,960,000, and by increases in gold reserves of $18,133,000 and cash reserves of $17,365,000. Federal Reserve notes in circulation, at $2,962,880,000, are at the lowest figure since Feb. 13, 1920, and are $442,000,000 below the amount shown in the Christmas-week statement. The decline in rediscounts is an additional sign of increasing strength. Rediscounts decreased $143,500,000 and are down $506,000,000 from the December high. Total earning assets declined $138,097,000.

Reports from the steel industry continue to show decreasing output. The U. S. Steel Corp. is working at about 45 per cent of capacity as against 60 per cent the week before, and the independents are said to be working at from 15 per cent to 25 per cent of capacity. The whole industry is working at a rate to produce about 16,000,000 tons of steel ingots per year, far below the rate for recent years but 17 per cent more than during the lean year of 1908. On the other hand there is said to be a perceptible increase in the demand in the trade.

Wholesale prices are still tending downward. Dun's reports show that for the forty-fifth consecutive week wholesale prices of commodities have a downward trend. Last week there were 77 reductions out of 101 revisions of wholesale prices; the week before there had been 59 out of 81. This is in line with the reports of slow recovery in the West, where the buying power of agriculturalists is still at a low ebb in view of low prices received for farm products. The Western mail-order houses reflect this in their reports for the first two months of the year. One of the largest mail-order houses in the country reports February sales of 50.35 per cent less than for February, 1920, and 10 per cent less than for January this year. The two months sales are reported to be 48.69 per cent less than for the corresponding period of a year ago.

Revised figures for the cotton production of 1920 as given by the Census Bureau may explain, together with the trade reaction and the decreased consumption at home and abroad, the present stagnation in the cotton industry.

Republic Truck Shows Deficit of $344,564

NEW YORK, March 22—The annual report of the Republic Motor Truck Co. for the year ended Dec. 31, 1920, shows after expenses, interest charges and adjustment of inventory values, etc., a deficit of $344,564.

The consolidated income account of Republic Motor Truck Co., Inc., and Republic Truck Sales Corp. for the year 1920 is as follows:

	1920
Sales*	$15,675,221
Manufacturing costs	12,793,001
Balance	$2,882,220
Other income	269,406
Total income	$3,151,626
Expenses, interest, charges, etc.	2,592,444
Net profit	$559,182
Prov. for bos. stock and in. adj.	903,746
Deficit	$344,564
Preferred dividends	60,634
Total deficit	$405,198
Profit and loss surplus	$1,508,806

BARLEY MOTORS LOSES SUIT

KALAMAZOO, MICH., March 18—A. C. Barley, president of the Barley Motor Car Co., has been denied a motion for a new trial in the suit brought against him by the American National Bank, of Nashville, Tenn. Judge George V. Weimer, of the Kalamazoo County Circuit Court, filed the opinion. The plaintiff brought suit to recover the contract price on certain automobile frames sold the Barley Motor Car Co. and won the case.

CORRECTION

A typographical error in AUTOMOTIVE INDUSTRIES last week was responsible for the statement that W. A. Ryan is general manager of the Ford plant. Ryan is general sales manager, which position he has held several years.

FINANCIAL NOTES

Dunlop Tire & Rubber Corp. of America has placed a $6,000,000 mortgage on its Buffalo plant with the Fidelity Trust Co. The plant is about 90 per cent completed and will have a capacity of about 12,500 tires daily.

Times Square Auto Supply Co., Inc., shows net profits for 1920 as $10,831 after preferred dividends and depreciation. Inventory is placed at $4,178,605 after writing off a depreciation of $919,000.

Kelsey Wheel Co. reports gross sales of $25,200,913 for 1920 and net operating profits of $3,325,804. Net profits for the year after depreciation, Federal taxes and fixed charges were $1,916,008. President Kelsey said the net profits were the largest the company has ever shown.

International Body Corp. of Newark, N. J., has been placed in receivership on application of two former officers of the company, who say that the company never began to function in the making of automobile bodies. The company was organized with a capital of $1,000,000. The bill of complaint fixes its assets at $38,000 and its unsecured liabilities at half that amount.

American La France Fire Engine Co. declared the regular quarterly dividends of 2½ per cent on the common and 1¾ per cent on the preferred stock. The common is payable May 16 and the preferred April 1. The company's balance sheet shows total assets of $8,574,594, with a surplus of $1,405,010.

Parish & Bingham Corp. reports net sales for 1920 as $9,128,443; cost of sales, depreciation, etc., $9,089,814; manufacturing profit, $38,629; selling, general and administrative expense, $203,492; deficit, $164,863; other charges, $192,726; deficit, $357,589; dividends, $450,000; deficit, $807,589; previous surplus, $3,139,952; total surplus, $2,332,363. The balance sheet shows total assets and liabilities of $5,686,770.

Jordan Motor Car Co. has declared a regular quarterly dividend payable March 31 to stockholders of record March 18.

COURT STOPS REYNOLDS SALE

MT. CLEMONS, MICH., March 23—The Circuit Court of Macomb county has declined to confirm the sale of the assets of the Reynolds Motor Truck Co. by Charles J. Reimold, the receiver, to Charles M. Kennan, for $26,250. Kennan operates a garage in this city. The report filed with the court stated that the bid of Kennan was the only one received but it was held by the judge to be inadequate and it is understood that since that time Reimold has been able to get offers from two other persons who would be willing to buy the property.

WASHINGTON OFFICERS CHANGE

SPOKANE, WASH., March 21—John B. White, president of the Washington Tire & Rubber Co. has resigned and J. L. Bowling, who was vice-president, has been selected to succeed him. Roy Hayes, a Waverly farmer, has been elected a trustee to fill the vacancy caused by White's retirement. The company has not been in operation for several months

Men of the Industry

Harvey J. Woodard has resigned as vice-president in charge of sales of the Republic Rubber Corp. of Youngstown, Ohio, and as president of the Canton-Blackstone Co. of Canton, Ohio, its affiliated subsidiary. Woodward went to Youngstown in 1917 to take charge of sales of the Republic Rubber Corp. Previous to joining the Republic corporation, Woodard was with the Knight Tire Co. of Canton, Ohio, as sales manager and, prior to that time, twelve years with the Diamond Rubber Co., serving from 1903 to 1912 as their district sales manager in New York.

Paul Fitzpatrick, who has been a vice-president of the General Motors Acceptance Corp., has resigned to become vice president of the General Motors Export Corp. Fitzpatrick left the Continental Guaranty Co. to go with General Motors and played a prominent part in the organization of the Acceptance Corporation. He is regarded as an expert on financing of automobile time sales. He recently returned from a tour of inspection of the Acceptance Corporation's offices in Europe. It is understood that several changes among the officers of the Acceptance Corporation will be announced after a meeting this week.

Henry W. Uhl has severed his connection with the Eisemann Magneto Corp., Brooklyn, effective April 1. Uhl's activities were centered chiefly upon the Eisemann magneto generator for 4-cylinder engines, also the new automatic advance type magneto. He has been connected with the engineering staff of the corporation since October, 1916. Uhl has not made any statement in regard to his future plans.

Walter F. Graham has resigned as metallurgist with the Spicer Mfg. Co., Plainfield, N. J., and is now associated with the Henry Souther Engineering Co., consulting, metallurgical and inspecting engineers, Hartford, Conn. Graham was formerly associated with the late Henry Souther as metallurgist for the Standard Roller Bearing Co. and subsequently with the Ferro Foundry & Machine Co. and the Ingersoll-Rand Co.

Herbert W. Bonnell, general manager of the Kissel Kar Co. of Milwaukee, distributor of the Kissel in Wisconsin, has resigned to accept the position of vice-president and general manager of the William F. Sims Motor Car Co., Milwaukee, State distributor of the Lincoln. Bonnell was for five years manager of the Mitchell Automobile Co. of Milwaukee, going to the Kissel Kar Co. about three and a half years ago.

Arthur E. Swanson, organization and efficiency expert of the Firestone Tire & Rubber Co., has resigned and will establish offices as a consulting efficiency expert in Akron. Swanson formerly was dean of the School of Commerce of Northwestern University. During the war he served as special expert for the United States Shipping Board and was also bureau director for the Federal War Trade Board.

William C. Jenkins of New York has joined the Bull Dog Tractor Co. of F du Lac, Wis., in the capacity of fiscal and advertising director. He was for twelve years on the editorial staff of the "National Magazine," Boston, and previously spent many years in newspaper work in Wisconsin.

W. R. Melcher, formerly Eastern representative of the Gemco Mfg. Co., has returned to his first love, C. A. Shaler Co., Waupun, Wis., with whom he was associated during 1918-19. Melcher will act in the capacity of special jobbers' service representative on Shaler vulcanizers and the Shaler road-lighter.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, will address the Pittsburgh Automotive Association on March 31 and the Philadelphia Automobile Dealers Association on April 1. The subject in both cities will be "1921 Prospects for the Automotive Industry."

L. G. Meldram, who has had wide experience in the motor truck, passenger car and export fields, has been appointed general manager of the Trailer Maufacturers Association, to succeed H. W. Perry, who resigned. Perry has not announced his plans for the future.

E. J. Thomas has been named private secretary to Vice-President and Factory Manager P. W. Litchfield of the Goodyear Tire & Rubber Co. of Akron. He succeeds George Miley, who is assigned as registrar at the Goodyear Industrial University for employees.

Edward J. Waltzer has been elected president of the Wisconsin Tool & Supply Co., Milwaukee, following his acquirement of the major interest in the business, in which he has been a stockholder since early last fall. William H. Lawton continues as vice-president and chief engineer.

C. S. Heimbauch has been appointed manager of the Des Moines branch of the J. I. Case Plow Works Co. He has been identified with the implement business since 1897, in recent years being sales manager of a Kansas City business in which he had a part interest.

H. C. Walker, managing director of Hooper & Co., Ltd., of London, returned to England Tuesday after a short stay in this country, during which he investigated the prospect for the sale of English-built automobile bodies here.

James W. Brooks has resigned as educational director of the Federal Highway Council and will make motion pictures visualizing educational problems and industrial progress. Associated with him will be John W. Wierk, formerly of Brooklyn.

R. G. Hendricks, who was connected with the King Motor Car Co. under the old régime as factory manager and who was retained by Charles Finnegan when he purchased the King assets, has resigned. Hendricks has not annbunced future plans.

James J. Harrington of Cincinnati has been appointed supervisor of all foreign branches of the Ford Motor Co., with headquarters in London, England, succeeding W. C. Anderson, who resigned recently.

Ward H. Marsh has been appointed sales and advertising manager of the Lincoln Motor Car Co., Detroit, resigning as advertising manager of the Burroughs Adding Machine Co. to take the position.

W. E. Finnigan has resigned as general sales-manager of the Gray-Dort Motors, Ltd., Chatham, Ont., and is now general director of sales with the Ruggles Motor Truck Co., Ltd., London, Ont.

Carl W. Bettcher has been appointed sales manager of the Eastern Machine Screw Corp., New Haven, Conn. He will give his special attention to the H. & G. die-head business of the company.

Fred McCarthy has resigned as sales engineer with the Jennings Corporation to join the C. C. Merz Sales Co., Pittsburgh distributors of H. C. S. cars.

Fred W. Cederleaf has resigned as chief engineer of the Sparks-Withington Co. to join the Ziegler Mfg. Co., Alexandria, Ind., as works manager.

Harry E. Marshall has been appointed Pacific Coast representative of the Mueller Electric Co. of Cleveland and will maintain offices in San Francisco.

H. M. Carroll has been appointed advertising and sales promotion chief of the Remy Electric Co. He was formerly connected with the Hyatt Roller Bearing Co.

A. H. Heller, metallurgical engineer, has become a partner in the Day Company of Washington and San Francisco.

Stewart Manufacturing Shows Slight Decrease

CHICAGO, March 18—Profits of the Stewart Mfg. Co., of which 95 per cent of the stock is owned by the Stewart-Warner Speedometer Co., showed a decrease during the year ended Dec. 31, 1920. In the previous year operating profits totaled $349,736 and in the past year, $272,897. Dividends were smaller, however, during the year just ended and there was a material reduction in the provision for Federal taxes, this resulting in a surplus for the year of only $2.000 less than for the year previous.

The income account with comparisons is as follows:

	1920	1919
Operating profits	$272,897	$349,736
Provided for Federal taxes	36,810	83,811
Preferred dividend	20,974	33,810
Common dividend	180,000	195,000
Surplus for year	35,113	37,115

Withdraw Junker Planes from Air Mail Service

WASHINGTON, March 22, 1921—All Junker planes owned by the Post Office Department have been withdrawn from service and under the recommendations of a special committee investigating numerous accidents to these machines while in flight, will be thoroughly tested at the McCook Aviation Field, Ohio. The committee which conducted an inquiry into the recent fatality at La Crosse, Wis., consisted of Major McCord, in charge of the Army Air Service offices at Chicago, John A. Jordon, superintendent of construction, Air Mail Service of the Post Office Department, and Randolph G. Page, chief pilot.

EDWARD LISLE, SR., DROWNED

Edward Lisle, Sr., founder of the Star and Briton motor companies at Wolverhampton and a pioneer British automobile builder, was drowned recently. He was 69 years old. He is said to have suffered from insomnia as a result of business worries. Lisle was a practical mechanic and introduced a British copy of the Benz 3½ hp. belt driven small car about 1899. Lisle, who was one of the old type of Englishmen, was much respected.

Calendar

SHOWS

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

FOREIGN SHOWS

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

Apr. 20 - May 5 — Mexico City, Mexican Automobile Show, National Theatre Bldg.

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

May 24-28 — West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

Oct. 12-14. 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Buffalo section—April 19—Paper on "Carbureter Performance," by F. C. Mock.

Dayton section—May 3.

Metropolitan section—April 14—Paper on "Low Grade Fuel Carburetion," by A. H. Beach.

Minneapolis section — April 6 — Discussion of repair equipment.

Washington section—April 1—Aeronautical Engineering Session.

Importers Organize in Mexican Capital

(*Continued from page 674*)

and of $100 for associate members, were fixed, with $50 monthly dues for the active and $25 for the associate. The association is controlled by a board of directors elected for two years, with a general manager named each month to carry out the plans and instructions.

An annual automobile show, automobile tours of the republic, and truck and tractor demonstrations in the agricultural sections of the republic are among the plans. The new association is a member, by virtue of the American firms on its rolls, of the American Chamber of Commerce in Mexico, and of the Association of Chambers of Commerce of Mexico. The president of the association, Carlos Wille, at the first meeting named committees on associate memberships, on a monthly publication, on good roads, tours and shows, and on legislation and statistics.

Mexico City firms—the active members of the association—are listed as follows:

National Auto Importing Co., Moore & Cummings, R. Lozano & Co., Lamborn & Co., Siemens-Schuckert Werke, Mohler & DeGress, Mexico Motors Co., International Commerce Co., Pena Motor Sales Co., J. M. Marquez, Plana & Mirabent, B. Estades & Co., American Motor Co., Compania Automotriz Mexicana, Compania Unida de Ventas, Azcarraga & Copeland, Mayfield Auto Co., F. J. Meckel and R. G. Canton, Inc.

Because of the extensive road-building program which has been inaugurated by the new government of Mexico, the Department of Communications and Public Works, and the Department of Development, are interested in the new association, and have applied for membership, at the same time offering all facilities of the government for the aid of the association in its program of automobile shows, truck and tractor demonstrations and road building. The balance of power in the association is in the hands of foreigners, mainly Americans and Germans, but all the newspapers express the hope that more Mexican business men will come into the association by taking up agencies.

WILLYS' COAST HOME BOUGHT BY CHRYSLER

DETROIT, March 18—Announcement has been made in Toledo that John N. Willys has sold his home site at Pasadena, Cal., to Walter P. Chrysler for a sum approximating $200,000. Chrysler is executive vice-president of the Willys Corporation.

British Exports Gain as Imports Decline

LONDON, March 10 (*Special Correspondence*)—British automobile imports for January numbered 513 cars and 364 car chassis, and 1095 trucks and truck chassis. These were valued at approximately $686,390, $624,410, and $900,000 respectively. Parts imports were valued at $2,782,340. Tractor imports valued at $742,145 compared with imports of $566,285 for January, 1920. Tire imports were valued at $1,545,610, a decrease from $1,757,990 in January, 1920. In every case but tractors imports showed a marked falling off.

Automobile exports for January increased in value from $459,445 in January, 1920, to $1,588,805 for January, 1921. Car chassis exports increased from $405,000 to $910,965. Truck exports also showed large increases over January, 1920. Parts exports showed a gain from $1,697,420 in 1920, to $3,539,275 in 1921. Tractor exports totalled $725,115 as compared with $106,805 in 1920. Tire exports fell off from $2,379,730 in 1920, to $1,758,360 in the current year.

$6,000,000 FOR LOUISIANA ROADS

NEW ORLEANS, March 21—Approximately $6,000,000 of Federal, State and local funds are available for highway and bridge construction in Louisiana this year, according to the apportionment of the bureau of public roads of the Department of Agriculture, on a basis of information compiled from reports.

Nineteen Cars to Race for Grand Prix Trophy

PARIS, March 19—Entries for the French Grand Prix 321-mile race have now definitely closed with a total of 19 cars representing France, England, Italy and America. The competitors, together with the names of the drivers so far as they are known, are as follows:

1	Ballot	Jean Chassagne
2	Ballot	Ralph de Palma
3	Ballot	
4	Ballot	
5	Fiat	Louis Wagner
6	Fiat	Pietro Bordino
7	Fiat	Ferdinando Minoia
8	Sunbeam	Rene Thomas
9	Sunbeam	Andre Boillot
10	Talbot	Dario Resta
11	Talbot	K. Lee Guinness
12	Talbot-Darracq	Zobrowski
13	Talbot-Darracq	Seagreave
14	Talbot-Darracq	H. J. Cooper
15	Mathis	
16	Duesenberg	Albert Guyot
17	Duesenberg	Inghibert
18	Duesenberg	Tom Milton
19	Duesenberg	Eddie Hearne

All cars in the race are limited to a piston displacement of 183 cu. in., with a maximum weight empty of 1763 lb. Eight in line engines will predominate, having been adopted by Ballot, Sunbeam, Talbot, Talbot-Darracq and Duesenberg. The Italian Fiats have four-cylinder engines, but experiments are being carried out with eights in line.

The number of starters is lower than was expected, this being due in a large measure to the high entry fees fixed by the Automobile Club of France. The fee for a single car is 15,000 francs, while the Duesenbergs which came in after January 1 had to pay double fees, or 86,000 francs for a team of four cars.

TO HOLD OLYMPIA TRUCK SHOW

LONDON, March 1—(*Special Correspondence*)— The date of the 1921 passenger car show at Olympia has been fixed for Nov. 4 to 12. Thus it will not clash with the Paris salon in October, nor the Brussels show in December.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Why the French Automobile Production Program Failed

Two years ago France was talking of producing 200,000 motor cars annually. Now the industry is in a state of near-collapse. Here is a review of the events of the period between the talk of large production and the survival of the fittest.

By W. F. Bradley

NO French automobile factory has lived up to the production program mapped out at the end of the war, while prices fixed at that period have not even approximately been adhered to. In looking back over the period of 28 months, it is amazing that so many errors should have been made in the time required to get into production, in the cost price of cars, in the possibility of the home and foreign markets, and in the general conditions that would prevail and influence the automobile industry.

It was estimated that the production capacity of the French automobile factories, as enlarged under the war program, was 200,000 cars per annum. This estimate was never explained in detailed reports of factories, but it is known that many war equipment factories planned automotive production that have never really entered the business.

At least three firms, Citroen, Renault and Berliet, had production possibilities of 100 cars per day, or each of them the ability to meet the requirements of the whole of France on the pre-war standard.

Six others, Panhard, Darracq, De Dion Bouton, Clement Bayard, Lorraine-Dietrich and Peugeot, had production facilities for at least 10 cars per day, thus making a total for nine firms of 108,000 cars per annum. There are numerous factories not referred to here which announced indefinite programs based upon war equipment factories. Also there are other automobile factories in France which did not announce definitely the production plans.

Never have the sales of automobiles in France exceeded 35,000 a year, and, granting that the sales would be doubled after the armistice, this left a large number of cars to be exported, if sold. French exports never reached a figure apparently anticipated in the disposal of this production.

These figures never have been reached by the industry as a whole, or by any single firm in the trade. Citroen united his workers a few days after the armistice and informed them that they must expect short time for a few months, but by the following March he guaranteed that they would be working on the same basis as during the busiest days of the war. Instead of this, Citroen was not in production until a year later, and, although he has been more successful in carrying out his plans than any others, he has never touched the 100-car-a-day figure, and is not likely to attain it in the immediate future. Probably the highest figure attained has been 75 cars per day, which constitutes a record for France; depression setting in, this had to be cut within a few weeks.

At the present time, despite the enlarged manufac-

turing facilities, the output of automobiles is not as high as immediately before the war. This means that the factories are all working well within 50 per cent of their possibilities; in certain cases the production is not more than 15 per cent of the capacity. The weeding out process proceeds slowly and is causing a minimum of disturbance in the industry, for the French factories, not being so highly specialized as those of America, it is an easier matter to get into other classes of production where the depression is less severely felt.

Renault is a pretty good example of this, for the automobile, truck and tractor business being insufficient to keep the works in full operation, he is now producing small tools, chains, jacks, hoists, change speed mechanisms, factory transmissions and stationary motors. Berliet is another big factory having had to convert to other lines of production, among these being railroad rolling stock. The French automobile factories not being big, as judged by American standards, and the fact that they had connections with other branches of engineering, or were able to convert with a fair amount of facility to other lines, has helped to attenuate the crisis in a considerable measure.

At the present time numbers of firms are merely living on the edge of the automobile business, and holding on to the industry in a precarious manner, although it undoubtedly would be to the benefit of all if these firms would drop out altogether. The French courts have shown a wonderful leniency, firms being allowed to remain in business by arrangements with the creditors, whereas in other countries they would have been forced into liquidation.

The Price Movement

France set out, after the armistice, with the idea that the era of economical motoring was about to break. Citroen's program was a four-passenger automobile with all modern improvements at 7,950 francs; Renault announced a slightly larger car, also with electric lighting and starting, spare wheels and five-passenger body, for 8,800 francs; Berliet promised a 15-h.p. complete car at 9,500 francs; Peugeot had a four-passenger model in preparation at less than 8,000 francs; Clement-Bayard intended to come into the same class, and Lorraine-Dietrich laid plans for a high-class six, on big production lines, which, it was expected, could be sold for about 12,000 francs.

Not a single program has been realized. Citroen climbed from 7,950 francs to 15,900, and has since dropped down to 14.310 francs; Berliet went from his original price of 9,500 francs to 23,500 francs; Peugeot got up to 21,000 for a model which it had been hoped to sell at one-third this price; the popular Renault jumped from 8,800 to 22,500 francs. These are but a few typical examples, but the same thing applied throughout the industry, although certain manufacturers displayed a spirit of reserve in fixing their car prices.

When the first post-war automobile show was held in 1919, a motor famine prevailed in France. Although a year had elapsed since the armistice, not a single factory had got into regular production, and the majority had nothing more than sample models to show, with very faint hopes of being able to deliver in less than another year. Clients were clamoring for cars, and orders flowed in, the show closing with practically all manufacturers booked up for two or three years ahead. Makers knew that there was no possibility of making deliveries within the time limits they had agreed to, yet, with very few exceptions, they continued to take orders. A few of the more conservative makers only accepted such orders as they knew they could execute, and declined the others.

During this apparently prosperous period makers failed to realize that they were being fooled by dealers and the public. Convinced that promises would not be kept, the dealer who had prospects for five cars placed his order with four different firms, intending later to cancel with those makers who did not live up to delivery dates. Had there been co-operation among manufacturers this danger could have been averted, but, although the French trade is grouped into two powerful trade associations, it was never thought to get together and verify the validity of the orders.

Duplicated Orders

It was not long before manufacturers realized they had made gross errors in calculating the cost of production, and in consequence prices began to soar until the peak was reached in the spring of 1920. The reasons given for the rises were the increased cost of coal and raw material, the 8-hour day and the consequent reduced efficiency of labor. There is no doubt that these had their influence on the production costs, but it is equally certain that, after the armistice, French makers established their selling prices light-heartedly and without any real knowledge of what it would cost them to produce.

On the whole, the public stood for the first rises without much complaint, but when deliveries were not forthcoming at even the higher prices, and in several cases it was announced that the cheap model had been withdrawn and replaced by a better and more costly type, the storm burst. Legal action was taken to compel manufacturers to deliver at the original price, and in some cases compensation was claimed for late delivery. The courts were divided, for while some decided that there had been increases in the cost of raw material over which manufacturers had no control, others concluded that manufacturers ought to have been able to foresee these increases and, in any case, it was they who ought to bear the consequences and not the clients. In certain cases the line of argument of the judge was that if there had been a decrease in the cost of raw material, manufacturers would not have voluntarily dropped the price to the client and, consequently, they were not justified in increasing it when conditions went against them. Adequate publicity was given to the cases decided in favor of the manufacturer, but not much was allowed to appear in print regarding the lawsuits decided against them.

The Orders Disappear

By the spring and summer of 1920 the public, as a whole, was convinced that it was being exploited by French automobile manufacturers, and, while some persons commenced legal proceedings, others simply cancelled their orders on the ground of late delivery. Naturally those dealers who had contracted for considerably more cars than they had ever hoped to get were very ready to take advantage of the cancellation clause, the final result being that manufacturers who had thought they were booked up for two or three years suddenly found themselves, in June and July of last year, with no genuine orders on their books.

Much as manufacturers have been criticized by dealers and the public for their actions during this period, it must be recorded that the faults were not all on their side. While the demand remained good, dealers refused to be tied down by price limits, and after getting cars on the understanding that they would be sold at the prevailing catalog price, they disposed of them to the highest bidder. The client imagined that the maker was responsible for this, and the reputation of the entire industry was damaged.

Although purchasers protested against the actions of

makers, they were not above taking advantage of the situation. One man of considerable local influence threatened legal action if he was not given delivery of a car at the original price. To avoid a legal action, the factory decided to stand the loss on the car by supplying at the initial price. Within 24 hours of getting delivery the client sold the car at a 25 per cent increase. In this case the dealer lodged a complaint with the public prosecutor for illegal speculation.

Move for Standardization

It always has been difficult to get French makers to pull together on matters of general policy, but even the hopes of united action which sprang up during the war have been doomed to disappointment. If tire and rim sizes are excluded, no standardization work has been done. Magneto bases have been made uniform, but this was a war measure.

Eight important manufacturers got together in 1919 to make purchases in common and to standardize the automobile industry, or at any rate their particular portion of it. The program was promising, and even went so far as a cheap car, the various parts of which would be built in the different factories and assembled and marketed for the benefit of the entire group. Offices were opened in the Champs Elysées and engineers set to work to adopt standards, without, however, paying any attention to the work which had already been done in this direction. Some of the engineers in this group admitted that they had never heard of the American standards promoted by the Society of Automotive Engineers. This organization had entirely disappeared within one year, owing to the inability of the manufacturers to work together. While the joint car was unnecessary, there was nothing in the rest of the program that was not perfectly feasible and likely to be beneficial to the industry.

Fluctuations in Automobile Prices on the French Market

	Armistice	Jan., 1920	July, 1920	Jan., 1921	March, 1921
	fr.	fr.	fr.	fr.	fr.
Citroen, 10 hp. 4-pass.	7,950	15,000	15,900	15,700	14,310
Berliet, 15 hp. 4-pass.	9,500	9,500	18,000	23,500	22,000
Delage, 6 cyl. chassis	45,000	55,000	70,000	63,000	48,000
Renault, 10 hp. 4-pass.	8,800	12,800	22,500	22,500	16,500
Ford, 4-pass.	10,500	18,000	20,070	15,000	13,900

The causes of the present depression in the French industry are multiple. It is doubtful if the increased cost of production is mainly responsible for the refusal of the public to buy, for there has been a small but gradual decrease in price during the past three months without any corresponding increase in purchasing. Gradually the public has been educated to higher car prices, but it cannot be made to accept the high operating costs now prevailing.

The Government 10 per cent luxury tax is not only unpopular but a real handicap to the whole of the industry, for it is impossible to convince the Frenchman that a Ford, a Citroen or a small Renault must be classed as an article of luxury. In order to overcome the effects of this tax Citroen instituted, and other makers adopted, the plan of paying the tax themselves, and presenting this as a reduction on the price of the car. In this way the pill is sugar-coated, but the purchaser does not entirely overlook the fact that it is still a pill. Frequent protests have been made by the industry against the luxury tax, and its repeal on at least small cars is constantly being urged, but without any result.

Taxation a Handicap

Another barrier to the progress of the industry is the high rate of taxation on automobiles. Even the smallest car pays 500 francs a year in direct taxation, while a medium four-passenger car of the European type has to contribute 800 francs per annum to the state. In certain districts the annual tax on a Ford is almost 1,000 francs a year, or $200 at nominal exchange. The Government plea is that funds are required and the automobile owner must pay, but there is no doubt that the total amount going into the treasury funds would be increased if the individual taxes were lowered.

The French automobile industry is being bled by the gasoline ring. When the Frenchman is called upon to pay 12 frs. 25c. for a 5-litre can of gasoline (67 cents per American gallon at present exchange) he is informed that American financiers who will do nothing to help bring down the rate of exchange are the profiteers. Gasoline is sold retail in New York at the present time at 30 cents a gallon, which at the prevailing rate of exchange (14 frs. to the dollar) would make the cost on the French market 4 frs. 52c. per 5-litre can, instead of 12 frs. 25c. The difference, 7 frs. 63c., represents shipping costs and the profit of the select ring which controls gasoline in France. In this sum is included a Governmen tax of 1 fr. per can.

A leader of the American oil industry has declared that if the present monopoly were removed gasoline could be sold retail in France at 5 frs. per can.

This would only be possible, however, by taking the business out of the hands of the present "refiners," whose refining operation consists in putting American gasoline into French cans and sticking labels on the cans. This group has no interest in the adoption of bulk storage and curb sales from gasoline tanks, with the consequence that the old-fashioned method of selling in cans, many of which will not contain the quantity they are supposed to hold, and all of which entail some loss through evaporation, filling and leakage, remains in force. Gasoline economy by the use of small high-efficiency engines, by scientific carbureters and the best carbureter adjustments has been pushed to the limit. The great problem which now confronts the French automobile industry is cheap fuel. The industry is being strangled by high gasoline costs, and unless these costs are lowered or unless other and cheaper fuel is found, it is certain that the industry will be permanently crippled.

Pleas Are Unheeded

High taxes, high gasoline and oil costs and the accompanying increased charges for garage and repair work are the leading obstacles to the recovery of the French automobile industry. On several occasions the restrictive influence of these taxes has been brought to the attention of the Government, but even the leaders of the industry appear to be more concerned in getting further protection against outside competition, or in maintaining the present protection, than in removing the national restrictions. At present there is a desire to obtain the introduction of another prohibition period, despite the fact that the rate of exchange has completely killed American and English competition. Only Italy and Germany have an advantage under the exchange rates.

By the sale in France of the whole of the American and French army automobile stocks, the truck market has been saturated, and at the present moment the sale

(Continued on page 698)

An Electric Truck for Industrial and Street Use

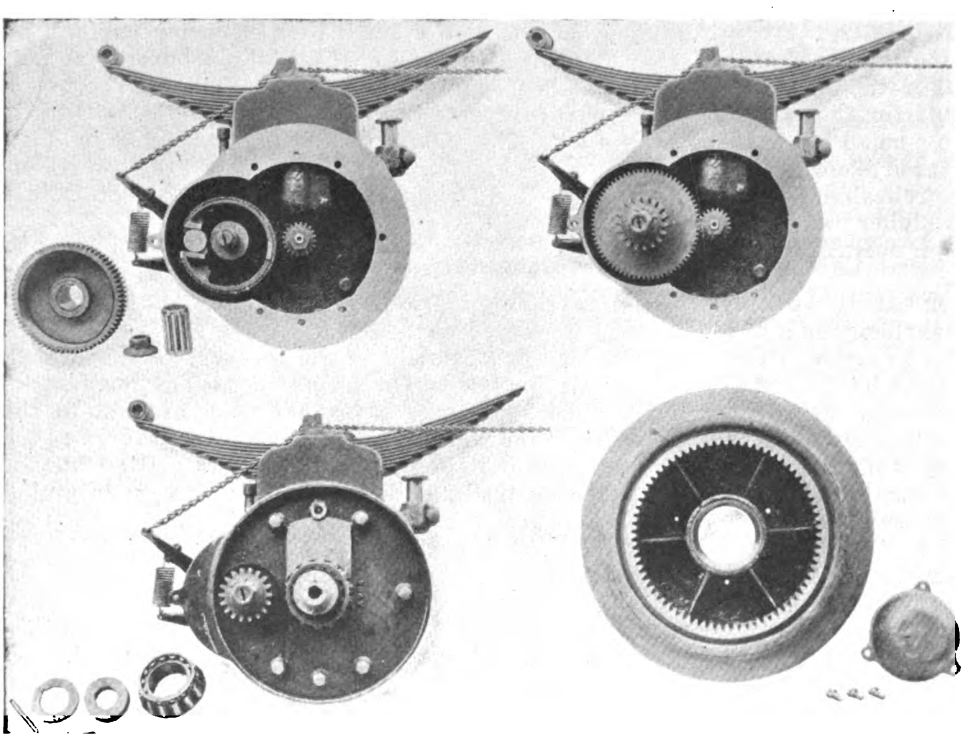
Combines in one vehicle features which adapt it for use between warehouse and dock when paving is good. Has short turning radius and elevating platform which enables quick handling and economy in time for loading and unloading, often without rehandling at destination.

By P. M. Heldt

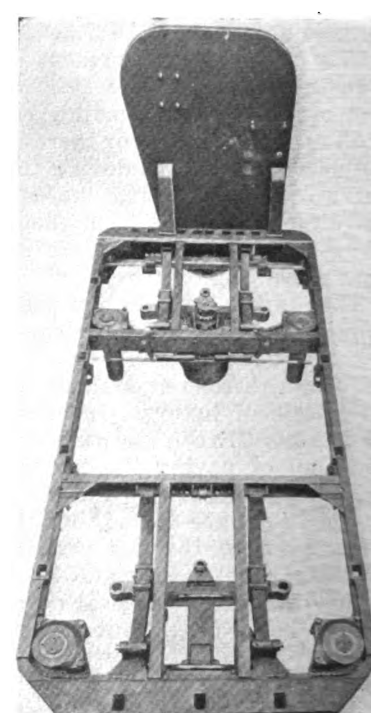
WHAT may be termed a cross between the regular industrial truck designed for use only on railroad platforms, steamship piers and factory floors, and the commercial truck for road service has recently been developed. It is based on the idea that there is a great deal of transportation between freight terminals and warehouses, for instance, which are only a short distance apart, say not more than a mile, and are connected by paved streets. If the freight is first handled at the dock or freight station on an industrial truck, then transferred to a commercial vehicle to be hauled to the warehouse and there again handled indoors on an industrial truck, a great deal of effort is wasted in loading and unloading. The Tec truck is designed to take the freight as it is unloaded from the steamer or freight car and carry it directly to its ultimate destination, even if this be on the top floor of a warehouse, provided the distance is not too great and the route is over hard surfaced roads.

In the design of this truck two points in particular were aimed at, namely, to secure unusual maneuverability, so as to be able to make short turns in factory and warehouse aisles; and to select such wheel and tire equipment as to make it possible to run at considerable speed over ordinary paved streets rather than over floors only. The truck, moreover, is of the lifting type and is used in connection with a set of loading platforms on which the load is piled and from which it is removed while the truck is engaged elsewhere.

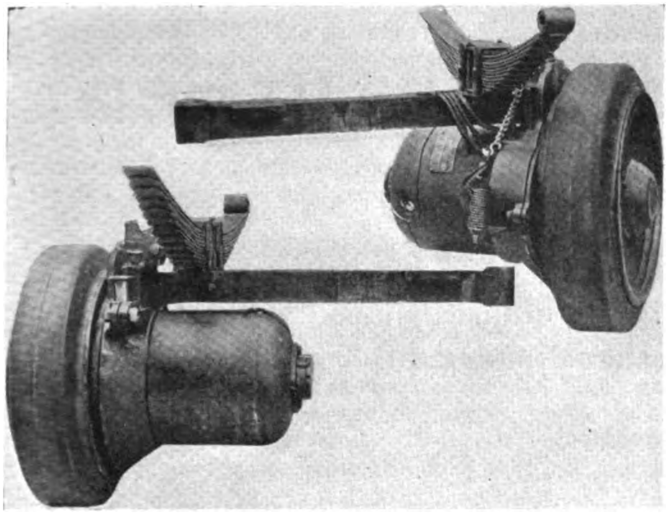
In order to secure maximum maneuverability the truck was made of the four-wheel drive, four-wheel steer type. In this way the turning radius is reduced to one-half what it would be with two-wheel steer and the same wheelbase and maximum steering wheel deflection. There is an electric motor on each wheel, so that the usual difficulties of transmitting power to a swiveled drive wheel are here eliminated, the motor turning with the knuckle in steering. The truck has a capacity of 5000 lb. and weighs complete 4700 to 4900 lb. There are five motors in all on each truck, four for the drive and the fifth, which is of the same size as the others, for operating the lifting jacks. All are G. E. motors, with the rating of 17 amperes at 60 volts. The manufacturers, the Terminal Engineering Company, Inc., make their own controllers, which give three forward and three reverse speeds, and also permit of the use of the



Details of driving gear and brake



Frame of Tec truck



Axle with wheel and motor unit

motors for braking purposes. The wheel drive gearing is built under the patents of the Commercial Truck Co. of Philadelphia. The drive from the armature shaft to the road wheel is by double reduction through a one-piece spur gear and pinion, the first reduction being from the spur pinion on the motor shaft to the intermediate spur gear, and the second from the pinion (integral with the intermediate gear) to the internal gear on the periphery of the road wheel. The mechanism, which is completely enclosed, is grease packed, and operates therefore under favorable lubricating conditions. There is an expanding brake on the intermediate gear of the drive to each wheel, and braking effort can be exerted on all four wheels.

The wheels are 20 in. in diameter and are fitted with 5-in. solid rubber tires. These tires are 3 in. deep, thus providing the same depth of rubber cushion as the solid tires on large-wheel street trucks, rather than the lesser cushion which is standard for indoor floor purposes.

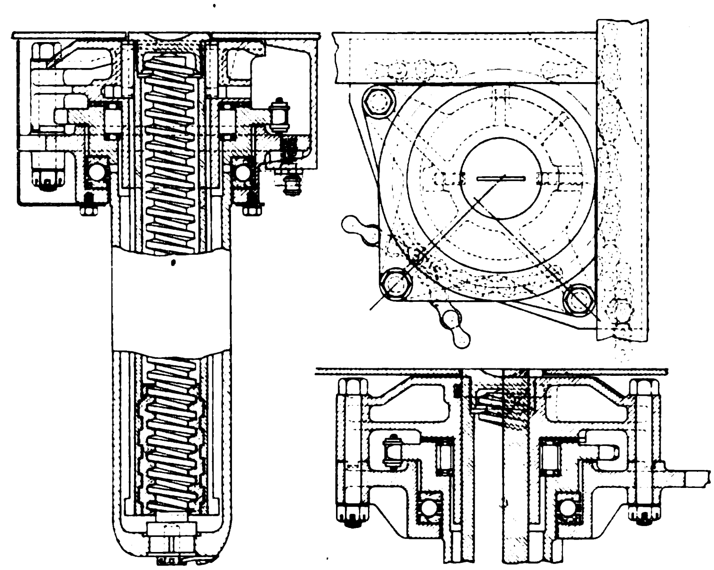
The frame is built up of 4-in. reinforced channel steel, hot riveted. It is supported on the axle by four half elliptic springs 26 in. long by 2 in. wide. The wheel units and jack units are packed with grease, so that the lubrication of the transmission gearing is effected automatically. Other bearing points are lubricated from oil reservoirs.

Tec truck carrying loaded platform

The elevating mechanism consists of four screw jacks driven by a roller chain. There is a spur gear reduction between the motor and the sprocket which operates the chain. This sprocket has a mechanical friction slip so there can be no danger of over-driving the elevating mechanism. One of the reasons for using the chain is that weaving of the truck frame does not cause binding in drive. The travel of the jacks is controlled from the dash. The maximum travel is 9½ in.

Either an Exide or an Edison battery can be used on the truck, the Exide being either the 34 cell M. V. 9 or the 35 cell M. V. 11 type and the Edison the 59 cell A-4 or G-6. There is a hinged cover in the truck deck, which permits of quickly changing the battery if it is desired to use the truck continuously. Another advantage of the hinged cover is that it permits of easy inspection of the battery. A charging receptacle of the Anderson type is provided, and there is an extra charging receptacle at the driver's platform for convenient use when charging the battery on the truck.

The controller is of the drum type and is mounted on the dash. Owing to the fact that a higher voltage is used



Detail of lifting jacks and their chain-operating mechanism

than the conventional industrial truck voltage, the operating current is comparatively low, and this, together with wide controller fingers, reduces the wear of these fingers. As a safety feature arrangements are made so that it is impossible to move the controller handle unless the operator is in the driving position. The speed range, light is ½ to 10 m.p.h. and with full load ½ to 7 m.p.h. Resistance is used in the main circuit only on the low speed, and on the high and intermediate speeds there is therefore no loss of current by resistance.

The frame is provided with stake pockets which are of steel, hot riveted to the inside of the frame, giving flush frame sides. Stakes can be conveniently carried in the rear of the dash when not in use. An automatic coupler is furnished with the truck. This has 2 x 8 in. double acting helical springs to prevent shocks when towing trailers, shifting loaded freight cars or when engaged in other heavy duty. The coupler can be released from the dash. The equipment furnished includes red and white running lights with Conophor lens, both front and rear. These lights are set in the frame so that they are protected against injury. Other items of equipment are an electric horn, license plate brackets, Veeder Odometer and a combination latch lock on the controller which securely locks

(Continued on page 711)

New Four-Cylinder Engine to Be a Stock Product

Conventional construction employed for most parts, but cast iron cylinders and pistons are of harder metal than is ordinarily used. Pressure-splash lubrication employed, with no external piping.

By J. Edward Schipper

A NEW overhead valve, 3½ by 5 in., four-cylinder engine for the general trade is now being prepared for production. The engine is a block-cast unit with the cylinders integral with the upper half of the crankcase. It has a detachable cylinder head and an overhead valve arrangement operated through rocker arms from the camshaft located in the crankcase.

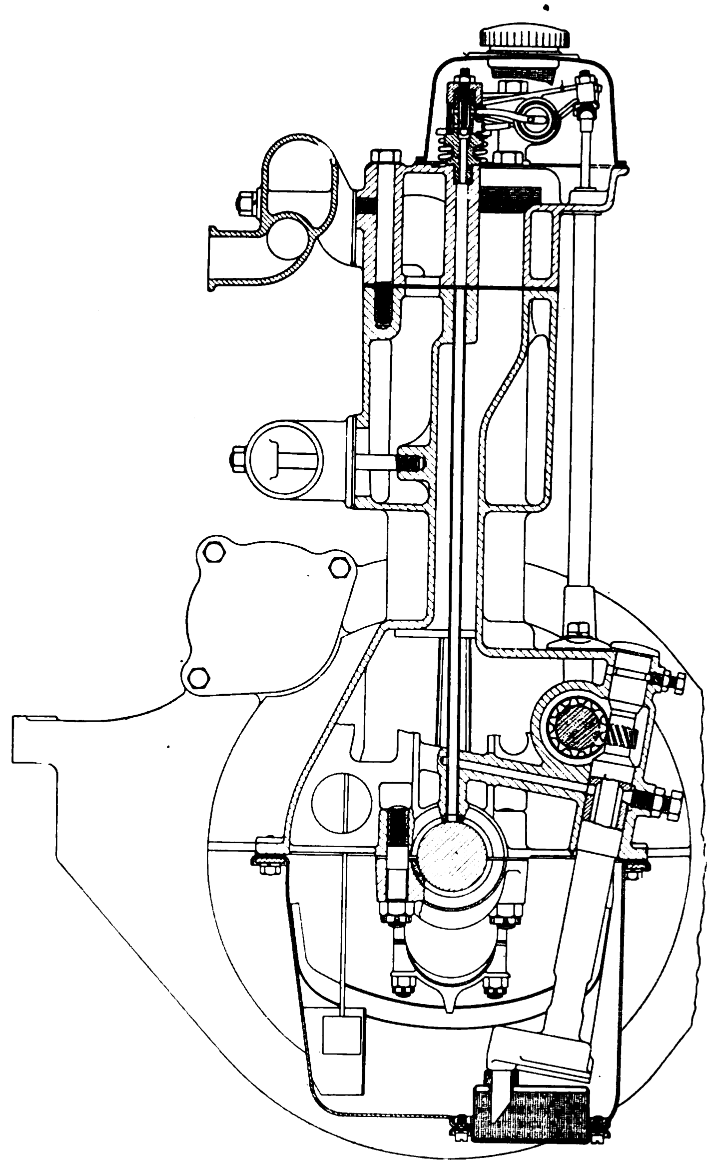
The combustion chamber surfaces are completely machined, so they will be alike in dimensions and finish. The cylinders are tested with the scleroscope and must show 38 points of hardness after annealing. This is rather hard for cylinder metal from the machining standpoint but gives extra endurance in service. The cylinder head is fastened to the block by thirteen heat-treated cap screws.

The pistons are also of hard, grey iron, ground to size and heat treated to eliminate internal stresses. They are held within narrow weight limits and are fitted with three piston rings 3/16 in. wide, all three being located above the piston pins. These latter are of case hardened steel, ground to size, and are full floating. In production they are inspected with Johansson snap gages and are held to tolerances of 0.0005 in. The scleroscope reading on these pins must be at least 80.

The connecting rods are drop-forgings of I-beam section, heat treated to a tensile strength of more than 100,000 lb. per sq. in. The center-to-center length is 11 in., or 2.2 times the stroke. The connecting rod bearings are 2 in. in diameter by 1⅞ in. in length. They are of die-cast babbitt in bronze shells. The bearing caps are held by nickel steel bolts and castellated nuts. Laminated shims are used as spacers between the bearings and caps for adjustment. In manufacture, the connecting rods are balanced against each other, not only as regards their total weights, but also as regards the weight at each end.

Medium carbon steel is utilized in the three-bearing crankshaft. The shaft diameter varies from front to rear, the three bearings being of 2 in., 2 1/6 in. and 2⅛ in. diameter respectively. The center bearing is as long as the front bearing; that is, 2½ in., while the rear bearing is 3⅜ in. in length. A large oil throw off ring is fitted at the rear, in connection with a special bearing cap construction, to eliminate oil leaks at the rear end. The shaft is put in both rotative and static balance before assembly. One of the features of the shaft is the lightness secured by drilling a 1½-in. hole through the crankpins.

The camshaft is also a three-bearing unit with integral cams ground to size. The cam has a spiral angle contour which is said to insure quiet operation in spite of considerable variation in tappet adjustment. The camshaft runs in cast iron bearings which vary from 1 13/16 in. diameter at the front to 1 11/16 in. at the rear. The center bearing of the camshaft is in two sections, between which is a helical gear for driving an oil pump. This gear is cut in the shaft and runs in a pocket of oil. End play of the shaft is taken up by spring pressure acting on a hardened button in the end of the shaft.



Transverse sectional assembly of new Gray-Beall 3½ by 5 in. overhead valve engine

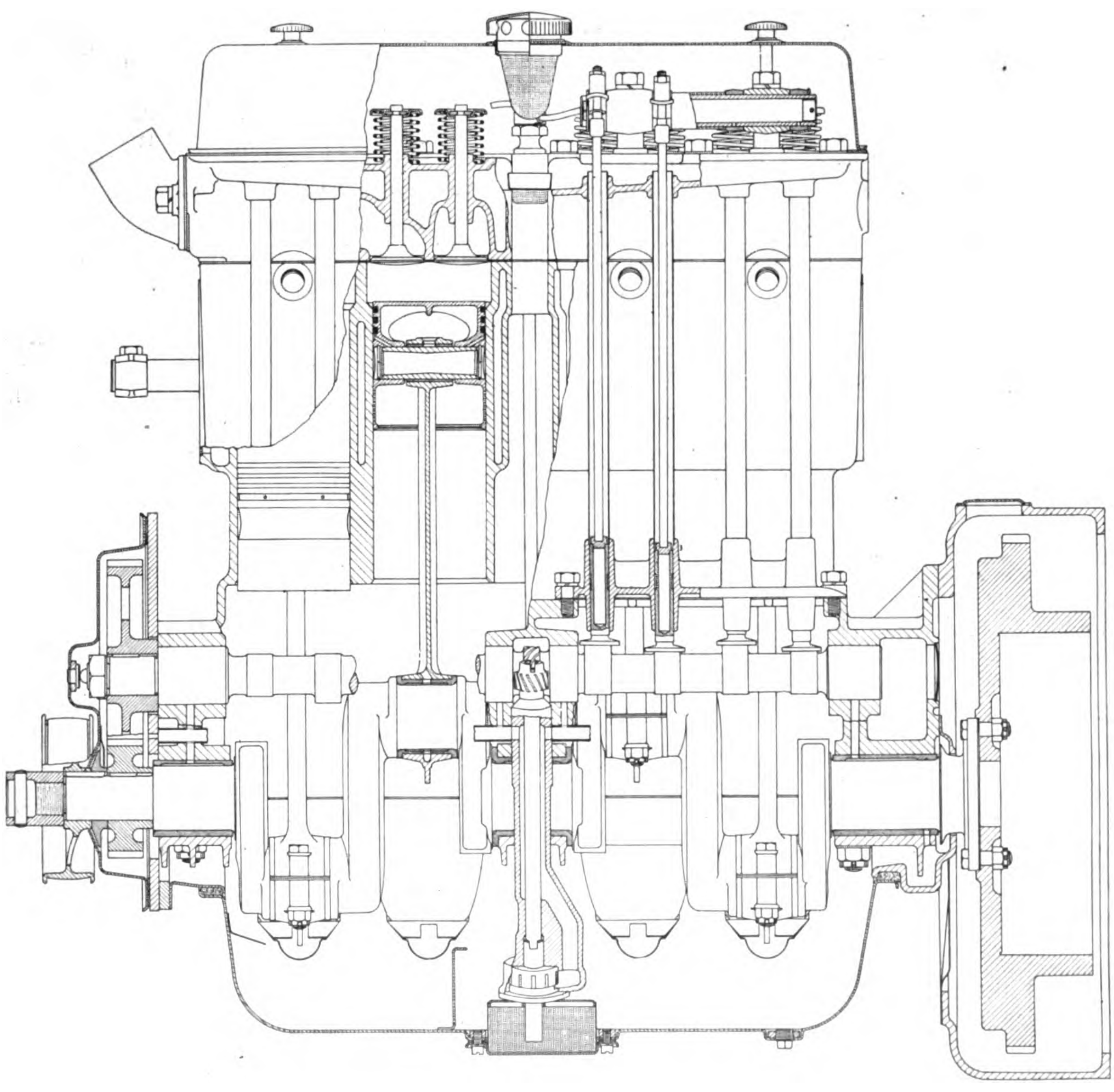
Each push rod is enclosed in a steel tube connecting the tappet guide with the cylinder head and cap inclosure, thus providing a dust-proof valve mechanism. The valves are operated by rocker arms on a 1-in. hollow rocker shaft mounted overhead. The rocker arms are of forged steel, pack hardened, and the holes in them are ground out. The fit of the rocker arms on the shaft, which is also hardened and ground, is held within 0.0005 in.

Lubrication is by pressure feed. The oil pump is located in the pan and is supported from the crankcase above by a removable shaft and housing. After passing through the screen and pump, the oil is forced up through the pump shaft housing and is conducted to the crankshaft and camshaft bearings through drilled holes and cast-in steel pipes. There are no copper pipes, or oil connections used at any point. It is not necessary to unfasten or remove any connections to take out the oil pump.

The oil is also forced to the three helical timing gears and to each of the connecting rod troughs in the splash pan. These are of special design, so arranged as to prevent the oil from splashing out laterally and also to keep the trough from emptying itself when the motor is severely jolted while passing over a bump, or running on an incline. The oil level in these remains constant when the engine is inclined, so that it is possible to install the engine for a straight line drive without interfering with the lubricating system.

In working out the design of the engine with a view to facilitating its use on different chassis, the timing gear cover was so arranged that it may be removed without disturbing the front engine supports. The bell housing is an S. A. E. No. 3. The oil pan can be removed quickly and easily without disturbing the front end supports, and either thermo-syphon or pump water circulation may be had. Ordinarily, thermo-syphon is provided, but provision has been made for the installation of a centrifugal water pump. The oil pump shaft has been extended and a mounting provided in such a way that a governor or distributor can be fitted on the side of the cylinder block without interfering with other accessories.

This engine, known as the Gray-Beall, is named from the combination of the Gray Motor interests with F. S. Beall, formerly vice-president of production at the Packard company. It is this engine which will be incorporated in the car to be produced by this same concern, with which F. L. Klingensmith, formerly vice-president of the Ford Motor Co., has associated himself.



Longitudinal section of new Gray-Beall 3½ by 5 in. overhead valve, rocker arm engine

French Propaganda Against the Straight Side Tire

Evidently the American tires left in Europe by our army are gaining popularity to an extent that has alarmed the French tire makers, who prefer the clincher type. Here is the protest of the French maker and an answer based upon experience with American tires.

SEVERAL of our French contemporaries, including Omnia and La Vie Automobile, have recently printed articles in which they attempt to convince their readers that the straight side pneumatic tire as manufactured in large numbers in this country, is far inferior to the clincher type of tire, the European standard, and has practically no merits at all. The straight side tire is used in the United States exclusively for all sizes above 30 x 3½ (31 x 4) in.

During the war large numbers of American cars with straight side tires were exported to France, and the replacement of these tires alone creates a considerable demand for the straight side type. It seems, moreover, that French users, having become acquainted with the advantages of this tire, are demanding it as regular equipment on new cars. This move is being fought by the French tire industry. As it is well for our tire makers (who believe in the straight side tire) to know what arguments are being put forth against it abroad, we reproduce below the article of La Vie Automobile in translation. The original article was appended to one describing the Michelin cable tire, thus revealing the evident source of inspiration.

By Charles Faroux

ALL of the pneumatic tires employed in France for a long time have been of the soft bead or clincher type. As every one knows, they are mounted on a rim having on each side a sort of internal clincher in which the round portion of the bead engages. Placing a clincher tire on a rim is made a very easy matter by the use of suitable levers.

In America use is made chiefly of so-called straight side tires, or hoop tires. The covers have no projecting beads. Near the edge of the covers a metallic core is embedded in the bead, thus preventing the diameter of the cover on the bead side from varying one way or the other. The rims which go with these tires comprise two flanges which may be made independent of the rim.

Mounting of the tire on the rim is possible only if the rim is detachable. In the systems in most common use one of the flanges may be detached from the rim; the flange which was removed is then replaced and is secured in position by means of a locking system.

This American system was almost unknown to us before the war, but the throwing onto the market of a larger number of American vehicles made it known in our country. At the present time a large number of vehicles in service in France are fitted with straight side tires.

Thus the pneumatic tire situation has been complicated, for to the single system formerly in use there has been added an entirely different system, which compels dealers to carry a double stock in order to be able to meet all demands.

Is this complication justified by any superiority of the American system? Not at all—quite the contrary. The two kinds of tires do not differ one from the other except by their methods of fastening; outside of the beads they are exactly alike in construction, and provided workmanship and material are the same, the American and European tire are equivalent. There remains the question of the fastening means.

The European method is simplicity itself, as already pointed out; with it there is no need for a complicated equipment for putting on the tire. Besides, the single piece rim is inexpensive and substantial.

On the contrary, the American tire absolutely requires either a detachable rim or else a rim which contracts temporarily while the tire is passed over its flange.

Disadvantages of the Straight-Side Tire

Straight-side tires entail the use of a relatively complicated rim, which necessarily increases the weight of the wheel at the rim and, consequently, its moment of inertia.

The farther away from the axis the weight of the wheel is located the longer will be the lever arm which moves the weight in its rotation, and the greater the effort required to get it up to speed. Inversely, the greater the amount of energy stored up in the wheel once it has been brought up to speed, the more violent must be the braking action, and the disadvantages of a road wheel acting as a flywheel are well known; it is these disadvantages which have led to the almost complete abandonment of the numerous designs of demountable rim, which apparently are more attractive than the demountable wheel.

It is easy to measure the power required to start a wheel when fitted with a clincher and straight side tire respectively. Experiments made by Michelin were conducted with two wheels identical up to the tires, in which the difference in weight at the circumference amounted to 23.43 lb.

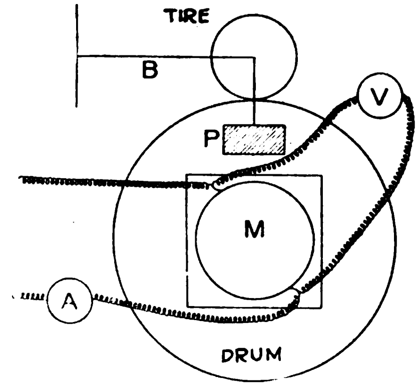


Fig. 1—Machine for testing tires as regards rolling resistance

Account of Test

The tire loaded with a weight P of 1100 lb. is carried at the end of a lever arm B. It

rests on the surface of a drum which turns at a peripheral speed of 30 m.p.h. The drum is driven by an electric motor M. It is possible to measure the power absorbed by the motor by means of a voltmeter V and an ammeter A. The tire is first raised in such a manner that it does not touch the drum on which it bears. On the voltmeter and ammeter are read off the power consumptions corresponding to starting and normal running. Chronometer readings are taken of the time elapsing before the starting point and the normal speed are attained.

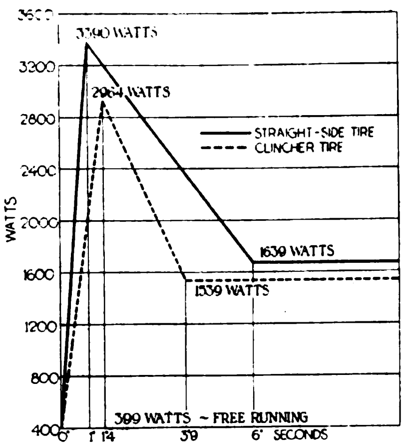


Fig. 2—Rolling resistance as measured by the machine shown in Fig. 1

The results of the experiment are plotted graphically in Fig. 2.

1—On starting the straight side wheel takes 426 watts more than the clincher wheel. This is more than ½ hp. and is enormous (1 hp. = 746 watts).

2—The normal speed is attained by the clincher tire at the end of 3 m. 9 s., and by the straight side tire at the end of 6 m.

3—At normal speed the straight side tire takes 100 watts (1/7 hp.) more than the clincher.

The phenomena observed at the moment of starting are reproduced, in an inverse sense, when the brakes are applied. The figures cited above refer to one wheel; the car has four of them; therefore, these figures must be multiplied by four in order to get an idea of what is going on on a vehicle. The phenomena above described take place not only on starting and braking but at every acceleration and deceleration, with reduced force.

Mechanism in the Mud

Aside from the disadvantage due to the greater inertia of the straight sided tire, there are disadvantages of a practical nature in connection with the mechanism. The rim of a wheel is extremely close to the ground, and, consequently, whatever you do, this rim is constantly covered with mud. The result is that all parts not protected by paint are quickly rusted. Now, the mechanical parts which hold the removable flange of the American rim in place—studs, nuts, lugs—are necessarily rusted, as it would be impossible to cover the threads of the nuts, for instance, with paint. As a new tire fitted to a wheel may remain in place for months, the difficulties encountered in trying to operate this rusty hardware, after having been in use for three months during the winter, in the mud of the suburbs, may readily be imagined. Every thing is locked and frozen by rust, and it is necessary to develop superhuman efforts to separate the parts from each other.

The tire dismounted, we are not at the end of our trouble, as it is necessary to fit a new cover to a rim completely covered with rust; if it should happen that the removable flange of the rim be slightly distorted, which is almost certain to be the case if it had to be removed with hammer blows, we can readily imagine all the fun which we will have in performing this operation.

Americans having the reputation of being practical people—a reputation sometimes ill deserved (see the kind of order that obtains in the heaps of merchandise in the American camps)—how is it that this extremely practical people continue to make use of such an unhandy tire?

Simply for the reason that automobiles are not used in the same way in America as in Europe. An American who has had a break-down never occupies himself, so to speak, with his car. If it balks he leaves it where it is, at the side of the road, and telephones to the nearest garage. The repairman arrives, takes the disabled car in tow, if necessary, hauls it to his shop and makes the repair.

This is the mode of procedure which is applied as well in the case of a tire blow-out as in that of a broken rear axle. The shops, consequently, are well equipped to do any kind of repairs. It is readily conceived that with an elaborate equipment the replacement of a tire, however defective its method of mounting may be, does not require much time. In any case, the owner of the car never soils his hands, and, consequently, he does not suffer from the disadvantages which the system presents.

On the other hand, it must not be believed that all Americans ride on straight side tires. In the cities, it is true, these tires are being used, but in the country, where the farmers use their Ford or similar vehicle in their daily work, these vehicles have wheels fitted with good old clincher tires; exactly the same as European tires.

Let us, therefore, not complicate the task of our manufacturers, to our own great detriment, by compelling them to carry two complete series of tire models. In the final analysis it is your own pocketbook which carries the burden of this complication.

The European tire has proven itself clearly superior to the American tire; let us stick to it and if the hazards of the liquidation of stocks have brought us into possession of a vehicle with straight side tires, let us not hesitate on the first occasion to have the special rims—however complicated and ingenious they may be—replaced by good old clincher rims, which will enable us to find tire replacements at the store of the nearest dealer.

Advantages and Safety of the Straight Side Tire

By P. M. Heldt

WE must first inform our confrère that he is very much mistaken as to the conditions under which cars are used in the United States. That they were used mainly in the cities may have been true twenty years ago, but we have moved ahead somewhat since the beginning of the century, in road construction as well as in automobile manufacture. There are now close to nine million automobiles in service in this country and we do not believe that our manufacturers would ever have succeeded in finding purchasers for so many if the owners did not have sufficient confidence in their cars and in themselves to drive more than a few miles away from a garage. That it is the common practice of American motorists, when suffering from a flat tire, to call up a garage is absurd.

Of course, we prefer to do our tire mending at home or in the garage to doing it on the road, and for that reason we carry demountable rims, but we fully believe that French motorists also prefer to do their tinkering at home at their leisure. That Americans are poor mechanics, as stated by Omnia, is untrue. It does not require any high degree of mechanical skill to operate an ordinary detachable rim, and the average American

is fully capable of removing either a straight side tire or a clincher tire. The American farmer, particularly, is probably more self-reliant and capable in mechanical matters than any class of European motorists except those with machine shop training.

The difficulty of applying and removing straight side tires is greatly exaggerated. Sometimes, if a tire has been in place on the rim continuously for a year or more, it may be rusted on and, therefore, hard to dislodge, but this is so whether the tire is a straight side or clincher type. This is naturally a rare occurrence. Ordinarily, after the straight side tire has been on the wheel for some time, it slides right off the wheel and on again and it is incomparably easier to handle than the clincher tire.

There are a number of positive advantages in the straight side tire, without which it would never have been made the standard of the American tire industry. First comes the factor of safety. It is obvious that in case of a sudden deflation a tire with a non-extensible bead (straight side) cannot be wrenched from the rim so easily as a flexible bead tire (clincher). The danger resultant upon shedding a tire when going at high speed is well known.

Another important advantage of the straight side tire is its greater immunity from damage when run under-inflated. The edges of the rim of a clincher tire have a tendency to gouge into the tire when the pressure of inflation is suddenly released. In the straight side tire, where the edges of the rim flanges flare outwardly, there is no such tendency, and rim cutting is, therefore, practically eliminated. Under-inflation is the abuse which is responsible for many cases of unsatisfactory tire service, and it is far less injurious to the straight side than to the clincher tire.

Observations of tires of otherwise substantially equal construction but with straight sides and clincher beads, respectively, have shown the former to be substantially longer lived. S. P. Thacher, technical assistant to the president of the United States Rubber Company, says on this point:

"In studying the reasons for this difference, we have come to the conclusion that they lie in the better structural arrangement of the plies of fabric or cord at and above the bead proper and in the larger volume of air carried by the straight-side type. These are the basic reasons, and they explain the margin in favor of the straight-side when tires of both types go through a road test without injury. The margin becomes still greater if the tires are run flat even the minimum distance required to stop the car after a puncture or cut has occurred. Under these conditions the deflated straight-side tire lies naturally over the out-turned flanges of the rim without injury, while the inturned flanges of the clincher rim cut and chafe many miles out of the clincher tire."

The superiority of the straight-side over the clincher type of construction is emphasized by its use in the giant truck tires. It is the firm conviction of our tire makers that tires of 8 in. and greater width would be impossible with clincher beads, as the tire would not have the required support on the rim, causing a certain lateral instability of the vehicle.

The reference to "rusted hardware" is hardly calculated to strengthen the argument of our French contemporaries. A clincher rim is no less "hardware" than the detachable rim and just as likely to rust. Such catch phrases prove nothing. We remember M. Michelin using the same mode of attack against rubber non-skid treads which he referred to as "sculptured tires," but this did not prevent the success of these treads.

The best answer to the French allegation that the straight-side tire is a makeshift which can be changed conveniently only at a garage furnished with elaborate equipment, is that there are hundreds of thousands of motorists in this country successfully using straight-side tires who never think of going to a garage or tire station to replace their tires. American tire manufacturers are not ignorant of the features of the clincher tire, as they have produced many times more such tires than European tire makers. The straight-side tire is based on the old Dunlop bicycle tire which had steel cables in its retaining edges to make them inextensible. American manufacturers supplied the detachable rim and combined it with the inextensible edged tire. This combination has become the standard of this country for all except the smallest size of automobile tire. According to late information, it has been placed in production by at least one British and one French firm, and we feel quite sure that if we ever come down to a single universal standard for pneumatic tires for automobiles it will be the straight-side tire.

Why the French Automobile Production Program Failed

(*Continued from page* 691)

of new trucks is even more difficult than the sale of passenger cars. French manufacturers feel that they have been made to suffer unnecessary hardships by these Government sales, and there is no doubt that there is a large element of truth in their contention. The sale of these army stocks has been woefully mismanaged, but this, of course, is not any consolation to the manufacturers who find themselves obliged to cut their production 75 per cent.

Dealers who have attempted to get on the French market with American cars and automobiles have not had a happy experience. For a long time imports were prohibited; then a 70 per cent duty; then, to make matters worse, exchange rates rose from 8 francs to the dollar to 17 to the dollar, to fall to the present comparatively high rate of 14 to the dollar. As a consequence, the sale of American passenger cars on the French market is now at a standstill, and the numerous dealers who got into this line at the armistice, as the result of the experience they had had during the war with American cars, have either been forced out or, if they possess the means, are waiting for an improvement in the future.

Ford has a rather special position and has remained on the market, for, although the price increased from 10,500 francs at the armistice to more than 20,000 francs, falling to the present price of 13,900, this car has continued to undersell French makes. Last year Ford suffered as much from the general depression as any others, the volume of business in 1920 being lowest on record.

For a time the tire field looked very promising, but even here immense sums have been lost. Up to the middle of last year the tire factories were unable to meet demand and American makes were sold readily. Firestone, U. S., Oldfield, Ajax, Fisk, Braender were some of the makes unknown here before the war which got on the market, either directly or through dealers. When the slump came many of the individual dealers found themselves with large stocks and had to sell out at very heavy losses. These deals have temporarily demoralized the French tire market.

New High-Grade British Chassis Is Designed for Production

Is equipped with four cylinder 3⅜ x 5-5/16 in. engine developing 40 h.p. at 2000 r.p.m. Overhead valves and detachable head are employed. Aluminum cone clutch without facing runs in oil. Clutch and gearset are easily dismantled for repair. Cantilever springs are mounted inside frame. American and British practice combined in design.

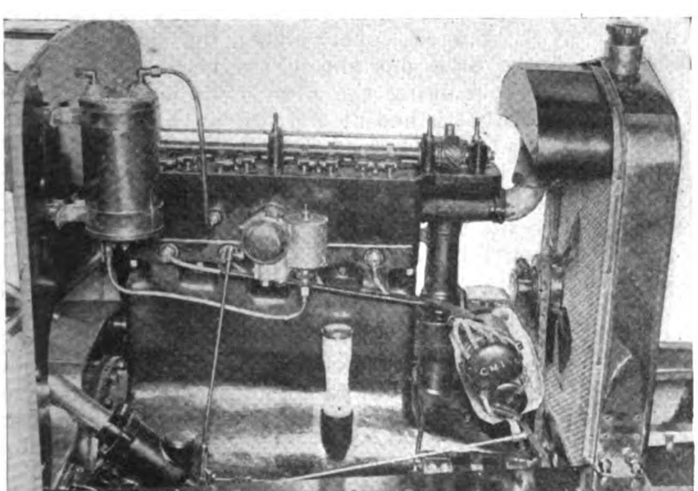
By M. W. Bourdon

THE criticism leveled, generally with good reason, against British chassis designs of all sizes and prices, i.e., that production costs are given insufficient consideration, cannot be applied to the new 18 hp. Phoenix. True, there are points where further economy is possible, as might be expected in a first attempt to design a chassis which shall be economical to produce and at the same time comply to the full with British standards in respect to efficiency, smoothness of running and ease of upkeep. This new model is not put forward as a cheap car, but as one of high-grade designed to make and sell at a reasonable figure; it is attracting the keen attention of a number of British manufacturers, who are only now coming to realize that economical production is absolutely essential to future success and that it can be attained without sacrificing ideals in other directions.

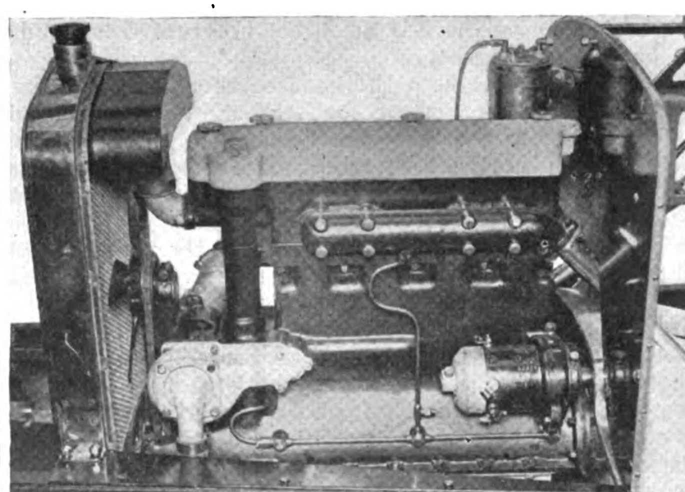
It is a subject for remark that Phoenix should be the first British manufacturer to make radical departures in order to reduce manufacturing costs while increasing engine efficiency, and that, too, in a chassis of medium power, for this maker has not in the past been renowned for up-to-dateness in design—even on British standards. The plant is modern, but Phoenix design has hitherto been more in accord with the length of time the firm has been in the industry—nearly twenty years. Further, the largest car yet made has been a 12 hp. with three seats abreast.

The new model, which sells at $3,200 with five-passenger body, has a four-cylinder block cast engine with overhead camshaft, valves in line and a detachable head. Bore and stroke are 85 x 135 mm. (3⅜ x 5 5/16 in.) and a power output of 22 hp. at 1,000 r.p.m. is claimed, and 40 b.hp. at 2,000 r.p.m. The camshaft is carried by four plain bearings, one at the rear, one central and two at the front—one of the latter at each side of the helical driving gear, which has a ball thrust. Camshaft bearings are lubricated by pressure through an exterior pipe leading direct from the pump to a union on the side of the cylinder head and thence by an internal duct to the central bearing; a small bore pipe runs from the latter to the end bearings with spray jets on to the cams and rockers.

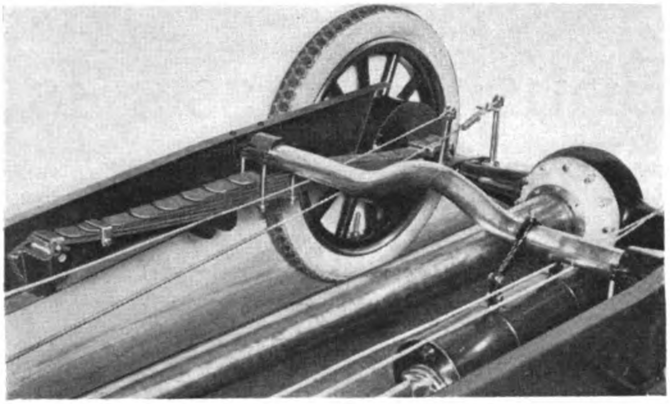
A feature is the design of the rockers, each of which may roughly be likened to a long link from a roller chain, with one end roller internal to form a bush and a third roller to which the cams apply offset between the two end ones. At present the rocker is built up of steel side plates, hardened steel pins and two hardened steel rollers, a bronze bush forming the pivot bearing; and here is an opening for economy in production which could probably be made use of by getting a detail on



Right side of new 18-hp. Phoenix engine. Overhead camshaft has four bearings and is driven by helical gears. Magneto ignition is used. Note recesses for nuts on inverted holding-down studs



Left side of Phoenix engine, showing water pump bolted to facing on block casting of crankcase and cylinders. Cored passages make hose connections between engine and pump unnecessary



Cantilever springs on new Phoenix chassis are located inside the frame. Trunnion bearing at center has oil-less bushing bearing upon the tubular cross member of the frame. Ends of springs have sliding contact on axle and frame bracket. Side member of frame is cut off short to give clearance to brake drum on wheel

the same principle made by a roller chain maker. The rockers are mounted in pairs and pivot at the ends opposite to the valves on short shafts in separate brackets attached to the top of the head. Thus low cams are used with the lift increased in the actual valve opening.

Valve clearance is adjusted by a cap screwing on to the threaded valve stem and locked by coned contact between it and the spring plate, the latter having a dowel which fits into a groove in the valve stem to prevent it from turning during the process of adjustment. There is scope for economy here also since it appears that but for the advantage of roller contact between rocker and valve—which is certainly worth considering—no benefit arises from this arrangement.

The cylinder head is held to the block by inverted studs ½ in. diameter and nuts; 5 on each side pass through the top of the block, the latter having exterior recesses for the nuts. The elimination of central studs is an innovation—in England at all events—and has two advantages (1) increased area gasket contact faces around the cylinder bores and (2) shorter studs of larger diameter. It is an arrangement which also simplifies the appearance if not the machining of the head in overhead camshaft designs. But obviously special precautions are needed to prevent distortion allowing leakage of water or compression at or about the longitudinal center line of the block, where there is no direct pressure from studs as usual.

Formed integral with the head casting is a trunk inclosing the upper end of the vertical drive-shaft and carrying two of the drive-shaft bearings, the other two being in a corresponding trunk extending up from the distribution casing and integral with the latter and the cylinder and crankcase block.

To enable the head to be removed and the valves taken out without disturbing the camshaft drive, the vertical shaft has a sleeve coupling secured to the lower half. Tongues on the shaft ends engage with slots in the sleeve and are offset from the shaft center line so that in reassembling the head it is impossible to upset the timing by coupling up the shaft half a révolution out. This is claimed to be a simple machining job without allowing backlash to occúr, but in the writer's opinion there is scope here for a small economy in the manner in which an undoubtedly excellent idea is carried out.

Magneto ignition is fitted, although the original intention was to use a dynamo battery system. The magneto has displaced the dynamo and the latter is therefore belt drawn, but by a separate belt from that driving the fan.

The top half of the crankcase is integral with the cylinder block and the housing of the cross-shaft for water pump and magneto drives. Three journal bearings support the crankshaft in the upper half of the crankcase, and these are fitted with die-cast liners of the same size as and interchangeable with those of the connecting rod big-ends.

Cast-iron pistons with three compression rings are used. The piston body is peculiar in that it is recessed and lightened by coring between the lower ring and the skirt. Hollow wrist pins float in the piston bosses, but are fixed in the small ends of the H-section connecting rods by a draw bolt engaging a shallow groove at the center of the pin. Three oil holes run from the bottom edge of the lower ring groove at each side to the interior of the unbushed piston bosses.

Pump water circulation is used. The pump casing has a self-adjusting gland and is bolted to the cylinder block with a cored passage to the water jackets, thus avoiding the need for separate pipes or connections between the two. Special precautions are taken to prevent water leaking into the crankcase, there being a drain hole in the pump shaft casing and a reverse groove in the cross-shaft bushing. The honeycomb radiator, in this model normally located, instead of being at the front of the dashboard as in the older models, has its shell and core separate, the latter being supported inside the steel shell at three points on rubber cushions.

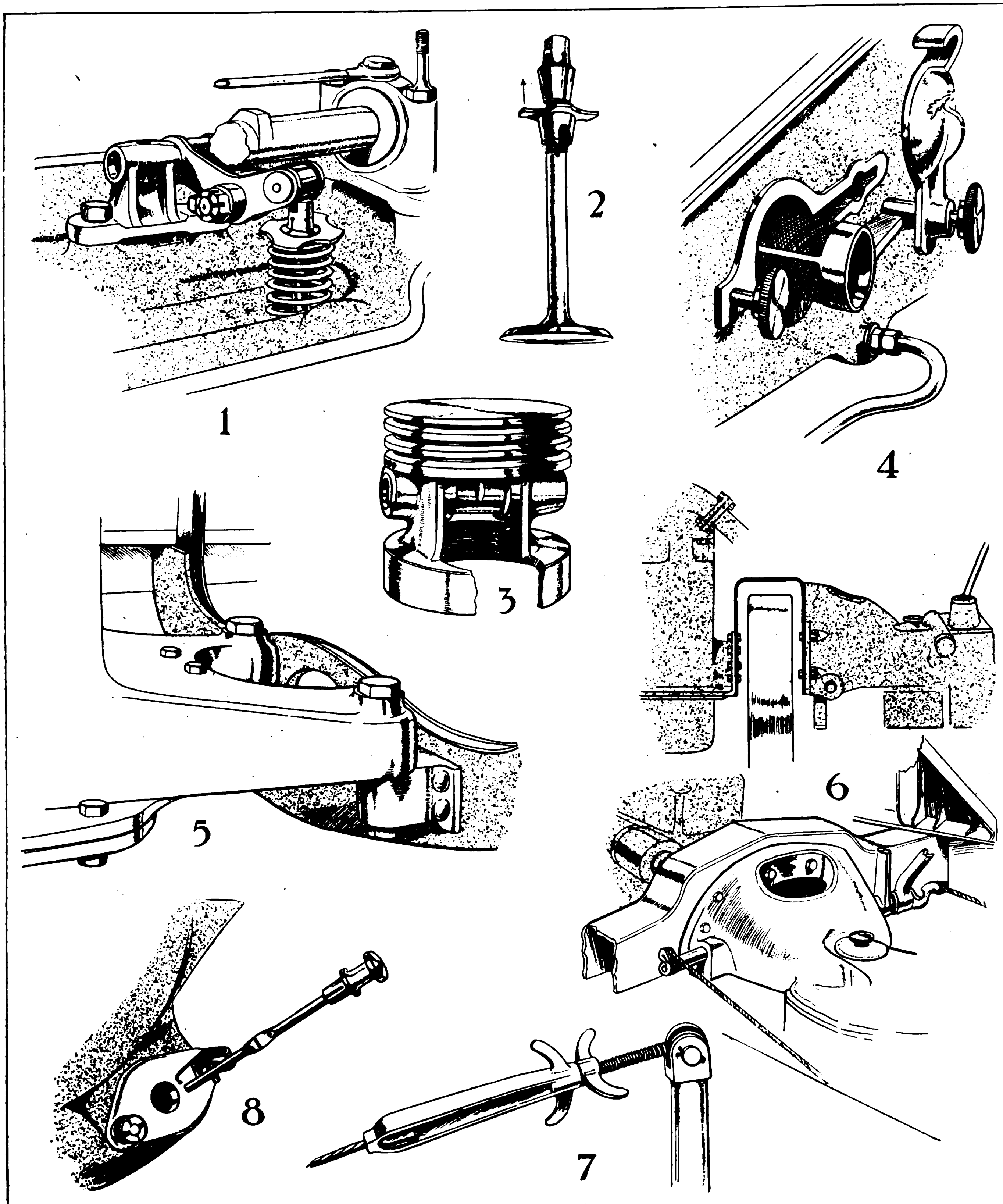
Engine lubrication is maintained by a modified trough system, for although troughs are used under the big ends, the oil is carried by direct exterior leads to the main journal bearings and to the overhead camshaft. The excess of oil fed to the camshaft lubricates the vertical and cross-shaft bearings and gears in returning to the crankcase. The oil pump is driven by a lower extension of the vertical driveshaft for the overhead valve gear.

Another special feature lies in the mounting of the oil filter, located at the bottom of the sump. It is a cylinder of gauze with its inner end closed and its open outer end making contact with the inner wall of the sump opposite a hole from the outside of which the oil suction pipe leads to the pump. Although the filter is submerged, it can be withdrawn in five seconds for cleaning without draining the oil. An inch or so above the high level of the oil is a round hole in the sump wall with a slot extending from one side, the opening being normally enclosed by a flanged cover plate; by slackening two knurled finger nuts, one end of the plate can be swung upward, thus bringing the filter cylinder opposite the hole. An arm, attached at one end to the bolt which is fixed in the pivoted end of the cover plate, carries the filter attached at the other end, as will be seen from the cut. When the filter arrives at this point, its arm or bracket and the cover plate can be withdrawn as a unit, the slot from the side of the hole allowing the arm to pass through.

While this filter arrangement is more costly than a cylinder of gauze with a flanged outer end bolted over the outlet hole to the suction pipe, it overcomes, without great expense, and with the advantage of still being on the suction side of the pump, the great objection of users to submerged filters which cannot readily be cleaned or inspected.

Engine and gearset are not truly a unit, for they are separately bolted to the front and back, respectively, of an inverted channel section crossmember of the frame. This is a deep bridge-like pressing, which half encircles the flywheel located within the channel. The arrange-

Details of Parts of New Phoenix Chassis



(1) *Overhead camshaft and valve gear.* (2) *Combined spring anchorage and clearance adjustment on threaded valve stem.* (3) *Lantern type cast iron piston. Note oil holes for lubricating piston pin.* (4) *Oil filter partly removed. It is easily taken out for cleaning without draining oil from sump.* (5) *Front engine brackets bolted to cross member of frame.* (6) *Two views showing method of mounting engine and gearset. They are both attached to the channel section pressed steel cross member, thus forming what is in effect a unit powerplant.* (7) *Brake cable adjustment and locking device.* (8) *Oil filler and level gage on rear axle*

ment allows either the engine or the gearset to be detached independently of the other, and yet has most of the advantages of unit construction. The clutch pit is inverted, being open below and enclosed above, though a hole in the top (which is integral with the upper half of the gearset casing) allows the clutch coupling and striking fork to be reached or seen from above.

The clutch is of the cone type, the driven member being of aluminum without fabric or other facing; it is enclosed and runs in oil within the flywheel, with a ball-bearing pilot. The aluminum-to-iron cone clutch has been a successful feature of Phoenix cars for many years past. Between clutchshaft and gearset is a single fabric disk coupling and this, together with the open-bottomed pit, allows the clutch as a unit to be dismantled and lowered clear in five minutes without disturbing any other detail. Similarly, the lower half of the gear-casing, being held up to the top by six bolts and nuts, can be lowered independently, bringing the layshaft with it and also bottom half of spherical housing of torque tube.

Three speeds are provided with central control lever, the six-spline shafts and the pilot end being carried on ball-bearings. The gear-casing is divided horizontally on the mainshaft bearing center line; the bottom half forms the housings for the layshaft and reverse shaft bearings and also half the housings for main shaft and torque ball at the end of the propeller shaft casing. The gearset overhangs from the crossmember, to which it is bolted, more than seems advisable, and this shortcoming is not mitigated by the fact that it takes torque and thrust from the propeller shaft casing.

The universal joint is of the plain bushed star type, directly lubricated from the gear-casing. Final drive is by spiral bevel, with the pinion formed solid with its shaft, the latter having a sliding coupling connecting it to the propeller shaft.

Two steel pressings welded together form the tapered torque tube, which is bolted to the aluminum front cover of the axle center. Steel pressings welded together on the vertical center line also form the casing of the full floating axle, with the differential, crown bevel and pinion mounted on a front cover of aluminum. At rear of the center is the usual oil-filling elbow on a detachable aluminum cover, the elbow cap embodying a bayonet gauge for oil level indication. The axle shafts are splined at each end and convey the drive through dog clutches to the pressed steel hubs which are mounted on Timken bearings. The front hubs are also steel pressings and run on Timken bearings.

All steering joints, spring shackles, clutch and brake-shaft bearings have oil-less bushings. The steering gear is of the worm and full worm wheel type with axial adjustment for the worm shaft, the housing being bolted to the front face of the crossmember between engine and gearset.

Both sets of brake shoes apply within the rear wheel drums, and are actuated by steel cable connections with adjustment at the rear ends. Full cantilever springs, 49 ins. long, are located inside the frame, are used at the rear, and semi-elliptics, 36 ins. in length, at the front. The cantilevers are pivoted with oil-less bushes on a tubular crossmember. Their front ends slide within pivoted brackets and rear ends slide within a fixed bracket on the rear axle, the sliding surface being lubricated from an oil well. The wheels are of the detachable pressed steel and hollow spoked pattern, with 815 x 105 m.m. tires (32 x 4 ins.).

Fuel is fed by vacuum from a 15-gal. tank arranged longitudinally inside the frame. A large filling spout, containing a combined filter and gauge, projects through the right-hand step-board.

The standard body is a five-passenger open type, upholstered in leather. This has the usual one-man top and divided windscreen with swinging upper panel. Beside the usual equipment, which includes a speedometer, spare wheel and tire, luggage-carrier and electric horn, a folding tonneau screen is provided, an item which is for the first time included in the standard price of a British car—and, so far as the writer is aware, in that of any car, irrespective of country or origin. But it is an item which many people maintain is as essential for completeness of equipment as is a front screen for the driver and his companion.

One of the designers of this new chassis is a man at one time with a British automobile firm whose cars are world-famed. He has lived temporarily in the United States, studying American production methods, which fact justifies the opinion of observers that American and British brains have collaborated in evolving the new Phoenix.

Effect of Varying the Number of Plies in Plywood

In making up plywood for a particular use the question frequently arises, Should three plies or more than three be used to obtain the required thickness? Some data from tests by the U. S. Forest Products Laboratory may be of assistance in answering this question.

An increase in the number of plies results in a decrease in the tensile and bending strength parallel to the grain of the faces and an increase in the corresponding strength at right angles to the grain of the faces.

If the same bending or tensile strength is desired in two directions, parallel and perpendicular to the grain of the faces, the greater the number of plies the more nearly the desired result is obtained. It must be borne in mind, however, that plywood with a large number of plies, while stronger at right angles to the grain of the faces, cannot be so strong parallel to the grain of the faces as three-ply wood, and hence a three-ply panel is preferable where greater strength is desired in one direction than in the other.

Where great resistance to splitting is necessary, as in plywood that is fastened along the edges with screws and bolts and is subjected to forces through the fastenings, a large number of plies affords a better fastening.

It is common experience that a glued joint is more likely to fail when thick laminations are glued with the grain crossed than when thin laminations are glued. The same weakness exists in plywood when thick plies are glued together. When plywood is subject to moisture changes, stresses in the glued joint due to shrinkage are greater for the thick plies than for the thin plies. Hence in plywood constructed with many thin plies the glued joints will not be so likely to fail as in plywood constructed with a smaller number of thick plies.

It is reported from Christiania that the North Electro-Kemisk Aktieselskab, the works of which are at Tysse, has been experimenting with a special ferro-chrome alloy, produced electrically, which will not rust and which is not affected by most acids. The process of production is said to be so cheap that the new steel will not cost more than other kinds. The company, it is said, contemplates the establishment of works for the production of this steel.

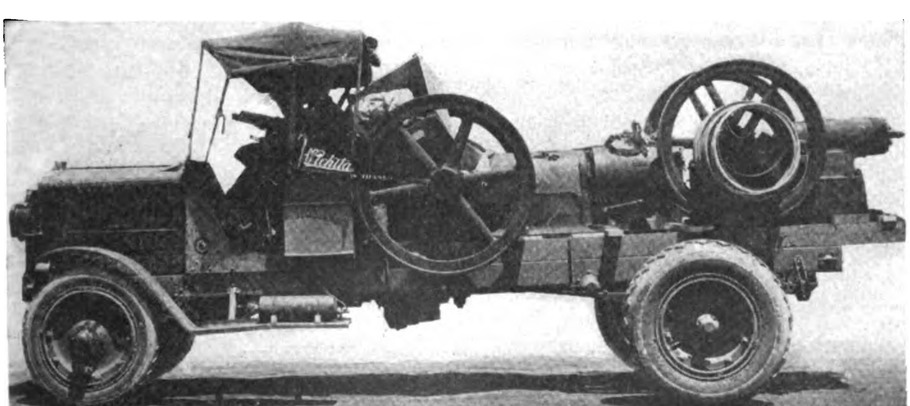
A Flexible Frame Truck Designed for Use on Poor Roads

Two and one-half ton job intended primarily for use in oil fields. Individual units protected against damage by frame distortion. Ample reserve power, unusual road clearance, and giant pneumatic tires featured.

ONE of the severest classes of service to which motor trucks are put is that in the oil fields. All of the material necessary for putting down a well, from the lumber for the derrick to the fuel required for the boiler, must be transported from the nearest railroad to the well location. This material varies in size and bulk from light hand tools to a boiler weighing more than 10 tons, the latter being used for generating steam to drive the drilling machinery.

When a well is once started, all of the material required must be delivered in an uninterrupted stream, for a delay may mean great loss. Where there are a number of wells going down in a field, the first well brought in has the biggest flow; each additional well put down weakens the flow of the others tapping the same pool. Therefore, if a well is brought in 10 days before its neighbors, and develops a flow of 2000 barrels, it will have a total flow of 20,000 barrels more than any of the others in the same field. At $3.00 per barrel, this represents a clear gain of $60,000. For this reason a well when once started is rushed through to completion as quickly as possible. Work is carried on night and day, no delay of any sort being tolerated. It is not unusual to pay as much as $200 for transporting a much needed load of oil well material over 10 miles of a particularly bad road during the rainy season.

Trucks designed for use mainly in the cities have been found unsuited for this work, owing to insufficient reserve power, insufficient frame strength and flexibility, and insufficient road clearance. Practically all oil field transportation is done with 2½-ton and 3½-ton trucks with 3-ton two-wheel trailers, the majority of the material hauled, such as lumber, boilers, drill tools, and casing, being too long and heavy to be carried on the long wheelbase truck. For operation over soft roads, both truck and trailer are equipped with giant pneumatics, as they give better traction and do not cut in as deep as solids.



Wichita Oil Field Special with typical load

A special study of the transportation requirements of oil well operators has been made by the Wichita Motors Co., whose plant is located in the center of the oil field district. They began by making changes and alterations on their standard 2½-ton model and after thorough tests under working conditions, built some other trucks in which the weaknesses of those previously tried were eliminated. The final result was a specially designed 2½-ton truck, known as the RX Oil Field Special. The particular features of this truck are giant pneumatic tires, ample road clearance, a form of construction whereby the individual units are protected against damage from twisting and distortion of the frame, heavy sectional flexible frame and ample reserve power.

The greatest problem was to obtain the proper balance between motor size, transmission and rear axle reductions, and rear wheel diameter in order to obtain an ability that would not put too much of an overload on the worm axle and transmission, and still give sufficient tractive effort and road clearance to pull through bad places with a heavy load on truck and trailer. Frame breakage was another problem. Some of the frames on the first experimental models were fractured at three different points at once after only four weeks of service, in spite of the fact that they were reinforced with a ¾-in. truss rod. These fractures always occurred at a point in the channel where a rigid cross member or bracket was attached. It was not due to overloading, but to the constant twisting and distortion, due to the numerous chuck holes in the road, and as the cross members and brackets localized all these twists and distortions on the side channel, it was only a matter of time before fracture occurred, regardless of the section of the channel.

The frame now used is of the flexible type of pressed steel having channels 7 in. deep of 5/16 in. alloy steel stock. It is free to deflect and distort for practically its full length, there being only two rigid cross members, one at the rear ends of the rear springs, and the other close to the flywheel, the latter being used for supporting the pedals and control levers.

Bad effects due to extreme distortion are eliminated by making the radiator, hood, floor board and dash, and seat box, each a separate unit, having no connection to its adjacent units. This permits the whole front end to weave without straining or loosening any of these units. Three point suspension is used for the power-plant, which is a four-cylinder, 4¼ x 6 in. valve-in-head, detachable head type.

In order to insure perfect vaporization of the fuel used the entire intake

manifold is surrounded by hot exhaust gases so that the entering charge is certain to get sufficient heat to properly vaporize low-grade fuels. Connecting rod bearings can be inspected and adjusted through hand holes in the side of the crankcase. Ignition is by means of a single high tension magneto. Frictionless, elastic fabric universal joints are used throughout, as they require no attention or lubrication, and are impervious to oil and water. The engine is governed by a Duplex governor; the clutch is a cone type, leather lined, 15¾ in. in diameter, and is preferred because of its simplicity and ease of adjustment. The transmission, located amidships, is a four-speed direct on fourth, with pump aperture for attaching an air pump for pneumatic tires, and is suspended in the frame at three points. Hotchkiss drive is used. The rear axle is worm driven. Both brakes are internals, 2¼ x 18 in. in dimensions, and located at the rear wheels. The wheels are of steel, spoke type for solid tires, and disk type for pneumatics. The tire dimensions in the case of solids are 36 x 4 front, 36 x 8 rear; in the case of pneumatics, 36 x 6 front, 42 x 9 rear. The wheelbase is 160 in., but can also be made 135 in. The total weight of the chassis is 5900 pounds. A power or hand winch can be supplied as extra equipment, to be used for loading or pulling the truck out of a mudhole.

Besides the work for which it was specially built, the RX model has been found to be well adapted also for high altitude work around mines and in South American countries, such as Peru, Chile, and Bolivia, where in many instances trucks are required to start with a full load at a seaport and climb to some inland town at an altitude of 10,000 to 15,000 ft. The usual procedure for high altitude operation is to increase the compression. This is quite satisfactory if the truck is to remain at high altitudes, but if its duties require it to descend, the engine knocks, and generally performs badly. The Wichita RX Oil Field Special is said to have a sufficient reserve of power to take care of the loss due to altitude. There are now twenty-seven of these Oil Field Specials in operation in South America, and all are working at altitudes over 10,000 feet. Other lines of industry in which the transportation requirements are similar to those in the oil fields are the lumber industry and sugar beet farming and the Model RX truck has also found application in these fields.

An Automobile for Operating Over Snow

A HIGHLY successful automobile for operating over snow and ice was revealed at the French competition for motor sleighs. The machine is the invention of the French engineer Kegresse. The Kegresse invention is of the self-track laying type, but instead of an all-metal track use is made of a molded rubber band with a canvas base.

On the Citroens entered in the French trials, Kegresse used an endless rubber band having a width of 9½ in. and a length of 63 in. in contact with the ground. This band is carried on pulleys of 18 in. diameter, the rear pulleys, mounted on the ordinary axle shaft being the drivers, and the forward ones carried in a fork with radius rods for maintaining tension, being the idlers. The belt has a minimum thickness of half an inch, but is fitted with stiffening bands along each edge and with ribs to secure greater adherence, which give an increased maximum thickness.

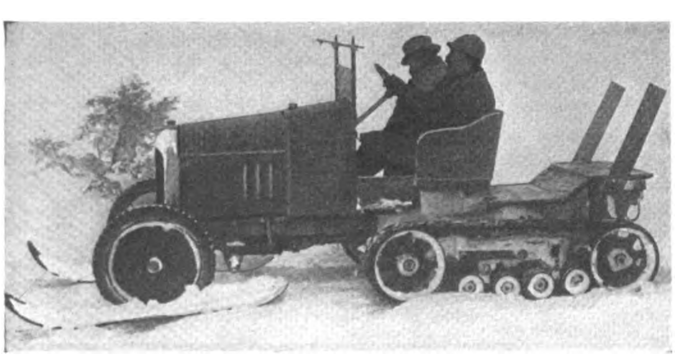
The method of holding the band on the pulleys, and at the same time of preventing slip without unnecessary tension on the belt, is interesting. Teeth of rubber and canvas, with a certain mixture of cork, are formed on the inner face of the band. The pressed steel pulleys have rounded edges and are in pairs. The face width is 4¼ in. Two are mounted on the same shaft leaving a space between them of 1 in., and the teeth on the inner face of the endless band run in this space. The inner pulley of each pair is fixed, and the outer one has a tendency to move inward on the shaft as the drive is taken up. The tendency to slip is thus minimized.

Between the driving and the driven pulleys there are four pairs of rollers of 7 in. diameter and 4 in. face. Practically all the load is carried on these, for the idler pulleys, being mounted in a pivoted fork, are kept on the ground only by their own weight. A couple of broad straps encircling the axle and a cross frame member keep these pulleys in a slightly raised position.

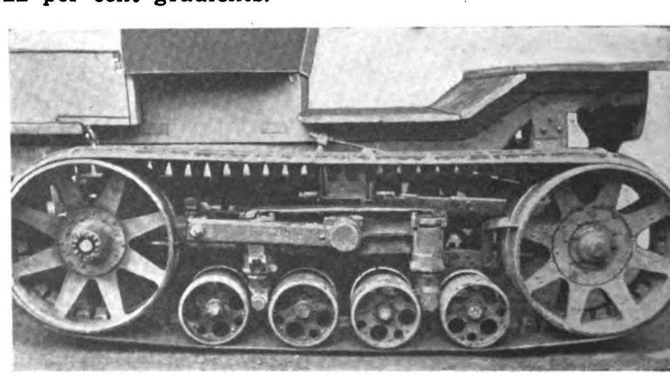
The weight of the machine is such as to give a pressure on the ground of about 1 lb. per sq. in.

The ordinary steering gear is maintained, each front wheel being fitted with a very flexible laminated wood skid with laminated springs, the dimensions being roughly 11 in. in width by 4 ft. in length. Each skid is cut away in the center so as to allow the wheel to pass through to a depth of about 1½ in., so that on a hard surface the weight is taken on the pneumatic tires, and the skids only come into play when the tire has bedded in the snow to this extent. The skids are carried in brackets from the steering pivot and are free to swing to a certain extent, so if an obstacle is struck the skid swings up before it, and its flexible construction enables it to absorb the shock. The front springs of the car are maintained.

Two of the Citroens equipped with the Kegresse appliance had the normal gear ratio of 4½ to 1. The third machine had an additional reduction gear fitted, giving a total reduction of 9 to 1. All three machines operated over the snow, but the low gear reduction one was more suitable for work on the mountain side. The machines were brought down 63 per cent gradients and climbed 22 per cent gradients.



Kegresse motor sleigh



Detail of the track-laying mechanism

Influence of Nickel on Cast Iron

Best results obtained with alloy containing 1 per cent nickel, the increase in compressive and transverse strength amounting to 30 per cent, while tensile strength increases 25 per cent and the hardness 18 per cent. Effect of cobalt reverse of that with nickel, except in respect to hardness.

THE use of alloy steels has assumed great importance during recent years, and their properties have been the subject of numerous researches. The same does not apply to the alloys which may be obtained with cast iron. About all that can be found on this subject in the literature of the industries is a few general studies on the influence of titanium and vanadium on the properties of cast iron. The influence of nickel it appears has never been investigated, notwithstanding the fact that this metal has long been used in the manufacture of steel. Messrs. Buner and Piwowarski have endeavored to supply information on this subject and have reported the results of their experiments in *Stahl und Eisen*.

The metal used in the experiments of the authors was Swedish charcoal iron with a total carbon content of 3.90 per cent, of which 2.80 per cent was graphitic carbon, 0.048 per cent of phosphorus, 0.18 per cent of manganese and 0.69 per cent of silicon.

Fusion tests on masses of 100 grams, to which had been added 1.2 to 3 grams of nickel, showed that this metal readily forms an alloy at a temperature only 50 deg. C. higher than the melting temperature of cast iron. Operations were then continued on larger masses. In a graphite crucible 8 in. high and 4 in. in diameter at the top, 2250 grams of cast iron (about 5 lb.) were molten. The temperature was then raised exactly 100 deg. C. above the melting point, and the nickel then added in small fragments. The bath was agitated with a ring of carbon and the alloy was then poured into molds in such a way as to obtain test pieces of 20 mm. diameter and 650 mm. length.

Several batches were thus made in succession, with increasing proportions of nickel, not exceeding 2 to 3 per cent of nickel, however, as in that case the product becomes too expensive.

The test pieces were subjected to tension tests on a length of 600 mm. until fracture. After the fracture, chips were removed from one of the parts by means of a milling cutter for the chemical analysis, and a piece 15 mm. in length was sawed off for photo-micrographic purposes. From the remainder there were made two test pieces for shock tests and two cubes for compression tests. The shock tests were made with a Charpy 10 kgm. shock test machine and the compression tests with a Martens 50-ton machine. The pieces remaining after the shock tests, which measured 10 x 10 x 15 mm., served to determine the solubility in acids. They were subjected for a period of 24 hours to the action of a 1 per cent sulphuric acid solution and the loss in weight determined, as noted below.

From the other portion of the original test piece there were made smaller test pieces for flexure tests. After photomicrographic records had been taken of polished surfaces, hardness tests were made with the Brinell ball hardness testing instrument. The hardness was calculated by the following formula:

$$\text{H (hardness)} = \frac{P}{\text{surface}} = \frac{2P}{\pi D\,(D - \sqrt{D^2 - d^2})}$$

in which P is the pressure exerted (1500 kg.); D, the diameter of the ball (10 mm.) and d the diameter of the impression. The results of these experiments are summarized in the accompanying table.

The best results are obtained with an alloy of 1 per cent nickel. The transverse strength is increased 30 per cent; the compressive strength, 30 per cent.; the tensile strength, 25 per cent, while the hardness is increased only 18 per cent. An addition of nickel of 1½ per cent gave no advantage whatever, the influence of the nickel on the separation of graphite more than compensating for the favorable effect on the ferrite.

Metallographic studies showed that the metal presented the aspect of a good gray iron, with needles of graphite regularly distributed in a mass of ferrite and nice laminations of pearlite.

For the manufacture of high tensile cast iron for machine parts, gear blanks, etc., a cast iron containing 1.2 per cent of nickel may be recommended. That the melting point is raised 5 deg. is of no particular consequence in practice.

It was considered interesting to find out whether cobalt, which is used more and more in alloy steels and whose physical and chemical properties are very close to those of nickel, had effects similar to those of nickel when alloyed with cast iron.

The methods followed in the experiments were exactly the same as those in the experiments with nickel. Table I gives the results obtained. They are diametrically opposed to those obtained with nickel. The resistance to bending diminished rapidly, the tensile and compression strengths decreased somewhat, while the hardness is slightly increased. These results are in accordance with those of the chemical analysis. Cobalt retards the separation of the graphite and favors the formation of carbides. Therefore the use of cobalt for improving cast iron is out of the question.

Table I—Results of Tests on Cast Iron with Nickel and Cobalt Additions

No. of Test	Ni., Per Cent	Co., Per Cent	Total Carbon, Per Cent	Ratio to Graphitic to Total Carbon, Per Cent	Graphitic Carbon, Per Cent	Transverse Strength, Lbs. Per Sq. In.	Flexure, In.	Tensile Strength, Lbs. Per Sq. In.	Compression Strength, Lbs. Per Sq. In.	Brinell Hardness	Shock Resistance, Lbs. Per Sq. In.	Solubility in Acids*
1	0	0	3.90	73.4	2.83	34,500	0.27	14,340	81,900	145	6.38	18.3
2	0.87	0	3.89	74.1	2.85	44,450	0.27	17,750	106,000	171	6.10	14.6
3	1.25	0	3.70	77.1	2.91	......	...	19,000	92,500	175	5.67	14.8
4	1.95	0	3.70	84.0	3.12	40,200	0.23	15,750	90,000	149	6.80	15.5
5	0	0.91	3.89	74.4	2.88	34,340	0.24	12,780	73,400	148	6.25	16.0
6	0	1.90	3.85	66.5	2.56	27,400	0.22	13,200	76,000	152	5.80	18.9

*Percentage loss of a 1 cm. cube in 24 hrs.

Opinions of British Leaders on the Future of Aircraft

Included in this article are some opinions expressed at the Air Conference which were not reported with full significance in the bulletins issued for the press at that time, but which are valuable to commercial world.

THE Proceedings of the British Air Conference, 1920, have been published as a White Paper. The conference, which was the first of its kind, took place at the Guildhall, London.

The range of subjects was so extensive that the proceedings are valuable both to the student of aeronautics and to the commercial world generally.

The proceedings were largely reported in the press at the time of the conference, but there is much interesting new matter, in the form of replies by the readers of papers to points raised in the course of discussion, which is now published for the first time:

Sir Frederick Sykes's Views

Major-General Sir Frederick Sykes, Controller-General of Civil Aviation, who read a paper on "Civil Aviation and Air Services" points out, in the course of his reply, that civil and service aviation are closely allied and that the nation which is the strongest in commercial air traffic will be the strongest also in the aerial warfare of the future. He thinks that the war has proved that military power, whether on land, on sea, or in the air, evolving naturally from the exigencies of imperial responsibility and world trade is healthier than a military system artificially imposed upon the State. The extent to which civil air traffic will be carried on in the event of a future war will depend, he believes, on the measure of importance air transport organization has attained. On the other hand, he states that there must always be a division between civil and service aviation and that the more useful aircraft become for commerce, the greater will be the tendency for civil and service types of machines to diverge. "You cannot economically in peace use service machines for air traffic," he says, "any more than you could use a warship as a passenger or freight steamer." For that reason some of the proposals which had been made that the Government should build airplanes capable of being used in war and lend them to companies to operate, and that the Air Ministry should make an allowance toward every machine and the salary of every pilot employed in commercial transport, on the understanding that the whole of the machinery should be taken over by the Government in emergency, are hardly practicable. Such schemes, if carried out, would possess, he believes, the double disadvantage of militating against the development of commercial types and of impeding private enterprise by a system of bureaucratic control.

Gen. Sykes expresses himself as being fully in accord with the proposal that *all* mails should be "surrendered" to aircraft operating on continental air routes, and while he thinks that this would be a great and essential step forward, he doubts whether the Post Office can organize this support quickly enough and on a sufficient scale to meet the difficulties of the next two or three years. In the interval he considers it necessary that direct subsidies should be granted, a proposal which has been authorized since the Conference took place.

Suggestions for Helping British Aviation

The paper on "The Operation of Civil Aircraft in Relation to the Constructor" was by H. White Smith, C.B.E., chairman of the Society of British Aircraft Constructors, who deals with many points raised by subsequent speakers.

He thinks that much has still to be done to improve the present standard of comfort on aeroplanes and he believes that if air services are to become popular the ordinary traveling public has yet to be convinced that the air fare is worth the difference over that charged for rail and steamer journeys.

While development of new types of civil aircraft is proceeding, he does not think that we can claim to have reached yet the point of commercial success and he considers that subsidies are highly necessary in order to carry on until such time as aircraft become developed. He points out further that although the running costs of the latest types of aircraft are most helpful, yet there are so few actually in service that little benefit is derived from improved economies, and that the transport companies will need to spend a large amount of capital in order to purchase latest types and to bring their fleets up to date. He suggests that possibly some help towards the provision of these latest types could be given in order to allow old war types to be scrapped.

Lines of Technical Development

Air Vice Marshall Sir E. L. Ellington, Director-General of Supply and Research, spoke on "The Present Position of Aircraft Research and Contemplated Development." In his reply he outlines the development which is taking place in the design of suitable aerial cameras, and in other experimental photographic work. Included among these are a shock-absorbing camera mounting, an automobile film camera, embodying all the necessary instruments for survey purposes, instruments for recording angle of tilt at the moment of exposure and the development of night photography.

Although the Air Marshall's advocacy of the possible usefulness of the steam engine for aircraft work was strongly questioned, he now states that "taking it all round I still strongly consider that the steam engine is sufficiently attractive for aircraft to justify some preliminary experiments on the matter."

Capt. F. S. Barnwell, who dealt with the question of "The Technical Aspects of Civil and Service Aviation," urges the continuance of research as to the efficiency of the thick tapered cantilever wing, suggests that all future aeroplanes (at least all civil ones) must be stable and states that there is no serious difficulty in attaining

stability without any appreciable loss of performance. In this connection he mentions that instability is not by any means the greatest source of danger; engine failure he places first with low power and poor range of vision as being nearly as serious in practice.

Co-operation With Navy and Army

Air Marshall Sir H. M. Trenchard, Chief of the Air Staff, who spoke on "Aspects of Service Aviation," deals mainly with the question raised regarding the seconding of naval and military officers for service in the air force. He thinks that the views expressed by representatives of the Admiralty and the War Office that "there might be danger of officers seconded to the Air Force losing touch with the parent services and in consequence becoming ultimately less valuable in their capacity as officers of that service," are too narrow.

There is some truth, he believes, in the suggestion that there is a danger of this sort in all specialization, but it is on the whole readily surmountable in practice and he voices the opinion that it is desirable for the two older services to obtain a knowledge of air warfare which can only be obtained by allowing some of their officers to be trained by, and serve for a time in the Royal Air Force. In so doing he is convinced that they will gain themselves and that the Air Force, too, will unquestionably gain seems clear to him that if the national forces are regarded (as they should be) as serving one common national purpose, that purpose must be advanced by maintaining a steady flow of officers of the sea and land forces to and from the air force. The air, which is over the sea and land, presents new problems to the fighters on each which must be studied in conjunction and not in isolation. The air is one, and the Air Force has been created to embrace all who fight in it.

Possibilities of Commercial Airships

Sir Trevor Dawson, R.N., who spoke on "The Commercial Airship—Its Operation and Construction."

Sir Trevor considers that one of the largest airship bases of the future will be somewhere in the Iberian Peninsula and will form the terminal station for airship services to North and South America and also to South Africa; the great advantage of a terminal station in Spain being that routes from there across the Atlantic entirely avoid the bad weather frequently prevailing in the higher latitudes. From this terminal station it would be practicable to use, for distributive services in Europe, smaller airships and aeroplanes of much greater speed, which would be little affected by bad weather.

He emphasizes also the need for extensive experiments being carried out in connection with the mooring of airships to mooring towers and also mooring over the water, and he hopes that the Air Ministry will be able to do some practical work in those directions, as well as in investigating the question of using hydrogen fuel, particularly for commercial purposes.

He believes that naval officers are now convinced of the great value of airships for long endurance patrol work over sea and that as the commercial airship will be readily convertible into a naval cruiser with very little alteration indeed, the ships could take up active service within a matter of days after receiving orders for mobilization. The development in design produced by commercial experience will be equally applicable to the design of service airships which, in his opinion, is a strong argument in favor of State assistance being given for the establishment of commercial airship services and for the construction of large types of airships which could be operated on a successful commercial basis.

Aircraft Cooling System Data

THE branch of the German army administration which, during the war, was entrusted with the procurement of aircraft and accessories was known as the Flugzeugmeisterei. In addition to purchasing this material for the army, it was the duty of the Flugzeugmeisterei to carry on the research work necessary to advance the design of aircraft as rapidly as possible. The result was that in the course of time there were organized departments of a technical character for every branch of aircraft engineering. A valuable working basis was found in the aircraft experimental laboratory at Adlershof, organized two years before the war, which placed all of its equipment and its whole personnel at the service of the aerial arm. Additional research men of established reputation were secured for investigating unsolved problems of design. The results obtained were circulated immediately among interested parties through technical reports, and at the conclusion of the state of war these reports were made available also to the general public.

The problem then arose of making available to aircraft specialists the results which had not been published in the reports up to the fall of 1918 and at the same time to give the greatest possible publicity to the general results of the experimental work of the Flugzeugmeisterei, which constituted a valuable basis for further development in this field. This led to the idea of issuing a large work, somewhat in the nature of a scientific legacy of the Flugzeugmeisterei (which latter was dissolved in accordance with the treaty of Versailles) for the promotion of scientific design and as a stimulant to the urgently needed research work in this field. Written in strictly scientific and impartial style, this Handbook of Aircraft Engineering was intended to place at the disposal of designers and testers of planes for the coming commercial aviation in compact form the exceedingly valuable data concerning experiences of the period 1914-1918.

This Handbook of Aircraft Engineering, written in German, is issued in a number of volumes, each dealing with a specific subject. Vol. VI, Part II, entitled Cooling and Coolers for Aircraft Engines, by Dr. Ing Pülz, with a supplement on the Elements of the Cooling Process by Prof. Dr. Trefftz and Dr. Pohlhausen, has been sent us for review, the publishers being Richard Carl Schmidt & Co. of Berlin. This book contains a great deal of experimental data on aircraft radiators, systematically arranged, and is well illustrated. A list of the chapter headings will give an idea of the contents and the manner of treatment. This list is as follows: Absorption of Heat by the Cooling Water; Circulation of the Water in the Cooling Circuit; Dispersal of Heat in the Radiator; Weight of Radiators; Air Resistance of Radiators; Internal Construction of Radiators; Development of Radiator Constructions; The Radiator in the Airplane; Radiator Accessories; The Cooling Medium and Treatment of the Radiator in Winter; Elements of the Cooling Process.

Malleable Castings Production as Related to the Automotive Industry

The history of an industry has a more definite bearing upon the quality of its product than is generally recognized. This article traces the technical and commercial development of malleable castings production. Similar articles will follow concerning other industries. The facts are worth consideration in analyzing materials for car and truck construction.

THE materials which go into automotive vehicles are being studied with renewed care. The time has passed when manufacturers were tempted to compete for material of doubtful quality at almost any price. Castings are now being more carefully inspected; performance is being more accurately followed and checked, with the realization that keen competition in the selling market is demanding more perfection of detail and more uniform standards of performance.

Among the products which have been extensively utilized in the automotive industry during recent years is the malleable iron casting. The history of the technical and commercial development of the malleable casting, moreover, indicates that comparatively meager information has been widely published concerning the methods by which it is manufactured, the reasons underlying its reputation for lack of uniformity, and the methods by which distinct improvements have been brought about in its qualities during the last seven years.

The special interest in quality and standards of materials which is being taken just at this time by engineers and purchasing agents renders of special interest an examination of the malleable castings industry in its relation to the automotive industry from an engineering and commercial standpoint.

Up until three or four years ago, the malleable iron industry was in a more or less chaotic condition. The process of making malleable iron had been known in a general way, of course, ever since 1722, but the early development of the industry, even in this country, was characterized by rule-of-thumb methods, lack of scientific data, and much secrecy about what scientific facts were known by individual manufacturers.

Among the pioneers of the industry in America, the name of Seth Boyden stands out prominently. Boyden performed his work in Newark, N. J., about 1820-1835. In attempting to duplicate the European practice in making malleable, by chance he hit upon the practical method of the graphitizing anneal. This he accomplished after six years' work trying to duplicate European castings. His discovery marked the beginning of a new process and formed the basis of the present malleable castings industry in the United States.

The early uses of malleable castings were chiefly for agricultural implements. Here malleable castings replaced cast and wrought iron to a large extent. About 1880, malleable castings began to be utilized in railroad car construction. For a considerable period of time the railroads absorbed a large percentage of malleable production.

This demand did not continue, however, and had fallen off very materially just about the time the automobile industry began to absorb a large number of malleable castings.

The reason for this falling off in railroad demand is worthy of special note, since it bears to a large extent upon more recent developments.

Until seven or eight years ago, the manufacture of malleable castings was supposed to be by means of a secret process. A few large organizations were equipped for research work, but the smaller companies were forced to go along as best they could. H. A. Schwartz, of the National Malleable Castings Co., wrote recently: "During all this time the results of none of these investigations became publicly available and therefore it is difficult to accurately chronicle the scientific development of the art. The organizations collecting scientific and research data did not feel it to be sound business policy to make public disclosures of their work. Regardless of whether or not this policy was fundamentally sound from the manufacturers viewpoint, it certainly proved a handicap to the consumer, who remained in ignorance both of the theoretical principles and practical applications of the manufacture of malleable castings.

". . . There still persisted in the engineers' handbooks and in the technical press a mass of ill-supported conceptions largely predicated upon a confusion with the white heart process. . . . Since none of those who knew better felt called upon to publicly combat statements of this character, it is not surprising that the engineering public was left in ignorance and hence in distrust of the qualities of the material.

"Moreover, it is not surprising that in the absence of guidance by those better informed, some of the less intelligent and progressive manufacturers did not clearly understand the principles of the process they practiced and therefore produced unsatisfactory castings."

The result of this condition was that so many poor castings were produced by those firms which did not have facilities for scientific research, that even those firms which did produce a more uniform product found themselves unable to market it properly because of the almost universal distrust of the malleable casting in general. As one writer put it, the users seem to blame the failure of a steel casting upon the way it was manufactured, while they blamed the failure of a malleable casting upon the inherent nature of malleable.

These factors are largely responsible for the falling off in the use of malleable in those lines which had formerly utilized it extensively. As engineers know, the chief faults attributed to malleable castings have been:

1. Lack of uniform quality; undependability.

2. Lack of ductility.

Facing these facts, together with the necessity for meeting the new problems brought up by the extensive use of malleable castings by the automobile industry, the malleable producers recognized the necessity for a definite effort on their part to restore confidence in their product through eliminating so far as possible the valid objections recorded above.

This was the condition of the industry about 1915 before extensive efforts in scientific research and testing of materials through co-operative action had begun. There were at that time about twenty-five members in the American Malleable Castings Association which had been formed some ten years before. This group of representative manufacturers determined to enlarge their past field of co-operative action and to take certain definite steps in advance. They determined:

1. To go the full road along the lines of metallurgical research, regardless of cost.
2. To make every public statement regarding progress conservative, and accompanied by data which would substantiate in detail every statement made.

The research and testing work was placed in the hands of a consulting engineer, Enrique Touceda, of Albany, N. Y., and extensive work has been carried on along these lines ever since. A careful analysis of the situation indicates that the importance of this work is relatively very great in considering the present status and future possibilities of the malleable casting. For this reason, an account of the general nature of the tests together with the results obtained will be of interest.

"When the research work was started," said Mr. Touceda recently, it was found that by far the majority of the members had no system of testing the quality of their product, aside from the twisting and bending of a casting, in order to ascertain its ductility, or the bending of test lugs attached to the castings. Consequently there was no way in which could be compared the quality of the product of one member with that of another. To be candid, there was available no information of value that could be given to the engineer who might be seeking information of this character."

The first step, then, was to standardize tests so that comparative records could be made and kept. This was accomplished and at the present time tests are made for ductility, tensile strength, and elongation. It is outside the scope of this article to describe in detail the methods by which these tests are made. It is worthy of note, however, that a visitor is welcomed very heartily at the testing laboratories by the consulting engineer and is given every facility for examining the methods and equipment used in making the various tests. A detailed description of the tests may be found in the paper on "Research Work on Malleable Iron," presented by Enrique Touceda before the A. S. M. E. at the Spring Meeting in 1919.

One tensile-test bar and one test wedge from some one heat of each day's run are sent by each member to the consulting engineer. Accurate records of all tests are kept, and by this means the following factors can be determined:

1. The quality of each member's product.
2. The quality of the product of the society as a whole.
3. The comparative progress of the quality in each case.

Each month a report is made of the results of the tests. This report is printed and is distributed in the form of a bulletin. The members are classified into those who make railway castings and those who do not. To the former is assigned a number and to the latter a letter. Thus each producer can identify his own record, but not that of anyone else. In this way he is able to compare the standard and quality of his own work with that of his competitors.

A certificate is issued to each foundry which for three months has sent daily samples for test, in cases where every one of these samples has met the requirements of the association as to physical qualities. The requirements of the association are identical with the standard specification for malleable castings set up by the American Society for Testing Materials which require a minimum tensile strength of 45,000 pounds per square inch and an elongation of 7.5 per cent in 2 inches.

It is worth analyzing just what this certificate means. In the first place, it obviously means that the holder for the last three months has done consistently high quality work. It is an indication that the vast majority of castings going out from that foundry are of a uniformly high quality.

Certain "loop-holes" appear, however, which must be considered:

1. The test bar sent to the consulting engineer is taken from only one heat of the day. There may be several heats, the test bar having been taken from a selected heat.
2. All bars from the same heat may not be of uniform quality because of defects in the furnace.
3. It might be possible for special bars to be laid aside to be sent for testing purposes.

On the other hand there are certain definite factors which offset these objections to a large extent. The consulting engineer maintains a force of four inspectors who spend their time going about from one to another of the 75 foundries comprised in the association membership. The inspectors mark and place certain bars in various heats and later choose samples from those placed for further inspection.

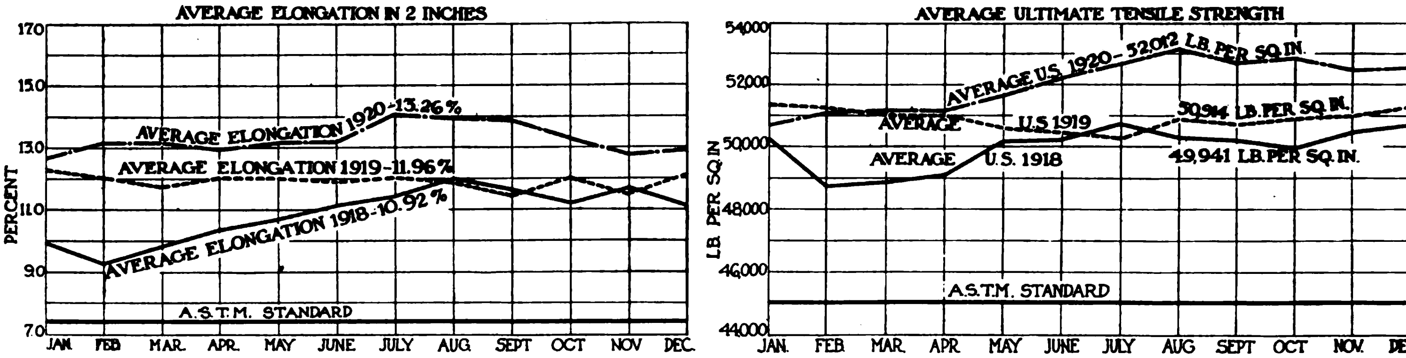
More than this, however, is to be considered the basic principle upon which this testing and research work was founded. It was begun because the producers realized the existence of a lack of confidence in their product. It was decided that the only possible way to rebuild the industry was to restore confidence. And that confidence could be restored in only three ways:

1. By scientific research to determine the way to make uniformly high grade castings.
2. By disseminating that knowledge among all members so that the entire association could make such castings.
3. By treating the engineering public with utter honesty in the publication of results.

In other words, these producers realize that any attempt to "beat the game" would be merely an act of fooling themselves; that it would really be very bad business for them in the long run. It was because they were sold on this idea that they undertook the research and testing work in the beginning.

There is no "hedging" in connection with the granting of a certificate. Some producers often miss by a very small margin, but the certificate is not granted in such cases. Moreover, a certificate granted for one quarter can be retained by the producer only during the next quarter. He must then return it to the consulting engineer. Then he receives a new certificate, if his record warrants it.

When a producer is not coming up to standards, the consulting engineer attempts to help him in every way



Charts showing a comparison between the results obtained by the association as a whole during the period shown above, and the requirements of the A. S. T.M. standard specification for malleable iron castings

possible, that his product may be brought up to the proper quality. Such advisory work is constantly going on.

New furnaces are now being designed in many cases by the consulting engineer in accordance with standards determined after a long period of scientific research.

It is worth special notice, in connection with the granting of this certificate of quality, that there are several firms, members of the association for a number of years, which have never yet obtained this certificate indicative of uniformly high quality for a period of three months. This fact in itself indicates that the certificate is awarded only on the basis of merit and that it may play an important part in the mind of the engineer and purchasing agent when determining the producer with whom to place orders. The certificate may be said in a general way to be a strong indication of the uniformly high quality of the maker's product.

The research work has resulted in the determination of standards for practical use and in the raising of the quality and uniformity of the castings produced.

The accompanying chart, Fig. 1, shows the comparative test records as regards elongation and tensile strength of the castings produced by members of the American Malleable Castings Association since 1918.

The chart shows a very definite rise in the quality of malleable castings since the beginning of the research work. The increased percentage of average elongation is specially to be noted. Before the research was undertaken many firms were producing castings with a very high ultimate strength but with an average elongation of something like 3½ per cent.

Another factor to be considered in examining this chart is that the membership of the association has been constantly increasing during the period covered. New firms were coming in which had not had the benefit of the results of the research work and which were in nearly every case "weak brothers" for a certain period. This fact tends, of course, to reduce somewhat the average rise in quality.

It will be noted that no very definite increase in tensile strength is apparent in 1919. According to officials of the association this is attributable largely to the fact that the material available for manufacture was so poor as to make it a very difficult task to keep castings even up to the former standard. Some users of the product, on the other hand, lay the blame at the door of lowered standards of manufacture. These users claim that because of excessive bidding for the product on the part of automotive manufacturers, the demand became so much greater than the supply that malleable producers yielded to the temptation to shorten the time of annealing and in other ways speed up production at the expense of quality. The 1920 curves, however, show a marked increase both in tensile strength and elongation.

The automotive industry has undoubtedly played a large part in the recent development of the malleable castings industry. W. G. Kranz told the American Foundrymen's Association several years ago that "It was not until the automobile industry sprang up that the physical properties of malleable iron received very much consideration from the consumer. The automobile engineer appreciated the necessity for a material to withstand shocks and yet be easily machined, and found in malleable castings exactly what he wanted. It is gratifying to note that to-day a very large tonnage is going to that industry."

It is not the purpose of this paper to attempt to discuss the relative efficiency of malleable castings as opposed to other materials for specific automobile parts. It was thought, however, that the extensive work which has been done during recent years by malleable makers in regard to scientific research, standard tests and definitely attempting to maintain and reward uniformity of high quality would be of special interest to automotive engineers and designers just at this time.

The claims of the malleable manufacturers as regards the adaptability of their product in certain cases are well known to engineers. Briefly, the chief properties claimed may be listed as follows:

1. Ability to be poured thin and to be flowed into more intricate designs than steel.
2. Ease of machining.
3. Ductility.
4. Light weight in relation to ultimate strength.
5. Relative cheapness under ordinary market conditions.

The following list of automobile and truck parts to which the malleable manufacturers consider their product adapted is of interest:

Steering wheel spider.	Control rod levers and clevises.
Differential housing.	Wheel hubs.
Transmission housing.	Robe rail fittings.
Rear axle brake housing.	Clutch parts.
Timing gear housing.	Radiator inlet and outlet pipes.
Universal joint bearings.	Hand brake and gear-shift levers.
Tire rack supports.	Pedal pads.
Door hinges.	
Steering post bracket.	
Windshield fittings.	

Concerning the increased use of malleable in the automobile industry, Robert C. Bell, secretary of the American Malleable Castings Association, writes:

"We attempted about two years ago to ascertain the production of malleable castings that were used in the automotive industry, although the questionnaire sent out at that time did not produce satisfactory results for the reason that so many of our members do not differentiate between the production of different classes of cast-

ings. We know, however, that from 1914 to 1919, and the same is true of 1920, that the production of malleables for use in the automotive industry showed a steady increase in tonnage. This statement is borne out by the fact that the foundries which specialize in automotive work have steadily increased their tonnage covering the past five or more years."

The automotive industry started to buy malleable castings at a point when the malleable industry was in a rather critical position. The malleable industry had multiplied its capacity by 5 between 1900 and 1913 and its productive capacity had risen accordingly. With the decrease in railroad and agricultural implement work, the automotive industry played a large part in utilizing the productive capacity that had been built up. And it may be said, that the malleable industry has in return been doing its part by the investment of large sums in research and experimental work to bring its product up to the standards of uniformity and quality necessary to meet the requirements.

Mr. Bell states that "There are no figures available to show the effect on the malleable castings industry by its contact with the automotive industry. We can say this, however, that the development of the automotive industry has been quite beneficial to the malleable castings industry both in volume of business and especially in the desire of the automotive buyer for better grades of malleable and the desire of the principal malleable foundries specializing in automobile work to constantly give the automobile manufacturer a more uniform and more dependable product."

The steel casting and the drop forging are considered to be the chief competitor of the malleable castings, although each product has certain individual properties which render it superior for specific purposes. In an effort to make the product more popular during recent years, the malleable producers have made a definite effort to bring to the attention of engineers the efforts which are being made to standardize its quality and render it more uniform.

The consulting engineer of the Association has been encouraged to explain the research and testing work before various engineering bodies and considerable literature has been built up in various trade papers by different members of the industry. In certain instances papers read before the American Foundrymen's Association concerning malleable have been reprinted and distributed to purchasing agents and engineers who might be interested. In brief, it may be said that during the last seven years the veil of secrecy has been lifted to a large extent from the malleable process and industry and considerable data are available concerning both the technical and commercial development of the industry for those interested to investigate the subject in more detail.

This work of the Association, together with the development of the malleable industry, has been discussed here because the automotive industry has played such an important, though an indirect, part in it, and because the factors behind the development of the industries contributing to the automotive industry may form a very valuable background for production and engineering men when discussing the relative merits and possibilities of the different materials which are to be utilized. The history and line of development followed by an industry is likely to have a more direct bearing upon the quality and properties of its product than is generally recognized.

Properties of Ordinary Wood Compared with Plywood

WOOD, as is well known, is a non-homogeneous material, with widely different properties in the various directions relative to the grain. This difference must be recognized in all wood construction, and the size and form of parts and placement of wood should be such as to utilize to the best advantage the difference in properties along and across the grain. Were wood a homogeneous material such as cast iron, having the same strength properties in all directions that it has parallel to the grain, it would be unexcelled for all structural parts where strength with small weight is desired.

The Forest Products Laboratory has found that the tensile strength of wood may be twenty times as high parallel to the grain as perpendicular to the grain, and its modulus of elasticity from fifteen to twenty times as high. In the case of shear the strength is reversed, the shearing strength perpendicular to the grain being much greater than parallel to the grain. The low parallel-to-the-grain shearing strength makes the utilization of the tensile strength of wood along the grain difficult, since failure will usually occur through shear at the fastening before the maximum tensile strength of the member is reached.

The large shrinkage of wood across the grain with changing moisture content may introduce distortions in a board that decrease its uses where a broad, flat surface is desired. The shrinkage from the green to the oven-dry condition across the grain for a flat-sawed board is about 8 per cent and for quarter-sawed board about 4½ per cent., while the shrinkage parallel to the grain is practically negligible for most species.

It is not always possible to proportion a solid plank so as to develop the necessary strength in every direction and at the same time utilize the full strength of the wood in all directions of the grain. In such cases it is the purpose of plywood to meet this deficiency by cross banding, which results in a redistribution of the material.

In building up plywood a step is made in obtaining equality of properties in two directions, parallel and perpendicular to the edge of a board. The greater the number of plies used for a given panel thickness, the more homogeneous in properties is the finished panel. Broadly speaking, what is gained in one direction is lost in the other. For a very large number of plies it may be assumed that the tensile strength in two directions is the same and that it is equal to the average of the parallel-to-the-grain and perpendicular-to-the-grain values of an ordinary board.

An Electric Truck for Industrial and Street Use

(*Continued from page* 693)

all electrical mechanism without the use of a key. It is noteworthy that anti-friction bearings are used throughout the truck, the armature shaft bearings being of the ball type, and the bearings on the intermediate dash and the axles, roller bearings.

Regular practice is to provide wheels on the legs on one end of the platforms, the other pair of legs being left plain. This has been found convenient should it be desired to move the platforms while the truck is busy elsewhere, since one end can readily be raised and the platform handled like a two-wheel wheelbarrow. The plain legs make an effective brake so that the loaded platform can be safely left on any grade. For special purposes wheels can be provided on all four legs, but this is not ordinarily done because of danger of rolling away unless left on a level surface.

Incentives to Better Workmanship Appeal to a Variety of Instincts

When the management is interested in the individual worker only to the extent of his immediate quantity of production, the workman probably will be interested in the company to the same limited extent. The incentive plan described here gives the worker numerous motives to strive for greater personal development, increasing his ultimate value.

By Norman G. Shidle

THE special production value of a willing and enthusiastic worker is pretty well recognized by industrial managers. Likewise the impossibility of producing such workers under conditions of continuous monotony work and without the use of incentives other than wage payments is becoming increasingly evident. Despite the realization of these facts, methods of effecting remedies for present difficulties have not yet been worked out except to a very limited degree.

Experiments of one kind and another have been tried in various plants, some with good results, others less successfully. Yet it is only through making such experiments and analyzing the results that standards for future procedure can be established. For that reason an examination of the methods utilized by certain firms which have based their action upon a carefully planned, intelligent basis is of special value.

Too many so-called incentive plans have revolved about the appeal to the single instinct of desire for monetary gain. This appeal is undoubtedly a very strong one, and works to a decided advantage in every case, but where it is the only appeal, there are very likely to arise storms which it cannot successfully weather. This fact must be recognized even though it is fundamental that satisfactory wages are a prerequisite to gaining the active co-operation of a worker.

A Varied Appeal

To successfully analyze the other instincts to which an appeal may be made, however, and to determine methods by which such an appeal can be made is not an easy matter. This is one of the important tasks which confronts the industrial manager in his study of the human element in industry.

A plan by which individual abilities can be rated in a general way and rewarded according to merit has been worked out at the Sperry Gyroscope Company. It involves a number of those factors just discussed and indicates certain practical methods of enlisting more active co-operation from the workman through an appeal to other instincts in addition to that for money.

Each employee is rated as regards four characteristics, each of which bears a definite relation to his job and on the basis of this rating his rate of pay, opportunity for advancement and several other factors are determined.

Before it is possible to rate a man as to his ability on a job, it is necessary, of course, to determine the requirements of the job itself; to outline the qualifications necessary in a man, if he is to fill that job in a first-class manner. In other words, an accurate job analysis is necessary upon which to base any estimate of the man's proficiency and possibilities.

Such an analysis can take any of the common forms; many firms already have on file job analyses for a majority of the jobs in their shop. The particular type used at the Sperry company is detailed in analysis, but brief in summary. The summary serves as a basis for the rating. Following is a sample which shows the job analysis summary used for all-round machinists:

Duties

Perform operations in the manufacture, assembling, erection and repair of various kinds of machinery and direct the work of helpers in this connection.

Qualifications

Machinists in this class must be thoroughly dependable, able to work rapidly with commercial accuracy from blue prints and sketches as well as to lay out the work, carrying it to completion on bench or machine. Must be able to operate as an expert all of the usual machine shop tools and be competent to do the work without the use of jigs or fixtures, checking dimensions with the proper measuring tools. Must have a thorough knowledge of various tools, speeds, feeds for different materials. Worker should possess a knowledge of the use of lubricating, cutting and polishing compounds. Must have a knowledge of such shop arithmetic as common fractions, decimals, simple algebra and trigonometry or be able to use hand books intelligently for the solution of problems in connection with his work.

On machine repair, erection and assembling work, worker must in addition to the above be competent to do the necessary filling, scrapping, fitting and assembling of machined parts making the necessary mechanical adjustments to secure the proper functioning of the apparatus. Must know how to babbitt and condition bearings and be able to do the necessary rigging work.

The requirements of the job having been accurately determined, the workman is rated on the basis of four characteristics:

1. Experience and Education
2. Knowledge of Work
3. General Value to Company
4. Physical Qualifications

Each of these four characteristics are understood to include certain definite factors, while each of them has been included after careful analysis for a specific reason.

"Experience and Education" is understood to apply only to his education as applied to that work which he will be called upon to do. A toolmaker, for instance, would require a knowledge of common arithmetic to

qualify for a high rating, but his knowledge of Latin would have no bearing upon his rating.

Under this head, too, is considered the length of time a man has served in a given trade. This counts for something, since a long experience gives a certain background and breadth of knowledge that is certain to be of value. In this connection, also, are considered the companies with whom he has been associated and the length of service with each. It is believed that a worker's connection with a concern known for a high standard of product and efficient production furnishes an important indication of his ability.

"Knowledge of the Work" comprises somewhat different factors. Although a person acquires knowledge of his work through experience and education, some persons acquire it much more rapidly than others. Under this head are considered familiarity with hand tools, measuring devices, machine tools and materials common to the trade. The worker's ability to plan and execute his work from given instructions, whether oral, written or in blue-print form, is also judged.

"General Value to the Company" is an important consideration. A man with excellent ability and qualifications may be of little value to the company unless he applies that knowledge in an effective manner. A man of less ability may surpass a better equipped man in value to the company simply through the energy and effort with which he goes at his work. Under this head quality and quantity production are taken into account; the ability of a man to maintain a high point of accuracy and skill, combined with speed, is important in determining his ultimate value to the concern.

Dependability and general attitude toward the work are considered under this head and go toward determining the final rating. It is recognized that a worker's disposition, habits and general attitude toward conditions have an influence upon his associates and also reflect directly in his work.

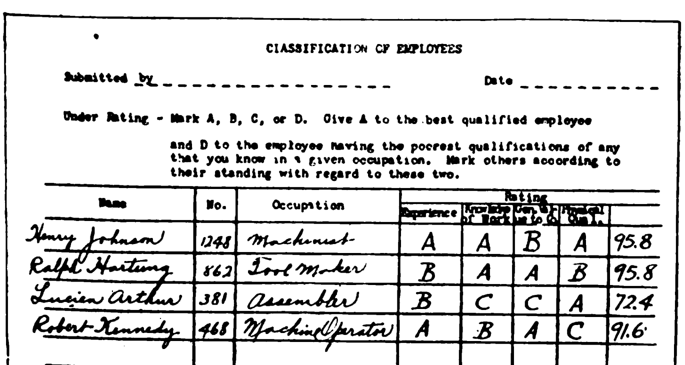
"Physical Ability" is often a vital factor in the effectiveness of a manual worker. His physical qualifications, as to general health, age, etc., are given due consideration.

The four factors are not considered as being equally important; in making up the final rating for the man, a weighted average is used, as follows:

Education and Experience	15%	Value to Company	25%
Knowledge of Work	50%	Physical Ability	10%

The values of the various factors were determined by the personnel manager after conference with the various executives and department heads of the concern, so that they represent the composite view of a number of men, each in a position to judge competently.

Upon the basis of the job analysis and these four factors just described the workman is rated by his foreman and division superintendent. The rating is made on an A, B, C, D basis and appears on a chart as follows:



CLASSIFICATION OF EMPLOYEES

Submitted by ________________ Date __________

Under Rating - Mark A, B, C, or D. Give A to the best qualified employee and D to the employee having the poorest qualifications of any that you know in a given occupation. Mark others according to their standing with regard to these two.

Name	No.	Occupation	Rating: Experience	Knowledge of Work	Gen. Val. to Co.	Physical Qual.	
Henry Johnson	1248	Machinist	A	A	B	A	95.8
Ralph Hartung	862	Tool Maker	B	A	A	B	95.8
Lucien Arthur	381	Assembler	B	C	C	A	72.4
Robert Kennedy	468	Machine Operator	A	B	A	C	91.6

The percentage value of each worker is determined, to quote from a recent article by M. R. Lott, Superintendent of the Personnel Department, in this way.

"It is assumed that in order that a man should be considered as belonging in a trade, he must possess at least 50 per cent of the qualifications of the ideal man for each general consideration in that trade. In order that the results may be unbiased, the foreman consults with the supervisor and the results are reviewed by a third person. . . .

"The A man would receive the full value for each of the qualifications according to the weighted average noted previously, while the D man would be given half the values of the A, and B and C would be rated in proportion. A score, then, is available for each worker and his rate of pay may be gaged accordingly. The actual values assigned to the groups really have no significance other than providing the same standard of comparison for all. They would be:

A worker scoring between 95 and 100 would receive the maximum rate
A worker scoring between 85 and 95 might receive the next lower rate
A worker scoring between 75 and 85 might receive the next lower rate
A worker scoring between 65 and 75 might receive the next lower rate
A worker scoring between 50 and 65 might receive the lowest rate

"While the plan is not perfect, it has assisted in arriving at a more consistent consideration of the merits of an indivdual and has been the means of correcting, in a manner very advantageous to the worker, discrepancies that existed when there was no standard for analysis and comparison."

This completes the plan insofar as the methods of rating the men is concerned. The man is given a temporary rating when he is employed with the company. This initial rating is made by the employment manager on the basis of the man's past record and the general impression which he makes.

All ratings are checked over, however, on an average of once every three months, so that a man has an opportunity to better his position within a comparatively short period of time.

But of what use is this rating plan? If operated simply to provide an interesting course in mental gymnastics for the personnel manager, it is obviously a waste of time and money. The chief value of any such plan lies in the effectiveness with which it is used. An analysis of the use in the Sperry plant indicates the possible value.

In the first place it is used in connection with wage rates to furnish an incentive for increased pay. All the men at this plant work on day rates, and the wages for each trade are graded from a given base in accordance with this rating plan.

The wage scales are laid out on a form similar to the one given here to illustrate more clearly just how the system is worked out.

Rate Schedule

Occupation	95–100	90–95	85–90	75–85	65–75	50–65
	Rate per Hour as per Score					
Trade No. 1	$0.80	$0.77	$0.73	$0.70	$0.67	$0.63
Trade No. 2	.73	.70	.67	.63	.60	.57
Trade No. 3	.80	.77	.73	.70	.67	.63
Trade No. 4	.73	.70	.67	.63	.60	.57
Trade No. 5	.53	.50	.46	.43	.40	.36
Trade No. 6	.73	.70	.67	.63	.60	.57

The plan, then, is useful in grading rates of pay in accordance with all those factors which go toward making

the workman of real permanent value to the company. When wages are dependent entirely upon quantity of production the management may be said to be emphasizing to the worker that this is about the only factor regarding his performance with which it is concerned. In such case, the worker is very likely to have his attention centered almost entirely on this single point and to disregard very largely those other factors which undoubtedly enter in to his ultimate value to the management.

In other words, this system of rating tells the worker, in effect, several things that tend to make him feel like actively supporting his company. Among these are:

1. That the management is interested in him as an individual; that his work is really being watched, and that when he does good work it is immediately recognized. He knows that he is being regarded as an individual personality and that he is not looked upon as merely one cog in the machine.
2. That the management appreciates the development in him of certain qualities which go toward making him a bigger, broader man. The mere fact, for instance, that he takes up some outside course to help him with his work is likely to raise his score, since it indicates a real interest in his task.
3. He knows that the management is interested in his personal development and that in a very practical, immediate and concrete way he can benefit by attempting to develop himself along a number of lines. He is encouraged to grow larger by this consideration which the management takes of a number of factors in adjusting his wage. Where there is but one consideration—quantity production on a single machine, for instance—he is encouraged to grow smaller so far as personality and mental development are concerned.

Every workman knows what his rating is. After it his been made up his foreman notifies him of it. And in this way another benefit of the system is brought out. Every man is not satisfied with the rating that is given him. In such cases he is privileged to go personally to the foreman and then to the personnel manager if he is still unsatisfied. The various factors considered are then discussed with him, his weak points are pointed out and he is encouraged to overcome them that his score may be raised.

Since the whole matter is on a frank and open basis with the workmen, the management is able to talk over strong and weak points with them. In this way the individual worker has been able to understand his own deficiencies and to correct them through personal effort. This is not merely a theory, but a statement of fact made on the basis of numerous cases recorded in Lott's office.

Another advantage of the plan has been to interest the foremen in the human elements of their supervising task. While there was some difficulty at first in convincing them of the practicability of the idea, the results achieved within a short time aided materially in this task. Moreover, the matter of rating men under supervision carries with it some very interesting features which appealed to the foremen and superintendents once they caught the idea.

With this increasing interest of the foremen has come, necessarily, an increased study of men and the human factors as related to production. This in itself is a notable achievement and ultimately will be worth many times the trouble and expense of the rating system.

Other uses are also made of the rating scale. Promotions are made from within the shop whenever possible, and the rating scale is used as a basis for making such advancements. When business depression necessitates laying off men, the rating scale is used again. The score of each man has been used recently as the prime consideration in keeping him or letting him go. The factors regarded in the order of their consideration have been:

1. Rating
2. Home responsibilities, family, etc.
3. Length of service .

Thus a high rating gives a man the best possible insurance against unemployment. It practically insures him permanent work, even in bad times, and thus adds another incentive to make him strive for a good score.

The broad scope and vision of the factors considered in making up the score must constantly be borne in mind when discussing the incentives given the men to attain a high score. In other words, the achievement of a high score by the employee means real personal development, both mentally and spiritually for himself, as well as increased value for the company. It is for that reason the high score is worth striving for; and some might say, for that reason alone.

To sum up, the following advantages may be listed as accruing from this rating plan and its intelligent utilization:

1. To the management:
   a. Good will and co-operation from the workmen, because of the practical demonstration of its interest in his personal all-round development and growth
   b. Better quality and quantity production
   c. Decreased labor turnover
   d. Increased study and knowledge of the human element on the part of foremen
   e. Gradual raising of level of ability of workers through understanding and remedy of personal defects
   f. Better and more pleasant "atmosphere" about the plant because of closer personal contact between management, foremen and workmen.
2. To the workmen:
   a. Increased wages through personal development
   b. Unemployment insurance through same means
   c. Opportunity to see his weak points clearly, to have them discussed sympathetically and to better himself through remedying them.
   e. An opportunity to have merit rewarded; the danger of being buried in the mass is eliminated.

There are other good features in the plan, some of which go far deeper into the fundamental factors of human relationships in industry than a superficial survey of the rating plan itself would indicate. The plan, though dealing with only a minor part of the industrial relations problem, furnishes an excellent means of meeting one of the questions which arises. Its practicality is attested not only by its success and continued use at the Sperry Gyroscope Company, but also by the fact that the Standard Oil Company of New Jersey is about to put into operation a plan moulded along somewhat the same lines. Since the latter company is instituting the plan at this time of business depression, there is a strong indication that it is regarded as a definite production and financial asset to the management.

A COMBINATION of several manufacturing concerns for the purpose of manufacturing automobiles and trucks has been effected in Poland, and the new concern will be financed by a number of leading Polish banks. Work will begin the coming spring, and it is planned to turn out 1000 complete trucks the first year, about one-half of which will be taken over by the Polish army. Assembly work will be carried on at the factory of Borman & Szwede, Warsaw, while the other factories in the combine will manufacture the parts. For the first year, however, probably 75 per cent of the parts will have to be imported from the United States.

Is the Dealer an Important Cog in the Wheel?

Dealers often express the doubt as to whether they are appreciated by the heads of the organizations of which they are a part. They quote many instances to support this doubt. Here is some evidence as to their standing as business men and of the amount of business they should do.

By Clyde Jennings

A CAR manufacturer's organization can be no stronger than its dealer organization will let it be. The dealer organization cannot develop beyond the limitations set by the manufacturer. Development must be mutual. All concerned will admit this. Neither organization can be paramount, although many situations will arise where the burden, for the time being, will fall most heavily upon one of these two organizations.

With this rather positive basis it is interesting to note the attitude taken by some manufacturing organizations. Recently the man responsible for the functioning of a rather large dealer organization said:

> **"We conduct our dealer operations on the Statler Hotel principle, that the dealer is always right. Sometimes the burden of the proof shows that the dealer is not right, and then we handle the situation as an individual case. It is the exception, not the rule, and it is not allowed to sway our policy or operation."**

Only a few months ago a man who has a considerable voice in the operation of a dealer organization talked at considerable length on his problems. All through the conversation he spoke of the dealers as "poor boobs," and always referred to their inability to select the proper papers for advertising, and an inability generally to handle the affairs connected with the selling of cars.

As a bit of pertinent comment on these contrasting attitudes, it can be remarked that the factory represented by the former speaker is now running on a very high percentage of the 1920 production, while the other factory was recently reported to be flat, and it has had some financial tribulations. **The present prosperity of these factories may, or may not, be in any measure due to the sales attitude.** You can draw your own conclusion.

Rushing Into Business

HERE is an incident worth considering:

A short time ago a man in a western city had something like $150,000 surplus in his selling business, let us say it was lumber. For reasons perfectly satisfactory to himself he did not want to put the surplus back into that business, but wanted to find another merchandising proposition. He investigated many lines and decided upon automobiles. He then studied the list of cars, eliminated those he knew to be well represented, and, after consultations with several persons, selected five makes, with a view of getting the local representation of one of the lines.

He sent out his letters, and waited. Within a week he had definitely turned down three of the factories to which he wrote. This is how he tells of his experience:

"The first man to see me in response to my letters came to my office at 9:30 a. m. I learned later that he had arrived in town at 8 a. m. First he told me how much money the company thought would be required to swing the deal. I agreed. He asked me if I had the money. I put my documents on the table and right away he accepted me as the future dealer.

"Then it became my turn. I wanted to know something about his company but he did not appear to know much. I asked him what investigation he had made concerning me. He said my letter was sufficiently convincing to his company.

"Long before noon I had turned down his proposition. I could not see that I cared to do business with a company that was so willing to accept a dealer merely on the looks of his bank account.

"Two other companies went the same way. The fourth, after a long period of correspondence and inquiry, offered me the dealership on conditions that I could not then meet. I am now looking for the man to get to join me in this dealer proposition who knows enough about cars to meet the requirements. I think the proposal is a fine one.

"The fifth company eliminated itself, as they did not have production to go into the territory I had asked for."

The net result of this effort to enter the dealer field was three companies out of the five did not make sufficient inquiry concerning the future dealer as to command his respect; a fourth made strong exactions and commanded the entire respect; a fifth showed a very sensible determination not to spread its distribution too thinly.

The question is:

> **How nearly does this incident show the trend on motor dealer selection?**

Size of Establishments

NOW as to the dealer.

Recently a number of distributors were asked to estimate the average number of persons employed by the dealers in their territory. The estimates are so close as to supply a very definite idea. The lowest number is 6 to each dealer and the highest is 12. A majority of the answers say 7. So let it be agreed that the average number of employees is something above seven.

One of these answers reads:

"The general average of employees in a town of 5000, handling about 100 low-priced cars annually, would be

seven. In a town of 25,000 handling 500 cars, 25 to 30; 100,000, handling 750 to 800 cars would be 40 to 50."

The point here is that a business establishment that employs an average of more than 7 persons is of a considerably higher rating than the average of mercantile establishments. The man in charge must be a man of some business ability and of some financial standing in his community.

How Many Cars?

THE question as to how many cars a dealer in a certain sized city should sell is a moot one. From the opinions heard here and there it is to be feared that some manufacturers, at least, have not given much thought as to whether their dealers were assuming a sufficient sales load to enable them to maintain an establishment in keeping with the merchandise they represented. Following are a number of opinions of distributors who have had a long experience in automobile wholesaling as to the number of cars necessary to maintain an adequate establishment in cities of certain size.

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1—In towns of 5000 persons, the number of cars would depend largely upon the price of the car. Taking them at the average of $1,000 he must sell at least 25 cars to make any money. In towns of 25,000 persons this number should be doubled. In towns of 100,000 persons he should sell a minimum of 126 cars. He must do this in order to conduct a satisfactory business. Assuming, of course, there will be small towns to bring up the population to greater than this in centers of this kind.

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2—It is difficult to estimate the number of car sales required to support a dealer in towns of 5000, 25,000 and 100,000. This all depends on the methods of doing business, whether they conduct a garage in connection and whether they conduct a repair department, accessory department, and so forth. I believe it is possible in any of the towns mentioned for a dealer to go into business and, providing his business is properly conducted, make a profit without selling a single automobile; therefore, his car sales should be his real profit. At present the average car dealer hardly takes time to wait on a customer who wants a tire or anything else at a small sum. We dealers have allowed ourselves to think in too large sums, that is, from a volume standpoint and have been negligent toward the small items which really constitute a profit in this business.

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3—It depends altogether on the car handled. In the South the medium-priced car always will be the biggest seller. A dealer in the town of 5000 should sell 25 cars to make it profitable, if he looks after his customers and renders any service.

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4—A dealer in a town of 5000 should retail no less than 25 cars. A town of 25,000 not less than 50 cars. A town of 100,000 from 150 to 200 cars.

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A Low Estimate

5—In a town of 5000, a dealer can probably get along with selling 12 or 15 cars because his rent and overhead are very low. He will be his own salesman, and his expenses will be divided between the repair shop, sundry sales, as well as selling cars. In a town of 25,000, if he is an up-to-date dealer, has a good service department and devotes his exclusive time and ability to pushing his car, and it is a good make, carrying not more than two makes of cars and one light truck and his reputation is established, he should sell 60 cars and trucks, providing the territory immediately adjoining his town can absorb some of his production.

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6—In a town of 5000 population the dealer would have to sell 50 cars or more. In 25,000, 150 or more, and 100,000, 300 or over. This applies, of course, to standard lines that are selling at a good price retail and with a reasonable profit.

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7—Using a popular low-priced car as a basis, a dealer should handle 100 cars in a town of 5000, 500 cars in a town of 25,000 and 750 to 900 cars in a town of 100,000.

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8—It would be my guess that a dealer in a town of 5000 could sell from 60 to 100 cars and make money constituting about three lines ranging in price from $1,000 to $3,000. A town of 25,000 population—80 to 200 cars; 100,000 population, 150 to 300 cars.

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9—The dealers in the 5000 town should sell at least 40 to 50 average-priced cars. In towns of 25,000 the market should be proportionate, and in cities of 100,000, if he cannot sell $400,000 in the year he will waste his time.

There are two sides to this question, just the same as to most questions. It certainly is a problem as to whether the small city dealer is doing as much business as he should, and could do if he put forth the proper effort. The other side is as to whether the manufacturer is supplying him with as many cars as the dealer is entitled to if he maintains a proper establishment. There are obligations on both sides.

This article, except as to the average number of employees, does not consider the dealer in the town smaller than 5000 inhabitants. There are points about the small-town dealer that deserve separate consideration, which will be given in due time.

Denaturants for Industrial Alcohol

A SUB-COMMITTEE of the (British) Empire Motor Fuels Committee has been studying the problem of the most suitable denaturants for power alcohol. In a memorandum drawn up at a conference of the sub-committee with the Board of Customs and Excise it is stated that the denaturant should be soluble in alcohol, benzole and gasoline and in certain mixtures of these; it should not readily be separable from the solutions, but be stable, cheap, plentiful, of nauseous taste and, if possible smell, but not poisonous, readily detectable in traces, and unaffected by metals which its combustion products should, of course, not corrode. J. Stanley has experimented at the Imperial College of Science, and has found that redistilled bone-oil, light caoutchoucine and certain shale-oil products appear best to comply with the desiderata. Bone-oil can be detected in traces of 0.001 per cent, and is less likely accidentally to occur in potable alcohol than some of the other denaturants, pyridine, etc. Bone-oil is a by-product of the animal charcoal manufacture; it contains pyridine (a coal by-product) which is found in some crude spirits. Experiments are also being made on the cracking of petroleum for the production of a denaturant; castor oil yields such a body, but it would be too expensive. It is further mentioned that a substance, capable of imparting to water certain characteristics at a dilution of one part in a million occurs "in certain roots growing in localities where alcohol may eventually be produced."

Exports of Automobiles and Tires for January, 1921

COUNTRIES	COMMERCIAL				PASSENGER				Parts	TIRES			All Other Tires
	Complete Cars		Chassis		Complete Cars		Chassis			Casings	Inner	Solid	
Europe													
Austria													
Azores, etc., Is.					1	$1,285			$34	$39	$4		
Belgium	2	$1,700			11	21,295			49,303	8,734	662		
Bulgaria									135				
Czechoslovakia										320	74		
Denmark	2	2,850			9	15,508			844,353	21,146	650	$1,353	$150
Finland					17	21,200			6,992	881			350
France	1	2,460			18	46,473	2	$2,450	758,624	79,117	106		28
Germany					1	3,000				9,129	1,221		
Gibraltar					3	4,140			369	195			
Greece	3	10,140			19	51,987	2	2,000	14,653	3,427	249		
Hungary													
Iceland, Faroe Is.									9,916				
Italy					3	2,950			8,841	249	21		
Malta, etc., Is.	4	1,666			8	14,622			3,835	750			
Netherlands	42	29,298			51	98,608			42,587	9,693	944		231
Norway	1	3,103	1	$2,260	5	5,576			70,884	26,321	664	5,806	
Poland and Danzig			12	37,314	9	14,031			10,463	540	60		
Portugal					2	1,980			5,448				
Roumania	7	6,147			54	32,956			11,008	6,761	1,929		
Russia in Europe	20	10,400							2,332				
Spain	12	23,879	9	14,573	162	283,878	1	2,542	370,393	79,410	4,383	3,394	17,000
Sweden	6	31,006	5	5,942	362	414,923			48,751	74,859	6,650	6,690	
Switzerland	7	14,677	2	252	46	76,455			9,958	6,635	89		1,264
Turkey in Europe					10	20,195			11,272	25,037	2,370		
England	22	43,406	15	12,433	15	31,973	6	13,209	2,617,307	288,497	3,394	55,364	1,586
Scotland	5	7,290					1	805	2,958	2,301	13		
Ireland					17	16,385			2,233	53	8		
Yugoslavia, etc.					2	2,000							
North and South America													
Bermuda									114	128			10
British Honduras					3	1,158	1	354	820	206	432		
Canada	67	129,812	11	12,405	88	185,595	2	3,285	729,706	62,245	7,393	4,680	2,575
Costa Rica	6	11,500			3	3,738			3,134	1,128	171	300	400
Guatemala					19	28,589	1	1,000	7,564	7,533	881		
Honduras					6	10,500			4,630	1,365	83		
Nicaragua			5	14,200	5	6,544			4,034	3,448	150		183
Panama	3	3,403			53	66,670			42,777	17,899	8,544	1,566	1,662
Salvador					5	18,600			2,223	13,376	2,612	422	402
Greenland													
Mexico	100	158,830	33	111,872	663	600,094			243,597	116,163	17,350	4,692	1,739
Miquelon, Langley, etc.													
Newfoundland and Labrador	3	6,275			2	4,800			1,297				
Barbados					15	13,003			6,172	3,769	122	250	108
Jamaica	3	11,500			52	46,776			47,334	18,297	1,291	2,040	243
Trinidad and Tobago			9	20,773	37	34,748			34,401	12,787	749	2,430	488
Other British West Indies	8	7,362			12	12,475			5,158	2,506	176	414	416
Cuba	72	89,551	14	37,730	549	437,259	3	4,006	222,546	226,717	13,089	35,500	9,542
Virgin Islands	1	495			18	11,991	2	594	3,429	1,622	143		
Dutch West Indies					12	7,905			1,688	930	149		
French West Indies	1	2,180	12	5,760	18	18,550			13,154	2,897	333	907	1,041
Haiti	11	4,945			5	2,100	1	430	9,962	6,636	1,205		211
Dominican Republic	7	20,257	2	10,350	30	19,678			47,289	23,060	2,010	2,344	740
Argentina	3	7,855	3	8,570	304	419,540			1,610,061	118,500	11,944	7,365	750
Bolivia					2	10,500			2,900	3,929	192	405	
Brazil	13	6,506	8	38,202	122	165,059	3	8,400	170,069	113,412	4,727		810
Chile	13	12,067	10	28,038	48	66,987	5	6,820	62,677	17,018	1,707	2,214	100
Columbia	3	13,605	3	7,650	31	55,628	1	4,900	20,913	6,994	921	594	
Ecuador	3	1,557			8	13,358	1	3,300	20,333	2,378	401		
Falkland Is.	1	545											
British Guiana					4	3,650			9,390	2,924	1,624		
Dutch Guiana					4	4,195			3,372	2,038	198		
French Guiana					1	1,000			238	100	76		
Paraguay					1	1,200			2,919	280	124		
Peru	25	50,524	4	13,387	29	66,207			53,751	39,888	6,603	4,020	
Uruguay	51	24,081			132	234,808			61,396	32,104	1,050		
Venezuela	5	2,248			65	63,944			27,035	26,420	1,558	743	
Asia and Far East													
Aden					2	3,308			3,471	3,217			
China	7	18,058	15	19,888	183	164,245	12	6,816	42,546	25,864	991	150	163
Kwantung, leased territory					1	6,500			90				
Chosen					1	571			1,097	199			
British India	56	114,141	16	31,196	280	306,822	4	7,860	152,074	54,897	4,245	1,412	
Straits Settlements	3	5,529	10	22,704	22	30,200			59,101	4,667	564	1,000	2,238
Other British East Indies	2	3,262			11	16,087			3,601	788	1,267	1,274	
Dutch East Indies	138	324,324	41	97,917	192	334,685	3	3,870	239,372	23,206	3,787	10,973	1,612
French Indo China			6	4,476	17	24,190	3	4,668	9,807				
Portuguese East Indies													
Hongkong	5	19,749			14	20,281			2,416	6,283	556	1,713	
Japan	89	90,321	11	32,730	60	103,770	10	13,400	119,227	13,165	696	6,387	60
Persia					36	17,023			4,650				
Russia in Asia									1,429				
Siam					19	23,929			8,350	6,350	100		
Turkey in Asia	7	5,102			129	111,674	13	6,180	19,118	8,819	2,018		
Other Asia													
Australia	83	125,919	116	177,450	165	193,026	430	495,767	194,819	77,509	5,452	230	2,163
New Zealand	34	61,410	15	27,422	259	358,586	5	8,647	130,031	128,696	1,843	3,032	23,741
Other British Oceania									1,137	4,632	1,097	148	25
French Oceania									762	1,161	75		213
Other Oceania									1,539	34			
Philippine Islands	116	63,466	44	56,683	334	258,814	29	64,620	109,550	90,609	17,513	22,429	4,190
Africa													
Abyssinia													
Belgian Kongo	10	9,095			10	7,033			2,930				
British West Africa	3	5,355	3	4,840	23	24,495	14	14,680	27,689	8,698	1,096		
British South Africa	13	26,668	3	3,644	164	187,693	11	23,613	87,588	30,206	2,526		193
British East Africa					20	29,173	2	1,699	8,095	9,249			
Canary Islands					5	7,455			2,507	2,703	115		
French Africa	4	2,078			60.	50,868	1	1,140	11,920	1,753	390	1,010	
Kamerun, etc.	1	449			2	1,695	1	354	2,193	825	94		
Italian Africa									422				
Liberia													
Madagascar													
Morocco					15	27,647			28,575	940	156		
Portuguese Africa	4	2,078	1	3.000	9	8,086			4,102			1,066	
Spanish Africa													
Egypt	6	2,970	8	19,876	45	50,007			21,055	8,744	1,892		69
Total	1,114	$1,633,094	447	$883,537	5,240	$6,186,132	570	$707,409	$9,679,295	$2,046,005	$157,972	$194,417	$76,705

The FORUM

Manufacturers' Parts Service Plan

Editor AUTOMOTIVE INDUSTRIES:

I have read the article "Parts Service Cuts Profits of Dealers" appearing in your issue of March 3 (page 534).

Our company was represented at the meeting held at the La Salle Hotel in Chicago referred to in your article, and as a member of the Parts Manufacturers' Committee conferred with the Truck Manufacturers' Committee.

As a commercial engine manufacturer, I would like to present the position of the Parts Manufacturer, as it appears to me. My company (The Buda Company) realized some time ago that eventually the parts manufacturer, with some exceptions, would be obliged to establish their own parts station, if their product was to be properly serviced. With this thought in view we established our first parts station some two years ago and have been gradually establishing new locations since that time.

The object of these parts stations is to provide an adequate stock of parts for all models of engines as have been and are at present manufactured by this company and the principal distributing points are located in zones where the greatest number of trucks using our product are located, and such sub parts depots located in that vicinity are under the direction of the principal distributing offices, much the same as the parts as are furnished by the electric and carburetor companies. Consideration should be given to the fact that these parts depots simply sell parts and do not undertake any work of placing them in the product of our manufacture.

The article starts with the assumption that parts stations of this character will cut into the profits of the dealers. I would like to point out that so far as our plan is concerned, we do not cut into the profits of the dealers, but rather we work closer and assist them so that their profits are increased.

I am very strongly of the opinion that the business should be handled through the dealer and he should be considered as the logical medium for distribution of parts. In our own case over 95 per cent of parts sold is done through the dealers, and it is only in cases where no dealer is established in a particular locality or in the case of the orphan truck that we deal direct with the owner.

Not a single objection on the part of the dealer to this method has been registered, in fact the dealers are enthusiastic over the service station idea, as it allows them to discontinue tying up a considerable portion of their working capital in repair parts and they are able to employ this money to better advantage in the sale of trucks. Supposing, for example, in a certain distributing center, there are located 15 truck agencies handling trucks equipped with a certain make of motor. It is certainly more economical for one parts station to maintain a complete stock of parts rather than have 15 stocks of parts maintained by the truck agents, probably none of which are really adequate.

Further, numerous truck manufacturers have been using certain units for 10 or 15 years. This unit has been improved as to design during this time, so that the unit being supplied the truck manufacturer to-day may be entirely different from the unit that he used two, three or more years ago. Does the agent who has just taken on a line of trucks wish to carry repair part stock for models of trucks that are now using a redesigned unit when he can depend on getting his parts promptly from a service station, and the cost to him being little or no more than he would pay by purchasing direct from the truck manufacturer?

The second-hand truck is becoming a problem to be reckoned with; in fact, there are cases where good-sized fleets of trucks are operated, all of which have been purchased second hand. One of the first things a purchaser of a second-hand truck wants to know is where he can purchase repair parts for the different units in his truck. If he finds that repair parts are not easily available, he will not purchase this truck, but will purchase a truck where he has the assurance of getting parts promptly when necessary.

It may be argued by the truck manufacturer that the establishing of parts stations will cut him off from all profits formerly derived from the sale of parts. While this could seem to be true, it is recognized by the parts manufacturers that the truck manufacturer should be compensated in some way for this loss, and a plan was suggested at the meeting which seemed to solve this condition.

Such truck manufacturers who still wish to maintain their own supply of parts at their branches or in the hands of their distributors are at liberty to do so, and the parts station plan does not contemplate the elimination of such stocks if the truck manufacturer desires to maintain same.

The logical development of the parts station idea in the writer's opinion would be to have certain groups of parts manufacturers have their parts handled by the same organization. In this way one series of parts stations might handle parts for a certain motor, axle, transmission and clutch, while another series of stations might handle parts for another series of units.

The plan, if worked out on a broad basis, would tend to infinitely strengthen the position of the assembled truck manufacturer, as the purchaser of any make of assembled truck would know that he would be able to get necessary repair parts for any of his units promptly at any time.

THE BUDA COMPANY,
Harvey, Ill. L. M. Viles, President.

Fitting Traction Devices to Disk Wheels

Editor AUTOMOTIVE INDUSTRIES:

We have been much interested in the editorial on page 35 of your issue of Jan. 6, entitled "Fitting Traction Devices to Cast Disk Wheels." This editorial seems to assume that equipment for such wheels has not been designed by any manufacturers of traction devices, and that the difficulties connected with applying equipment to such wheels have not been solved.

As you know, many trucks equipped with disk wheels

were used by the army during the war, and our equipment known as No. 66 was designed particularly for use on army trucks. After the army had adopted this equipment the disk wheels furnished on trucks on their orders were drilled for the attachment of the equipment.

Some manufacturers of disk wheels are still furnishing their wheels with holes bored to fit this equipment. However, where disk wheels are not drilled in this way, it is a very simple matter to drill the six holes necessary on each rear wheel to accommodate this equipment.

GIANT GRIP MFG. CO.

"Fuel Economy Comparisons"

Editor AUTOMOTIVE INDUSTRIES:

The truth of the general proposition that comparisons are apt to be odious has never been so forcefully presented to me as in a reading of your editorial comment under the title "Fuel Economy Comparisons," in the March 10 issue. These comparisons are the more odious because they will convey a half truth, or less than that, to many of your readers.

There seems to be but little justice or advantage in comparing the *overall* fuel consumption performances of tractors, involving their crudities of power transmission, and the great losses therein, with what is known to be an extra special performance of a highly developed aircraft engine operating *without power transmission losses*. Perhaps it was merely sought to set a mark at which the builders of tractor engines might shoot. But it must be recognized that the aircraft engine can show such results with only certain special grades of fuel. If aircraft engines were operated on commercial or car grades of gasoline, their performances would be very little if any superior to those of good tractor engines; and it is safe to say that their trouble-free working lives, under this condition, would be materially less than those of good tractor engines.

While it will not be attempted to argue that the results of the tractor tests named in your editorial are a credit to the tractor industry, it seems, on the basis of our own work with this class of engines, that the apparently poor showings discussed must be largely attributable to transmission losses, of which no mention is made in your comments. It is obvious that it is entirely unreasonable to have a mean consumption of 1.35 lb. b.hp.-hr. at rated load, considering the power to have been measured at the engine crankshaft.

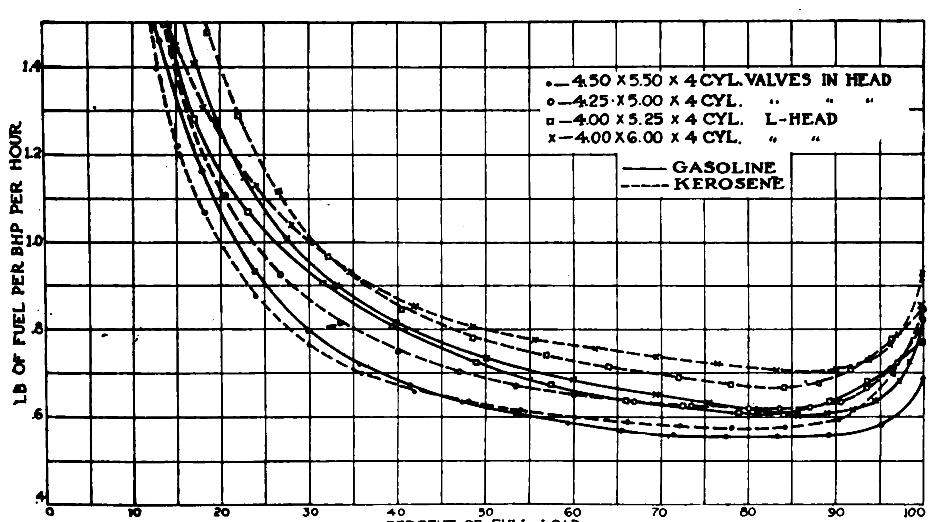
Accompanying this letter is a graph of fuel consumption vs. per cent of maximum load, for four tractor engines, operating at governed speed on both gasoline and kerosene. Two of these engines were valve-in-head and the other two L-head designs. It will be seen that in two cases the performances are superior on kerosene, on the basis of horsepower-hours per gallon (gasoline = .75 sp. gr. = 6.25 lb. per gallon: kerosene = .84 sp. gr. = 7.00 lb. per gallon). Assuming that a tractor engine is rated at 85 per cent of its full load capacity, these four engines stand as follows, on the basis of b.hp.-hrs. gal. and maximum B.M.E.P. developed:

Engine	Kerosene B.H.P. hrs./gal.	Kerosene B.M.E.P.	Gasoline B.H.P. hrs./gal.	Gasoline B.M.E.P.
(a) 4.50 x 5.50 x 4 cyl., overhead valves	12.05	83.0	11.15	84.5
(b) 4.25 x 5.00 x 4 cyl., overhead valves	11.29	74.9		
(c) 4.00 x 5.25 x 4 cyl., L-head	10.42	70.0	10.08	71.0
(d) 4.00 x 6.00 x 4 cyl., L-head	9.88	72.2	10.22	73.1

The test conditions under which these results were obtained were of the same order of excellence as those in the tests of the aircraft engine cited in your editorial comments. And the results cannot but lead to the conclusion that good tractor engines are not so far behind the best in aircraft engines, for which latter the value of 13.7 b.hp. hrs./gal. is admittedly a record.

The writer holds no brief for kerosene or other heavy distillate as a general engine fuel, since the conditions that must surround its satisfactory use demand the best there is in engine design. It has often been found to be much easier, as a way out, to condemn the heavier fuels than to make the necessary reorganization in engine design details. However this may be, it is a certainty that the heavier fuel distillates are not quite the pariahs some would have us believe.

P. S. TICE.



Fuel economy comparisons of tractor engines at governed speeds

Automobile Electrical Systems

FROM the time that the first combined starting and lighting system made its appearance on the market, about 1912, many systems have been brought out and have disappeared; that is, these systems are no longer being manufactured, but in many cases they are still doing service in cars and have to be looked after by the owners or operators and repaired and overhauled by garages. In some instances the manufacturers have gone out of business and it is very difficult if not impossible to get detailed information on their systems, such as would be helpful in making repairs.

A book that should be of considerable help in such cases is Automobile Electrical Systems, by David Penn Moreton and Darwin S. Hatch, published by the U. P. C. Book Co. This is a sequel to the volume on Electrical Equipment of the Motor Car by the same authors and deals particularly with individual systems. It must not be understood from the above that only obsolete systems are described. No less than fifteen chapters are devoted to descriptions of special systems for Ford cars and nineteen to systems for general use. There are also chapters devoted to a general discussion of wiring diagrams, to the maintenance and repair of electrical apparatus and the diagnosis of troubles. The book is of pocket size and bound in flexible covers.

Standardization Without Understanding Is Harmful

Knowledge of the fundamental elements involved in human actions and relationships is so very limited at present, that attempts to standardize practice and methods of handling this factor are premature. Development lies in closer study of the elements. A noteworthy commentary.

By Harry Tipper

THE following abstract taken from a New York newspaper may not appear to be interesting to the average business man and yet it is one of the symptoms of development in this kind of work that should be noted and considered in its relation to the study of the human side of industry.

> Plans for standardizing methods of selecting men and women for vocations to which they are best fitted were discussed yesterday at a luncheon in the Keen Chop House, 72 West Thirty-sixth Street, and a committee appointed to go further into the matter, led by George Kingdon Parsons, president of The G. K. Parsons Corporation, who was the host.
>
> The committee will confer with the Personnel Research Federation, organized in Washington last Tuesday at a conference of the National Research Council, attended by representatives of some thirty scientific and welfare societies.
>
> Dr. Beardsley Ruml of the Carnegie Corporation agreed that what Mr. Parsons had said reflected a general feeling and described the origin of the Personnel Research Federation as a result of the conference in Washington a week ago. He said that the federation was still in a formative period and that he had been chosen as acting director. He added that it was planned for the federation to keep records of as complete a nature as possible regarding all agencies fitted for specialized research in connection with questions of personnel.

The first sentence in this article is perhaps the most significant because it is the general tendency of all organization work of an abstract character in connection with these problems. It states that plans for standardizing methods for selecting people were discussed.

> **This idea of standardization runs through all the discussions which have taken place in connection with the organizations of employment managers, personnel directors, industrial engineers and the innumerable other societies springing up with the idea of taking care of the human side of the industrial problem. I am reminded of the statement which I quoted about two years ago in one of the first of these articles:**
>
> **"In their meagre imagination uniformity seems a lovely thing—when it is only the night in which all cows are black."**

It is true that there are certain fundamental elements of similarity in human reactions, but the principal possibility of development lies not in these fundamental similarities but in the endless individual variation which develops an infinite variety in the quality of action and thought. We do not even know with any certitude the fundamental elements of similarity and what they mean in practical action. We have no understanding of the way in which these fundamental elements govern the endless individual differences, and we are utterly without information as to the potential powers which exist in these variously combined qualities.

We have already standardized to such a degree in our attempt to use human beings easily in industry, that standardization has in many cases developed into a dangerous suggestion of uniformity. This standardization has grown up out of the ignorance of fundamental human requirements, and it has been one of the chief elements in the growth of trade unionism and the development of socialism.

All methods of examination of human beings which are standardized are inefficient to that degree—the most desirable method of selection, like the most desirable method of education, is the one which is individual and arises out of the instinctive capacity to draw the individual out.

As a matter of fact, this idea of standardization in human relationships is simply another way of attempting to do by system what we have not sufficient knowledge to do by understanding, and the result is likely to be more confusion and more difficulty, because these organizations of various kinds will be limited by the systems which they have adopted.

> **It is a sufficiently hard matter to standardize effectively the technical practice in a business which is dealing with understood mechanical principles. Every step in the progress of such technical practice demands the elimination of old standards and the readjustment of standards to the new state of knowledge. We are thoroughly well informed regarding mechanical principles, and are able to govern the results with a fair degree of accuracy and with a fair degree of foresight.**
>
> **Our knowledge of humanity is meagre and we have not made any notable progress in this respect in the growth of our mechanical convenience. To attempt to standardize and to classify into systems in our present ignorance of human relations is to assume a knowledge which we do not possess and seriously impede the possibility of progress.**

Equally significant is the indication in this report concerning three or four additional organizations with the sole object of establishing new systems of dealing with the human being. This multiplicity of organizations is leading already to a great deal of confusion and to the development of a large amount of unnecessary propaganda for this or that method of increasing the efficiency in dealing with the human side.

If these groups were based upon discussion and the gradual illumination of the matter by the definition arising out of the friction of the discussion there would be

some valuable progress in their development. Almost all of them have been formed by people who are not only interested in the subject, but who are also interested in certain systems of development—of which each system, of course, contains the only elements of thorough value in dealing with the situation.

Such organizations have a tendency to establish a terminology and a technique of operations long before they have thoroughly illuminated the principle upon which such a technique should be built. They may be of some value in a limited way, but their constant multiplication is of no advantage and may be a great disadvantage.

No operating technique or system of dealing with the selection or co-operation of workers is of any particular importance at the present time. The co-operation depends largely upon the development of a spirit of fairness among all parties, and the selection depends upon an increase in the measure of understanding on the part of those who must select. Selection must always take place because of the fitness of the individual for the work, in his skill and the quality of his mental development.

The total efficiency of the group is the average of the value of each individual in the group. A thorough understanding of the individual, his skill and his quality will automatically raise the average possible efficiency of the group, while neglect of the individual, in the attempt to standardize and provide easy systems for mass selection will merely bring the individual quality to the average upon which the system is based: Practically all of these organizations act as though the individual was no longer the basis of human development and efficiency was no longer a question of the individual capacity.

The very necessities of our organization have driven us to standardize work and pay, the unions have attempted to make skill a uniform matter and these things are disturbances enough to our present system of organization. To organize for the purpose of furthering these standardizations and elevating the neglect of the individual into a scientific technique, seems to be a method of improvement by increasing the present difficulties.

It may be imagined from this discussion of organization that I do not favor special study of the human side. This is not so. No man can expect to understand humanity even in a slight measure without giving it a great deal of study. The lack of definite knowledge on the subject means, in fact, that this study is more severe and more laborious than any other study in the attempt to acquire definition. My objection is that these organizations are systematizing on too little study and too little understanding of the matters with which they are dealing. Their efforts at organization are based upon the most fragmentary and partial examinations of the matter.

The systems are not based upon much more knowledge than the course which undertakes to teach all about handling humanity in six months. In thirty centuries we have not been able to define the frame work of fundamental human principles and determine the elements of human co-operation. Under these circumstances, it seems unlikely that organizations can be started after a few months or a few years fragmentary study of the question and build up systems of operation which will be of great moment in dealing with the subject.

It would be better, for a time at least, if the systems grew out of the individual methods of operation in each case, and were discussed in the endeavor to find those principles which threaded through all systems. Some real progress might be made in an organization by such discussions and the understanding of the human side would be greatly forwarded.

It is not standardization we need, but definition. What is a square deal? I have been unable to secure the same definition from any half dozen men. Most of the time the square deal we talk about is concerned about what the other fellow should do to us, and doesn't refer very much to what we should do for the other fellow.

I have yet to find a dozen men who can agree upon the term fair wages. Efficiency, alertness, initiative and all these other words which we use to describe human qualities, lack definition entirely, and their meaning is so vague that no two men translate it into the same actions.

There can be no standardization of effort worth while without a definition of fundamentals so clear that the terminology is thoroughly understood. With the present vague, indefinite, fragmentary ideas of human quality and action, systems based upon such ignorance are not likely to be of any importance and they may be dangerous.

Air Service Engineering School

A SCHOOL at which officers of the Air Service may learn the engineering principles of airplane construction, tests and maintenance is conducted by the Service. Requirements for admission include a rating as an air pilot and one of the following three educational tests: (1) Graduate of naval or military academy; (2) graduate of recognized technical college or (3) a thorough high school education and well versed in the fundamental sciences and exceptional experience along lines of special importance to the Air Service.

It is hoped that as a result of this instruction the student officers will get a point of view and a sufficient knowledge to allow them to speak the language of engineering and that a deep interest in mechanical matters will be instilled in them which will result in their returning to their stations with an educational foundation and an interest in technical matters which will cause them to continue reading, studying and constantly improving themselves as Air Service officers.

Following is a list of the topics covered by the course: Mechanics; Shop Work (machine tools, wood work, metal construction, plane construction and maintenance, inspection); Business Administration (scientific factory management, cost accounting, business law, patents, contracts, civil service); Armament (machine guns and synchronizers, bombs and flares, cannon); Strength of Materials; Materials Laboratory (chemistry, metallurgy, physical testing, wood, fabrics, rubber); Electricity (direct currents, alternating currents, miscellaneous airplane electrical problems, radio); Thermo-dynamics and Engine Design (heat engineering, steam power plants, radiators, engine design); Gasoline Engine Laboratory (ignition, power tests, general engine data and repair and upkeep, accessories and power plant installation inspection); Theoretical Aviation (aero dynamics, airplane design, propeller design, performance tests, airship theory, meteorology, navigation, airplane accessories, equipment, photography and instruments, camouflage).

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Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly) July, 1907.

Increasing Interest in Costs

AN increasing number of the letters received at this office are concerning the cost of manufacture and of merchandising. This indicates a healthy frame of mind as to business of the immediate future. There has been an inclination on the part of some persons, during the recent era of free selling, to conduct their business on the principle of "charge all that the traffic will bear."

If the signs that are pointing to the immediate future can be read at all, they say that the principle of business must be "charge as little as the traffic will bear." This means that the manufacturer and merchandiser must know what his costs are, add a reasonable profit, and put all possible energy into his work.

But when it comes to discussing costs there is an almost insurmountable barrier. There is lacking a recognized terminology of costs. When two men meet to discuss costs they do not call the same thing by the same name, nor do they charge it in the same division. Cost discussions are not effective until the definitions have been fixed, and that takes so much time that the real facts are left undiscussed. The Industrial Cost Association, which is composed of cost executives, chief auditors, works managers and similar executives of manufacturing and mercantile firms, has undertaken to establish a terminology for cost accounting. The members of this association also hope to agree eventually on where the items represented by these terms shall be charged. When this is accomplished, the Association will have accomplished a great work, for then two men can meet and discuss costs intelligently.

Automobiles and Necessity Again

A FREQUENT topic of conversation in the automotive industry is the great battle that was waged in Washington several years ago to establish the automobile, and its kindred vehicles, as necessities. In these conversations it is always assumed that this battle was won and a favorable peace treaty adopted.

There are some of us who have always doubted that the favorable verdict was as well grounded as it might have been. Now it appears that the "luxury" forces in this battle are comparable to the Germans. They recall something about this battle, but since the smoke was cleared away they are rather in doubt as to who was the victor. Indeed, some of them are calmly assuming that the battle was merely a skirmish with the laurel wreath awarded to the other side.

Representative James W. Good, chairman of the House Appropriations Committee, has put himself forth as spokesman for the luxury side and has sounded a call to arms for those efficient orators and economists who made such a good showing for the automotive industry at the time America went into the war. Mr. Good says:

"We have in the United States more than 8,000,000 passenger carrying automobiles. Practically every one is a luxury, and if we placed a tax upon the passenger carrying vehicles and made the amount of the tax dependent upon the horsepower, a reasonable tax, we could easily collect $200,000,000 from that source."

That is an average of $25 a year for each automobile, as Mr. Good presents the numbers, with enough additional tax to pay for the political machinery set up to make the collections—an average of $5 a seat in an already well taxed automobile. All of this tax would act as a brake on the sale and use of motor equipment.

This statement from Mr. Good confirms what a number of investigators have said recently concerning the stand of bankers, legislators and others in a position to do the automotive industry great harm. C. C. Hanch, after an extended investigation for the National Automobile Chamber of Commerce, said that he had found that even the bankers, who appeared to be most soundly converted to the automotive industry, still held back in their minds a suspicion that the industry was not well established upon a necessity basis.

Mr. Good's statement should at least serve as a sufficient warning of what the position is in Washington and that most of the basic work thought to be completely accomplished must be done over.

The British Tractor Trials

EVIDENTLY the British tractor industry has come to the conclusion that tractor trials are a paying proposition, for it has been decided to repeat the annual trial this fall. Originally the Lincoln trial was held under the auspices of the Royal Agricultural Society; last year that organization and the Society of Motor Manufacturers and Traders stood sponsor jointly for the event, but this year the last-mentioned Society will have sole charge. The joint sponsorship was accompanied by a good deal of friction, and as most of the tractor manufacturers are members of the S. M. M. & T. the latter body probably had little difficulty in securing exclusive control. Whether the farmers will have as much faith in the trials with the Agricultural Society excluded from the affair remains to be seen.

National tractor demonstrations, which evidently are a thing of the past in this country, are apt to flourish in Europe during the next few years. A national trial naturally has a much better chance of success in a country of relatively small area than it has here. Moreover, the tractor industries in the different European countries are quite young and the manufacturers individually (as tractor manufacturers at least) have little to lose and everything to gain.

From the rules of the British 1921 trials, which have just been received in this country, it is seen that an endeavor is being made to extend the scope of the trials, motor cultivators and garden tractors being provided for in addition to regular farm tractors, cable sets and farm implements. The tests which will be made will yield information similar to that given by the Nebraska tests, and the fact that the Nebraska results are available to any prospective purchaser is another reason why we are not likely to have national demonstrations in this country again, at least for some years to come.

Save the Patent Office

THE last Congress adjourned without legislating for the benefit of the Patent Office. Because of certain quibbles between members of the Senate and the House, the Nolan bill died between these two branches of Congress.

The neglect of this important branch of the Government by Congress should stand as an indictment of every member of both branches. There is no branch of Government activity that can do as much to promote the engineering and mechanical development of this country as the Patent Office. Its best services are needed as an aid to the advancement of all engineering work and to the great task of efficient production.

The Patent Office is not an expense to the Government. It pays its own way and industry does not object to this fact. It would not even object to the Patent Office making a safe profit on its operations. But industry does demand that the Patent Office shall be efficient, that it shall be permitted to spend enough of its own money to pay the technical men who work there a decent salary.

No other industry is more interested in an efficient Patent Office than the automotive industry. It would be within reason for every manufacturer and engineer in this industry to inform his representatives in Congress that unless proper Patent Office legislation is passed at the coming session, that the participants in the deliberations of the session will be classified as unfavorable to business interests.

This matter is important. Write to your Congressmen to-day before they again become involved in the activities of the coming session.

Low Mechanical Efficiency at Part Load

AMONG the many factors which adversely affect the fuel economy of the conventional passenger car and truck engine, the loss due to engine friction is ordinarily considered to be of small moment. Broach the subject to the average engineer and he will as a rule draw attention to the fact that the mechanical efficiency of a well-constructed automobile engine is around 90 per cent, and so it is—at full load. At part load, however, the situation is quite different. Friction losses, in which are included the very important items known as pumping losses, do not decrease, at a given speed, as the load decreases. In fact, they increase, as a result of throttling, until at no load, that is with the engine running idle, they absorb the entire amount of power developed in the cylinder. At intermediate points friction losses become a very important factor. In the case of the class B truck engine, for example, at quarter load, when running at 1000 r.p.m. the brake hp. developed is about 12, while the friction hp. is over 6, or more than one-third of the total indicated power developed. At lower loads the condition is worse, especially if the engine speed is high. Yet these are the conditions under which the average passenger car engine operates most of the time it is in use.

Under the average operating condition, perhaps about one-fifth load, it frequently happens that half or more than half of the total power developed in the cylinder is used in simply turning the engine over. This is a bit startling, but it certainly points to the need, now more than ever apparent, of providing means whereby automotive engines can not only be operated at more efficient loads, but be run at lower average speeds, for friction losses in the engine increase rapidly as the speed increases. It may, in fact, prove to be better economy to use larger and slower speed engines together with high gear ratios and consequent better load factor, than to continue in the other direction, as we have so long been going. In any case there is food for thought along this line.

Too much is now being sacrificed in respect to fuel economy in order to secure good acceleration. This is a good time to investigate every factor that will make for better economy.

Sales Show General Improvement

New Orleans Finds Keen March Demand

New Business Much More Stable Than Formerly—Tractors Gain in Favor

NEW ORLEANS, March 28—The first 21 days of the month of March showed greater improvement in the automobile industry than did the entire 30 days of any previous month since the first of November, 1920. The period of depression reached its lowest ebb in December, revived somewhat around Christmas and the holidays—due largely to the pre-Christmas show—and then dropped again in January. Sales for the first three weeks of March, however, exceeded those of October, 1920, the last month before the period of depression set in, by about 20 per cent, which is considered a remarkable showing by the majority of the sixty-odd automobile dealers in this city.

The return to the normal of 1920 was a surprise to many dealers, who had expected an improvement in the spring, but had not looked for so great an advance. Truck and tractor men, who have not felt the depression so heavily as the passenger car dealers, have not noted much of an upturn for March, though their sales have remained steady, and there are prospects that their business will improve later in the summer and this fall.

Greater diversification of crops, succeeding the hard lesson the one-crop cotton planters learned when cotton dropped from 45 cents to nine cents, is making the use of tractors and trucks almost imperative in the agricultural regions of the South, and is having a direct effect on orders for tractors for future delivery, but most of the planters are not in condition just now to accept immediate delivery on either trucks or tractors.

Conditions General in South

These conditions, both in the truck, tractor and passenger car fields are true in much of Alabama, all of Mississippi and Louisiana, and parts of Arkansas and all of eastern Texas, which territory is tributary, in the automobile industry, to New Orleans. While the farmer has not made much money on his cotton, sugar or rice, the brokers, forwarders and other intermediate handlers of these crops have made some money; salaries in these industries, for the majority of those who work in them, have remained high, and the consequence is that numbers of the city people have been able to buy passenger cars, and have bought.

(*Continued on page* 729)

TRADE STUDY SHOWS INCREASES GENERAL

Dispatches from correspondents of AUTOMOTIVE INDUSTRIES in representative sections of the country indicate steadily improving sales conditions. The improvement this month has been much more marked than was expected.

For example, the first three weeks of March showed a greater improvement in the New Orleans district than any full month since November. There also is a steady upward trend in the Atlanta territory.

Even in Des Moines there has been a great improvement. One distributor sold more cars the first 15 days of this month than in all of January and February.

General merchants in the rural districts of Kansas and Missouri report improved business.

Sales conditions are getting better on the Pacific Coast, as shown by reports from Los Angeles and Portland.

Dealers in Montana have decided there is business if they have the energy to go out and get it.

Sales in New York, which fell off during the income tax paying period, have begun to mount again.

Parts makers in the Milwaukee district report substantially increased orders in the last four weeks.

Cleveland and Detroit passenger car manufacturers are adding more names to their pay roll. The same condition prevails in other automotive centers.

Altogether the situation is decidedly encouraging.

UNEMPLOYMENT HURTS SALES

FORT WAYNE, IND., March 26—Sales of popular priced cars are picking up to a certain extent here, although it is still difficult to make sales readily. It is believed that business here and in this generally prosperous northeastern section of Indiana will get much better within a few months. At the present time the fact that so many people are out of work locally makes business far from good. The local branch of the Indiana free employment bureau reports that there are 4000 more men out of employment there now than there are at normal times. Most of these men are from the Pennsylvania shops, General Electric Co., Dudlo Manufacturing Co., Fort Wayne Rolling Mills and Wayne Knitting Mills, where a strike is on.

New York Visions Big Selling Months

Effect of Income Tax Period Passes Quickly—Cheaper Cars Popular

NEW YORK, March 28—The metropolitan area is recovering from an acute attack of incomtaxitis, which slowed up passenger car sales, particularly in the high priced lines during the early part of March. Sales, which dropped off from the February level during the first 20 days of this month, have begun to pick up again and the prospects for April, May and June business are bright.

As an instance of the psychological effect of the filing of income tax returns and the payment of the first installment, One dealer handling a $3,000 car had sales during March numbering 51, as compared with 86 during February. Several other dealers in high priced cars had similar experiences, though two or three with decidedly popular makes had a March business considerably better than February. The income tax period seems to have had little effect on the sales of low priced cars and in several lines these are running very strong. One dealer in a popular priced car had sales for March running only a little below 200, as compared with 150 in March a year ago.

Practically all dealers have intensified their canvassing and mail solicitation efforts, and several have been added to the list who keep their establishments open evenings, with good results so far, according to reports. The junior salesman idea, under which quite young men are used to develop information on prospects later to be canvassed by senior salesmen, is spreading and general good results have been obtained. Used car sales prospects have picked up with those in the new car line, despite the fact that used car prices have shown little disposition to decline.

Truck sales have improved materially in the light truck classes, and there is an upward slant in the heavier duty field.

EARLY SPRING HELPFUL

PORTLAND, ORE., March 25—The early spring has proved a distinct boon to the automobile industry in the Portland district and during the past week business has picked up in a decided manner. Spring this year promises to be nearly a month in advance of last year and the country motoring should start correspondingly early. Comparatively few cars are held in storage here and dealers have been placing orders with the manufacturers during the past two weeks in a more substantial way.

Factories Reflect Growing Demand

Milwaukee Factories Report Steady Gains

Capacity Production Within Sight in Some Plants—Truck Demand Certain

MILWAUKEE, March 28—Companies in Milwaukee and vicinity manufacturing motors, parts and equipment for the automotve industries report a substantial increase of orders during the last four to six weeks, according to the current issue of Business and Financial Comment, monthly review of local business conditions issued by the commercial service department of the First Wisconsin National Bank of Milwaukee. One concern reports that its January sales were equal to those of the same month in 1920; its February record is better still, and March business shows accentuation over both. This concern is running at 85 per cent of capacity, and orders for immediate shipment are of such volume that it is two weeks behind in deliveries.

It is significant that the stimulus which brought this new business was a substantial cut in prices made possible by lower costs. Another company making motors has recently received some good-sized orders for immediate delivery. Still another large firm doubled its sales in February and expects enough business in April to run at full capacity.

The motor truck business seems also to be on the mend. Orders have been increasing and there are almost no cancellations. The truck industry is, however, not taking anything for granted. Selling trucks may be hard work, but the future of the industry is assured, the review says:

Must Distinguish Between Prospects

"In discussing the motor car situation, one must be careful to distinguish between immediate and long run prospects," it continues. "Everybody knows that there will be a good future market for passenger cars and also that motor trucks are pretty sure to be more in demand as more good roads are built and farmers and business men are convinced of the economies of motor truck transportation. In the immediate foreground manufacturers see about 50 to 60 per cent of the business done last year. One production manager puts it well when he says that 'the automotive industries are facing a sales problem after twenty years of production problems.'

"Some discontent is being expressed at the slowness of trade improvement. General revival, at first predicted for early spring, is now scheduled for late spring or summer. The best opinion is that the return of normal conditions will not be in the least spectacular. Each month will see steady gain. By the end of the year, barring the unforeseen, business should be on its feet again. It is not good sense to look for the fortuitous and unexpected in business. This is not real optimism. The confidence of reward from unremitting toil is the only kind of optimism that has any certainty of winning. The sooner everybody in trade and industry makes up his mind that he will have to work for what he gets, the easier it will be to get over this period of readjustment."

Los Angeles Business Makes Rapid Strides

LOS ANGELES, March 29.—Automotive sales conditions in this part of the country are showing a pronounced improvement. Passenger car business is advancing quite rapidly and truck sales likewise are showing increased activity. There is a certain backwardness shown by truck buyers, however, that is attributable to prospects of unfavorable legislation. Some bills now before the state legislature would tax truck owners very heavily.

A recapitulation of February registrations of passenger cars shows that some Los Angeles firms enjoyed the greatest business in their history. A total of 1913 new passenger vehicles were registered by purchasers during February. This was 145 less than the total for January, but this discrepancy undoubtedly was due to February being a short month. The truck registrations for Southern California during February totaled 277, which figure included the Fords and other light commercial cars.

Reports from dealers state that March will show a pronounced improvement over February in almost all lines.

VICTOR RUBBER SPEEDS UP

SPRINGFIELD, OHIO, March 28—Starting to-day, the Victor Rubber Co. will speed up its output to a normal basis, which is 500 cord tires per day, according to announcement made by Treasurer H. H. Durr. Since the first of the year the company has been turning out an average of 400 tires daily. The business of the company has been steadily improving, it is stated.

PIERCE OVER 50 PER CENT

BUFFALO, March 28—There has been a substantial improvement in the business of the Pierce-Arrow Motor Car Co. so far as passenger cars are concerned but few trucks are being sold. The company is operating at something over 50 per cent of capacity.

Schedules Increased in Cleveland Plants

Growth of Sales Results in Reemployment of Many Men Laid Off

CLEVELAND, March 28—Within the present week the automobile factories in this city have given signs of a business revival and have restored several thousand employees to positions that they left weeks ago. The automobile industry is setting the pace for a general comeback in production in this city.

The Peerless Motor Car Co. is employing 1500 men, and the number is being increased daily. Orders have come in increased number each week since the first of the year. More than 150 men have been hired in the last 30 days. The company is now increasing its force by taking on 10 to 15 daily.

At the Jordan plant the statement was made that more automobiles are being shipped than the company is building at the present time. Although the pay roll has not been increased since the first of the year, the force of employees will be augmented on April 1.

The Chandler Motor Car Co. started on Feb. 1 to increase its working force. During March a marked addition was made to the pay roll. The week of March 21 to 28 brought about a substantial increase. The company expects to see pre-war conditions restored before the spring ends.

The White Co. has added no employees since Jan. 1. Working hours were decreased since then and shifts have been shortened in order to give as many employees as possible an opportunity to earn money. While other companies were curtailing production the last half of 1920, The White Co. operated at capacity. Prospects at this plant are brightening daily, it was said.

Harvester Employees Agree to Reductions

CHICAGO, March 25 — The Works Council, as the supreme body governing the operation of the International Harvester plant, has accepted the company's proposed cut in wages of 10 to 20 per cent. Reasons for the reductions were explained to the council at a conference with officials.

Wage reductions were decided upon by officials of the company after analysis of business possibilities, working conditions and the present cost of living. In determining for reductions in wages it was agreed that the cut should be made indiscriminately, affecting everyone from the president down.

April Schedules Revised Upward

General Expansion Meets Sales Trend

Dodge Makes Increase to 60 Per Cent Capacity—Expectations Surpassed

DETROIT, March 28—Rapid improvement in the automotive industry is reflected in the big step-up in production in most of the factories in and around Detroit. This is true particularly in the case of Maxwell-Chalmers, Studebaker, Hupp and Dodge. The only instance where there has not been increased production is at the Reo Motor Car Co. at Lansing where the time and working force were cut 50 per cent last week. This, however, was not due to sales recession but rather to permit factory readjustments. Return to a full time schedule is expected next week.

Dodge opened on a 10 per cent schedule recently, but last Thursday started on a 60 per cent production basis, which means close to 400 cars daily. Arthur T. Waterfall, assistant general manager, made the announcement regarding the production increase.

"The country is well out of the depression," said Waterfall, "and even in foreign countries conditions that have affected the automobile industry are beginning to improve. We are now operating on a 60 per cent basis with all indications pointing to a gradual return to normal. That is the best indication I can give of a change for the better. Other lines of business seem to be following the turn in the automobile industry."

Charles Adams, production manager of Maxwell-Chalmers, said to-day rapidly improving conditions had brought about a readjustment of Maxwell-Chalmers schedules, and with the step-up during the last part of March, the total figures for the month would show an output of 1500 Maxwells and more than 500 Chalmers. This schedule will be increased the first of April, and efforts will be made to reach a total of about 300 cars in the next month.

Cars Sell Fast as Made

The best feature, Adams said, is the fact that the cars are being sold as rapidly as they are being turned out. Maxwell-Chalmers virtually has been closed down for several months pending reorganization activities, but the sales demands, Adams said, forced the increased schedule in February, followed by another increase in March, with indications that within the next 40 to 50 days both plants will be running close to normal.

The completion of the new pressed steel plant, which now is about ready for manufacturing activity and which covers 217,000 feet, will take care of the work for both Maxwell and Chalmers cars, and will permit of greatly increased production. The main building contains two craneways each with a double row of presses 300 feet long, and each equipped across its entire span of 60 feet with a crane capable of picking up material, or even the presses themselves, and moving them to any other part of the building. The presses are so placed that the steel passes from one to another without the need of extra men, and the working force is thereby greatly curtailed.

Hupp April Schedule, 2000

Hupp Motor Car Corp., which built 700 cars in February, increased the schedule in March and the month probably will close with a total around 1400. April schedules at Hupp called for a production of 2000 cars, which rapidly is nearing the peak of last year.

Hupp officials a short time ago announced that while the factory had not been closed throughout the depression and was increasing gradually, there was nothing to indicate that production above 50 per cent of normal would be reached this year. Sales activity, however, has shattered that belief. The more than doubling of production during April, as compared with February, and the great increase over March, is due entirely to sales demand.

Studebaker to-day started in on a production in the Detroit plant of 800 cars for this week, and 500 in the South Bend plant. Next week Studebaker has scheduled 830 cars in Detroit and 575 in South Bend. "And the best of it is they are all being sold," said A. J. Chanter.

Buick Motor Co. at Flint, which had been employing about 12,000 men on a three-day a week basis, to-day started a schedule of 5½ days a week. This will mean that Buick in April will almost double its production. Buick was building about 200 cars a day in February and March, and indications are that the April schedules will run between 350 and 400.

Operations in the Hudson plant were resumed to-day upon a 100 per cent basis. The company has been operating with a curtailed force on a reduced working schedule for several months.

Federal Truck on Increase

Federal Motor Truck Co. is another Detroit factory that has made a remarkable jump in production in the last few days. A full time operating schedule was announced Saturday by M. L. Pulcher, vice-president and general manager, who said the plant beginning today would be on a 50 per cent basis.

Durant Takes Over Long Island Plant

Former Ford Assembly Factory to Supply Eastern States and Export Trade

NEW YORK, March 28—Production of the new Durant car which will be put on the market about August 1, will begin in the eight story factory building of the Goodyear Tire & Rubber Co. in Long Island City which has been purchased by the Durant Motor Co. of New York for $2,000,000. Preliminary operations already have been begun and the first cars will be under test in a few days.

The first real estate acquired by W. C. Durant for his new venture was erected by the Ford Motor Co. for an assembling plant but later was sold to Goodyear. It is located at Jackson Avenue and Honeywell Street. The structure has a floor area of approximately 500,000 sq. ft., is of reinforced concrete and steel construction, and is located on the Long Island Railroad. Not all the space will be required by Durant for some time to come.

The main plant of Durant Motors, Inc., will be located in Flint, Mich., but negotiations for its construction still are pending and considerable time must elapse before a factory can be established there. The Long Island City factory will be one of a chain of independent organizations to be located at strategic distribution points. It will be operated by the Durant Motor Co. of New York, a $3,000,000 corporation, and each assembling plant will be under the control of an individual company to be operated under contract with Durant Motors, Inc., which will supervise and direct the production.

When operations are fully under way it is expected 25,000 Durant cars a year will be assembled and shipped from the Long Island City plant, which will supply the New England and Atlantic Coast territory and the export trade.

Details of Car Not Available

No details are available as yet concerning the new Durant, but it will be largely an assembled product and will be made in two models, one of which will sell at something less than $1,000. It is being designed by the designers of the Chevrolet.

The capitalization of Durant Motors, Inc., the parent concern, is $5,000,000, consisting of 1,000,000 shares of no par value. The initial offering made in January amounted to 500,000 shares, which was immediately over-subscribed at a price around 12. The stock now is selling on the curb at 21.

Ford April Orders Approximate 90,000

Predicts Time for Full Operation Near—Financial Position Much Improved

DETROIT, March 28—Ford Motor Co. orders total approximately 80,000 for March delivery and 90,000 for April, according to figures furnished by Henry Ford personally, while on the trial trip of the Dearborn, his gasoline propelled railroad coach. That means, he said, that nearly every car and bit of finished stock on hand when the depression set in has been sold.

"The time is not far off," he declared, "when we will have to begin full operation to produce new cars and new parts to take care of the host of orders that come rolling in. Indications are manifest," he asserted, "that the bottom of business depression has been reached and passed, and the trend of industry is now definitely upward."

The annual report of the Ford Motor Co. for 1920, filed at Lansing, shows total assets of $384,554,941, as compared with total assets of $332,998,121 in the report for 1919. All of the outstanding stock in the company is shown held by the Ford family—Henry Ford, 95,321 shares; Edsel B. Ford, 71,911, and Clara J. Ford, wife of Henry Ford, 5413 shares. The amount outstanding totals $17,364,500 of $100,000,000 authorized.

Chief items shown on the balance compared as nearly as possible with similar items in the 1919 balance sheet, are as follows:

CHIEF ITEMS OF BALANCE SHEET

	1920	1919
Real estate	$50,861,000	$54,975,541
Cash in banks....	13,557,244	156,011,984
Credits owning corporation	54,438,633	
Merchandise, equipment, &c...	124,350,295	100,612,925
Goodwill	21,262,833	......
Investments	20,084,033	20,903,512

Large sales of cars in the past few weeks have put the company on a much sounder footing than the annual report might indicate. The position now is considered so good by officials at the factory that they think it quite probable no bank loans will be required at present. This possibility was indicated in AUTOMOTIVE INDUSTRIES in the report of negotiations between Ford and New York financial interests.

It is also declared to be likely that when the $35,000,000 in Federal taxes and outstanding bank loans become due May 1 the company will be in a position to meet the demands in cash. In the event that recourse has to be made to bankers, Mr. Ford has been assured that ample funds may be had. Recent short extensions granted by New York and Detroit bankers are said, however, to be the last for some time.

Ford to Make Plate Glass

ROCKFORD, MICH., March 26—Henry Ford's new factory here will begin the manufacture of plate glass within a few weeks. Equipment is on its way from the Highland Park plant, where it was made, and engineers are preparing to set it up quickly.

Chemists recently made a survey of the silica deposits in the vicinity and reported them particularly suitable for making glass for Ford cars.

Mr. Ford's engineers say they have a new method of making plate glass which is cheaper than ever before known.

Ford Irish Plant Closed

CORK, March 28—Fifteen hundred workers have been made idle through the closing of the Ford Tractor Works here. It was stated that the plant might be shut down for several months.

Ford Railroad Coach Damaged in Accident

SPRINGFIELD, OHIO, March 26.—Henry Ford, owner of the Detroit, Toledo & Ironton railroad, had visions of a high speed inspection trip over the road this week, but was disappointed owing to an accident to his new gasoline propelled railroad coach which was derailed at Quincy, north of here. The trial trip of the coach known as the Dearborn, was made Wednesday out of Detroit.

The new coach, which is equipped with a high power engine, was going at a mile-a-minute clip when it had to be stopped near Jackson Center. As it was approaching the Big Four railroad crossing at Quincy the brake on the Dearborn failed to work and the car went through the derail, but Ford and party including his son Edsel Ford, escaped injury. The car was pulled back on the tracks and the journey southward was resumed under difficulties.

On Thursday the Dearborn met the party at Kingman and continued the inspection trip south. At Jeffersonville more engine trouble was experienced and the party secured automobiles and returned to Springfield. On Friday the party started for Detroit, the coach being hooked on behind a steam locomotive. It is expected that Ford will make another test of the car as soon as the engine is put in condition again.

It has a seating capacity of 50 and resembles a street car.

Ford Plant Increases Tractor Production

DETROIT, March 28—Tractor production at the River Rouge plant of the Ford Motor Co. is now progressing at the rate of 150 machines daily. A rate of 100 daily had been continued to March 1 when this was stepped-up to the present figure. Officials say tractor demand is increasing largely and shipments have been made to New York, Pennsylvania, Massachusetts, District of Columbia, North Carolina, Indiana and Wisconsin. Michigan is taking hundreds of tractors, all of which are being driven away from the factory.

N. A. C. C. Committee to Work with Hoover

Accepts Suggestions to Form Part of Advisory Board—Will Study Markets

WASHINGTON, March 28—Herbert Hoover, Secretary of Commerce, has announced that automobile manufacturers will be the first to co-operate with his department in obtaining accurate statistics of production, consumption, exports and other details. He has taken up with J. Walter Drake, chairman of the foreign trade committee of the National Automobile Chamber of Commerce, the question of appointing a small committee to represent the industry in its relations with the Department of Commerce. The suggestion will be accepted and a committee will be named in a short time. This committee will form a part of Hoover's advisory board, which will consist of representative business and industrial leaders. The work of this board will be supplemented by that of service committees from the trade associations.

One of the plans proposed by Hoover is a survey of world markets to ascertain the best fields for commodities available for exportation from this country. He believes that a scientific survey of world markets is one of the pressing trade needs of the country. The first survey will include foreign markets with respect to automobiles, cotton and cotton products and a few other commodities. Government commercial officials abroad will be requested to report all available data as to the trade possibilities for particular commodities in the principal foreign markets.

It is the intention of Secretary Hoover to obtain full information direct from producers and distributors as to production costs, credits, financial standing, trade routes, markets, transportation, surpluses here and abroad, dumping and other important subjects. Whatever legislation may be required to assist in the promotion of trade will be recommended to the Congress by Secretary Hoover after he has studied the problem thoroughly.

Export Interest Keen

Automobile exporters have evinced a lively interest in the efforts of the Department of Commerce and the Federal Reserve Board to lessen the damaging effects of cancellations. Complaints have been received by the Department of Commerce of cancellations which put American manufacturers in a delicate financial condition. The Federal Reserve Board believes that uniformity in foreign trade and foreign banking practice is essential to minimize the possible scope of cancellation of orders and in order to fix more definitely the responsibility of banking institutions which have opened confirmed credits. It is stated that advantages would accrue through emphasizing the binding force inherent in commercial letters of credit.

Tractor Factories Increase Production

Minneapolis Finds Business Far in Excess of Expectations Earlier in Year

MINNEAPOLIS, March 26—As a part of an enlarged program for the manufacture of tractors, the Minneapolis Steel & Machinery Co. will reopen its foundry early next week, it is announced by George M. Gillette, president. One hundred to 200 additional men will be employed, this number to be increased gradually.

"We have an order for every tractor we have made," said Gillette. "Our people feel that the business situation is greatly improved. Trade is far beyond the expectations of sixty days ago."

Demand for tractors for spring farm work is good in sections where the crops matured early last year and where the growers had the opportunity of selling before the slump in the price of farm products came, Gillette said.

This company recently made a shipment of tractors to Venezuela and Czecho-Slovakia, but, according to Gillette, no great improvement in the export business is anticipated until rates of foreign exchange become more normal.

Other tractor firms in Minneapolis report good business.

The Shaw Enocks Tractor Co. is operating its plant on a twenty-four hour basis, turning out tractors for road maintenance work. Many of these machines are being sold direct to county commissioners.

Reports received from dealers indicate that there will be a marked improvement in the demand for tractors after the first of the month, according to R. C. Brewsaugh, sales manager of the Toro Motor Co.

Plenty of Farm Funds, Says Wisconsin Banker

JANESVILLE, WIS., March 28.—Formal announcement of a 20 per cent reduction in the price of the Samson Model M tractor, and 10 per cent in all power plows and harrows was made at a big Farmers' Day demonstration at the works of the Samson Tractor Co., division of General Motors, in Janesville, Wis. More than 5000 people, mostly farmers, were present. President James A. Craig, in announcing the reductions, which make the list price of the tractor $995 instead of $1250, said:

"The cost of production does not justify these reductions, but they are effected to meet the popular sentiment among farmers and dealers to help bring conditions back to normal as rapidly as possible. During the day there were talks by bankers and business men. F. H. Jackman, president of the Rock County National Bank of Janesville, said: "There has been a lot of loose talk about Janesville banks not lending money to farmers. I do not know of a single instance of a farmer in need of money being refused reasonable money credits.

"Any substantial farmer who needs money to buy tractors, implements or motor cars can get it at Janesville banks. There never have been any regulations put on the lending of money to farmers. We realize that banks are dependent upon farmers as well as business men and so much so to the former that we never have been inclined to discriminate against them."

Southeastern Towns Show Steady Gains

ATLANTA, March 26.—The automotive industry continues its gradual but steady improvement throughout the Southeast, especially among the dealers in the smaller towns who, for the first time in some months, are beginning to report something substantial in the way of sales. Since the first of March a number of Southeastern newspapers have published Associated Press dispatches emanating from some of the smaller towns in Alabama, Georgia and Tennessee, the gist of which indicate that the automobile business in the small towns has taken on a brighter tone, that real sales are being made and that there is a much better feeling among the small dealers as regards the outlook for the future.

Distributors in Atlanta report a substantial increase in the volume of business during March as compared with the two previous months, with the promise that April and May will see the industry in this section more nearly normal than it has been since the period of depression first made its presence felt last fall.

HART-PARR GIVES BONUSES

CHARLES CITY, IOWA, March 29—The Hart-Parr Co., manufacturers of tractors, distributed to its employees who were eligible under their continuity-of-service participation plan for 1920, checks for their share of the 1920 business of the factory at a banquet given Friday evening. The bonus plan applies only to employees who have been in continuous service for a period of two years prior to 1920. Checks were given to individuals ranging from $10 to $500 each according to the length of period of continuous service with the company.

TO FORM REVERE COMMITTEE

FORT WAYNE, IND., March 28—An abandonment of the bond sale plan for the saving of the Revere Motor Car Corp. of Logansport has been announced by the board of directors. A committee will be selected to draft a reorganization plan, it is said. Attorney M. L. Fansler, of the company, said that at least one member of the committee will be a resident of Logansport, another will probably represent the Chicago interests, another the southern Indiana interests and another the eastern stockholders.

First Akron Plant Starts Three Shifts

American Rubber Begins Maximum Production—Other Factories Ready for Increases

AKRON, March 25—The fact that the American Rubber & Tire Co. has gone to maximum production with three eight hour shifts at work in the plant, is taken here as an indication that the dealers have begun to feel the shortage of tires predicted during the last month. The company is working the maximum number of men and is producing 600 tires a day. Practically all the orders which have occasioned the increased production have come from the dealers. H. L. Houk, general manager, said in a statement to-day:

"We do not care to say that we will continue on this basis indefinitely. We are proceeding with cautious optimism. We will if business continues as at present. We made no strenuous fall efforts to sell tires for spring delivery, and as a result our dealers are badly in need of tires."

Other companies are known to be making plans to increase production, and announcements are expected daily. Many of the companies have received large orders from the automobile manufacturers who are resuming production.

Oshkosh Truck Reports $4,000,000 Rush Order

OSHKOSH, WIS., March 28.—A contract involving approximately $4,000,000 worth of quadruple drive motor trucks has been closed by the Oshkosh Motor Truck Co., and will be put into production immediately, according to official notice given stockholders. The company recently completed a new plant costing about $250,000 and the contract will require a capacity of four trucks a day for twelve months.

This output will go to a large distributor, the name being withheld for the present because of a reorganization now being effected. It calls for both commercial vehicles and special fire fighting apparatus. The Oshkosh company intends to start work on a second unit, 50 x 200 ft., which was to have been erected last fall but was postponed because of conditions in building construction as well as the general situation in the motor truck industry.

HARVESTER PLANT BUSY

SPRINGFIELD, OHIO, March 26—The busiest place in Springfield is the Springfield works of the International Harvester Co. It is now turning out 50 high speed motor trucks per day. These are being shipped about as fast as they are manufactured. The men identified with the works state that there is a general demand for the motor truck. About 1000 men are employed at the local plant.

Minnesota Licenses Based on Car Price

Decreases Allowed Under New Bill for Cars Three Years in Service

MINNEAPOLIS, March 26 — The Child's motor tax bill fixing automobile license fees in Minnesota under the Babcock good roads amendment has been passed by the lower branch of the Legislature without a dissenting vote and indications point to its acceptance by the Senate next week. The bill provides a tax within the average of $18, as promised by the proponents of the amendment at the last elections.

According to the measure, the tax for passenger cars is fixed at 1.8 per cent of the factory price and for trucks at 2 per cent. The minimum tax on passenger cars under 2000 lb. is $12 and over 2000 lb. $15. The minimum on trucks is $15, with an increasing scale for heavier vehicles. Decreasing fees based on percentages of the original price are provided for cars after three and five years' service.

These license fees are in lieu of the present tax and the personal property tax.

Based on figures compiled by a subcommittee, the bill will yield $4,939,344 from passenger car licenses, $600,000 from trucks, about $500,000 from chauffeurs' licenses at $2 each, and an undetermined amount from trailers, motorcycles, bicycles and other vehicles.

The tax was computed to raise $3,000,000 for maintenance and $2,840,000 to meet Federal aid for road construction.

BAY STATE PROTESTS NEW FEES

BOSTON, March 26—For nearly seven hours this week the Joint Committee on Ways and Means at the State House listened to arguments for and against a proposal to increase the State fees for motor vehicles, as proposed in a bill submitted by the Department of Public Works.

Chairman Cole of the Department of Public Works, spoke nearly two hours, giving an exhaustive analysis of the problems of his department and of the costs of building highways and their maintenance.

Showing that the industrial life of the State depends upon transportation, he said that the railroads have lost the short haul work, which has been taken over by the trucks and that hereafter the railways must depend upon long hauls.

KILL CAR COMPENSATION BILL

ALBANY, March 26—The Assembly Committee on Labor and Industry to-day returned an adverse report on the Stitt motor vehicle compensation bill which provides for compensation for personal injuries or death from the operation of motor vehicles and for obtaining payment as a condition precedent to registration of motor vehicles.

FINANCIERS DECLARE CARS HAVE MADE GOOD

NEW YORK, March 28—The current issue of The Financier, a magazine going to several thousand bankers, contains a long article under the title, "Rural Bankers Find Cars Are Business Builders." It states that thrifty country bankers are enthusiastic motorists because by their use of automobiles they can save much valuable time. The article also quotes prominent New York bankers who have declared the automotive industry has made good. The list includes J. P. Morgan, George E. Roberts of the National City, A. Barton Hepburn of the Chase National and Francis H. Sisson of the Guaranty Trust.

New Orleans Finds Keen March Demand

(*Continued from page* 724)

The attitude of the banks toward automobile paper—though possibly not toward automobile credits—has become more free. That is to say, it is easier for the salaried man in good standing in a community to obtain the backing of his bank in the purchase of an automobile than it was three months ago, but it is just as hard for the dealer or distributer to get a large amount of credit to handle a number of automobiles as it ever has been.

The reason for this is not just clear, but it appears to be that the banks are treating the automobile dealers on a strictly business basis rather than as a sort of gambling prospect, as they were treated up to about a year ago. This very action by the banks seems to have created a healthier condition among the dealers themselves. Buying an automobile nowadays in the country tributary to New Orleans is much like buying a piece of valuable real estate, or a housefull of furniture, in that the dealer is 100 per cent more careful.

Payments Made in Shorter Time

This means that more passenger cars are being paid for in shorter time, and more promptly than ever before, since the dealer—unless he be of long standing and full of capital—has to have money of his own with which to get his cars out of the railroad terminals. Consequently, he calls on the individual buyer, not only for money down but for larger and more prompt payments.

The new Foreign Trading Corp., the bank formed under the Edge Act recently, to aid shipments of Mississippi Valley manufacturers to foreign ports, is extending assistance to automobile shipments with about the same freedom as to cotton and to other manufactured goods, so that considerable shipments of cars are going foward, especially to Latin-American importers.

Underwriters Drop Fixed Value Risks

Fire and Theft Losses in Future to Be Adjusted on Value When Lost

NEW YORK, March 28—The National Automobile Underwriters' Conference has unanimously passed a motion to abandon the valued policy for fire and theft risks. The measure takes effect May 1.

The value policy is one in which the amount of insurance is specifically named instead of depending on an adjustment to determine the actual value of the automobile at the time of loss. During the recent decline in values insurance companies found themselves carrying insurance far in excess of market values. This is a dangerous situation, as it makes the companies most tempting "customers." Statistical analysis attributes much of last year's heavy losses to this evil.

On the ground that tires, motor meters and spare parts are also poor moral risks and that insurance losses are suffering from the multiplicity of claims they involve, many companies will not include them in the policy. The conference declined to make this compulsory.

The National Automobile Underwriters' Conference has decided to continue writing full coverage on automobile collision insurance. The majority of the fire insurance companies disapproved making the deductible clause compulsory, but recognized that rates would have to be increased for full coverage, and instructed the rate and statistical committee of the conference to determine the proper rate revision upward.

Tampico Oil Fields Offer Big Tire Market

TAMPICO, MEXICO, March 28.—According to George N. Anderson, sales manager for the Goodyear Tire & Rubber Co. for the northern district of Mexico, no area of corresponding size in the world offers a better market for automobile tires and accessories than Tampico and the adjacent oil fields.

"In the Tampico district," said Anderson, "there is an enormous demand for tires. This comes from the fact that here as nowhere else is time considered as of such great importance, and from the further facts that roads are bad, shelter not to be had, and drivers reckless.

"But there is strong evidence of a tendency toward economy in the use of automobiles. Buyers are talking quality now as never before and accessories, particularly tire savers—patches, boots, etc.—are being used more than ever before. The conditions in the automobile trade are becoming much more normal."

There are more motor trucks employed in the Tampico district than in all the rest of the Republic of Mexico.

British Cut Prices Despite Guarantees

Vauxhall and Rover Choose Refunding Money to Losing New Car Sales

LONDON, March 20—(*Special Correspondence*)—While no general landslide is occurring in the prices of British cars, notifications of reductions are occasionally being issued. One of the biggest drops recently announced is that of Vauxhall cars, the decreases range from £250 (say $1,200) in the case of the 25 hp. chassis (£1050 to £800) to £375—approximately $1800—for the 30-98 hp. open four passenger. These drops have come on top of the Vauxhall reductions in October last, which were of only slightly smaller amounts.

Rover has knocked nearly $200 off the price of the 8 hp. air-cooled light car (approximately $1500 to $1300); Arrol Johnston and Vulcan have reduced their five passenger car prices $120 and $370 respectively—these are 15 hp. and 20 hp. cars, the A. J. now selling at $3500 and the Vulcan $3370.

Vauxhall and Rover were two of the firms to adopt the price refund guarantee scheme. Rover is continuing it on the lower figure, but Vauxhall has decided to give no guarantee from now on. Both apparently felt quite safe a couple of months back in offering to refund to purchasers meanwhile the amount of any reduction made before June 30th next; but circumstances have been too strong for them, and they have been faced with the choice of two evils—either refunding to purchasers who have bought under the guarantee or losing the sale of many new cars during the rest of 1921.

Obviously the reimbursing of part of the cash already received is not going to ease the financial stringency which so many firms in all industries are still experiencing.

Belgian Shop Seizure Meets Quick Action

PARIS, March 18—(*Special Correspondence*)—Refusing to work with an ex-soldier who was not a member of their labor union, the workmen at the Metallurgique automobile factory at Marchienne-le-Pont, Belgium, took possession of these works and turned out the entire technical staff, the office employees, and the caretaker.

The occupation was short lived, for threatened with a new law which punished by prison any attempt to interfere with the liberty of labor, the men undertook to negotiate. The result was a complete climb down on the part of the workers, who recognized their mistake in refusing to work with a non-union man and the illegality of the seizure of the shops. In consequence the men abandoned the shops without any guarantee as to the future policy of the directors and work was resumed twenty-four hours later.

FIJIANS QUIT EATING TO TAKE UP SPEEDING

AKRON, March 26—Shades of the Polynesian aborigines!

The heathen Fiji Islander has given up his time honored sport of eating missionaries, and has gone in for automobiling.

Figures obtained by one large Akron tire company show that about 150 automobiles now are operating in the Fiji Islands, whose inhabitants for decades have been classed with the "wild man of Borneo" and the bushman of Tasmania.

The Fiji Islanders show a preference for American cars and American tires. A Goodyear dealer who had courage enough to penetrate the Fiji Island jungles, and to establish an office at Suva, the capital city of the Islands, has just been rewarded by orders from the native islanders for 500 tires and 1000 tubes.

Business Methods Hurt American Goods in India

NEW YORK, March 28.—The practice of changing agencies without sufficient provocation has been detrimental to the good-will of American automotive companies doing business in India, is the opinion of Innes Randolph, who is in charge of Far Eastern affairs for the General Motors Acceptance Corp. The Indian dealer in American automobiles feels, Randolph says, that he simply is being used and that as soon as the manufacturer can make a more advantageous connection he will be thrown aside. He cites an instance of one company which took an agency away from a man who handled its car for 10 years and gave it to another man who agreed to take a larger quota of vehicles.

Randolph's investigation has convinced him that India does business with the United States not because it likes Americans but because it likes our products. As soon as some other nation comes into the field with equally good products at a similar price, America will lose its business in India. Indians do not like American business methods.

ALUMINUM TARIFF OPPOSED

WASHINGTON, March 28—When the work of framing tariff legislation begins at the extra session of Congress, a spirited fight will be made by automobile manufacturers and other industries against the proposal to increase the tariff on aluminum. The entire supply in this country is controlled by the Aluminum Co. of America which has made enormous profits in the last seven years. Manufacturers feel that if aluminum is not placed on the free list the present tariff of 2 cents a pound should be left undisturbed instead of being raised to 7 cents as the company is urging.

Dealers in China Form Association

Will Boost Industry Through Organization—To Hold Show and Foster Roads

SHANGHAI, CHINA, Feb. 18—(By Mail)—A dealers' association, embracing all of the motor interests of the Central China territory, has been organized in this city and will begin operations within a short time. The association is now in a tentative form but will be placed on a firm basis by spring. Among the proposals which are to be taken up is that of an annual motor show.

A separate company is being formed to finance the show and stock is being taken by all of the principal distributors of Shanghai. A representative is being sent to the United States to interview the manufacturers represented in this field and to obtain their assistance in the way of exhibits and advice. The show will probably be held in October and will be the first of its kind in the Orient, with the exception of small exhibits in India and the Straits Settlements.

The good roads movement will also be fostered by the new association, and it is probable that its formation will lead to similar organizations in the North and South China territories, and the linking of the three into an organization that will embrace all of the motor interests in the nation.

Wolseley Production on 175 Weekly Basis

LONDON, March 11—(*Special Correspondence*)—The Wolseley Co. of Birmingham is now producing at the rate of 175 cars weekly on a 47 hour week, with 7000 to 8000 men employed, according to a statement given out at the Adderley Park works of the company this week. The company expects to reach a 250 weekly output when it will institute the conveyor system of assembling the chassis.

The molders' strike imposed a loss of about $5,000,000 in production, the company declared, to the corresponding advantage of importers of cars. The management made it clear that it was not out for mass production and that there is no margin for reducing prices.

TRACTOR MARKET IN INDIA

OTTAWA, ONT., March 26—H. R. Poussette, director, Commercial Intelligence Service, says that a market exists in India for farm tractors. According to his report to the Trade and Commerce Dept., Ottawa, the Director of Agriculture of the Madras Presidency is also very sanguine as to the future of tractor plowing. Demonstrations are necessary to convince the agricultural population of the very great advantages to be secured from this method while the extra profits are the strong dealer point.

Imports to Dwindle Under New Tariffs

Application of American Valuations to Foreign Cars Expected to Reduce Market

WASHINGTON, March 28—Imports of automotive products which have increased of late are expected to dwindle when Congress enacts amendments to the Customs Administrative Act, effecting the transfer of the basis for the estimation of ad valorem duties from foreign to American wholesale market value. This change would automatically increase the price of foreign cars on American markets.

Judge Marion De Vries, of the United States Court of Custom Appeals, has been consulted by the House Committee on Ways and Means as to the proposed amendment. He has recommended the adoption of the language of the existing law in every possible detail, adding only where absolutely necessary, changed words to effect the new purpose, and thus avoid any possible uncertainty as to the new phrases.

Upon the insertion of the words United States alone, the basis of valuation is made the American valuation unqualifiedly and without any deduction. He further suggests that the actual duties levied upon the imported goods should be deducted after the American market value is properly determined. Otherwise, importers would be paying duties on duties so that it would approach an embargo.

The American valuations would be calculated on the wholesale market value of such merchandise in the principal markets of this country. The value at the port of importation or entry is not the dutiable value. The importer would be required to pay duty on the American valuation taken at the time of exportation to the United States. In the case of automobiles the customs officials would have to take into consideration the prices on markets throughout the country, noting the differences in quality, make and value. The details as to application will be determined by the Committees shortly.

Truck Manufacturers Look for Better Sales

NEW YORK, March 28.—Twenty-four truck manufacturers whose production has just been checked up are making an average of 33⅓ per cent of their normal output, as compared with 16⅔ during the period when production was at its lowest ebb. The latter period in some cases dated back as far as August, and in others began in December, but the average low month for these manufacturers was December.

Most of these manufacturers expect the next step upward in production to be made in April, and while a good many state frankly that they don't know how greatly production will be increased, several expect to reach 50 per cent of normal and a few 75 per cent. The average forecast of these manufacturers for the latter part of 1921 is a production of between 50 per cent and 75 per cent of monthly averages early last year. All of these manufacturers report encouraging indications from the retail field of a decided improvement within 60 days.

Car Production Brings Increased Tire Business

AKRON, March 29—The Goodyear Tire & Rubber Co. announced to-day plans to materially increase production early in April with the re-employment of at least 1200 men. The opening up of automobile factories and the general increase in orders from all parts of the country have stimulated both original equipment business and sales direct to consumers, necessitating larger production.

Under present plans, Goodyear will go to basis of 16,000 casings and 16,000 tubes daily, as compared to present production of 12,000 casings and 13,000 tubes. They will continue the five day week for the time being, but hope soon to go to five and one-half days, with possibly two eight-hour shifts.

The increase in production, amounting to about 33 per cent, is brought about by a 70 per cent increase in April orders over March orders for original tire equipment of automobile manufacturers. Notices are being sent to former employees to return to work early in April. The company will rehire only former employees.

The meeting of Goodyear stockholders called for to-morrow to act on the reorganization plan has been postponed until April 6.

WESTCOTT ON FULL TIME

SPRINGFIELD, OHIO, March 28—"April promises to be the best month since last July," said General Manager H. G. Root of the Westcott Motor Car Co. "Dealers in some parts of the United States report a steady demand for cars. This is especially true in Chicago. The East is also showing a revival in business and the outlook is encouraging. In the Far West it is not so good." All departments of the Westcott plant went on full time to-day. Some of the departments so far have been running about four days a week. While all departments started full time, only about 75 per cent of the normal force is at work.

LUCIEN PERISSÉ DIES

PARIS, March 10—(*Special Correspondence*)—Lucien Perissé, vice-president of the Technical Commission of the Automobile Club of France, died here to-day at the age of 53. Perissé was a leading figure in French automobile technical circles, and in addition to his work at the technical commission was secretary of the Syndicate of Automobile Transportation.

French Exports Gain 854 Per Cent in Year

Great Britain, Spain and Belgium Best Customers—American Gain 600 Per Cent

PARIS, March 18 (*Special Correspondence*)—French automobile exports for the year 1920 show an increase of 854 per cent compared with the preceding year, the total figures being 124,509,000 francs for 1919 and 1,187,972,000 for 1920. The greatest volume of business has been done with England for a total of 265,599,000 francs, Spain coming second with nearly 219 million francs' worth of automobiles, and Belgium a very close third. French automobile exports to the United States have jumped from 2,187,000 francs in 1919 to 15,705,000 in 1920.

French automobile imports have decreased 45 per cent during the year, dropping from 383 million francs in 1919 to 211 millions last year. The following table gives the details of French exports to the leading countries, the values being in francs:

FRENCH AUTOMOBILE EXPORTS IN 1920

	Frs.
Great Britain	265,599,000
Germany	10,361,000
Belgium	217,361,000
Switzerland	36,533,000
United States	15,705,000
Argentine	17,313,000
Italy	22,649,000
Spain	218,949,000
Brazil	10,955,000
Other Countries	138,475,000
French Colonies	234,072,000
Total	1,187,972,000

City Business Best in Missouri District

KANSAS CITY, March 28—Motor car dealers in small country towns and larger cities inland from distributing centers, can get inspiration from a condition in merchandising other commodities, revealed this spring.

It is said that volume of business of country merchants, especially those in cities of the interior, has increased more rapidly in February and March, than the business of merchants in the "distributing centers."

So far, to the end of March, the reverse has been the case in the motor car business. The Kansas City dealers, it is reported, have had better retail trade than have the dealers of interior towns. The natural query is whether the country dealers have been asleep and have missed an opportunity that dry goods and clothing merchants have grasped?

Analysis of developments in general merchandise lines tends to show that the public in smaller cities and rural communities have patronized more largely than last year the stores which have built up local prestige and have apparently spent almost as much money as a year ago.

Rumanians Bring Cars to U. S. Free

Branch Bank Here Gets Army Trucks

Buys American Made Vehicles from British in France—Come in Duty Free

(*By Cable to* AUTOMOTIVE INDUSTRIES)

PARIS, March 28.—The British army's automobile park at Abbeville, comprising 1000 trucks and passenger cars, has been purchased by the Banca Marmorosch Blank & Co. A majority of the vehicles are of British make, but in the lot are 350 trucks of American manufacture, including Peerless, F. W. D., Locomobile, Pierce-Arrow, Packard and Riker as well as a considerable number of Studebaker and Cadillac passenger cars.

The bank will ship most of the American vehicles to the United States for sale there. The first lot already has left. The sale will be handled through the New York branch of the bank.

Banker "Not Interested"

NEW YORK, March 29—The Banca Marmorosch Blank & Co. occupies ornate quarters on the first and second floor of the new building at 31-33 Broadway. The bank, controlled by Rumanians and representing the Rumanian government in financial transactions, has obtained permission from the New York State banking commissioner to do business in this State. Its headquarters are in Paris, but it has important branches at Constantinople, Saloniki, Avlona, and many of the important towns in the Balkan states.

The manager of the New York branch is Dr. Zeltner. When asked to-day by AUTOMOTIVE INDUSTRIES for a statement regarding his plans for disposing of the American made motor vehicles which are being brought into this country duty free, he had much difficulty comprehending the purpose of the information, and stood pat on the statement that he was "not interested."

It was claimed, however, that the first lot consists entirely of trucks and that they will be sold through the United States Truck Sales Corp.

N. A. D. A. Roused to Action

ST. LOUIS, March 29—Resolutions adopted by the directors of the National Automobile Dealers Association protesting against the reimportation of American made motor vehicles duty free, from France and England to be sold at low prices in competition with American dealers, have been forwarded to all the State associations of the N. A. D. A. to be discussed and acted upon by them. When the State associations have gone on record on the subject, United States Senators and representatives will be informed of the position taken.

Attention of the Iowa Automobile Dealers Association has been called by Moock to a recent statement by Representative James W. Good of Cedar Rapids, chairman of the House Appropriations Committee, in which he declared practically all the passenger carrying automobiles in the United States are luxuries and should be taxed accordingly. Good asserts that a horsepower tax should be imposed on automobiles to bring in revenue of $200,000,000 a year.

M. A. M. A. FINDS TRADE STEADILY IMPROVING

NEW YORK, MARCH 31—Optimism with a capital O has been radiated at the last group meetings of the Credit Dpartment of the Motor and Accessory Manufacturers Association. These are some of the rock bottom facts brought out by the reports of members:

Business in March has been better than January and February combined. Orders already received make it certain that April will exceed March and that May will be at least equal to this month.

Collections are quite a bit better than they have been. Motor vehicle manufacturers who have given notes are whittling them down with greater rapidity.

There has been a substantial number of releases on old orders and some new orders.

A considerable number of passenger car manufacturers are operating at 50 per cent of capacity or better.

Several parts manufacturers now are operating at above 50 per cent of capacity, but the majority of plants are running about 25 per cent.

All the parts manufacturers are agreed that motor car prices must come down before there can be any more stimulation of business.

Nearly all parts manufacturers have reduced wages but are getting greater efficiency. A few have cut the salaries of office employees.

It was reported that factories operating at more than 75 per cent of their capacity include Franklin, Cadillac, Reo, Nash, Studebaker, Ford, Autocar, Velie and International. Oldsmobile and Grant are rapidly getting into this class.

Plan Special Clause on Rebuilt Trucks

Congressional Leaders Recognize Importance of Protecting Home Market from Flooding

WASHINGTON, March 30—It seems quite likely that the House Committee on Ways and Means will insert a clause in the proposed anti-dumping law which will effectively block English and French exporters from selling rebuilt trucks and cars of American manufacture on local markets at prices below production costs. Senator Penrose, chairman of the Senate Finance Committee, advised AUTOMOTIVE INDUSTRIES to-day that ample protection would be given domestic producers from all forms of foreign competition in this bill which must originate in the House.

The Congressional Draft Bureau, a new organization created to assist the various committees in preparation of legislative measures, has not taken up the anti-dumping bill yet. The committees will frame the bill when it has disposed of the emergency tariff and American valuations amendments. It is believed that representatives of automotive organizations will appear before the Senate and House committees before the bill is written in order to have their recommendations incorporated in the draft as it will be reported out to the Senate and House early in the session.

John E. Walker, chief of the Senate Draft Bureau, in an interview with AUTOMOTIVE INDUSTRIES declared that the question of reimportation had not been considered because of the pressure of other work. The agitation in behalf of this measure has found many willing advocates in the Senate and House. The fact that the Army sold this surplus equipment abroad at low prices in order to prevent an economic depression by dumping in this country is recognized as an important reason why foreign dealers should not be permitted to take advantage of present customs laws and sell at prices below labor costs here.

Will Ask Specific Proviso

There is some question as to the probability of proposed American valuations effecting the desired protection. It is argued, however, that customs officials would find it difficult to appraise these trucks on the new valuation basis which is reckoned from wholesale prices prevailing on principal American markets. Truck dealers insist that a proviso should be included in the anti-dumping bill which would cover this item specifically. The Treasury is expected to recommend certain paragraphs in the bill when the Ways and Means Committee asks for advice.

Parts Service Plan Starts Storm

Fight Threatened by Manufacturers

Truck Assemblers Declare They Will Not Tolerate Units Station System

DETROIT, MICH., March 30—Bitter opposition to the direct parts servicing plan proposed by prominent unit parts manufacturers and under which they propose eventually to cover the entire country with a chain of service stations, was displayed by members of a committee representing the Motor Truck Manufacturers Association, at a meeting here yesterday. The conference was called to discuss the plan and make recommendations to the association.

At the close of an all-day session at which several representative truck manufacturers were heard, a resolution was adopted to be presented at a meeting of the membership of the association to which parts makers and others interested will be invited. This meeting will be held April 12 at the Detroit Athletic Club.

The text of the resolution will not be made public until after it is presented at this meeting, but it can be stated that it expresses strong and unalterable opposition to the plan as being detrimental to the interests of the truck manufacturer, dealer and distributor as well as to the parts manufacturer.

The resolution was adopted by unanimous vote of the committee which was composed of B. A. Gramm, chairman; J. W. Stevenson of the Indiana Truck Corp.; M. Cook, general manager of the Service Motor Truck Co., and Otto Armleder, president of the O. Armleder Co.

Not the Function of Parts Maker

Recognizing the fundamental right of the owner to demand parts standardization, prompt service and reasonable costs, and admitting the present condition of the truck industry is due to woeful lack in that regard, members of the committee and other executives insisted it was not the function of the parts maker to attempt to remedy the existing evils but a duty up to the manufacturer.

Declaring their views represented the opinion of 90 per cent of the truck assemblers, members of the committee described the parts station plan as a "selfish and arrogant attempt" of the parts manufacturers to take advantage of conditions. They declared the plan, if permitted to operate, would strike at the very heart of their business in that it would put a premium on the curbstone dealer and the mushroom manufacturer and drive the legitimate manufacturer with heavy investment into bankruptcy.

The man who wanted a truck under such conditions, it was asserted, would simply go to the parts depot, secure the necessary units, purchase blueprints and build his own truck.

"That is our greatest objection," said one member of the committee. "The fact that 20 per cent of our profit comes from the parts and service end, which necessarily would be eliminated, is but a minor consideration."

Must Give Owners Service

Back of all the discussion, however, stalked the ghost of the owner demanding prompt, efficient and reasonable service coupled with the fact that more than 30 major parts depots now are functioning successfully. Committee members, while very willing to speak freely with regard to the action to be taken to check the progress of the plan, would not speak as official representatives of their organization. They declared it would be their plan to go to the parts manufacturers participating and demand that they renounce affiliation with the group participating, and in the event of refusal, simply to cancel contracts and cease to do business with that manufacturer.

It was even suggested unofficially that truck manufacturers go to the parts makers in a body and make the demand, holding out the threat of establishment of co-operative parts manufacturing concerns or diversion of their business to independent concerns now existing. No action was taken, however, on this proposal.

Parts makers interviewed after the meeting did not appear perturbed by the veiled threat. They take the position that the owner is the man who must be satisfied, and they declare that the owner is going to demand the standard parts now being marked in his car or truck. They assert that when a man contemplates a purchase, no matter how little he may know about the automobile or truck, the first thing he is going to ask is regarding the make of engine, axle clutch, transmission, etc., and that he is not going to buy the car or truck that is not built of standard and well known units.

Read Letters from Makers

Practically the entire day was spent in reading letters from truck mnaufacturers and assemblers. Committee members said the tenor of a great majority of the letters was the same—violent and unalterable opposition. The morning session was confined to committee members and truck executives, including M. L. Pulcher, vice-president of the Federal Motor Truck Co.; J. F. Bowman, sales manager of the Garford Motor Truck Co., and R. M. Reid, secretary of the Master Truck Corp.

Telephone messages were sent to parts

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Earl Chosen Head of Briscoe Motors

Former Willys-Overland Executive Succeeds H. F. Wardwell —To Push Production

JACKSON, MICH., March 30—Clarence A. Earl, former executive vice-president of the Willys-Overland Co., has been elected president and general manager of Briscoe Motors Corp. He will succeed H. F. Wardwell, who retires from the presidency to become a vice-president and member of the board of directors.

K. R. Jacoby, formerly vice-president in charge of purchases at the Willys-Overland, will also go to the Briscoe.

There have been persistent rumors for several weeks of impending changes in the Briscoe company. The plant recently closed for inventory following announcement of a largely increased production schedule and this aggravated the reports regarding its affairs. This was followed by a report that W. C. Durant had made an offer for the property. President Wardwell admitted the Durant report was correct but declared there was no possibility of a sale.

Earl was called to Chicago Monday by the financial interests back of the company and announcement of his election to the presidency was made yesterday. As executive vice-president of the Willys-Overland Co. he became widely known and is regarded as particularly strong as a production man. Earl left the Willys organization several months ago after a disagreement with Walter P. Chrysler and was succeeded by C. B. Wilson.

Earl said to-day the Briscoe company now was assured of ample financing and that production would be maintained at a pace to meet the increasing demand.

Fort Wayne Tire Files Petition in Bankruptcy

FORT WAYNE, IND., March 31—The Fort Wayne Tire & Rubber Co., which has had a very checkered career since its organization two years ago, has filed a petition in bankruptcy in the Federal court. According to the petition the concern's assets amount to $427,976.42 and its liabilities total $246,496. The assets consist principally of open accounts, tools and machinery and stock in trade.

The assets listed included ground and buildings valued at $59,095; stock in trade, $104,449.46; note receivable, $6,071, and machinery and equipment $172,881. Unsecured claims amount to $210,236.22.

Penrose Declares for Unit Hearings

Opposition Is Declared to Separate Presentation of Taxation by Organizations

WASHINGTON, March 30—Assurances have been given business interests of the country that improper taxes will be abolished and income taxes reduced all along the line to the collection point which is almost equivalent to relief legislation, according to Senator Penrose, chairman of the Senate Committee on Finance. He believes that this definite statement should be sufficient to inspire the business world into renewed activity and confidence in the future.

As the various organizations in the industry have expressed a desire to speak independently on tax proposals it is of importance to note that the chairman of the Senate Committee and other Congressional leaders are opposed to proposals of this kind. In an interview with AUTOMOTIVE INDUSTRIES to-day, Senator Penrose stated that the committees would insist on short hearings when internal revenue revision is considered. "I regard the individuals and associations demanding special hearings as enemies of their own interests," he said, "for they often insist on presenting their views on frivolous grounds and generally we find wide-spread duplication."

The Senator makes clear the need for few witnesses in the fact that the testimony taken by the Senate Committee will be used by the House Committee on Ways and Means in the formulation of tax schedules. The fact that the Senate conducts the tax hearings first and the acceptance of this testimony by the House is a new departure which is accepted by both bodies in the interest of expediency. The House Committee will call only such witnesses as are necessary to clear up points in the testimony adduced before the Senate Committee. Treasury tax experts will be called into executive sessions of these committees before the schedules are submitted to the House and Senate.

Revisions to be Non-Partisan

The tax revision will be carried out in a non-partisan spirit, Senator Penrose says, and therefore it should encounter but little delay when the committee reports are placed before Congress. Senator Penrose believes that the collection point on income taxes must not be prohibitive. He contends that the wheels of industry will be stopped when the amount of tax robs the taxpayer, who is an investor, of all initiative and enterprise.

The chairman holds that the Government will ultimately gain in tax reductions where it restores sufficient incentive to the taxpayer to invest in industry and other forms of development. An effort will be made to determine the collection point on various commodities on a plan similar to that used before the prohibition period, when the tax on whiskey was known almost to a mathematical point. Experts argued, and experience has proved, that the revenue decreased as the rates were increased.

Because of the expensive litigation which developed from the uncertainties as to the intent of Congress in framing fiscal legislation, Senator Penrose has announced the creation of a Congressional Draft Bureau which will determine the phraseology of all laws.

Associations Oppose Single Hearing Plan

NEW YORK, March 29—Announcement by Senator Penrose that each industry should present its taxation views to the Senate Financial Committee through a single spokesman instead of having a presentation by each branch of the industry, runs counter to the plans of the various automotive organizations. All these associations with the exception of the Motor & Accessory Manufacturers Association have adopted virtually the same platform. It calls for strict governmental economy, funding of the war debt and a general retail sales tax. The M. A. M. A. is in accord with these plans except that it favors a turn-over tax.

It has been proposed that the various tax committees present their arguments individually instead of through a spokesman for the whole industry. The National Automobile Chamber of Commerce would speak for the passenger car and truck manufacturers; the Rubber Association of America for the tire makers; the M. A. M. A. for the parts manufacturers, and the N. A. D. A. for the dealers and garage men. It is the contention that each in itself is a big industry and that each is entitled to sufficient time to present its program.

Information gathered to-day indicated that the associations would not recede from their determination to have individual hearings at Washington notwithstanding the attitude of Senator Penrose, and there was a disposition to take the position that they were entitled to adequate time to present their arguments in the most forceful way. It is probable a conference will be held soon of representatives of the national associations to determine upon a plan of action.

To Push Tax Resolution

The tax committee of the N. A. C. C. will submit to the Chamber of Commerce of the United States at its annual meeting at Atlantic City beginning April 27, a formal resolution in conformity with its own tax program which has already been submitted to Congress. The resolution will call upon Congress to reduce Governmental expenditures to a sane, normal standard at once; fund the cost of the war and repeal all special taxes growing out of the war including excess profits, surtaxes, transportation and excise taxes. The resolution will assert that if further revenue is necessary after the adoption of a "moderate, scientific-

(*Continued on page* 736)

February Exports Drop to 40 Per Cent

Passenger Cars Show Greatest Loss Compared with 1920 Shipments—Engines High

WASHINGTON, March 28—Automotive exports from the United States during February of this year were approximately 40 per cent in comparison with exports the same month a year ago. Including trucks, motorcycles, passenger cars, parts and engines, the exports for February this year totaled $10,400,168 in comparison with $26,186,399 for the same month of 1920.

These figures, announced to-day by the Bureau of Foreign and Domestic Commerce, are preliminary totals and do not show the detailed exports to the various countries. Consequently, it is not possible to determine what territories are chiefly responsible for the decline.

The export trade in all products from the United States showed a decided falling off for this month and the course of automotive trading apparently was in sympathy with that of the broader markets. However, February is the shortest month of the year and this naturally would bring about a lower total than in the preceding month of January. Furthermore, shipments would not be made in February to countries south of the equator, as they would arrive at their destination too late for the normal sales season, which is the reverse of that in the northern countries.

As was to be expected, the shipments of passenger cars showed the largest decline, the comparative values of the two months being $3,165,170 and $11,604,622. The slumping off of motor truck sales was much less, being $1,952,736 for February, 1921, and $4,161,494 for February, 1920. The shipments in parts and equipment, not including tires, were slightly more than 50 per cent.

The totals for engine shipments, which include automobile, marine, stationary and tractor gas engines, were $1,523,408 as against $2,291,507 for February of 1921, the exports in this category showing the smallest decline of any of the lines. The shipments of stationary gas engines were, in fact, of a slightly higher value for the month of this year than they were for last year.

The sales of gas tractor engines were about 66 per cent in comparison with last year, dropping from $1,247,431 to $827,694. This is the item which covers farm tractors. According to unofficial estimates of the Bureau, about 90 per cent of all the shipments coming under this head are tractors.

DEALER GETS BARLEY VERDICT

DETROIT, March 28—C. C. Stubbs, a Kansas City dealer, was awarded a verdict of $3,692.68 in the Federal Court for eastern Michigan against the Barley Motor Car Co. of Kalamazoo for cancellation of contract.

INDUSTRIAL NOTES

Hydraulic Steel Co. has been assigned the Frayer and Howard patent by the Phelps Mfg. Co., Columbus, for a consideration of approximately $50,000. The patent is for a wire wheel with spokes laced in the side ring grooves. The rims will be manufactured and marketed through the Cleveland Welding & Mfg. Co., a subsidiary.

Hercules Steel Casting Co., Milwaukee, which operates one of the largest exclusively electric steel foundries in this district, is increasing its capital stock from $300,000 to $400,000. The new issue, consisting of 7 per cent preferred stock, will be used to purchase additional land and equipment and to increase the working capital.

Lee Tire & Rubber Co. reports net sales for the first two months of the current year as about $1,500,000. This is about the same as sales for the corresponding period in 1920. The plant is now running at about 75 per cent of capacity.

Jefferson Rubber Co., Jefferson, Wis., has made its first deliveries of tires, and by April 15 or May 1 production is expected to be on a regular quantity basis. Orders on the books will require maximum capacity to July 1.

Connersville Foundry Corp., a subsidiary of the United States Automotive Corp.. which makes the Lexington car, is completing extensive additions to its already large plant.

Goodlin Automotive Equipment Co., South Bend, Ind., has been organized for wholesale distribution of automotive equipment. Operations will be started April 1.

Storm King Mfg. Co., Hartford, Wis., probably will relocate its plant and office in Winneconne as the result of negotiations with the Commercial Club.

Sidney B. Bowman Automobile Co. has been appointed New York distributer for Briscoe. In addition to Briscoe, Bowman handles Grant and Kissel.

Bonney Vise & Tool Works, Inc., has changed its name to the Bonney Forge & Tool Works.

Parenti Motors Corp., Buffalo, is planning the location of a branch factory in Atlanta.

Towmotor Co., Cleveland, has re-elected officers and directors.

FINANCIAL NOTES

Fisk Rubber Co. in its report for 1920 shows surplus earnings, following inventory adjustments and Federal taxes, of $2,130,133. After payment of preferred dividends, this was equal to $1.68 a share on the $15,494,000 common stock of $25 par value. In 1919 the company reported earnings of $3,994,657, equal to $5.99 a share on the $12,254,500 stock in that year. Net profits for the year were $5,034,950. The profit and loss surplus Dec. 31 was $7,789,085.

Timken-Detroit Axle Co. reports net profits for 1920 after reduction of inventories and Federal taxes of $712,509 and a total surplus of $17,820,062. Cash on hand was shown as $671,151 and inventories $10,932,521. The land, building and equipment account totaled $8,357,801, of which notes to banks were $3,000,000 and accounts payable $387,480.

Hupp Motor Car Corp., in a balance sheet as of Nov. 30, shows total assets of $16,119,-231, which includes cash of $281,542 and inventories of $5,232,145. This is an increase in assets of $1,351,424. The net assets applicable to common stock amounted to $7,296,472, or $14.05 a share of $10 common stock.

American Bosch Magneto Corp., in a balance sheet as of Dec. 31, shows total assets of $9,896,083 for 1920 as compared with $7,655,-044 for 1919. The cash balance at the end of the year was $332,596 as compared with $88,379 in 1919. Inventory totalled $4,344,727 as against $2,928,582 the year previous.

Gray & Davis for the seven months ended July 31, 1920, reports net loss of $463,109 and for the five months ended Dec. 31, 1920, a net loss of $4,998. This does not include depreciation of about $93,000 in the earlier period, which should have been charged.

H. H. Franklin Mfg. Co. reports net profits for the year ended Dec. 31 as $2,225,625 and net addition to surplus for the year of $696,515. Inventories Dec. 31 totaled $7,614,-696, compared with $11,100,000 in September last.

Times Square Automobile Supply Co. for the year ended Dec. 31, 1920, shows net sales of $5,456,953, which after deductions for cost of sales, Federal taxes, expenses, etc., leaves a net profit of $9,952.

Kelsey Wheel Co. reports gross sales of $25,200,913 for 1920 and net operating profits of $3,325,804. Net profits for the year after all charges were $1,916,008.

Handley-Knight Co. will float a $200,000 bond issue, which will be taken up by present stockholders and will not be offered to the general public.

Thomart Motor Co. reports the sale of $750,000 of the $1,000,000 stock of the first issue, sold between August, 1920, and March, 1921.

Moon Motor Car Co. has declared a regular quarterly dividend of 1¾ per cent on preferred stock outstanding, payable April 1.

F. B. Stearns Co. will pay the regular quarterly dividend of $1 a share on April 11.

Parts Service Plan Arouses Truck Makers

(*Continued from page* 733)

makers asking their attendance in the afternoon, but Fred Glover, general manager of the Timken-Detroit Axle Co., was the only one who responded. It was said G. W. Yeoman, general manager of Continental Motors, credited with evolving the parts servicing idea, was ill. Glover said after the meeting that his company was in a neutral position and would await the outcome of the meeting April 12 before making any statement regarding its position.

"If it is the best thing for the industry," he said, "then we will be in, but until there is something more of a unanimity of opinion we will remain neutral."

Glover voiced the sentiment of everyone present that the time has come when adequate service is demanded. Committee members, admitting the truth of the statement, declared it was a matter clearly within their province and expressed assurance that in future every truck manufacturer would see to it that every dealer and distributor gave the major portion of his attention and a big part of his investment to the parts and service end of his business, guaranteeing full protection to the ultimate consumer.

METAL MARKETS

WHILE the larger part of steel shipments going forward to automotive consumers continues to be on account of previously suspended and lately reinstated orders, a fresh buying movement, modest in scope but nevertheless evidence of a genuine demand, is beginning to crystallize. Especially gratifying is the representative number of automotive interests that are renewing their interest in the steel market. Much misinformation has been spread abroad with reference to prices applying to shipments on account of reinstated suspensions. In some quarters it is sought to create the impression as though all such shipments were being billed at last year's obsolete contract prices. In fact, however, reinstatements have been as much a matter of individual negotiation with reference to the price at which they are to be billed, as have been fresh orders of late. In all representative shipments of such reinstated orders the price was one resulting from a mutually agreeable compromise between seller and buyer. Stocks of automobile sheets in consumers' warehouses, which have been admittedly large, are beginning to shrink, and sheet makers are trying to ward off encumbrance of their order books by sacrifice commitments when a turn for the better might be just around the corner. This, at least, is the producer's point of view. He is not so eager for more business at prevailing price levels as he is for more business at prices that will be expressive of the better demand. Clear understanding of this frame of mind, in which sheet producers and, for that matter, steel producers generally are at this time, should help the automotive purchasing agent in planning his buying campaign. In the pig iron market automotive foundries, in spite of the fact that most of the buying is in carload and 100-ton lots, continue to play first fiddle, because of the lack of demand from most of the other iron consuming industries. The non-ferrous metal markets show a somewhat steadier tone, but absorption by consumers is still light.

Pig Iron—Better demand for foundry and malleable from Middle West automotive foundries is noted. Cleveland melters are turning out more castings than they have in weeks. Two automotive interests are inquiring for from 500 to 1000 tons each. Furnaces are rather reserved when it comes to accepting contracts for future deliveries at current prices, which are nominally $25 for both No. 2 foundry and malleable, valley basis.

Steel—Youngstown sheet mills will make no quotations except on individual specifications. This does not imply, however, that the market is higher than the previously quoted 4c. basis for No. 28 black. A small amount of business in No. 22 gage automobile body sheets is reported to have been done at 5.20c. Automotive demand for cold-rolled strip steel is steadily improving and sales at 5.85c. were reported.

Aluminum—The market remains dormant for the time being. There is, however, quite a little activity in Middle West aluminum foundries in the preparation of patterns, and a steady improvement in the demand for No. 12 alloy is looked for. Quotations are unaltered.

Copper—Chicago reports state that automotive buyers have resumed buying of radiator tubes and radiator brasses. The copper market shows a somewhat steadier undertone, sales of casting metal being reported at very close to the prevailing 12c. quotation in the "outside" electrolytic market.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, March 31—Last week was marked by noticeably easier money, and a more active stock market, with rising prices and one "million-share" day. The bond market, on the other hand, was still irregular with no pronounced trend. Call money ranged from 6 to 7 per cent, with a ruling rate of 6½ per cent, while "outside" money was said to be available at from 5 to 5½ per cent. There was little business done in the time money market, and rates were unchanged from the week before.

The Federal Reserve note circulation of the Federal Reserve System as a whole declined $32,151,000 last week, making a total reduction of $474,200,000 from the December high. Federal Reserve bank notes declined $3,760,000; and gold reserves increased $5,226,000, and cash reserves $7,188,000. Total bills on hand, however, increased $62,005,000, and total gross deposits $66,252,000. As a result of these changes and of the new method of computing the ratio, the ratio of total reserves to deposit and Federal Reserve note liabilities combined declined from 51 per cent to 50.8 per cent. The ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against net deposits, on the other hand increased slightly, from 60.6 per cent to 60.7 per cent.

For the two weeks ending March 12, there was a 61½ per cent increase in building plans filed in New York City, an increase which reflected the stimulus of the tax-exemption subsidy granted on new structures for residential purposes. Reports from the various sections of the country indicate a general increase of activity in the building industry. From some points reported estimates of costs range from 15 to 25 per cent lower than those of a year ago.

Associations Oppose Single Hearing Plan

(*Continued from page* 734)

ally regulated protective tariff" it should be secured "through a consumption tax on all commodities based on retail sales to the consumer." This presentation will be made by C. C. Hanch, chairman of the tax committee.

Another resolution which will be submitted at the Atlantic City meeting will deal with discriminatory duties in relation to the tariff. It will declare that a request should be addressed to the "legislative bodies of the United States urging provision in the general tariff for application of additional duties on products imported from countries that directly or indirectly discriminate against the trade of the United States in favor of that of other nations."

This subject will be taken up by J. Walter Drake, chairman of the foreign trade committee of the N. A. C. C. He will outline the discriminatory duties imposed on American made automobiles by Canada, Australia and other portions of the British Empire. It will be contended that the tendency to extend the British preferential policy to the disadvantage of American commerce justifies a provision for additional duty on products from countries which discriminate against American trade.

Advance-Rumely Shows Surplus of $1,277,231

LA PORTE, IND., March 28—The annual report of the Advance-Rumely Co. for the year ended Dec. 31 shows a surplus after charges, Federal taxes, inventory adjustments, etc., of $1,277,231, equivalent after deduction of preferred dividend to $3.84 a share earned on the $13,750,000 common stock. This compares with a surplus of $2,401,907, or $12.02 a share in the previous year.

Finley P. Mount, president, in his report showed that mark down of inventories which are carried at cost or market value, whichever is lower, necessitated a deduction of $837,936 from 1920 earnings. A loss of $279,336 was also taken on account of Government bonds, which were entirely disposed of. With another crop nearly due, President Mount said the outlook was good.

Receivers Are Named for Liberty Starter

NEW YORK, March 26—Receivers have been appointed for the Liberty Starter Corp., manufacturers of starters for automobiles and airplanes with a plant at Poughkeepsie and a sales office in this city. The liabilities are listed at $62,748 and the assets are said to be in excess of this amount. The company controls the Delano starter.

The company was organized Oct. 4, 1918, and has an outstanding capital stock of approximately $1,000,000 common and $1,000,000 preferred. The petition for receiver alleges that the corporation received about $700,000 for the stock sold and has still due it $92,000 on subscriptions. The patent rights to the starter which the company manufactured are listed as valued at $1,000,000.

Fred S. Taggert as trustee for Howard S. Borden, principal creditor of the company, instituted the proceedings. James J. Lyons and John Inwood were named receivers.

COURT RULES ON PATENT

CHICAGO, March 28—Judge Carpenter in the Federal District court has handed down a decision holding that the Grosvenor patent, No. 1,186,477 is valid and has been infringed by the Rockford Bookcase Co. The patent covers a varnish drying process and it is owned by the Wenborne-Karpen Dryer Co. of this city. The owners state that the only manufacturers of drying equipment now licensed under the patent are Drying Systems, Inc., Chicago, and the A. S. Nichols Co., New York.

THE MOTOR STOCKS

By JACQUES S. COHEN, of J. S. Bache & Co.

NEW YORK, March 31—Some time ago, at the request of AUTOMOTIVE INDUSTRIES, we prepared a statement on the automobile industry from the banking point of view and at that time we saw constructive elements at work toward the cleaning up of unsold stocks of automobiles throughout the country. At that time we also stated that we believed there would be a consistent improvement from that point, but that, as the year advanced, there would be a tendency toward concentration of the business in the hands of a few large, efficient and well-financed companies, while the smaller companies would be obliged either to consolidate for their own protection or go out of business altogether.

We see no reason to change this opinion at the present time. As stated above, we have seen distinct improvement in the automobile situation as a whole. Production schedules have consistently increased to a point where some of the larger companies are now operating anywhere from 50 per cent to 65 per cent capacity. From what we can learn sales have also been picking up and the momentum thus developed can very well carry an optimistic feeling through the first six months of this year. Thereafter, we should not be surprised to see a considerable falling off in the demand for passenger cars.

While it is accepted that the first six months of any automobile year usually produce 65 per cent of the total year's business, we cannot see how enthusiasm can be kept up beyond July 1. The purchasing power of the farmer and the planter has been reduced to a minimum by reason of extremely low prices for cotton and grain. The general purchasing power of the country, because of a substantial reduction in wages in all industries, has been considerably impaired.

So far as automobile security prices are concerned, the recent improvement in motor stocks seems to be discounting the favorable atmosphere during the first six months. However, we believe that as we near the end of this period, prudence would demand extreme caution regarding further commitments, pending the readjustment of the country's purchasing power to a basis somewhat nearer normal.

ASK FOR TIRE RECEIVERS

HOUSTON, TEXAS, March 30—Stockholders of the Universal Tire & Rubber Association, capitalized at $500,000, with a plant in this city, have filed application for the appointment of a receiver. An injunction has been granted restraining several persons named as defendants from disposing of bonds held by them as collateral. It is alleged that a receivership is necessary to conserve the assets of the company. The plant has been leased for one year to the Standard Rubber Co. at a rental of $21,000.

Men of the Industry

E. A. Taylor has assumed his duties as works manager in charge of production for the Liberty Motor Car Co. To take up this work he resigned as production engineer for the Pierce-Arrow Motor Car Co., where he was responsible for all standard and special tools, plant layout, arrangement of machine shop and assembly departments, and for the installation of progressive assembly. His duties at Buffalo consisted of criticism of design from a manufacturing point of view and the determination of all mechanical processes. Before going with the Pierce-Arrow Co., Taylor held executive positions with the Cadillac Co. for three years and in 1912 took charge of the Detroit plants of the Maxwell Motor Co. A year later he was transferred to the Maxwell plant at Dayton, where he was in charge of the entire factory, and in 1917 he became general superintendent of the Chalmers plant. He remained there two years.

George H. Hannum, general manager of the Saginaw Products Co., has been placed in charge of the Michigan Crankshaft Co., a subsidiary of General Motors Corp. The Crankshaft company operates plants in Saginaw and Lansing for the manufacture of crankshafts for General Motors cars. By this action the corporation consolidates all its Saginaw plants under one management except the National Plate Glass Co. plant, which is controlled by Fisher Body Corp., also a General Motors subsidiary. J. W. Wilford, who has been general manager of the Crankshaft company with headquarters in Lansing, is to become general manager of the Central Axle Gear & Products Co. when Hannum assumes his duties as supervisor in both crankshaft plants. The local crankshaft plant will continue under the active direction of T. M. Carpenter, local manager.

B. F. Page, formerly manager of the truck department of the Maxwell Motor Sales Corp., has been appointed supervisor in charge of the Omaha district for Maxwell-Chalmers, and S. W. Munroe, who was for several years in charge of the New England district for the Maxwell Motor Co., Inc., is appointed supervisor of the Boston district for Maxwell-Chalmers.

W. C. Petersen has been placed in charge of the metallurgical department of the Atlas Crucible Steel Co.'s mills at Dunkirk, N. Y. He was formerly associated with the Packard Motor Car Co. doing similar work. His work at Atlas will include research and standardization of the new chrome-molybdenum products.

G. W. Machtreib, formerly of the B. F. Goodrich Co., has been made general sales manager of the Detroit Trailer Co., taken over recently by the Mansfield Steel Co. Machtreib was connected with the Goodrich company several years, and is well known to passenger car and truck manufacturers.

Charles H. Keel, patent counsel for Curtiss Aeroplane & Motor Corp., and formerly in charge of the Washington office of General Electric Co., has opened a law office in New York.

John F. Creamer is now associated with Thomas J. Wetzel, New York, as manufacturers' agent. Creamer was formerly with the Firestone Steel Products Co., Akron.

Leroy Kramer, formerly vice-president in charge of production at Willys-Overland Co., has taken a position as vice-president of the Pierce-Arrow Motor Car Co.

Carl H. Becker has been appointed assistant sales manager of the Saxon Motor Car Corp., and Charles P. Ackerson has been appointed supervisor of dealers.

D. P. O'Keefe has been appointed general purchasing agent of the Chevrolet Motor Co. He has been assistant purchasing agent of Buick for the past ten years.

F. E. Badger, formerly general manager of the Canton plant of the Standard Parts Co., has joined the Detroit Steel Products Co.

R. E. Carpenter to Head Hartford Parts Company

HARTFORD, CONN., March 28.—R. E. Carpenter of Boston, has been elected president of the Hartford Automotive Parts Co. to succeed Jarvis McA. Johnson who has resigned because of ill health. James M. Carney also has retired as general manager and chairman of the board of directors. He is an expert in efficiency engineering and it is understood he will return to this work. Carpenter has taken active charge of the plant. He will be assisted by L. J. Harley, Jr., of Springfield, Mass., who has been elected vice president, and by H. W. Bigelow, re-elected secretary and treasurer.

For ten years Carpenter was connected with the Taft-Peirce Mfg. Co. of Woonsocket, in charge of the research and development laboratories. Early last year he went with Hollister, White & Co. of Boston with whom he will retain his connection. He is optimistic over the future of the Automotive Parts Company and predicts an entirely satisfactory business this year. It is understood he was selected for his present position by Boston bankers who have been financing the company.

Houston Buys Up Cars; Truck Business Slow

HOUSTON, TEX., March 29—The automobile industry has revived unexpectedly fast in Houston, which is in the best position of any city in Texas as it is the center of the oil industry. Ford dealers here are sold out and Cadillac has more prospects than at any time in two years while Buick and Nash report a heavy sales increase in the last three weeks. Several medium priced lines are moving more slowly. A few lines are heavily stocked but there has been a general improvement in all makes.

The rural districts are not buying as rice and cotton farmers will be out of the market for some months. Houston is filled with used cars and sales of these are slow. Most cars are selling for one-third cash and the balance in 10 or 12 months.

Truck sales are very slow and several dealers are heavily stocked. Probably 50 per cent of the present truck dealers will give up their agencies when the stocks they now have are sold. Several are reducing prices.

There have been no tractor sales in the rice area south of Houston, but vegetable crops between this city and Brownsville are being marketed and are helping car sales. The repair business has been slow but is improving.

Receivers Are Named for Empire Rubber

TRENTON, N. J., March 30—On complaint of the Big Bend Mining Co. which has a claim of $12,710, Arthur H. Wood and C. Edward Murray, Jr., of this city have been appointed receivers for the Empire Tire & Rubber Co. The complaint filed by the coal company charged that while the rubber company was solvent, its obligations amounted to more than it had the ready cash to pay. It was asserted that unless receivers were named litigation would result which would dissipate the assets.

The complaint requested the court to enjoin all persons from levying attachments against the rubber company. The papers in the case stated that the plant is appraised at more than $2,000,000 and that with merchandise and other assets amounting to about $3,500,000 it would eventually be put on a paying basis. The liabilities, excluding capital stock, were given as $1,500,000.

The decree of Judge Bodine in naming the receivers stated that the company was judged solvent but had no funds to meet its obligations. The receivers, who were required to furnish a joint bond of $100,000, were authorized to borrow not more than $50,000.

Sterling Ends Sales Contract

RUTHERFORD, N. J., March 30—The Sterling Tire Corp. announces the termination of its arrangement whereby Sterling tires and tubes, during the past year, have been sold exclusively through the Rubber Corp. of America, which also was the selling agent for products of the Empire Tire & Rubber Corp.

There has never been any connection between Sterling and Empire except that both employed the same selling agent.

The Sterling Tire Corp. has never been financially interested in Empire, and no one connected with Empire has been interested in Sterling.

HARES ADVANCES PRICES

NEW YORK, March 28—Production is steadily increasing in the plants of Hare's Motors, but particularly in the Mercer factory which is now somewhat behind its orders. The engineering department of the corporation is continuing its experimental work on a car which will be in a lower price class than either Locomobile or Mercer. Hare's Motors has found it necessary to revise its prices. The Locomobile is selling now at $8600 as compared with the old price of $8900 and $7750 when the first big slash was made. The Mercer, which was reduced from $4950 to $3950 now is selling at $4500. Production at a profit was found impossible at the lower prices.

Calendar

SHOWS

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

FOREIGN SHOWS

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

Apr. 20 - May 5 — Mexico City, Mexican Automobile Show, National Theatre Bldg.

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

May 24-28 — West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

Oct. 12-14, 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Buffalo section—April 19—Paper on "Carbureter Performance," by F. C. Mock.

Dayton section—May 3.

Metropolitan section—April 14—Paper on "Low Grade Fuel Carburetion," by A. H. Beach.

Minneapolis section — April 6 — Discussion of repair equipment.

Washington section—April 1—Aeronautical Engineering Session.

General Motors Export Names New Officers

NEW YORK, March 31—At a meeting of the directors of the General Motors Export Co., Paul Fitzpatrick, who recently resigned as a vice-president of the General Motors Acceptance Corp., was elected a director and vice-president.

The board of directors is now constituted as follows: J. Amory Haskell, Curtis C. Cooper, Paul Fitzpatrick, Alfred P. Sloan, Jr., Peter S. Steenstrup and Alfred H. Swayne.

The officers are as follows: J. Amory Haskell, president; Peter S. Steenstrup, vice-president and general manager of sales and service; Paul Fitzpatrick, vice-president and general manager of operations; Alfred H. Swayne, vice-president directing financial policies; Curtis C. Cooper, vice-president; Alfred P. Sloan, Jr., vice-president; Austin S. Murray, treasurer; Thomas S. Merrill, secretary; George S. Bartholomew, assistant secretary.

Fitzpatrick while vice-president of the General Motors Acceptance Corp. was in close working agreement with Steenstrup of the Export company, thereby gaining an intimate knowledge of the export trade.

Steenstrup as vice-president and general manager of sales and service, relieved of such duties as have been transferred to Fitzpatrick, will be free to devote his whole time and attention to the development of sales and the problems incident to service which are ever present in conducting successfully an overseas business involving as many problems as the motor car business.

Under this new plan the Export company is enabled to care for the enlargement of its organization both at home and abroad through division and realignment of duties and responsibilities.

TO BUILD TAMPICO HIGHWAY

MATAMOROS, MEXICO, March 28—Construction of an automobile highway between Tampico and Matamoros will be started soon. According to advices received from Tampico the work of securing the right of way for the proposed road from that city to Victoria, capital of the State of Tamaulipas is already under way. Large American oil interests and the American chamber of commerce of Tampico are promoting the proposed project by the state government. The necessity for a highway that will accommodate automobile traffic between the two points is keenly felt. It will be about 325 miles long.

Regulations Revised for Pulitzer Trophy

NEW YORK, March 28 — Revised rules and regulations have been announced for the second annual Pulitzer Trophy contest to be held at Selfrudge Field, Mt. Clemens, Mich., on Sept. 8, 9 and 10, 1921. In order to arouse the widest possible interest in flying and to stimulate the development of commercial aviation, the plans have been elaborated since last year so as to include diversified types of planes.

The intention is to attract a varied field of entries to compete for prizes to be awarded for desirable airplane performance apart from high speed. For this purpose there will be a series of contests comprising four distinct events in one or another of which there will be opportunity for any type of airplane to compete.

The trophies for the three contests besides the Pulitzer race have not yet been announced, but will be specified later.

UNIVERSAL INCREASES OUTPUT

GARWOOD, N. J., March 28—Steady and growing increases in orders are noted by the Universal Tool Co., Inc., manufacturers of automotive equipment and tools, after a period of depression which extended up to the last week of February. The company, formerly a Detroit organization, is now in extensive operation in its new plant in this city.

A continuance of orders as at present leads the company to the declaration that it will within a short time be doing more business than it was at the pinnacle of the automobile rush last spring.

Court Order Stops Interlocking Action

AKRON, March 26—Efforts of a group of stockholders of the defunct Interlocking Cord Tire Co. of Akron and Mogadore, to reorganize the company under a new name, have been blocked by order of the Summit county common pleas courts, upon petition of Elihu Harpham, receiver for the company. The court order enjoins the stockholders from making any further collections of stock subscription amounts due the company from stockholders. The injunction also restrains the Ohio Savings & Trust Co. from serving further as collecting agency for the stockholders reorganization project, and requires an account of all moneys collected be made to the receiver.

The stockholders reorganization committee is composed of C. A. Rukamp, R. E. Cartledge, Karl A. Dorn and Herman Gustave who recently were named temporary officers of the company at a stockholders meeting.

Receiver Harpham in formal court charges against the stockholders committee, alleges that there are open accounts on unpaid stock subscriptions, amounting to more than $242,000. He charges the committee with misrepresentation of facts and with violation of the order of the court in naming him as receiver.

Under the court injunction Harpham will proceed to collect all unpaid amounts due on stock subscriptions, and will proceed at once to liquidate the firm's affairs. Creditors have presented claims for over $150,000. The Interlocking plant at Mogadore has been shut down for several months.

FINANCE OFFICES MOVED

NEW YORK, March 28—The Colonial Finance Corp. and the Republic Acceptance Corp., both under the same management, have moved their executive offices from Pittsburgh to this city and are now located at 300 Madison Avenue. The companies are engaged in the automobile and general finance business with branches in Pittsburgh and Detroit.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XLIV. NEW YORK—THURSDAY, APRIL 7, 1921 NO. 14

The Crime Against the Small Town Dealer

Present distribution of ownership of automotive vehicles indicates where the dealer problem is the greatest. Factory sales managers have not appreciated this fact. Why neglect 55 per cent?

By Clyde Jennings

THE National Automobile Chamber of Commerce recently issued an estimate of the ownership of automobiles which indicates that 33 per cent of the cars are owned in the towns of less than 1000 inhabitants and 22 per cent in towns of 1000 to 5000. This, of course, represents a large percentage of farm ownership.

Coincident with this comes a report from the Southwest that cites many instances like this:

> **A Texarkana distributor, representing a good medium priced car, had 18 dealers in 26 counties a year ago and only three have survived.**
>
> **A Little Rock distributor for one of the leading cars has lost three of his five smaller city dealers.**

If these two instances indicate anything like a general fatality among small town dealers it is pertinent to ask who is going to sell the cars in the small cities. Still more pertinent might be the question as to **who is going to service and supply parts for the cars already sold.** It seems that this service question will not down, and any experienced automobile salesman will tell you, without hesitating, that unserviced cars are an exceedingly strong sales resistant.

Still another complaint is frequently heard from the West. It is that many companies are inclined to treat the small town dealership as a good deal of a joke. For instance:

Numerous cases are reported where a local banker has been named as dealer for a certain car. This banker wanted a car for himself and one for each of his several friends. He gets himself named as the dealer, gets the dealer discount on the wanted number of cars, sells them to his friends at a very mild profit and then shuts up shop as a dealer.

The result is that within a comparatively short time these cars **become orphans and will not take the road when they are wanted.** As a result, the owners and their neighbors place the blame entirely upon the manufacturer, for, of course, their profit-evading stunt was not bad business in their eyes. The matter of business ethics does not appeal to them.

Now, really, is it not right and just that the manufacturer should take the blame for oversight of decent business methods?

It is not by any means a new statement that a manufacturer will:

> **Spend a lot of money getting a proper design of the article that he is to manufacture, then spend a lot more money perfecting the best method of making this article and then**
>
> **Dump it on the market without any study of the market or,**
>
> **Without any definite policy of marketing it.**

Only such foolishness as this can explain some of the stunts similar to that of letting a banker supply himself and friends with cars at dealer rates.

There has been, is and will be for all time to come

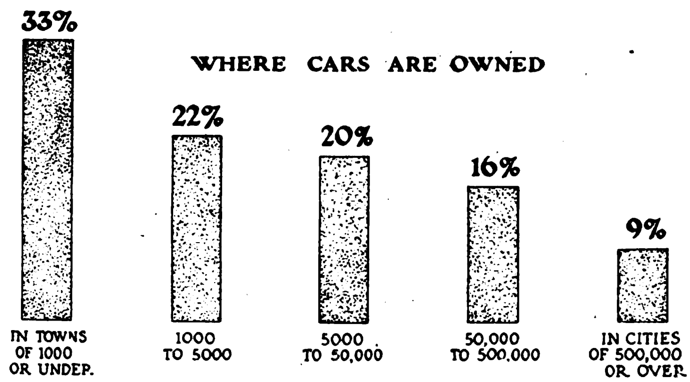
more or less academic discussion as to who is to blame for the disastrous experiences of small merchants, not only in automotive products, but in other lines.

This discussion is practically useless if one will take time to consider only briefly the broad justice that should govern business. It is an axiom that none can successfully dispute that:

A business contract is helpful only in that it benefits both parties to the contract.

Certainly no manufacturer of automotive products can afford to go about the country establishing dealers in small (or large, for that matter) towns who cannot make a living and who, after they have made a few sales, will go broke and leave this equipment standing in sheds just like so much junk. Automotive equipment is much too valuable to be deserted when the first accident happens to some minor part—and yet the country is spotted with just such junk piles.

It is plainly the duty of the manufacturer to insure that his dealer can and will make a living. If the individual established in trade is found to be lacking in the qualities necessary to conduct such a business, then another individual should be substituted, but the business should go on and make a profit for the person in charge.



Analysis of present ownership of registered automotive vehicles published by National Automobile Chamber of Commerce, based on a survey made by J. M. Gunn, president of U. S. Tire Co.

It has been a mistake to insist upon exclusive representation down to the point that this has been the practice. If the community will not buy enough Sennett cars to make a living for the dealer, then let him add the Rolls-Royce or some other car for a side line, but insist that he provide adequate service for the number of cars in his vicinity.

It is a fact to-day that a number of car manufacturers will establish a dealer in a more or less isolated community and not talk to him about parts until after he has sold several cars. It is quite likely that this man, especially if he is a novice, as so many dealers have been at the time they first signed dealer contracts, will not have thought of the necessary investment in parts, at least he will have no idea as to how much parts cost in sufficient number to safeguard his cars.

It is fortunate that this method of establishing dealers is less frequent than formerly, but it has not disappeared, nor will it disappear as long as there are adventurers in the vehicle manufacturing field, nor as long as manufacturers put all of their attention onto the designing and production of cars, and consider the marketing incidental.

To-day many men are made factory sales managers because they have been successful individual salesmen. That is not the test.

Perhaps they sold successfully, so far as total sales were concerned, but sold wrong so far as future was concerned. Time was when salesmen changed employers very often. In many cases it was because they had worn out their welcome. In some cases these very men have used their long list of former employers and their total sales in short periods with each as the means of getting a factory job, when, in fact, that record was the very reason they should never have had an opportunity to get an executive sales job or any other kind of a selling job.

There is no valid reason why almost any hamlet in the United States should not support a progressive, intelligent automotive dealer—provided he combines the selling of differently priced cars with service and accessory selling. Why not add the motorcycle to his list of products for sale? Some time ago a motorcycle concern did seek to interest small town dealers in cycles, but eventually they gave it up. The dealers had no special encouragement to round out their line; if anything, the car influence was against their branching out. If the car influence had been otherwise, the motorcycle manufacturers would probably have succeeded.

It appears to have been a mistake to have encouraged the small town dealer to undertake the sale of trucks. He can sell the delivery wagon type—which is much like passenger car sales—all right, but when it comes to the slow-moving vehicles he does not seem to have been able to measure up. He has not been able to analyze his customer's need for transportation, which must be the keynote of successful truck selling. Besides, until truck transportation is better understood, a small community cannot absorb enough trucks to support an active dealer.

As to tractors, the evidence is very spotted. It seems to be a case of individuality rather than of location, previous experience or environment. Some small town automotive dealers sell tractors like the country merchant buys eggs; they just naturally understand the tractor problem. These men, of course, are successful even if they only sell a few tractors a year, because they estimate the possibilities of their communities fairly accurately, make money on each vehicle and then make service an asset rather than a liability.

There is a very great difference in the attitude of elements of the automotive personnel toward their business representatives. During the last winter J. D. Dort made the dealer circuit and met and talked with every dealer who wanted to talk to him. The comment that this action caused is evidence of the unusual character of such a course. In contrast we will here print some comment that originated in the sales department of an automobile manufacturing company. It is self-explanatory:

> To quote a specific instance—a certain dealer in a given locality writes to the sales manager of one of the large corporations, complaining about his low car discount, stating that he discussed this at length with his distributor, but in vain, and now appeals to the factory for a fair deal.
>
> The sales manager never sees this letter.
>
> It is sorted out in the morning by one of the lesser mail clerks, who passes it on to one of the zone correspondents, and he, in turn, forwards it to the field man, who is requested to look into this matter at his convenience.
>
> Sometimes the correspondent acknowledges the dealer's letter. Other times he does not think it is worth while, depending largely on his mental attitude at the time the letter is placed on his desk.
>
> The field man places the letter from the zone correspondent in one of his many folders and if he is a systematic and aggressive sort of a fellow he so

arranges his files that this letter will come to his attention upon his next visit to the distributor's place of business, which may be within two weeks or two months.

When he finally arrives at the point of discussing this with the distributor the subject has grown cold, and at the very best all he can hope to get from the distributor is that the dealer is only a small town fellow, not worthy of any particular investigation.

In other words, the field man gets the distributor's side of the story and the matter is dropped there. He reports to the factory accordingly.

But what about this poor little dealer out in the "sticks" who probably doesn't write more than two or three letters a week and has been waiting anxiously for some word from the manufacturer that would make him feel he was really worth while in the organization. Days, weeks, finally a month passes without even an acknowledgment.

How would you feel if you were that dealer? Draw your own conclusions. Further elucidation is unnecessary.

The man who contributed this illuminating information was presenting the idea that this system did not prevail at the Elgin Motor Car Corp. and we are glad that it does not. It is not good business, but it is exactly what does prevail wherever an attempt is made to organize a system to function in matters where only the spirit behind the action can adjust the situation.

This is merely one of many phases of the situation that could be brought to bear to explain why the small dealer is not up and going.

Here is another contribution. This is from a man who has made a study of selling. He writes:

> One of the mistakes frequently made by manufacturers is to assume that they know all there is to know about the business. Recently a well-known truck manufacturer held a conference of dealers and told them how the merchandising effort was to be carried out during the coming year.
>
> One of the older dealers was then called upon to express his views on the subject. This man, who had been in the automobile business for nearly twenty years, and knew something of both manufacturing and retail selling ends, began by saying that he objected being told exactly how to do everything by someone who perhaps did not know as much about the business as he himself did.

The manufacturer can, of course, be a great help to the dealer in many ways; he can assist him in his merchandising efforts; he can offer helpful suggestions. But he cannot always assume that the dealer is a novice in merchandising methods and practice. It is undoubtedly true that many dealers to-day hold a really big conception of the automobile industry and are impressing their capabilities and their industry upon their respective communities in a very favorable light.

One really constructive piece of work was accomplished a few years ago by a distributor who had some southern states in his territory. He found that this territory had not been educated to pay the price for a car that his vehicle must sell for. So he decided to feed that territory on used cars.

He arranged his own repair shop to turn out overhauled cars and these he shipped into this territory. They were sold with certain guarantees and in opposition to cars of considerably less value as new cars. This trade thrived and had the advantage of clearing the distributor's best new car territory of used car problems.

After two or three years of this work this southern territory developed into a fine new car territory. Of course a distributor who would do this sort of a thing encouraged proper service.

A New Test for Motor Fuels

IN Europe considerable use is now made of blended fuels comprising members of the paraffin group (pentane, hexane, heptane, octane and nonane) on the one hand, and members of the benzene group (benzol, toluol, xylol) on the other. When buying such fuels in large quantities it is, of course, desirable to have some means of checking the composition of the fuel, especially as to the proportion of these two groups of components. This can be done by means of a refractometer, as the paraffin series has a higher refractive index than the benzene series. The Abbe refractometer, made by Adam Hilger, Ltd., is specially recommended for this purpose. The refractive indices of liquids give valuable information concerning the purity of oils and other substances, and the strength of aqueous, alcoholic, ethereal, and other solutions. Mixtures of two liquids are also readily analyzed by the use of the refractometer.

While determining the refractive index, another physical property, the dispersion, is obtained at the same time. Only one or two drops of liquid are required. So thin is the film of liquid employed that turbid and highly colored liquids, notwithstanding their absorption of light, can be investigated. Wherever the proportion of solvent to substance dissolved is often required to be known, a refractometer affords the quickest means of obtaining the information.

Measurements can be made using either daylight or artificial light, and the refractive index is read directly on the scale. Dispersions are obtained by reference to a printed table. The liquid to be investigated is enclosed as a film between two prisms of dense flint glass. The upper prism has a polished face in contact with the liquid, and it is the ray which grazes this face which is utilized in making measurements. Each prism is enclosed in a hollow jacket through which water at constant temperature can be circulated. The interior faces of the water jackets are gilded to prevent corrosion. The use of daylight is made possible by employing a compensator to neutralize the dispersion of the liquid and thus to give an achromatic field. The compensator consists of two direct vision prisms, which are rotated at equal rates in opposite directions by turning a milled head, and together form a system of variable dispersion. The compensator is provided with a scale, readings on which give dispersions by reference to printed tables provided with the instrument.

To make a measurement, a drop of the liquid to be investigated is introduced between the prisms. On looking through the eye-piece and moving the index, a dark shadow with a sharply defined edge comes into the field of view. This edge is brought onto the cross lines in the eye-piece and the corresponding refractive index read off on the divided scale. A test piece of glass, on which is engraved its refractive index, is supplied with the instrument, for the purpose of checking the setting, and simple means are provided for correcting the setting should it become necessary.

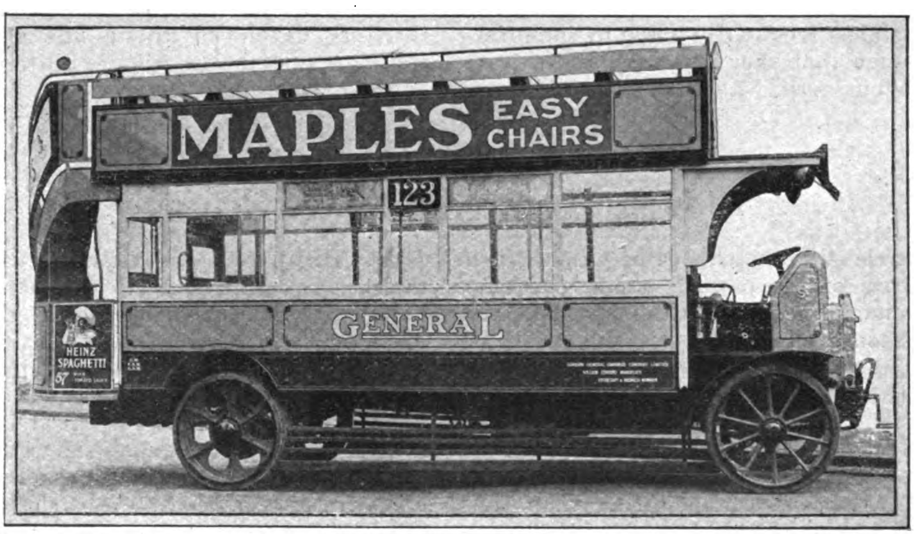
New British Bus Chassis Is Equipped With Body Seating 54 Passengers

New type will supersede model "K" heretofore described in these columns, and will accommodate 8 more passengers. Since the crew and the fuel consumed per mile are the same as that of earlier type the margin of profit is greater. Changes in construction include use of larger wheels and a single plate instead of multiple disk clutch. Half elliptic front and rear springs are supplemented with volute springs.

By M. W. Bourdon

PRACTICALLY the whole of the fleet of London buses now in use will eventually be superseded by a new model known as "S" type, which has a longer wheel-base, larger engine and a double-deck body seating 54 passengers. This new model has been running almost unnoticed on the London streets for the past few months, fifteen experimental chassis and bodies (with 57 seats in these first few examples) having been completed early last autumn. The first batch of production chassis is now in hand, and the last fifty of the preceding type are being finished off, making 1000 to be completed in all.

It will be recalled that in AUTOMOTIVE INDUSTRIES of Aug. 12 and 19, 1920, there were given particulars concerning the "K" type chassis and body which at that time represented the last word in London bus construction and had a seating capacity for 46 passengers, as compared with 34 of the pre-war "B" type bus. The latest increase in size and passenger accommodation has been made possible by a relaxation of the regulations laid down by the Metropolitan police, this variation being made at the instance of the new Ministry of Transport.

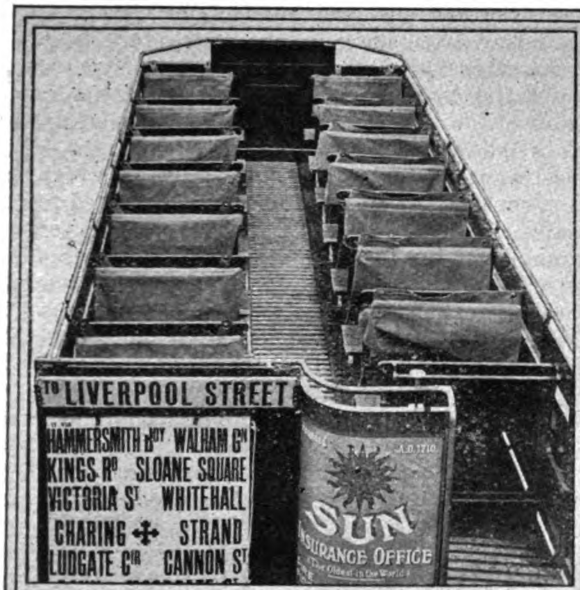


Side view of the new 54-seated London bus, known as the "S" type

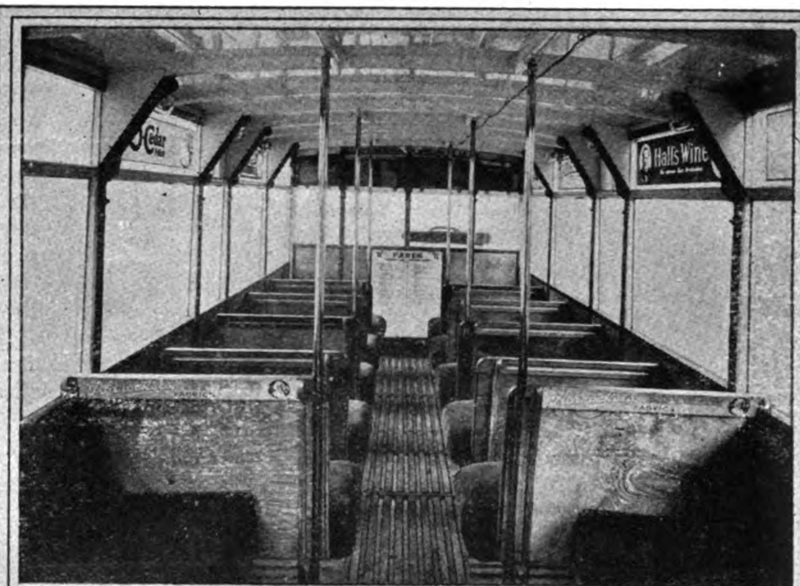
The "K" type (1920 model) chassis represented an endeavor to fulfil the stringent requirements of the police authorities in regard to weight, simultaneously increasing the passenger capacity, but in endeavoring to comply with these requirements it was necessary to cut down chassis weight to an extent which, it must be admitted, rendered the chassis less reliable and durable than might otherwise have been the case. In the new "S" type the designers have been given more latitude, and in respect to both unladen and laden weights the old standards have been exceeded. Thus, not only has still greater accommodation been provided, but chassis details have been strengthened and, incidentally, the size of the road wheels has been increased.

A four-cylinder engine is used. It has a bore and stroke of 108 x 140 mm., approximately 4¼ x 5½ in. as against "K" type, 100 x 140 mm. The new S type engine develops 34 hp. at 1,000 r.p.m. The L head cylinders are in pairs on an aluminum crankcase, while the valves on the left are inclosed. The "K" type were not inclosed. The engine as a whole is suspended by means of four bolts from a pair of H section drop forgings resting on brackets secured to the side members of the flitch plate frame. In general construction the latter is unchanged, but, although the overall width of its members remains as before, the steel plates are now 3/16 in. thick as compared with 5/32 in.; they are also 2 in. deeper midway between the wheels and are slightly inset at the front to give the necessary steering lock. The top of the frame members is 3 in. higher off the ground, this being mainly due to the use of wheels of 1050 mm. (42 in.) diameter in place of those of 920 mm. (37 in.) diameter on the "K" type.

Reverting to the engine, this has hollow crankpins, a feature which is not, however, made use of to provide hollow-shaft lubrication, for the latter is on the circulating splash system with direct leads to the three crankshaft bearings. A separate lead is also taken to a point over the timing chain, which is rendered adjustable by mounting the magneto on a slotted bracket behind the timing case on the left side and this providing means to take up slack. In addition to the driving sprocket at the front end of the crankshaft there is a worm wheel engaging below it a worm gear on a trans-



Upper deck with seats for 28 outside passengers on the new "S" type London omnibus



View looking forward inside "S" type bus, showing seating arrangement in the 54-passenger body

verse shaft. This drives through a flexible coupling, the lighting dynamo which supplies current for interior and exterior illumination.

The grouping of the engine accessories and valves is entirely on the left side of the engine, so as to make these accessible upon raising that side of the hood, for, as in the "K" type bus, the driver's position is slightly above and alongside the engine on the right. Thus we find the exhaust manifold carried higher than the inlet branch on the left. The two are separate units and the inlet branch is completely water jacketed almost down to the carbureter flange. The carbureter is a Zenith without hot air supply, the jacketing of the branch being alone depended upon for vaporization of the fuel. Oil filler and oil level rod are also on the left. The magneto is entirely inclosed by a cast aluminum cover, which not only protects the magneto from water, but prevents the driver from tampering with it. The magneto has fixed timing; a throttle governor is not provided, but a slow running stop for the throttle pedal is fitted on the back face of the dashboard.

Oil is circulated by a pump driven by helical gearing from the camshaft, which is carried on three plain bearings and operates the slightly inclined valves through roller ended tappets of 1 1/16 in. diameter, drilled throughout practically the whole of their length to an internal diameter of ¾ in.

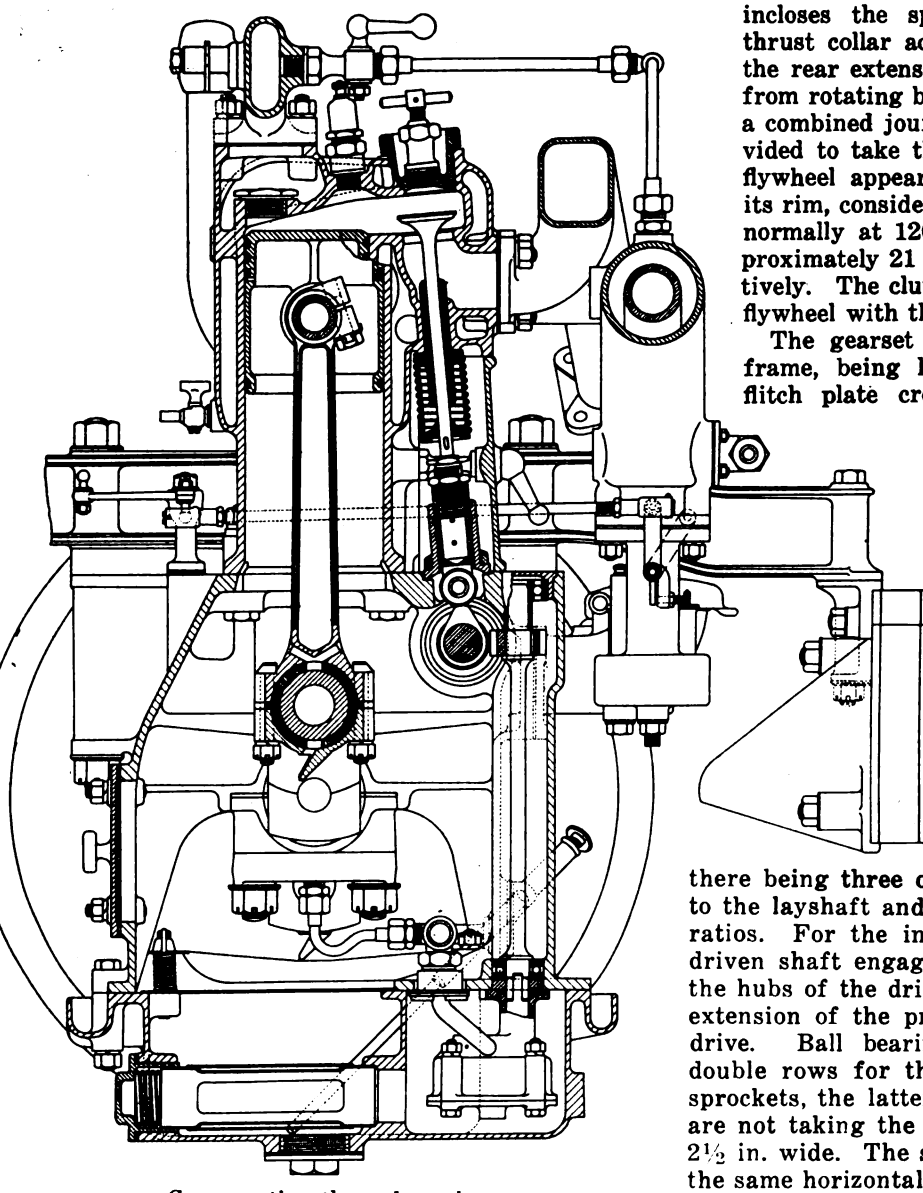
A point worthy of note is the position of the spark plugs in the cylinder heads; they are not screwed as usual into the castellated valve caps, but directly through the cylinder head toward the center of the bore, where they are in a better position for firing the charge and more intimately water-cooled. Four-bolt plain bearing big-ends are used on the 2⅛ in. diameter crank pins. Dippers are formed integrally with the big-end caps, but adjustment is provided for the troughs by holding each one, at its right hand extremity, down to a compression spring by a bolt. The H section connecting rods have 300 mm. centers, the upper end of each being split and provided with a pinch bolt to secure the hollow piston pin. The latter oscillates within unusually large bosses in the aluminum pistons, the dimensions of these bosses being such as to allow of their being bored out when worn after considerable use for the insertion of phosphor bronze bushes.

There is nothing remarkable in the design of the pistons, the axially split skirt with internal ring having been discarded in favor of a plain straight-side design. Three compression rings are fitted, with the land below the bottom one reduced in diameter so that this lower ring can form a scraper returning oil to the interior through small holes drilled radially. There is a second scraper ring in the skirt. No difficulty has been experienced with the use of aluminum for these heavy duty engines, and it is asserted that even with 0.003-in. clearance there is neither piston slap when cold nor a tendency to seize when the engine is hot—and it may be mentioned that these engines are more often than not running with the cooling water at approximately boiling point. In the latter connection it may be said that the V-shaped leather link belt driving the fan is kept under tension automatically by means of a loose front flange on the driven pulley, a volute spring keeping it constantly pressed toward the belt and the rear flange, an arrangement which has been found to be entirely satisfactory.

Water circulation is by a pump located on the front of the cylinder casting, its shaft being a continuation of that on which the driven fan pulley is mounted; thus the pump is belt driven. No underpan is fitted when the engine is assembled in the frame. Oil dripping is prevented by a trough which passes completely around the detachable aluminum sump, an arrangement which is also used in the case of the gearset.

In the "K" type chassis, which the "S" type supersedes, a multiple disk clutch is used, but in the new model a single plate pattern has been adopted. This has its central steel plate bolted to a flange on the clutch coupling shaft. At the friction surfaces the driven plate is reduced in thickness, the object being, of course, to reduce inertia as much as possible. Eight adjustable springs are used to clamp the driven plate between the fabric surfaces riveted to the rear cover and floating plate respectively. Four multiplying levers serve for disengagement purposes, but take no thrust from the spring when the clutch is engaged.

Lubrication of the clutch coupling shaft is accomplished by oil periodically fed by hand through a tube and cup, the latter being made readily accessible by passing through the pressed steel rear dust cover which



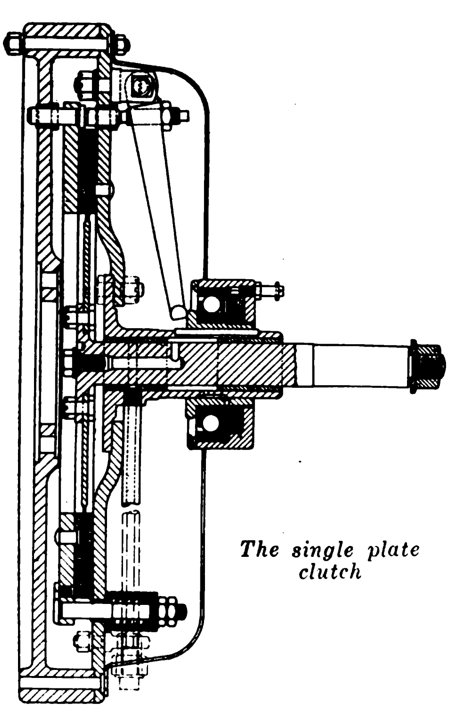
Cross section through engine

incloses the springs and multiplying levers. The thrust collar acted upon by the clutch fork floats on the rear extension of the back plate and is prevented from rotating by means of a link carried to the frame, a combined journal and thrust ball-bearing being provided to take the end thrust of disengagement. The flywheel appears to be unusually light in weight at its rim, considering that the engine is designed to run normally at 1200 r.p.m., but with a diameter of approximately 21 in., it seems to serve its purpose effectively. The clutch as a unit can be detached from the flywheel with the springs retained under compression.

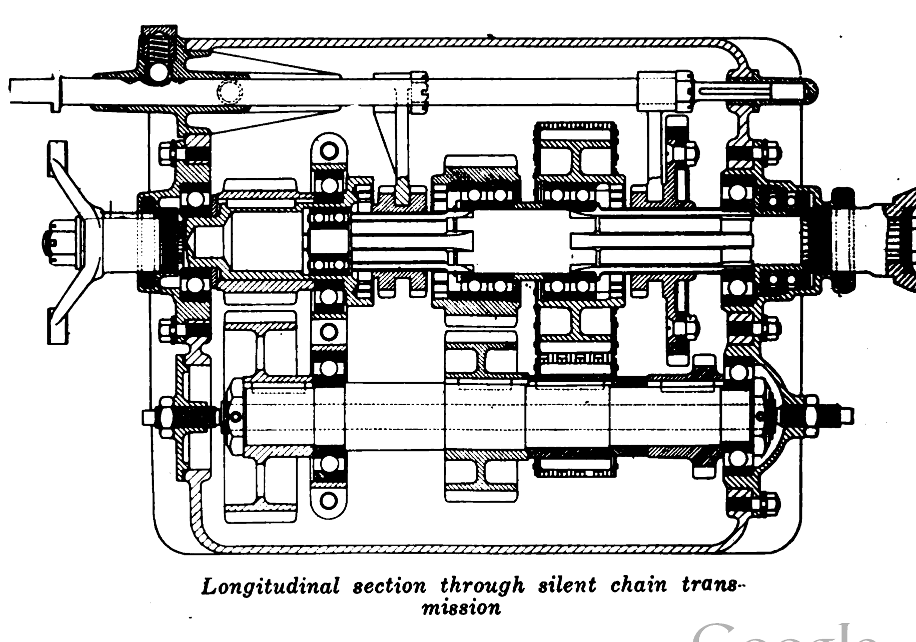
The gearset casing is separately mounted in the frame, being hung by three bolts from a pair of flitch plate cross members. Between it and the clutch is a coupling shaft at present fitted with flexible joints having steel disks, but these are to be displaced in the production chassis by fabric disks, trouble having been experienced through the steel plates cutting into and tending to shear off the bolts holding them to the star pieces.

Like the engine, the gearset is slightly inclined rearwardly so as to provide a straight-line transmission when the bus is loaded. There are three forward speeds with selector change. The indirect ratios, with the exception of the reverse, are obtained by silent type chains, there being three of these, one from the primary shaft to the layshaft and the others for the second and third ratios. For the indirect drives sliding sleeves on the driven shaft engage with internal teeth formed within the hubs of the driven sprockets and within a rearward extension of the primary chain sprocket for the direct drive. Ball bearings are used throughout, including double rows for the pilot bearing and for the driven sprockets, the latter, of course, rotating idly when they are not taking the drive. The chains in each case are $2\frac{1}{2}$ in. wide. The shafts have $5\frac{1}{4}$-in. centers and lie in the same horizontal plane; the casing, of cast aluminum, has an oil level inspection and filling hole in the center of the overall lid.

From the rear end of the driven shaft the drive is taken by a ball-bearing star or cross-pin type of uni-



The single plate clutch



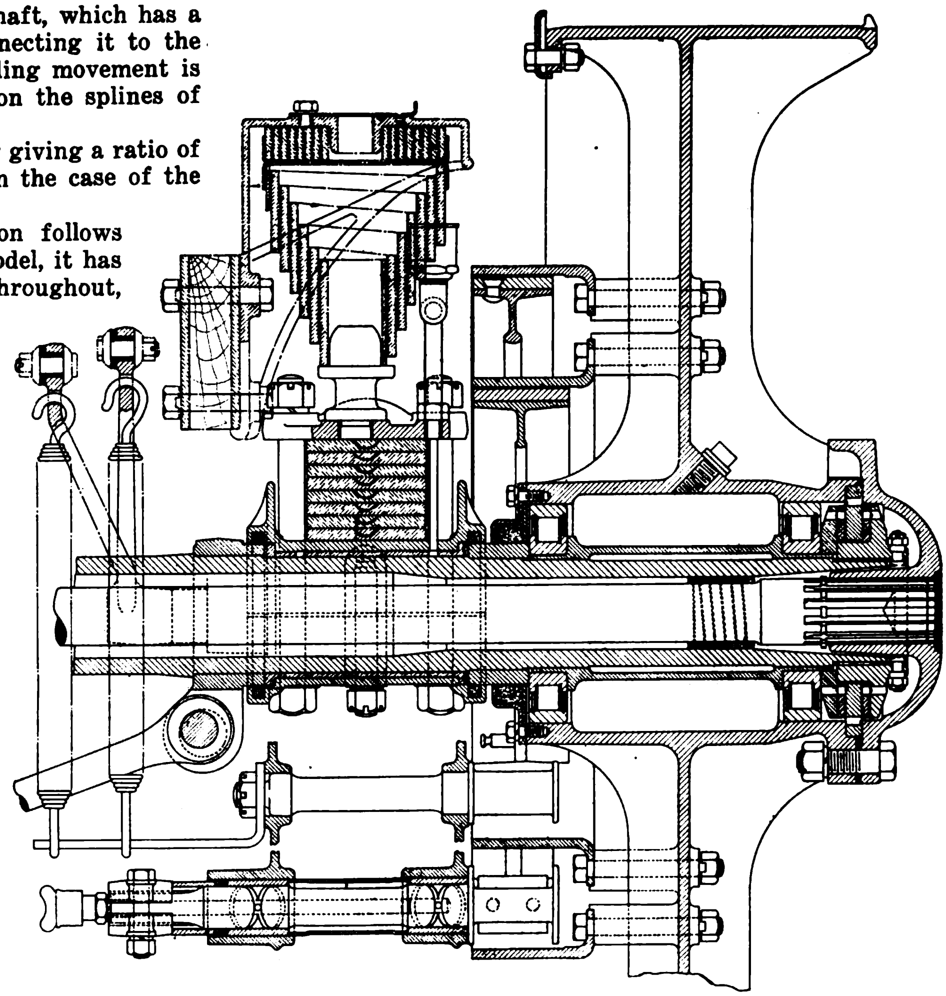
Longitudinal section through silent chain transmission

versal joint to the tubular propeller shaft, which has a similar type of joint at the rear connecting it to the worm shaft below the rear axle. Sliding movement is permitted at both ends of the shaft on the splines of the solid extensions.

A straight worm is used, the gearing giving a ratio of 9.3 to 1 as compared with 8.25 to 1 in the case of the "K" type chassis.

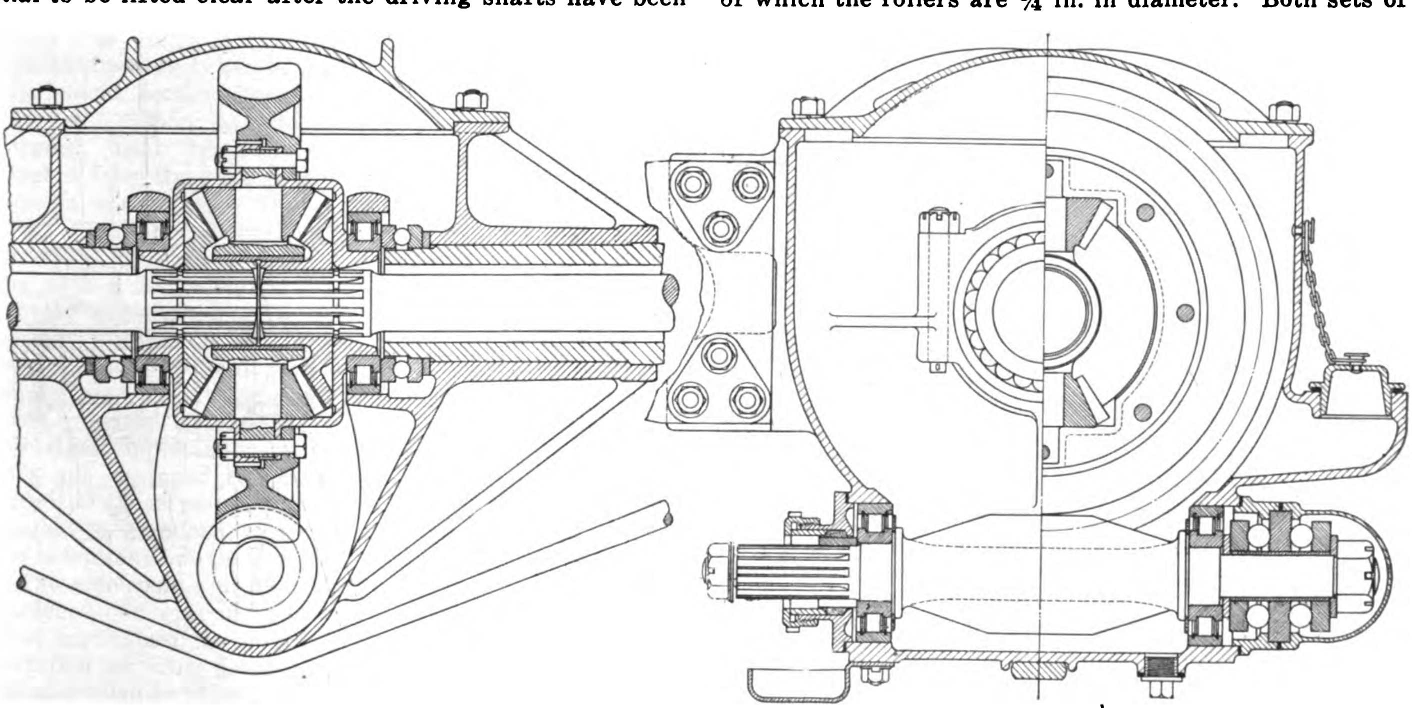
Although the rear axle construction follows generally the lines of the preceding model, it has been very considerably strengthened throughout, and, while the previous model had conical roller bearings for the differential casing and wheels, the "S" type has straight rollers with ball thrusts at each side of the differential and plain thrust washers for the hubs. The worm shaft also is mounted on straight roller bearings with ball thrusts. The axle center is a unit steel casting with webs on the horizontal and vertical center lines. It has its extension tubes pressed directly into the center, with a tie rod below mounted at each end on eccentric pins for maintaining the tension.

A special feature is the triangulated steel plate torque member, which is bolted to the front of the axle center; a forward extension is suspended between bronze blocks in which it can slide fore and aft or partially rotate, these blocks being supported above and below by rubber buffers in the supporting bracket. The plate is of spring steel, and the sliding motion permitted in its anchorage and the lateral "give" of the plate allow for axle movement due to equal or unequal spring deflection.

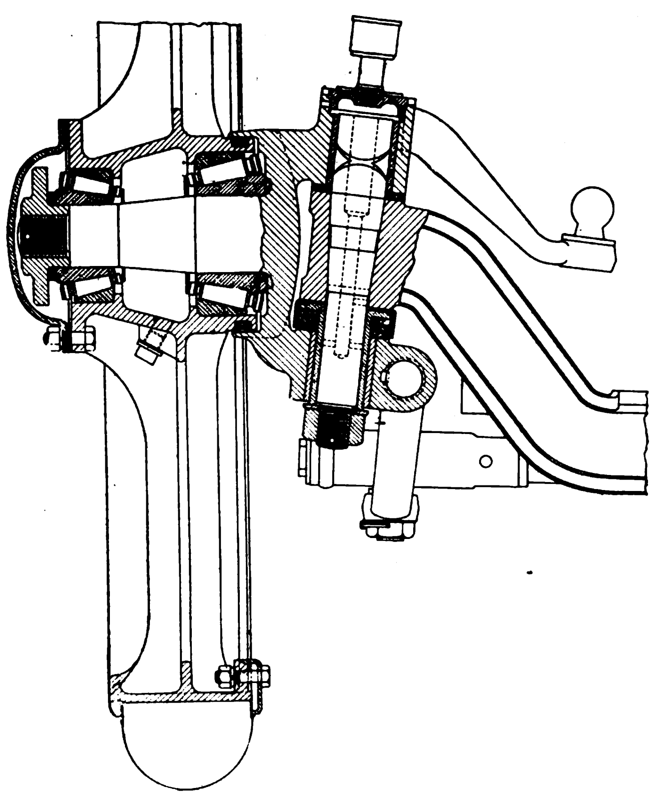


Rear axle end, spring and cast steel wheel

The rear axle casing has an overall cover plate, the removal of which allows the worm wheel and differential to be lifted clear after the driving shafts have been withdrawn. The latter have splined outer ends engaging with the hub caps which convey the drive to the wheel hubs, the latter, as already mentioned, being mounted on widely spaced (7-in. centers) straight roller bearings of which the rollers are ¾ in. in diameter. Both sets of



Rear axle center and undermounted worm drive



Front axle end and front wheel

brakes apply within concentric drums on the rear wheels, the latter being of the cast-steel web-spoked type with twin solid tires each of 120 mm. cross section. The brake shoes are faced with fabric, the outer sets being pedal applied; the inner drum has a diameter of 13½ in. and the outer 18 in., the width of the friction surfaces being 2⅞ and 2⅜ in. respectively.

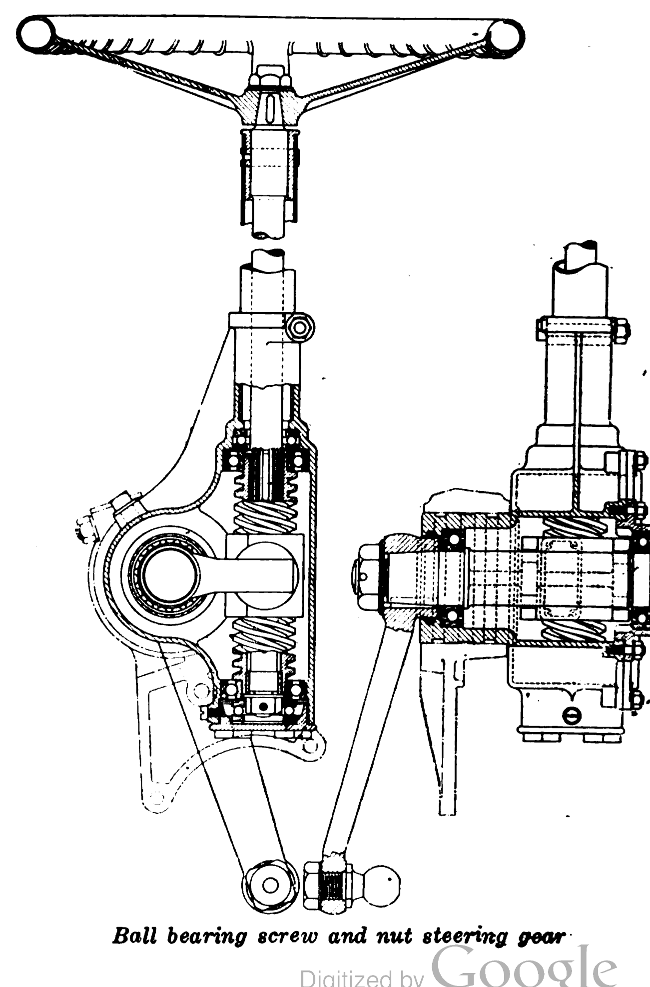
One of the most interesting features of the chassis is the spring suspension. Half-elliptic laminated springs are used fore and aft, but supplementing these to take an increasing proportion of the load as the bus fills up with passengers is a series of volute springs backed by brackets above them attached to the frame; the springs at their lower ends encircle studs or bosses projecting upward from the center clamping plates of the laminated springs. Each supplementary unit consists of two volute springs, but the first of these is merely a buffer spring for the second, serving to keep the latter always in firm contact with the axle so that it cannot lift away from the central stud. The main volute spring varies both as to section and width of the strip of which it is formed and it is in the "grading" of the spring in these respects that the main advantage of the arrangement is derived. Provision for introducing lubricant occasionally to prevent squeaking occurring due to the frictional contact between the coils is made by a swing lid surmounting the bracket attached to the frame.

In regard to the laminated springs themselves, the second main leaf is continued so as partially to encircle the eyes of the upper one at each end, while the center of each leaf is "pipped" to lock it in relation to the others and prevent end movement on the axle.

The front axle is an H section drop forging of 3 per cent nickel steel. Plain bushes and a plain thrust ring are used for the swivel pins, the latter being tapered where they pass through the ends of the main axle and drilled for lubrication of upper and lower bearings from the grease cup at the top end. The front wheels run on roller bearings, which supersede the floating phosphor bronze bushes of the "K" type chassis. Worm and nut steering gear is continued, with the lever shaft mounted on ball bearings. The wheel shaft is similarly supported with ball thrusts above and below the thread. In the "K" type chassis the steering link passed from the steering lever located on the right to the left-hand wheel swivel lever, the motion then being taken back to the right-hand wheel by the coupling rod; but in the production model "S" type chassis, this arrangement is being varied and the steering housing is supported at the front extremity of the frame immediately behind the radiator, with a short drag link running back over the axle to the right-hand swivel lever, this arrangement having been found to give easier and more precise steering control than the transverse drag link.

In regard to the bodywork, this follows very closely the arrangement and methods of construction adopted for the "K" type bus, described in detail with drawings in AUTOMOTIVE INDUSTRIES of Aug. 19 last year. The variations in the seating arrangement giving accommodation for 11 additional passengers in the fifteen experimental buses of the series consist of (1) a transverse seat for five passengers facing rearward immediately behind the driver within the interior, (2) two more two-passenger transverse seats added inside after reducing the longitudinal seating capacity from six to four, and (3) two more two-passenger seats outside. But the rearwardly facing seat has not been found completely satisfactory and the final decision is to eliminate it and return to the longitudinal seats, each accommodating 3 passengers. Thus, although the intention all along has been a 57-seated bus, 54 seats only will appear in the production model—eight more than in the "K" type bus.

The lengthening of the body has, of course, necessitated additional side pillars, but other variations are purely matters of detail. To relieve the body of the stresses due to overhang at the rear, the left-hand chas-



Ball bearing screw and nut steering gear

sis frame member is extended beyond the right-hand unit; the former therefore supports the loading platform and staircase, enabling the superstructure to be appreciably reduced in weight at this point.

The running of the fifteen experimental buses during the past six months or so has not merely been for the purpose of testing out the chassis, but also to ascertain various points of doubt in connection with the running of such comparatively large units; for instance, whether it is a paying proposition to run a larger type, whether the conductor could collect all the fares, etc.

Actually, it has been found that the margin for profit is greater with the larger unit, and for some reason, which is as yet obscure, the fuel consumption of the 57 seater has proved to be almost exactly the same as the 46-seated bus, approximately 5.8 mi. per gal. Obviously, with the wages of driver and conductor the same, this result cannot be viewed as other than extremely satisfactory.

As is probably known, the vast majority of London buses are operated by the London General Omnibus Company, which is one of the units of the combine having control also of the Underground Railways, but the chassis manufacturing concern is the Associated Equipment Company, which has a modern plant at Walthamstow, London, E., where, when in full swing manufacturing bus and truck chassis, some 3000 hands are employed. The output at the present time of bus chassis alone has been worked up to 50 per week. The Resident Director in charge of the plant is H. Kerr Thomas, who for some ten years prior to 1920 held a similar position with the Pierce-Arrow company.

All units—engine, gearset, back axle, steering, etc.—are made in the Walthamstow plant, for although until a year or so ago engines were bought outside, the conclusion was then reached that it was preferable to produce all components under the one roof.

The Associated Equipment Company are also makers of chassis for provincial buses and 3 to 4-ton trucks, which vary in certain details from the bus chassis; for example, they have pressed steel frames and 4-speed spur pinion gear-boxes. Why the London Omnibus Company still continues the flitch plate frames is not made clear, and their preference is the more peculiar because the cost of these is admittedly 50 per cent more than that of the pressed steel variety.

The following comparative dimensions and weights of the three types of London buses referred to in the foregoing will be of interest.

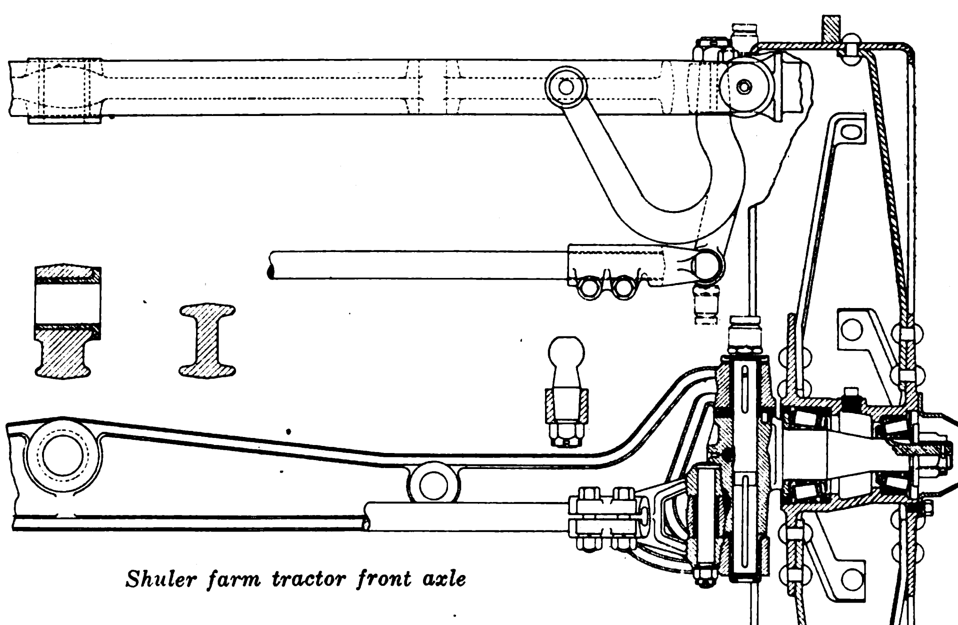
	"B" Type*	"K" Type†	"S" Type†
Seats	34	46	‡57
Overall length	22 ft. 6½ in.	22 ft. 4½ in.	24 ft. 7 in.
Overall width	6 ft. 10 in.	7 ft. 1 in.	7 ft. 1 in.
Wheelbase	12 ft. 10⅝ in.	14 ft. 2¼ in.	14 ft. 11 in.
Track	5 ft. 8 in.	5 ft. 10 in.	5 ft. 10 in.
Rear overhang	7 ft. 7⅝ in.	6 ft. 8 in.	7 ft. 2¾ in.
Body length	11 ft. 9¼ in.	13 ft. 10¾ in.	16 ft. 1 in.
Weight of chassis	5,590 lb.	5,150 lb.	6,500 lb.
Weight of bus (unladen)	9,000 lb.	8,400 lb.	9,800 lb.
Weight of bus (laden, 54 passengers, driver and conductor, gasoline and water)	14,240 lb.	14,850 lb.	18,000 lb.

*Driver behind engine. †Driver alongside engine. ‡To be 54 in the standardized body.

Front Axles for Tractors

TWO sizes of front axles for farm tractors have been put on the market, one for 2-3 plow tractors and the other for 3-4 plow. The former has a load capacity limit of 2000 lb. and the latter of 3000 lb., the whole weight at the forward end, including axle and wheels, being considered.

In order to permit vertical oscillation of the axle it is pivoted under the frame at the center. The axle center is of the customary I-beam section, made from a 0.30-0.40 carbon one-piece drop forging, heat treated, and is tapered from the yoke to the pivot boss in the center. The central pivot boss is provided with a hardened and ground steel bushing with a flange on the aft side to take the thrust. The axle is pushed almost entirely through radius rods secured to it at points near each yoke and converging to an axial point some distance behind the pivot boss. The I-beam is thickened appreciably at the points where the radius rods are fastened in order to resist any stresses induced at those points. The balance of the axle is very similar to standard motor truck axle construction with the exception that the camber is taken out of the spindles.


Shuler farm tractor front axle

The axle center at the steering heads is bushed with hardened and ground steel and the king pin is of nickel steel carbonized, hardened and ground, the whole construction at this point being inclosed. The thrust is taken on two hardened and ground steel washers of large area. The steering knuckles and steering arms are low nickel chrome steel drop forgings, heat treated, the steering arms being bushed with steel. The cross rod is of cold-rolled steel. The rod ends are drop forgings, tied to the arms with a hardened and ground pin. The steering arm ball is of 3½ per cent nickel steel, hardened and ground, and may be located on either side of the axle with either the fore and aft or cross type of steer. The tie rod, however, is always placed behind the axle. The wheel spindles are equipped with Timken roller bearings.

The Shuler Axle Mfg. Co., who build these axles, supply wheels of their own design also if desired, these being either a fabricated type of wheel or an integral cast wheel of malleable iron.

A Device for Automatic Control of Airplanes

Is designed to relieve the pilot from fatigue in long flights. Pendulum, usually employed in devices of this character, is replaced by a mercury column which, by means of electric contacts controlling air valves, operates ailerons and elevator. Control equipment weighs about 150 lbs.

IT is quite obvious that controlling an airplane continuously for long periods of time places a heavy strain on the pilot, especially in a gusty atmosphere, and many attempts have been made in the past to render airplanes self-righting or provide them with automatic stabilizers. Most of these have been based upon the pendulum principle, but these encounter the difficulty that in describing a curve the pendulum is subject to centrifugal force and tends to assume an inclined rather than a vertical position.

A French aircraft engineer, Georges Aveline, has invented a rather ingenious device in which the effect of centrifugal force is compensated for, and this has recently been fitted to a Handley-Page passenger airplane in England and tried out with apparent success. In piloting a machine so fitted, the pilot does not have to bother with the aileron and elevator controls, except in getting off and in landing, and has only to control the rudder to maintain the desired course.

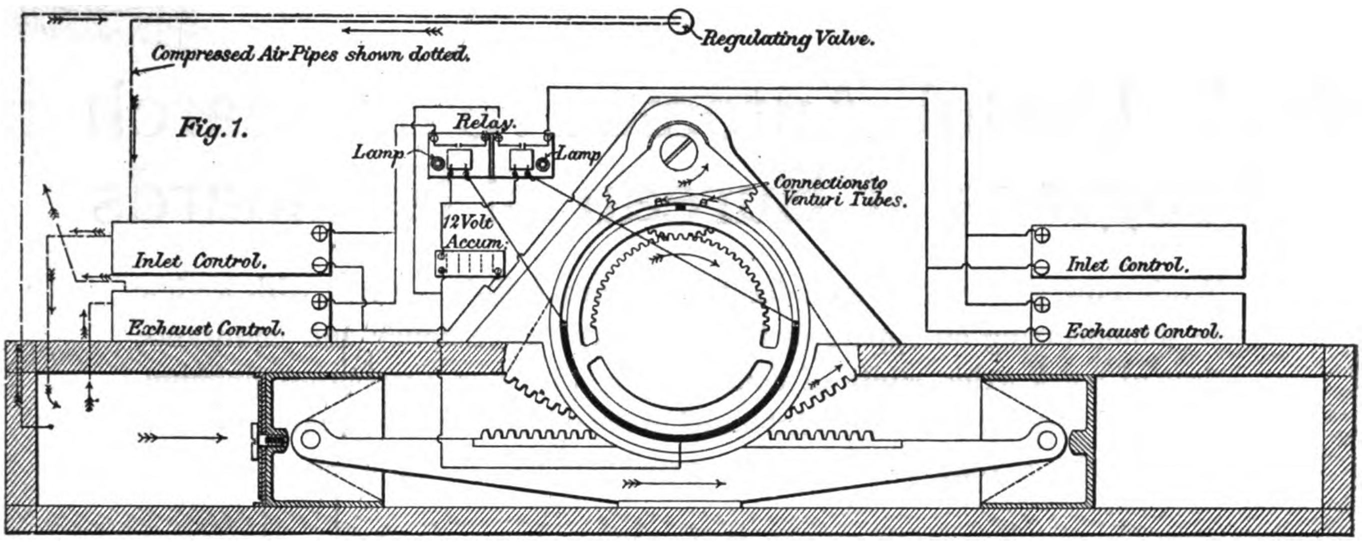
The mechanism employed for controlling the ailerons, shown in Fig. 1, is mounted transversely in the cockpit. It comprises a disk of red fibre in which is formed a circular channel that is half filled with mercury. There are three electric contact terminals in the channel, one at the lowest part and one just above the level of the mercury in each branch. If the machine tilts to one side the mercury on that side of the circular groove will come up to the electric contact and the electric circuit will be completed from the bottom contact through the mercury. Each of the two circuits which can thus be completed contains a relay, and these relays each control a 12-volt circuit including electro-magnets which in turn control the inlet and exhaust valves of a compressed air servo motor. A section of this servo motor is shown in Fig. 1, and it will be seen to be of the single cylinder, double piston type. The two pistons are connected by a toothed rack which meshes with a quadrant to which the aileron control wires are connected.

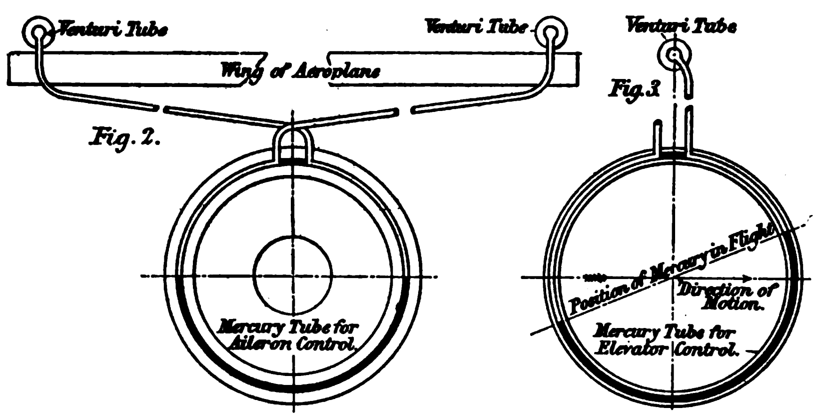
When air is admitted to one side of the servo motor and the exhaust valve at the other end is opened, the pistons move, turn the quadrant, and so operate the ailerons to correct the tilt. The disc containing the mercury channel is also geared to the quadrant, so that it turns in the opposite direction and, by this means, the contact is broken and the pistons are brought to rest after moving through an angle corresponding to the amount of tilt. By means of a valve fitted in the exhaust pipes the rate of movement can be regulated as desired.

It is obvious that this is a gravity mechanism like a pendulum and that centrifugal force has an influence on the level of the mercury. To overcome this Mr. Aveline has provided suitable means which form one of the most ingenious features of his device. To turn the machine the pilot moves the rudder bar with his foot, and the machine immediately commences to swing around in a more or less horizontal plane—say to the right. The resulting centrifugal force causes the mercury to rise in the left-hand arm of the mercury channel, making contact on that side, and the effect of this is to pull down the outer aileron and raise the inner aileron, thus causing the machine to bank in the correct manner. The fibre disc, of course, moves in the opposite direction to the quadrant and would break the electrical connection and leave the ailerons in the positions above described but for the special means referred to.

As soon as the correct banking is reached, it is necessary to replace the ailerons into the neutral position, otherwise the banking would become excessive and the machine would probably side slip. To avoid this the arrangement illustrated diagrammatically in Fig. 2 is employed. A Venturi tube is mounted on each tip of the upper wing of the machine and the throats of the tubes are cross-connected to the arms of the mercury tubes as indicated in the diagram. Obviously, the suction from the Venturi tube on the outer wing tip will be greater than that from the other tube, since the former is moving faster than the latter, and the effect of this will be to raise the mercury in the inner arm and make an electrical contact on that side. By this means the ailerons are returned to the mid position, and the machine continues to travel on a properly banked turn until the rudder bar is again moved by the pilot, when the reverse action takes place, bringing the machine back on to a horizontal straight-line path.

The apparatus for controlling the elevator is generally similar in principle to that used in connection with the ailerons, the main distinction being that the plane of the mercury channel is in a fore and aft direction and that one arm of the mercury tube is connected to a Venturi tube in the centre of the machine, while the other arm is open to the atmosphere. The arrangement of this part of the apparatus is indicated by Fig. 3. In normal flight the position of the mercury would be as shown in the illustration, the forward arm being at a higher level than the after arm, owing to the suction of the Venturi tube. The pilot has to adjust the fibre disc so that the electrical contacts are just above the level of the surfaces of the mercury in the arms and any alteration in the speed, or fore and aft inclination of the machine will then complete the circuit to a relay and servo-motor similar to that already described, thus effecting the necessary adjustment of the elevator. It is equally possible for the pilot to set the disc for any desired angle of climb and the machine will then continue to climb at this angle until the disc is readjusted for horizontal flight. In the event of engine failure while the fore and aft automatic control is in use, the drop in speed and the consequent diminution in the suction from the Venturi tube will allow the mercury to fall in the right-hand arm of Fig. 3 and rise in





Aveline automatic control apparatus for airplanes

the left-hand arm. In this way the servo-motor will be operated to put the machine into a downward glide without any action on the part of the pilot, who would only have to steer the machine to a possible landing ground and flatten it out just before alighting.

If it is desired to control the machine in the ordinary way, either or both of the servo-motors can be instantly put out of action by the pilot, without leaving his seat, by means of valves fitted in the compressed-air pipes or by slackening the cables connecting the quadrants with the main control cables. If the former method of disconnection is adopted, the apparatus can still be employed as an inclinometer to indicate a tilt in either the longitudinal or lateral directions. This is due to the fact that small incandescent lamps are included in the circuits connecting the mercury channels with the relays. The lamps are fitted in the front of the relay casings, which are mounted on the instrument board in the cockpit in full view of the pilot. When the machine is flying level laterally, or at the correct longitudinal inclination, all the lamps are extinguished, but a slight tilt in either direction, by disturbing the level of the mercury, will cause one or other of the lamps to light up and indicate the existence of the tilt to the pilot.

The compressed air required to operate the servo-motors is provided by two small wind-driven rotary pumps mounted on the bottom longerons on both sides of the fuselage. These pumps maintain a pressure of about 60 lb. per square inch in a cylindrical reservoir placed inside the fuselage. The reservoir also serves as a receptacle for oil for the rotary pumps, these, of course, requiring constant lubrication. A maximum pull of 500 lb. can be produced in the cable attached to the quadrant, this pull being ample for the control of the largest machines at present in use.

The apparatus complete, as fitted to the Handley-Page passenger-carrying machine, weighs 150 lb. This, of course, is considerable, as it reduces the carrying capacity by one person, but it is argued that on long trips the fitting of this automatic stabilizer permits of dispensing with a reserve pilot which would otherwise be needed. It is, moreover, hoped to reduced the weight to 100 lb. by refinements in design. A company to exploit the invention has been formed in England. The drawings herewith are reproduced from *Engineering*.

THAT a rush for oil leases in the Brazeau Forest reserve, west of Edmonton, Alberta, is being experienced is indicated by the payment of nearly $25,000 in fees to the Aines Branch of the Edmonton office within the first two weeks of December. Land Office officials estimate that nearly 95,000 acres have been filed upon, half of which, under the new regulation, is reserved to the right of the Crown. Chief among the interests which have filed on this property are the Imperial Oil Company and the Oliphant Manson Collieries. It is stated that the Imperial Oil Company will set aside $2,000,000 for development in the Alberta oilfields this year, and that, if results warrant, the appropriation will be increased.

A PROCESS for reducing tungstic acid into tungsten powder and molybdenum sulphide into metallic molybdenum has been worked out by a Norwegian firm. It claims that the final products, which are in the form of small tablets, are of the most superior quality, being completely free from sulphur, carbon, or oxygen. It also says that the price for converting the ores into metal is lower than by any other method known by it. It is at present projecting a plant for the reduction of tungstic acid in Norway.

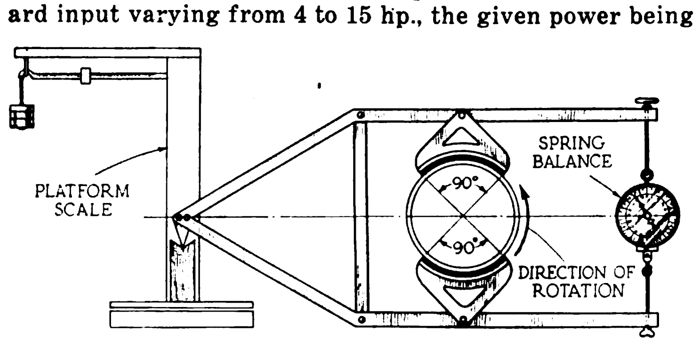
Much Useful Automotive Research in Progress at Bureau of Standards

Work now proceeding includes tests of brake linings made with a view to standardizing an apparatus for this purpose, efficiency and endurance tests of truck axles, study of flame propagation and detonation phenomena, and tests of lubricants intended to determine definitely what physical characteristics render an oil best suited for use in automotive engines.

By Herbert Chase

AUTOMOTIVE organizations which have been sufficiently interested in the research work being undertaken at the Bureau of Standards to urge upon Congress adequate support of this work, should find in the results being attained ample justification for their efforts, even though Congress has not yet voted the funds necessary to continue much of the work now in progress. Quite a large proportion of the latter is being done for other departments or bureaus, but the results are certain to be of general value in most cases.

One line of work which will be of immediate value to automotive manufacturers is that being undertaken for the purpose of standardizing tests and test apparatus calculated to determine the relative merit of various brake-lining materials. This work is being done in co-operation with the Motor Transport Division of the Quartermaster Corps and the S. A. E. Standards Committee. The apparatus used is illustrated in the accompanying cut. It consists of a 2½ x 14-in. brake drum such as is used on Dodge cars, arranged to be driven by any convenient means, such as an ordinary automobile engine. Bearing on the drum are two external shoes to which the samples of lining to be tested are riveted in the conventional way. The shoes are carried by a linkage (as shown in the cut) one end of which forms a brake arm resting on platform scales used to measure the torque applied by tightening the hand wheel, at the other end of the linkage. A spring balance placed between the upper and lower members serves to measure the total pressure exerted on the two brake shoes. It will be seen that the apparatus is simply a prony brake, by means of which the power input to the brake facing is readily measured. The facings are each cut of such length as to cover one quadrant of the drum. Tests have been made at selected constant speeds from 200 to 1000 r.p.m. and with a standard input varying from 4 to 15 hp., the given power being



Apparatus used for tests of brake lining

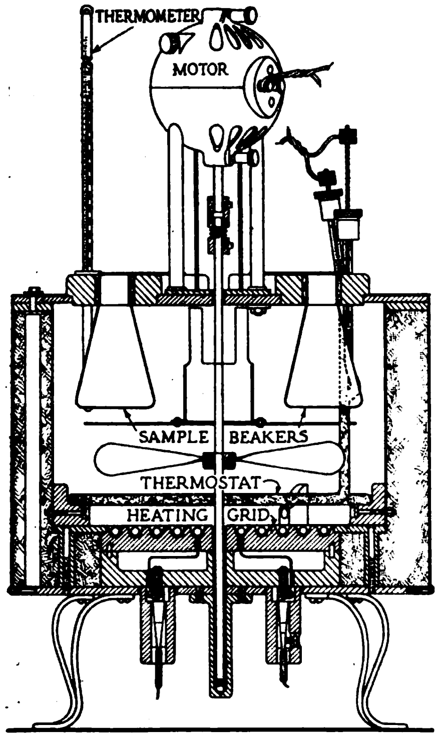
maintained by applying to the brake shoes the necessary pressure by turning the hand wheel.

The linings are run until worn away to one-half their original thickness, the power absorbed and the time required for wear being measured. These tests are being tried with various power inputs and various speeds in order to determine the speed and power which will enable a fair comparison to be made of wearing quality without requiring an undue amount of time for the test. When a sufficient number of tests have been made on the various makes of lining it is proposed to establish a standard test, the application of which will make it possible for users of brake lining to intelligently specify the properties that an acceptable lining must have. At present so many kinds of tests are employed that the lining manufacturers find it impossible to predict in advance what performance can be expected of their product. Some tests have been made, for example, in which the lining was simply allowed to run against a pulley traveling at a given speed, while a weight tied on the end of the lining was used to pull it taut. In this test account was taken only of the time before the sample wore in two, without regard to the power absorbed, with the result that the sample which had a certain amount of material, such as paraffin, which acts as a lubricant impregnated within it showed the best performance, whereas other samples were better suited to perform the function for which brake lining is intended. It should be noted that the apparatus described enables determination of the coefficient of friction as well as of the wearing qualities of the lining.

Axle Tests

Tests for the purpose of determining the efficiency and durability of various types of final drive in truck rear axles are proceeding and should also furnish much data of value to manufacturers and designers. The axles under test include for the present only those types intended for use on army trucks, but the apparatus being used is applicable to test of any axle. The axles undergoing test include the White double reduction type, and the worm gear type used on Class B army trucks, the latter being fitted in various tests with Timken roller bearings, ball thrust bearings, or deep-groove ball bearings, in order to determine which of the three bearing types is best suited for the service in question.

The layout of apparatus is as follows: Power is supplied by an electric dynamometer, running as a motor, on current supplied from an external source. To the



Standardized apparatus for Waters carbonization test

field frame of the dynamometer is rigidly connected a four-speed gearbox such as is used in the Class B truck, the outer end of the transmission being supported in a ball bearing trunnion similar to that used on the field frame of the dynamometer. The driven shaft of the gearbox is attached to the dynamometer shaft, and the driving shaft of the gearbox to the driven shaft of the axle to be tested. The purpose of the gearset is to enable direct drive, or drive through either of three sets of gears with reductions of 1.76, 3.23 or 5.93 to 1, as desired. In every case the torque delivered at the final driving shaft of the transmission is the torque measured on the dynamometer arm, the losses in the transmission being automatically deducted by the expedient of carrying the gearbox on the field frame of the dynamometer. This enables accurate measurement of the power input to the rear axle to be tested, and a wide range of torque output.

In order to enable measurement and absorption of the power output from the axle, the differential is locked and two large prony brakes are applied to the rims of the driving wheels carried by the axle, the rubber tires having been removed and the rims machined to afford a smooth surface for the bands of the prony brakes to bear upon. Each brake carries two bands, one bearing upon each of the dual rim bases. Chattering of the brake, which at first gave some trouble, is prevented by lubrication with graphite grease. Load is applied by tightening nuts on eyebolts attached to each of the bands. The wheel drums are kept cool by evaporation of water fed to their inner surface.

Each prony brake is provided with a long arm extending the entire length of the testing apparatus to a point near that end of the dynamometer shaft furthest from the transmission. The combined torque of the two arms is transferred to and weighed by a system of linkage with counterpoise arranged adjacent to the scale used for measuring the torque output of the dynamometer. By properly proportioning the length of the various arms and weighing the difference in torque it is possible to determine directly and accurately the efficiency of the axle under test. The method employed is identical in principle with that used by Prof. Allen of Worcester Polytechnic Institute.* Efficiency tests are being made with power input varying from 5 to 55 hp. The speed of the electric dynamometer is maintained constant at 1200 r.p.m., this corresponding to the governed speed of the Class B truck engine.

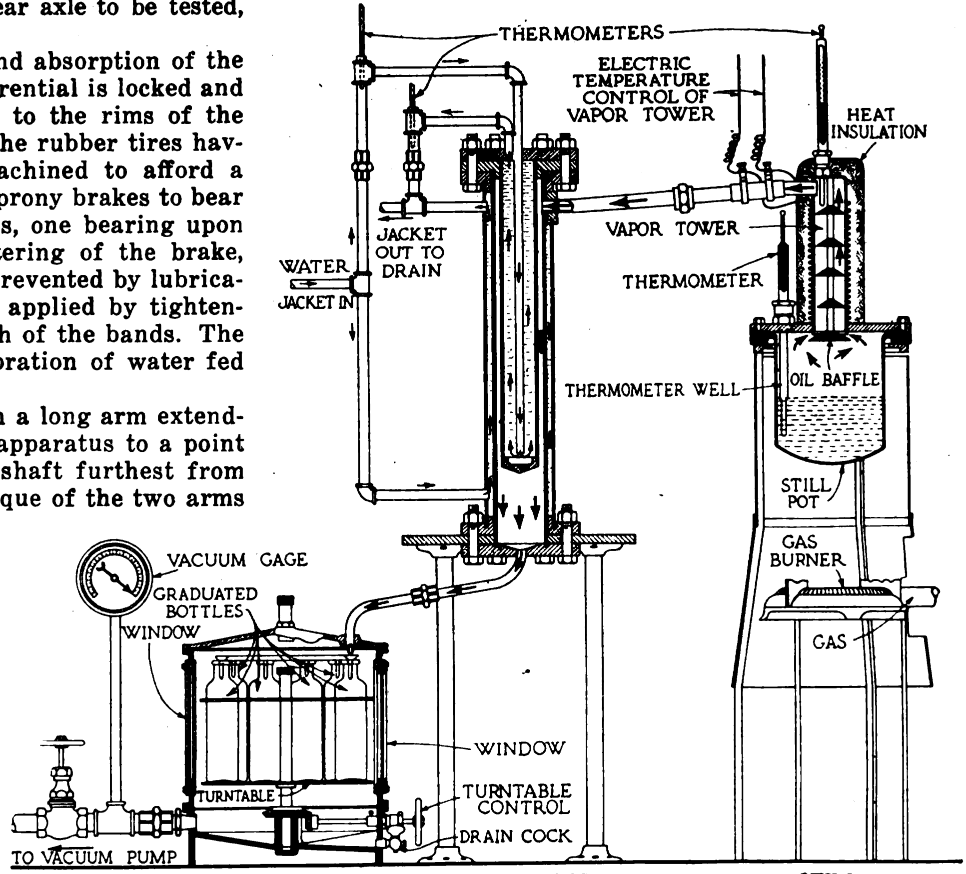
By use of the transmission gears, a wide range of torque is obtained in the same manner that it is obtained in truck operation. The lubricant used in the rear axle is 600 W cylinder stock. The temperature of the lubricant is maintained constant in various tests at 80 deg., 116 deg. and 212 deg. Fahr. respectively by a spray of water on the outside of the axle housing, the temperature being measured at the thrust bearing and in the sump below the worm gear.

Following the efficiency test it is planned to make an endurance test in which the transmission will be set in low gear and the dynamometer adjusted to deliver 55 hp. continuously until breakage of some axle part occurs, thus similating the most severe condition possible in actual service with the Class B truck.

Tests of Lubricants

Tests of lubricants which have been proceeding for many months have been much handicapped by lack of sufficient personnel, but these tests are going forward as rapidly as possible under the conditions prevailing. The program of lubricant tests includes tests of trade oils, standardization of Waters carbonization test, physical properties of lubricating oil when diluted with engine fuel, investigation of tests for greases, investigation of bearing friction, fractionation of finished hydro-carbon lubricants to find original constituents of blended oil, effects of temperature on oil film adhering to a hot plate, engine tests of hydro-carbon oils and absorption of gasoline vapors in hydro-carbon oils:

Among the items which it has proved possible to give most attention to are the following:



Vacuum still for fractionation of lubricating oils

*See AUTOMOTIVE INDUSTRIES for June 13, 1918.

The apparatus developed for the purpose of standardizing the Waters carbonization test is shown in the accompanying cut. It consists of a double compartment cylindrical air bath, the walls of which are made of sheet iron with heat insulating material between them. This apparatus was built around a hot plate having a low heat capacity in order that changes in the temperature of the heating element will be quickly felt in the air bath. Directly above the heating coil is located the bulb of an adjustable mercury thermostat of special design, which serves to keep the temperature of the bath at 250 deg. C. and constant to within ½ deg. C.

The thermostat is not designed to carry the total heating current, but a commercial type relay is interposed in the circuit to interrupt the current passing to the heating element. A closer degree of regulation can be obtained by connecting a variable resistance in series with the heating coil, and allowing the relay to short circuit this resistance upon closing.

The cover of the bath consists of a circular sheet of hard asbestos board and is bored to hold six glass flasks and thermometer. The flasks are held in place by split collars so arranged that no leakage of air around either the flask or the collar can occur.

The air in the bath is stirred by a two-bladed fan, driven by a motor vertically and centrally mounted on the asbestos cover and connected thereto by a shaft and flexible spring coupling. The lower bearing of the shaft is an ordinary single ball thrust type. The air in the bath driven by the fan is forced to circulate around the flasks by baffling, and is returned to the center of the chamber through a cylindrical spider which also serves as a mount for the baffle plate.

In making a determination of the carbonization value, 5 g. samples of the oil to be tested are weighed to the nearest drop in the flasks. The bath is heated to 250 deg. C. and the flasks containing 5 g. samples inserted. The temperature of the bath is then kept constant to within ½ deg. C. for a period of 2½ hours. The technic of operation thereafter is practically the same as described by Dr. C. E. Waters in Bureau of Standards Circular No. 99.

Fractionation of Finished Hydrocarbon Lubricants

In order to find the original constituents of blended oil and determine other qualities by means of distillation, it has been necessary to develop an apparatus for low pressure distillation, since complete distillation, if attempted at atmospheric pressure would require temperature sufficiently high to decompose or crack the lubricant.

This apparatus is similar to that employed in research work conducted for the Tidewater Oil Co. and others by C. W. Stratford, but has been improved in detail. Referring to the diagram:

The vacuum distillation apparatus in use at the Bureau consists of a steel still having a 2½ liter capacity and a still head. The still head is connected with a vertical water jacketed condenser which in turn leads to a receiver holding ten graduated bottles, each having a capacity of 200 c.c. These bottles are arranged on a turntable brought into position without alteration of the pressure in the distillation system. The whole system is connected with a pump capable of maintaining a vacuum of 1.5 mm. absolute pressure. For recording the pressure, a manometer is placed between the pump and the receiver. The temperature of the oil in the still, the vapor temperature and also the temperature of the condenser water are measured by standardized thermometers. Violent boiling or bumping occurs in distillation under reduced pressure. At times this bumping becomes so violent that unless special precautions are taken to prevent it, oil is carried over into the condenser, thus contaminating the distillate. This can be overcome by using conical screens attached to a steel rod suspended in the still head and a steel baffle plate attached to the bottom of the still head.

The still is charged with 2000 c.c. of the oil under examination. Great care is taken to have all connections and joints air tight to prevent oxidation of the oil, due to leakage. The pump is then started and when the manometer indicates the desired pressure, heat is applied. A ring type gas burner is used which is set low so that no fire touches the still bottom, thus preventing localized heating and consequent coking or cracking. When the first drop of distillate comes over, the temperature is read and recorded as the initial boiling point. Thereafter the temperature is recorded for every ten per cent of distillate, and when 200 c.c. of distillate have been collected a new bottle is brought into place. The rate of distillation is easily controlled. The time for a complete distillation varies with different types of oils, the usual time being from 2 to 2½ hours.

The fractionation of finished lubricating oils under vacuum is a satisfactory method for determining the boiling point limits with the least decomposition of the product, provided, however, that the distillation is not carried on after a temperature of 300 deg. C. has been reached in the still. Experiments have been made in which it was attempted to distill oils above 300 deg. C., but it was found that above this temperature cracking occurred; more extensively in some cases than in others. When cracking takes place, the heavier hydrocarbon molecules break up and are altered so that low boiling hydrocarbons are formed. Temperatures above 300 deg. C. are favorable to this reaction.

There are several means of determining whether or not cracking occurs during distillation. When cracking takes place the distillation continues for some time with little or no increase in temperature. Specific gravity, flash point and viscosity measurements would indicate cracking if the suspected fraction showed marked variations with regard to these properties. Cracked distillates have a disagreeable burnt odor.

Gasoline engine tests are being run at the Bureau of Standards to compare the lubricating qualities of paraffin and naphthene base motor oils. These tests are being run with a view to answering the following questions:

1. How long can an oil be used in service?
2. At what rate does lubricating efficiency decrease?
3. What are the causes of decrease in lubricating efficiency?

In connection with these engine tests, the vacuum distillation test will enable a selection to be made of a series of oils from both paraffin and naphthene bases having a known boiling point range. The vacuum distillation test also determines the loss of volatile constituents of motor oils during use in an engine by comparing the volatility of the oil before and after use. The difference in volume of the distillates up to 300 deg. C. is taken as a measure of the loss due to evaporation of the light constituents of the oil during exposure to the high temperatures of the engine. This test also serves to indicate the relative consumption to be expected with various oils.

The distillation of finished lubricating oils under vacuum as described meets all the requirements of a successful routine method for the examination of lubricating oils determining of what groups of hydrocarbons, highly volatile or less volatile, they consist, and permits separation of these portions into graduated fractions. It also shows the quantity and quality of the component light, intermediate and heavy oils used in blending.

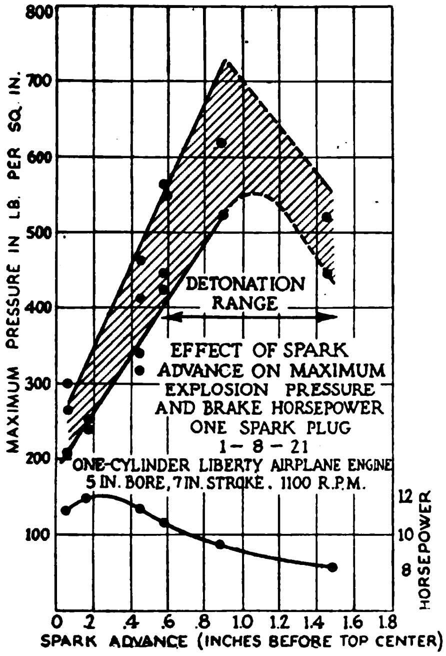


Fig. 1

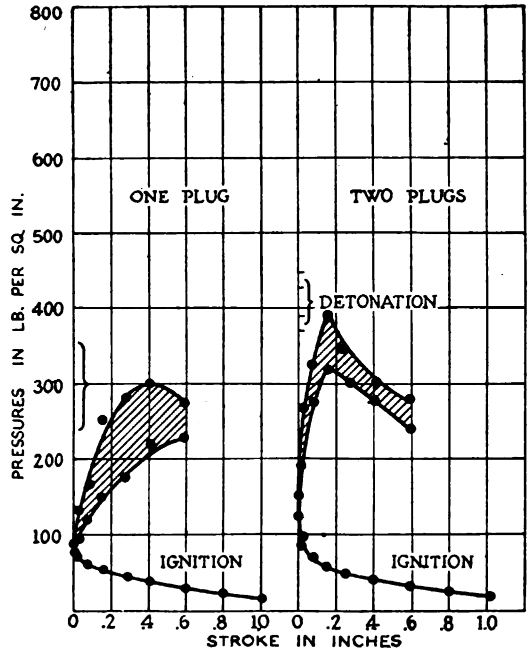


Fig. 2

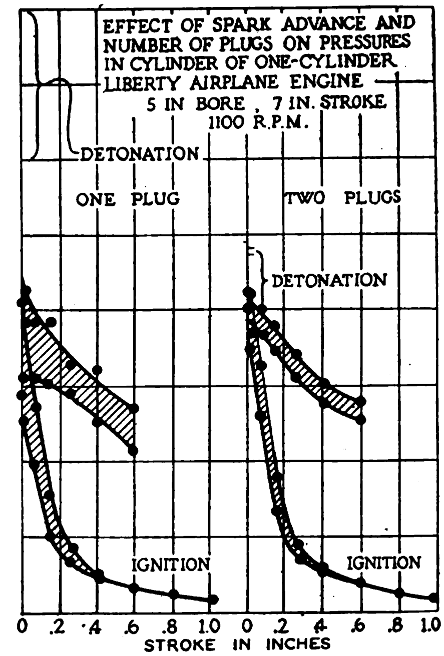


Fig. 3

Curves showing effect of spark advance and number of sparks on maximum pressure, detonation and power output of a single-cylinder Liberty engine

This method is one of the most valuable means of identifying the source of crude from which lubricating oils are derived, as there is a marked difference in the boiling points and the yields of distillate obtained between paraffin and naphthene base oils.

Engine Tests of Hydrocarbon Lubricants

It is the purpose of the Bureau to test numerous different oils on the market before and after use for considerable period in automotive engines. In order to do this engines are run under constant test conditions and change in the character of the lubricant noted by collecting representative samples at various stated intervals during the test. The lack of personnel has prevented completion of many tests of this character, but some work in this direction has been done.

It has been found that the fit of pistons and rings plays a very large part in determining the oil consumption of a given engine. In order to prove this, pistons and rings, with various qualities of fit, have been tried in an engine arranged to measure the oil in the exhaust from the engine when driven by an electric dynamometer. In this way some of the relations between ring fit, piston fit and speed have been determined, but the results obtained to date are too far from complete to draw any general conclusions. In some cases very low oil consumption has been obtained by pinning the rings in order to prevent them turning to such a position as to bring the ring slots into approximately the same plane. When they turn to this position the oil consumption is much higher than when they are pinned to prevent this occurrence.

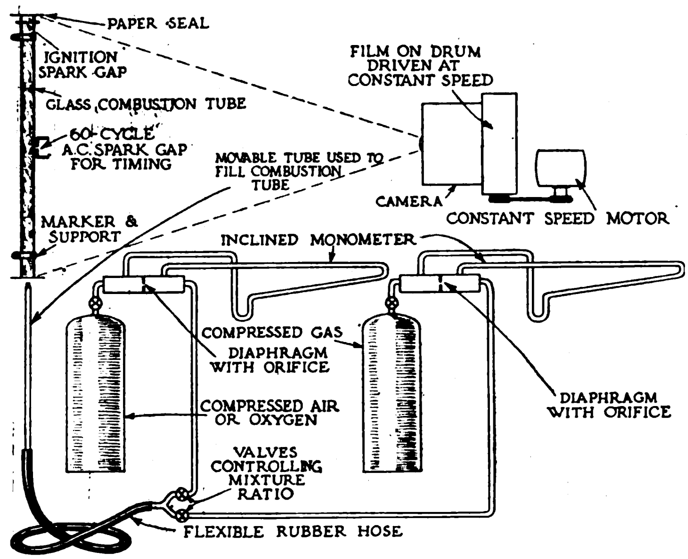
In addition to the tests of lubricants above mentioned, the Bureau is, of course, equipped to make the ordinary flash fire, viscosity, gravity and cold tests, as well as the Waters carbonization tests, the Conradson carbon residue tests and the Herschel demulsibility test to determine rate of separation from water.

Tests of Fuel

Tests of fuel with respect to their utilization in automotive engines are not proceeding rapidly, owing to the lack of appropriation for such tests, but many interesting results have been obtained in spite of this fact. It has been found, for example, in studying the effect of detonation that, with an engine having a 5 to 1 compression ratio, maximum pressures in excess of 1300 lb. per sq. in. are developed when using kerosene for fuel and pressures in excess of 1200 lb. per sq. in. with commercial gasoline. These pressures do not occur with regularity, but are the result of occasional detonations much more violent than others.

Other tests have proven definitely that spark advance is at least to some extent a controlling factor with respect to the occurrence of detonation. The effect of spark advance on maximum pressure is shown clearly in the attached curves. Fig. 1 is plotted from the results of tests on a single cylinder Liberty engine of 5-in. bore and 7-in. stroke. The effect on horsepower output is also to be noted. It will be seen that the maximum power is developed when a spark advance of approximately ¼-in. piston travel is used. An advance beyond this point causes detonation and a falling off in power, but the maximum pressures are not reached until a spark advance of 1 in. is used. Beyond this point the maximum pressure decreases though detonation continues. The range of pressure recorded is marked by the upper and lower curve.

It has sometimes been said that an engine which will knock badly with a single spark will cease knocking when two sparks are applied by plugs in different parts of the cylinder. This is true within certain limits, but from tests made at the Bureau it becomes evident that the determining factor in this respect is in reality what may be termed the effective spark advance. Suppose, for example, that in the case of the engine referred to detonation occurs with a single spark at a point 0.6 in. before center. (Fig. 1.) Using two sparks at this point will in effect advance the spark and cause more violent detonation. If, however, the engine is knocking badly with an advance of 1.4 in. on a single spark, and 2 sparks are applied, knocking will cease, due again to the earlier effective advance. Hence it is clear that the effective advance is the controlling factor and not the mere occurrence of one or two sparks.



Apparatus used in study of flame propagation phenomena

This is further illustrated in Figs. 2 and 3. Under the conditions obtaining in Fig. 2, it will be noted that with one spark detonation does not occur, the range of maximum pressure, from cycle to cycle, varying as shown by the bracket from about 240 to 350 lb. per sq. in., while with two sparks, and the same actual advance, maximum pressures due to detonation, as shown by the bracket, run from about 370 to 450 lb. per sq. in. On the other hand when the spark advance is increased and ignition occurs nearly 1 in. of piston travel before center (see Fig. 3), violent detonations resulting in occasional maximum pressures (as shown again by the bracket) of 600 to 800 lb. occur, whereas, when two sparks fired simultaneously occur at the same advance, the maximum pressures are much less, although detonation is not entirely absent.

Other tests made with varying ratios of air to gas indicate that the detonation is also dependent upon the proportion of fuel in the mixture, under a given spark advance.

With a constant velocity of cooling water through the jacket of a cylinder it has been noticed that a very rapid rise in temperature takes place when detonation occurs, this indicating that considerably more heat is lost to the jacket under this condition.

A quartz window in the cylinder reveals the fact that detonations are accompanied by extremely brilliant flashes of light. It is thought quite probable that carbon particles cracked out of the fuel during the process of combustion are heated to incandescence by the sudden liberation of energy which accompanies the detonation. It seems likely that the radiant heat liberated under these circumstances accounts, in part at least, for the rise in temperature of the jacket walls. It has generally been supposed that the amount of energy released during detonation is small, although the rise in pressure is extremely rapid. The foregoing phenomena indicate, however, that detonations are accompanied by very considerable energy liberation, but that this energy produces only a small equivalent in work, the bulk of it going to increase jacket losses.

It appears that there is still a considerable difference of opinion regarding the cause of detonation and the resultant knock or ping. Some still think that the knock is due to the impact upon the combustion chamber walls of gas molecules in the rapidly moving wave front. In this case it would be expected that the maximum pressure would occur on the combustion chamber wall opposite to that in which the spark plug is located. Tests made at the Bureau indicate, however, that the maximum pressures generated are the same in different parts of the cylinder.

Others attribute detonation to the following phenomena: a charge compressed in the cylinder is fired, say at one point. The combustion of the gas through which the flame travels during the earlier stages of burning results in a rapid rise of pressure and consequently of temperature in the remaining unburnt gas, until finally a temperature high enough to cause auto-ignition throughout the entire mass is attained, this resulting in very sudden release of energy and corresponding temperature and pressure rise. Whether or not either of these theories will stand or one or both of them prove to be incorrect remains to be seen.

Study of Flame Propagation

One of the interesting activities in progress at the Bureau is that in which a study of flame propagation is being made. Two methods are being followed in the prosecution of this work. One of these involves the use of a photographic means for determining the rate of propagation in a glass tube which can be readily filled with a mixture of the desired richness. The proportion of air to combustible gas is determined by allowing streams of each to flow through calibrated orifices. The two are then mixed and introduced into the tube. The mixture can be pre-heated if desired. After the tube is filled with the mixture the ends are sealed by a soap film or very light tissue to prevent diffusion of mixture into the air of the room. The mixture is then ignited by a spark at one end of the tube. The tube is located near one end of a darkened room, and at the other end of the room a camera is set up. The film is mounted on a drum driven at constant speed by a small electric motor. The film is allowed to turn continuously with the shutter opened during the time that the room remains dark. When the gas is ignited and the flame travels through the tube the photograph is taken on the film, the moment of passing of the ignition spark being clearly visible. Alternating current is passed through a second spark gap placed near the tube. The sparks resulting from alternations at known frequency show on the film and enable accurate measurement of the time interval for passage of the flame between markers placed a known distance apart on the tube. To date only fixed gases have been used in these experiments, but tests with vapors of gasoline and other hydrocarbons are to be conducted later.

It appears that it is possible to accurately duplicate, with tubes of given diameter, tests made in this manner, but that the results vary considerably with change in diameter of the tube. For this and other reasons another method of measuring the rate of flame propagation is being employed. This consists of photographic means for measuring the angle of the flame contour in a jet of combustible mixture issuing from a tube at known speed. Knowing the mixture speed and the angle it is possible to determine accurately the rate of propagation.

The process of combustion is evidently gravely affected by temperature and pressure of the explosive gases as well as by their composition and mixture ratio. The presence of inert gases and the size and shape of the container have also their effect. The difficulty has been to determine with certainty the individual effect of these factors; for, in the engine cylinder they are massed together and are constantly changing. The same gaseous mixture, for instance, under one condition, may give an

apparent rate of flame propagation of ten meters per second. Under another set of conditions, it may show a rate of sixty meters per second; or, it may detonate and travel at a rate of 2400 meters per second. The conditioning factors seem to be chiefly those of pressure and temperature. The methods of study of these phenomena have been carried out, for the most part, in spherical bombs and the results analyzed from imperfect pressure records. The movement of the flame in glass tubes has also been observed and accurately measured; in both of these cases, however, there is a mass movement of the charge masking the true flame velocity. In the case of the tubes, a profound cooling effect is present, and the pressures and consequently temperatures are not continuously determinable with the changing rate.

The direction of the investigation of this subject at the Bureau of Standards has therefore been to seek the effect of these factors on the rate of combustion. The flame angle method referred to has been chosen for following these reactions at constant pressure. It seems to meet all the ideals of this condition as completely as the spherical bomb does those of constant volume. It has the further advantage of being wholly visible and of allowing the apparent flame velocity to be corrected for the mass movement of the charge, together with a high accuracy of temperature determination. There is also being developed a method of determining the effect of temperature (preheating) upon the rate of combustion at constant pressure, and for varying pressure at constant initial temperature. For adiabatic conditions, velocities and pressures are simultaneously recorded.

Tests, the purpose of which was to measure the impact effect of gas molecules traveling at high velocity in a flame front, have been made in the following manner: A metal tube of known weight about 30 in. long is suspended in a horizontal position from the ceiling by two fine wires, thus forming a ballistic pendulum. The tube is filled with the combustible mixture and lightly sealed with a soap film at the open end. A spark, igniting the mixture near the open end, causes the flame to travel toward the closed end and react thereon. This causes the tube to swing backward as a result of the gas impact. The energy of the impact can then be determined by carefully noting the distance the tube moves.

Tests of Aviation Engines

Exhaustive tests of a 180 hp. Hispano-Suiza aviation engine are being made for the National Advisory Committee for Aeronautics for the purpose of determining accurately the effect of varying compression pressures and mixture ratios upon power output at atmospheric pressures corresponding to different altitudes from ground level to 25,000 ft., in steps of 5000 to 10,000 ft. The speeds used are 1,400, 1,600 and 1,800 r.p.m. At each altitude five different mixture ratios are employed, the spark adjustment in each case being that necessary to give maximum power. Tests are also made at ½, ¾ and full load. Friction hp. is also determined and the actual compression pressure at 1,600 r.p.m. on all cylinders is measured. When completed this test, which is conducted in the laboratory especially designed for the purpose, will be the most complete of its kind ever conducted. It should prove of great value to designers of aviation and other types of automotive engines.

Tests of Ignition Apparatus

Work is now proceeding for the purpose of determining mathematical expressions for the electrical characteristics involved in the design of magnetos.

Certain tests recently made on spark plugs indicate that the voltage necessary to break down a spark gap is lower when the electrodes are hot than when they are cold, this condition being independent of the temperature of the gas between the electrodes.

Much other work along automotive lines is in progress, but most of this is being done for various branches of the service and it is not permissible at the present time to describe the work or outline the results being obtained. Ultimately, however, it is expected that these particulars will be made available for publication.

A Drop Forged Steel Wheel

A NEW type of wheel has made its appearance on the market—the drop forged steel wheel. As compared with wood wheels, the forged steel wheel has the advantage that it consists of only a single piece and therefore has no joints to come apart. Being made of wrought steel, it is practically unbreakable. Even the brake drum is made in one piece with the wheel and where it fits to the spokes the joints are nicely rounded so as to prevent the accumulation of mud and dust at these points. All trouble due to the shrinkage of wood is eliminated, and if the wheel is made true in the first place it should remain true.

It is always difficult to make a comparison of the weights of wheels of different kinds, as the comparison should be made between wheels of exactly equal strength, and as the strength of wheels in different planes is not always proportional, this is difficult to do. It is stated by the manufacturer that the wheel in question is practically as light as the standard wood wheel and of much greater strength. The wheels are said to be easy to clean. Soft mud will stick to the concave side of the spoke, but when it has dried it will be thrown off by centrifugal force, it is claimed.

The drop forged steel wheel should prove particularly popular in arid sections where wood wheels give trouble, owing to shrinkage. The wheel is designed to carry the standard demountable rim and it is not necessary to carry a spare wheel on the car. It is manufactured by The Jefferson Forge Products Co. and at present seems to be made chiefly for replacement on several makes of small, popular-priced cars.

The Jefferson drop forged steel wheel

Utilization of Special Machines in Cylinder Block Production

One of the distinguishing factors of the cylinder block production described in this article is the use of specially simple jigs, while an effective location system permits positive alignment of all faces and finish surfaces. The various machining operations are discussed in detail.

By J. Edward Schipper

THE manufacture of the Paige cylinder blocks is distinguished by the use of very simple jigs and by an extremely simple system of location which permits positive alignment of all faces and finish surfaces, and renders unnecessary complicated means of determining location.

The cylinder block is for the Paige little six, which is manufactured in the Paige Motor Car Co. plant. Normal production on this model runs 100 per day, and the shop is tuned up on a 9 hr. basis, which gives a production through the machinery of nine pieces per hour. The operations are so arranged and the machinery has been selected in such a way that no particular machine runs ahead of the rest of the shop. Thus all piling up of parts is avoided and the floor kept absolutely free from accumulation of parts around any one machine. This idea is carried further than in most plants, as instead of cylinder blocks entering a finished stock department, or at least accumulating beyond requirement, they are passed immediately to the engine assembly line. In other words, there is no definite hiatus between manufacture and assembly on these blocks. The floor is so laid out that the final manufacturing operation on different parts takes place adjacent to the point at which they are required for the assembly line.

The raw castings for this cylinder block average 240 lb. apiece, and the finished casting 200 lb. Thus, about 40 lb. of metal are cut from each block during the various processes of manufacture, or 4000 lb. of metal per day in the cylinder block machining department. As the operations are followed through this article, it will be noticed that no deep cuts are taken at any particular point along the line. The rough casting is very closely approximate to the finished casting in its exterior and machining dimensions.

The cylinder block is checked over in a rough inspection jig before any operations are performed. This jig has stops between the No. 3 and 4 cylinders and the top and bottom. The amount of metal required endwise is checked by the stop between the third and fourth cylinder, and the depth of these castings is checked by the top and bottom stops, which indicates that there is sufficient metal for all of the machining operations made.

The first machining operation is located in exactly the same manner as the casting check on the rough inspection jig. In other words, the stops on the jig for the first operation are duplicates of the stops on the rough inspection jig. The machine is an Ingersoll reciprocating miller which mills the valve side of the casting. This machine has three cutters and is capable of handling nine blocks per hour. All faces on the valve side are finish milled in this operation.

The second machining operation is on an Ingersoll of the long table type, capable of carrying five blocks at a time. There are double rows of cutters in this machine, giving first, a rough, and second, a finish cut on the three faces of the block not milled by the first machine. Location for this work is from the top and bottom flanges. This machine leaves the block with all four sides finish milled.

After the milling operation, the next operation is to drill two dowel holes from which every subsequent machining operation is located. In drilling these dowel holes on a Cincinnati-Bickford radial, the block is located from the milled faces and from a V-block between the third and fourth cylinders. Besides the dowel holes, which are ½ in. in diameter, the main feed holes for the oil line and the oil pump holes are drilled and reamed on this machine.

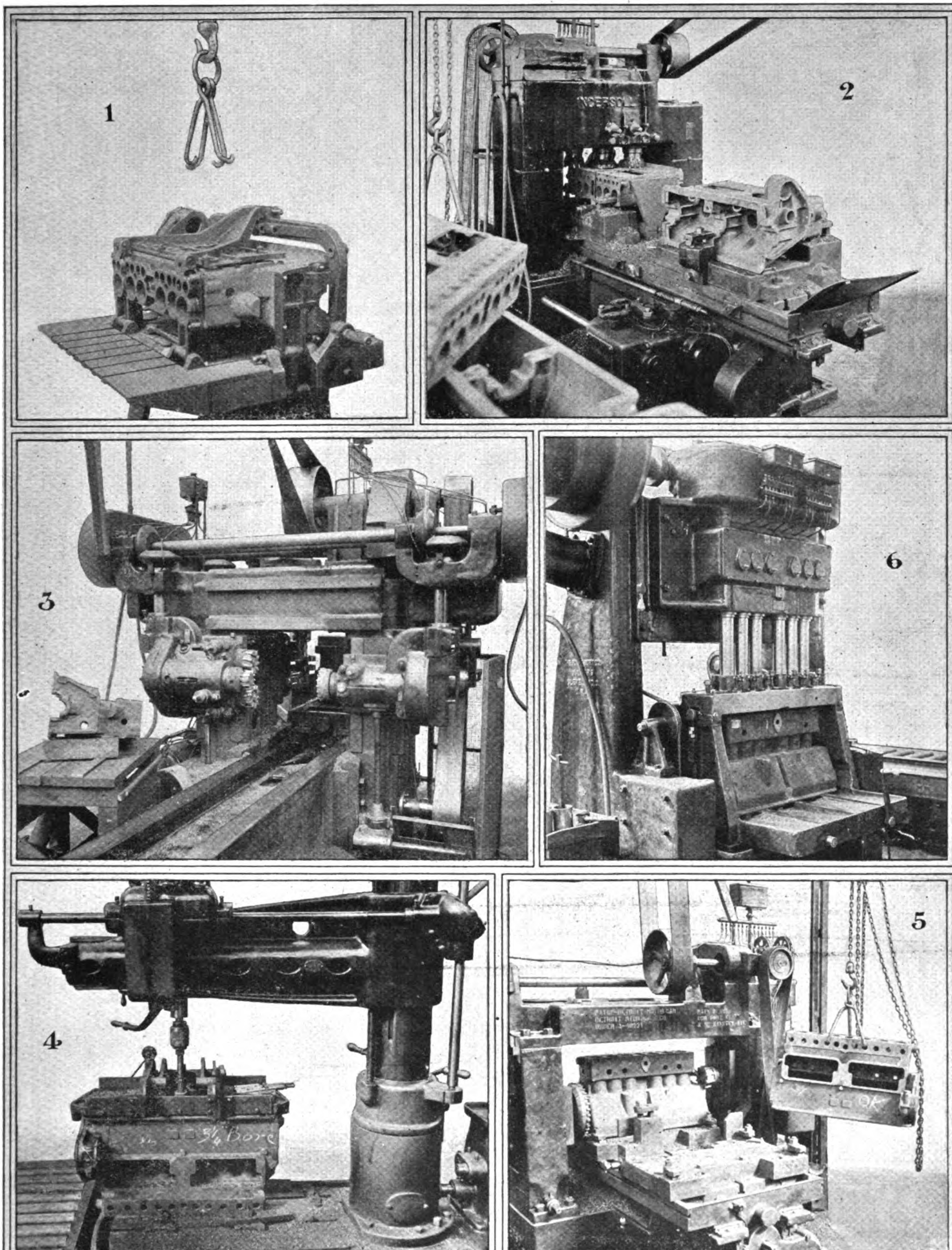
A special Ingersoll miller with a traveling cutter takes care of the next operation, which is milling both ends of the block. On one end, the cutter is designed to rise and fall. It is timed so that as the table feeds, the cutter travels over the surfaced portions of the rear face in what is, roughly speaking, a three-sided figure. The cutter rises, milling one face, then remains stationary while the table travels, milling the top face, and then descends, milling the third face. The table for this machine takes two cylinder blocks at a time and the machine makes the finish cut. Location is from the dowel pin holes.

Three Foote-Burt cylinder boring machines give the cylinders a rough, semi-finish and finish bore respectively. After the final bore, 0.020 in. is left in for reaming. On the finish bore, the limit is 0.0005 in. Location for this operation is from the dowel pins only. The cylinders are then left in their finish bored condition to go through the remaining operations, the final surface being put on the cylinder walls later, as will be described subsequently.

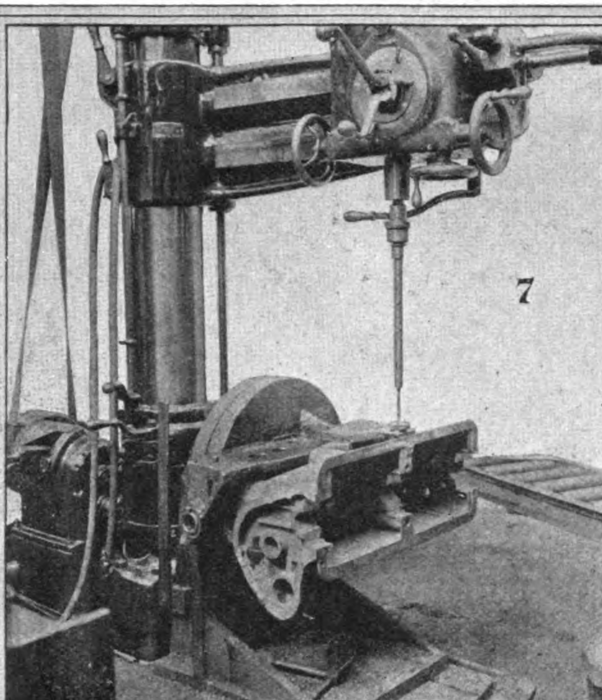
Two American radial drills take care of the next operation, which is drilling the fan stud holes and the Hubbard plug holes, as well as the cylinder drain holes. In this same operation, the intake passage in the top of the cylinder is drilled out and also the stud holes for the carbureter.

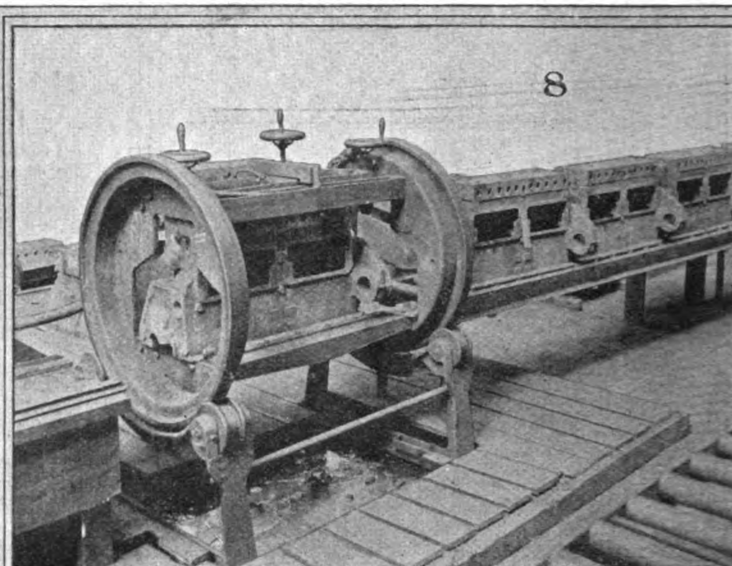
As an economy measure, a preliminary water test is given the cylinder block at this point. This is done on a jig which seals all of the water holes and allows the application of a 60-lb. hydraulic pressure. Only relatively few operations have been taken up to this point and leaks can be detected at a time when it is not expensive to salvage the block. This is only a preliminary water test, of course, as a later test is necessary after other cuts have been made.

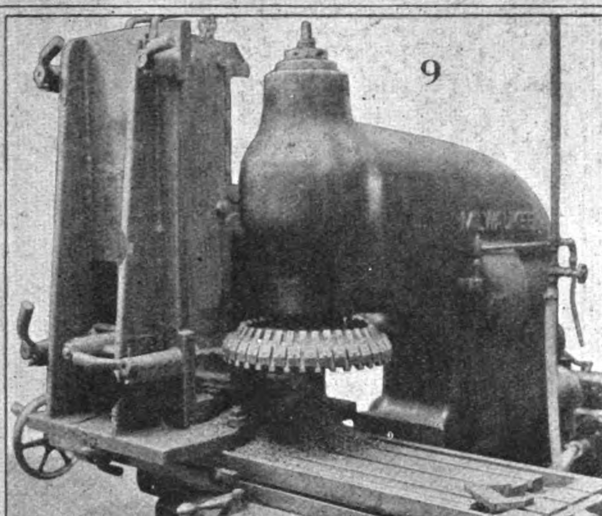
Milwaukee millers are used for milling the water pump

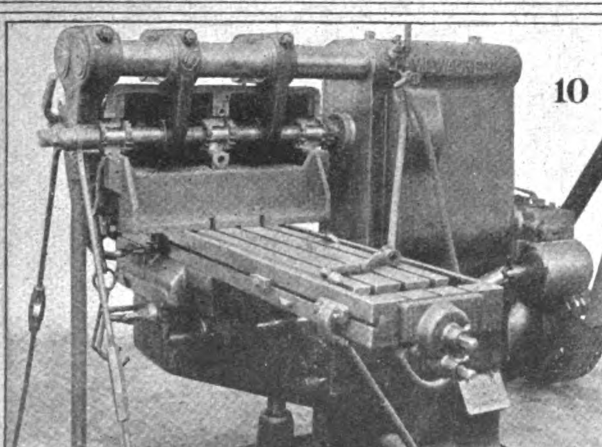


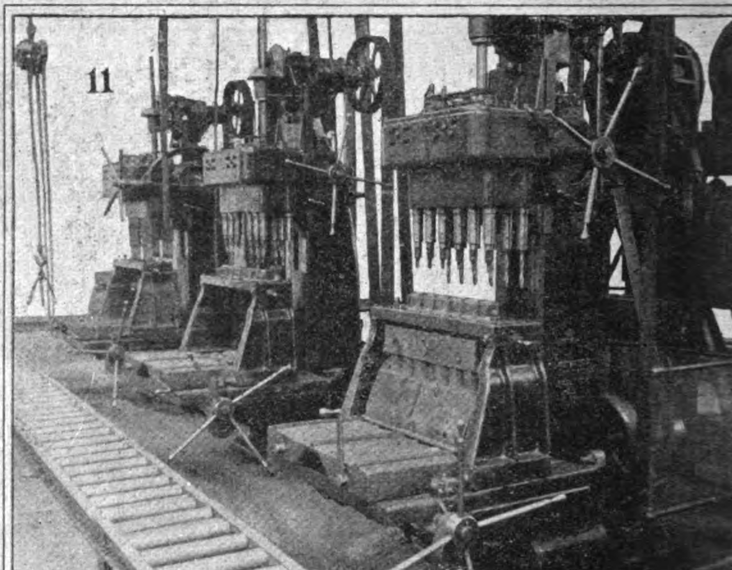
(1) *Inspecting the rough casting on the rough inspection jig.* (2) *Milling exhaust manifold sides on Ingersoll reciprocating milling machine.* (3) *Milling face, bearing caps, top and bosses on side opposite the valve on an Ingersoll six-head, nine spindle, fixed rail milling machine.* (4) *Drilling and reaming two dowel holes from which practically all of the subsequent operations are located.* (5) *Milling the ends of the blocks on a special Ingersoll miller. The small cutter shown at the right of the machine is a traveling cutter described in the text.* (6) *Foote-Burt cylinder boring machine, boring six cylinders at one time*

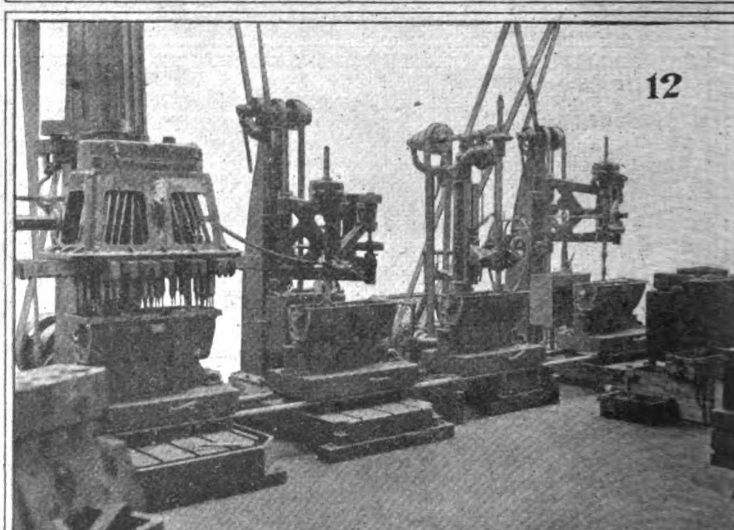




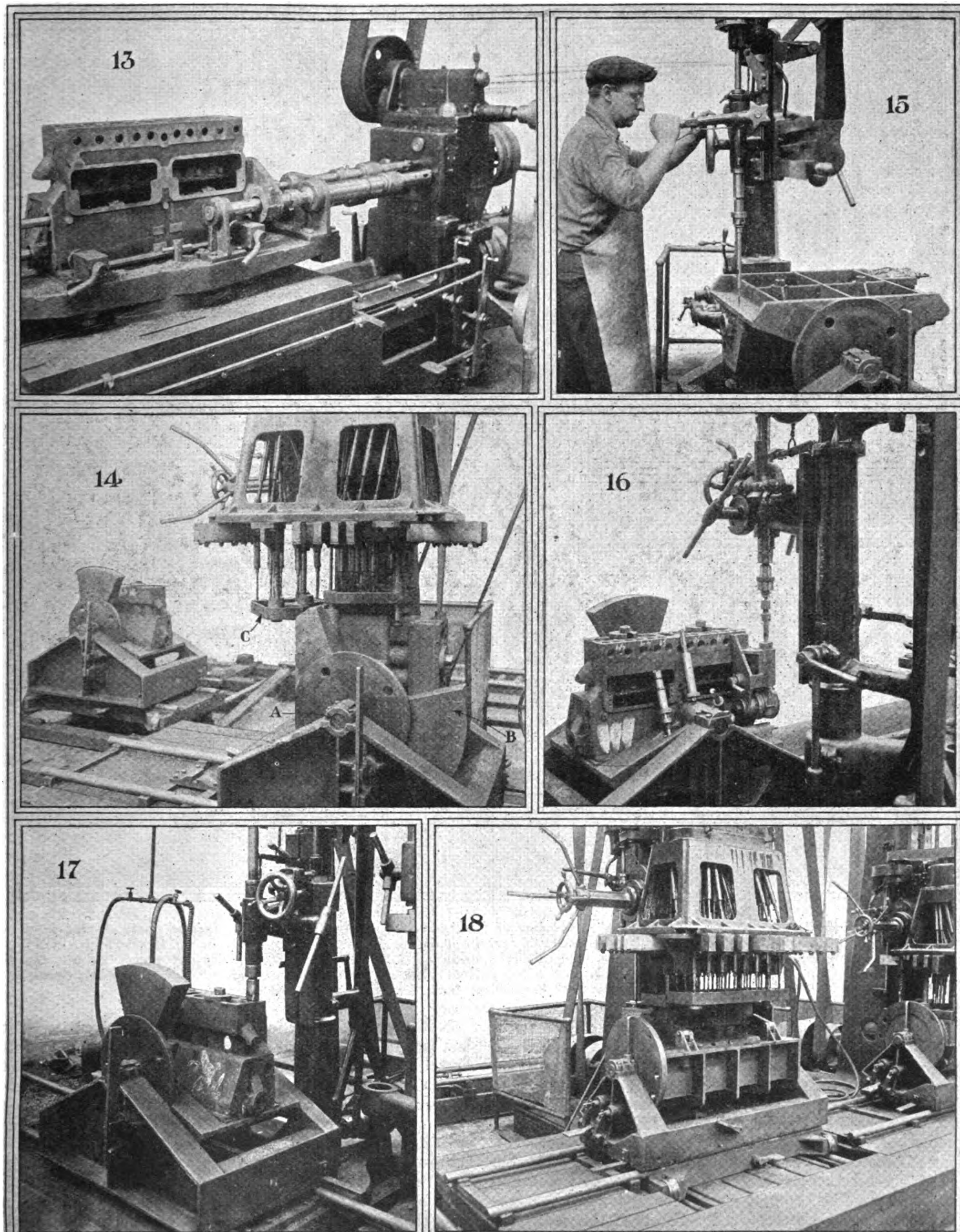




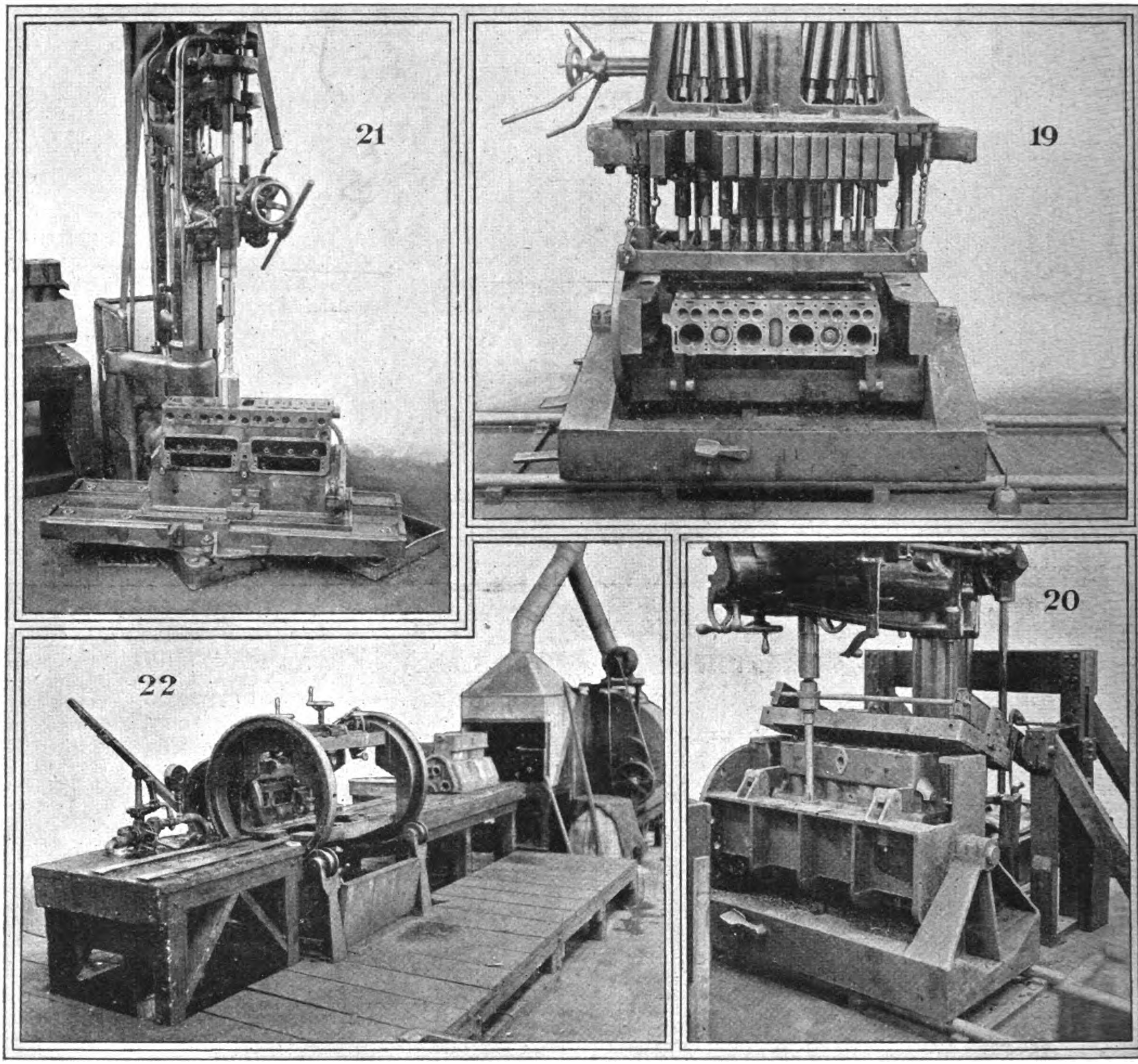




(7) *One of the two American radial drills used for drilling the fan stud holes and the Hubbard plug holes, as well as the cylinder drain holes.* (8) *Jig for water testing the block. The jig seals the block and a hand pump is used for a 65-lb. hydraulic test.* (9) *Milwaukee miller for the water pump pad.* (10) *Milling the faces of the main bearing holes and the oil sling slots on a Milwaukee miller with a special support arm and an extra long table. This is a straddle milling operation.* (11) *Battery of Foote-Burt multiple spindle drills for the valve and valve guide holes. The first two machines are roughing cuts and the third machine shown in the background is finish cut. The first two have twelve spindles each and the rear twenty-four.* (12) *Railway jig arrangement for a group of four operations*



(13) *Moline boring machine which rough bores the main bearings, the camshaft bearings and water pump support holes.* (14) *Turnover jig operation showing the jig in a Baush multiple with one set of spindles at work. The jig is then thrown over on the shaft A, assisted by the counter-weight B, and the second series of spindles at C brought into operation.* (15) *American sensitive drill press used for tapping some of the holes in the previous operations, employing the turnover jig.* (16) *Barnes power-feed drill press which drills, reams and spot faces the distributor holes. Similar machines are used for spot facing the valve seat and for milling the clearance in the timing gear case.* (17) *Barnes power-feed machine spot facing the top of the valve seat.* (18) *First of a series of five machines operating on one jig carried along on roller tracks. This is a Baush thirty-six spindles*



(19) Baush thirty-three-spindle, the second in the line of five machines taking care of the intake ports, water inlet holes, etc. (20) American radial drill press indexed for the breather holes 2 deg. and 20 min. off the vertical. (21) Cylinder bore lapping machine. This is a special carborundum stone machine with spring-out pieces to put the finish surface on the cylinder bore. (22) Washing the cylinder blocks in a Blakeslee washer. This is the last operation before the block goes to final inspection from which it is passed on to assembly

pads (this being a finish cut located from the dowels) and for straddle milling the main bearings and the oil thrower grooves. A battery of three Foote-Burt multiple spindle drills is required for the valves and valve guide holes. The first of these three machines, all of which are exactly alike, is for the valve holes and valve guide holes for six of the cylinders. There are twelve spindles for this operation, taking care of six alternately faced valves. It is impossible to machine all twelve holes at the same time because the tools cannot be brought close enough together, therefore two machines are required. The block is shifted to the second machine, which also has twelve spindles for the six valves. The third machine, however, reams all of these holes at once. A very noteworthy jig is used for these operations. It is an indexing type which comes forward for the six valve holes and moves back for the six guide holes on each of the first two machines. On the third machine, the same type of jig is used except that all of the holes are taken care of on the one machine.

Nothing has been mentioned regarding location of the last few operations, but as indicated, these are all from the dowel holes cut for this purpose. This same applies to the series of operations which are done on a jig which travels along a track in front of four machines, performing the next series of operations. These four operations are all drilling and the jig rolls from one to another on a track before them. The first drill is a Baush multiple spindle drill with forty-seven spindles which take care of practically all holes in the bottom of the block. This is followed by a Hammond radial which taps all of the holes necessary, after which the block is rolled through a Barnes sliding head drill press which chamfers the bottom of the cylinder bore. The last operation in this train is performed on a Hammond radial which screws in the main bearing cap studs and fastens these caps in place.

After the main bearings are in place, the block is passed to a Moline boring machine which rough bores the main bearings, the camshaft bearings and water pump support

holes. There are three cutter bars on this machine which operate horizontally. After the rough boring operation, a finish cut is taken immediately after by a built-up compound tool; that is, the bar which holds the cutter is equipped with gun locks which hold both the rough and finish cutters which follow each other through the bearing.

One of the most interesting jigs in the entire manufacturing scheme is used in the next series of operations. This is a turn-over, indexing jig fitted with counterweights so as to permit ready handling of the block. There are five of these jigs which permits of one being loaded, passed along through the five operations which are in the series, and then being unloaded ready for the next block. These jigs, of course, follow each other through in rapid succession, the entire series of operations being timed so as to meet the nine per hour schedule. The first machine in this series of five is a Baush multiple spindle. The spindles are divided into two parts, the left half taking care of the drilling on the rear end of the block and the right half on the front end of the block. The turn-over jig allows the block to be swung over, first on the rear end, so that these holes can be drilled, and then to the front end, so that the other set of holes can be drilled on this same machine. The loaded jig is then passed along on its roller carrier to the next machine, which is an American radial. This taps some of the holes which were drilled on the previous operations. These include the flywheel housing cap screw holes, timing gear cover holes, etc. On this same machine, the main bearing groove for the oil thrower rings is chamfered also.

The loaded jig is then hauled along to the third machine in the series, which is an American sensitive radial. This drills and taps the water pump body bracket holes and drills the packing holes for the rear main bearing. The fourth machine in the series is a Barnes power-feed drill press, which drills, reams and spot faces the distributor holes. The fifth machine is also a Barnes power feed drill, which spot faces the top of the valve seat, this machine being tilted to take care of the angle of inclination of the valve. The sixth machine is similar to the fifth, being a Barnes power feed type which mills the clearance for the timing gears in the timing gear case. This is merely a precautionary operation, as on a great many of the cylinder block castings this machine does not have to take a cut as there is already sufficient clearance for the gears. On all of these operations, in all holes that the depth is fixed, the drilling is held to a positive stop.

Another traveling jig of the indexing type takes care of the next series of operations, the track along which the jig rolls passing before five machines. The first of these is a Baush multiple spindle drill with thirty-six spindles. On this multiple the jig rolls back and forth so that it is first rolled out for twenty-four stud holes and then moved back in against a rear stop for twelve water holes. The rolling is done on a track on the table of the machine. On this operation, locating is done primarily from the dowel pins and checked by plugs in Nos. 1 and 6 cylinder bores.

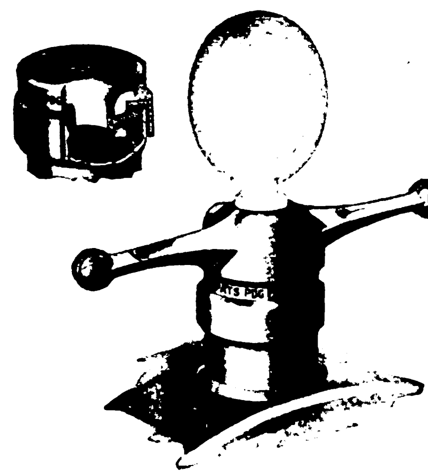
The second machine in this line is exactly the same as the first, being a Baush multiple spindle drilling thirty-three holes at once. These include the exhaust and intake ports, water inlet holes, manifold stud holes, stud holes for the valve cover plate, tappet bracket cap screw holes, generator cap screw holes and camshaft bearing set screw holes. The third machine in the series is an American radial drill in which the throttle control cross-shaft hole is drilled and six stud holes for the valve cover spot faced. The breather hole is drilled and tapped. These operations are located from the casting by a V-block.

The block is then passed to a Hammond radial drill, which taps and spot faces the distributor setscrew holes. It also drills four dowel pin holes for the tappet bracket and drills and reams two dowel pin holes for the generator bracket. Another Hammond radial takes care of the final operations in this series, which are to chamfer and tap the cylinder stud holes, exhaust manifold stud holes, generator bracket and tappet bracket stud holes, the cover plate stud holes and the setscrew holes for the camshaft bearing.

The cylinder blocks are now through the main machining operations and are ready for the final surfacing. This is done on a Barnes power feed drill with a lapping cutter specially designed by the Paige company. This lapper is really an oil stone proposition with the segments of oil stone set into a plug which fits the cylinder bore. The lapper takes care of any size cylinder, so that the same tool may be used for oversize cylinders. This is accomplished by setting the carborundum segments on springs with about 15 lb. tension. These springs hold the stone segments in contact with the cylinder walls and a few revolutions is sufficient to lap the cylinder to size. It is merely a finishing operation for the bore.

The remaining operations are minor in character, consisting of air drilling a diagonal oil hole, pressing by means of a Metal-wood hydraulic press all of the valve guides, making a final water test at 60 lb. pressure, washing the block in a Blakeslee washer and then passing it along for final inspection. Final inspection is done by special inspection gages in the usual way, a very interesting gage used on this work being the Walker micro gage, which measures the cylinder bores for taper as well as out-of-round. It is a dial instrument which affords an exceptionally ready means for checking the accuracy of the cylinder barrel.

Locking Radiator Cap



A locking radiator cap to prevent theft of motometer

AS an outcome of frequent thefts of motometers and radiator caps, the Zinke Company is putting on the market a new Protex-A-Cap that is locked in place by an eight tumbler lock with over one thousand key changes and no master key, precluding the possibility of professional thieves being provided with one or a set of keys to fit. The action of the lock forces a hardened steel bolt into a slot in the adapter ring, which is secured to the radiator neck by three cup point set screws, seated from inside the ring. These screws are forced tightly into the inside of the neck by means of an "L" wrench furnished with the cap. The adapter fits all radiators with screw caps except a few with caps of abnormal size. It is claimed by the makers that the Protex-A-Cap is one of the most attractive radiator trimmings.

Helping Workers to Be Proud of Their Skill

A customer made a complaint. Two workmen were called in to discuss it with him. They felt their employer had confidence in their knowledge, and learned as well some of the troubles of the management. This article traces the development of a labor policy and a plant "personality."

By Norman G. Shidle

MANUFACTURING firms in many ways resemble individuals as to characteristics, habits of thought and mode of action. Most of us are creatures of habit to a large extent, the difference between those who are successful and those who are unsuccessful being somewhat a matter of good habits and bad habits. Being sober with some men is simply a habit; being drunk is a habit with others (or was until Jan. 16, 1920, since when it has been an evidence of one kind of intelligence). Some men are habitually pleasant, others habitually gruff or grouchy. Whatever our habits are, they cast about us a certain atmosphere—which is usually called personality. And that atmosphere, though intangible, admittedly plays an important part in determining our progress or success in life.

So with manufacturing plants does the atmosphere or personality affect definitely the quality and quantity of the work done. The personality of the chief executive may determine this atmosphere to a large extent, but the traditions of the firm itself—how and why and for what purpose it grew—always make a marked impression. Especially is this true in regard to human relationships within the factory. Sometimes an opportunity given to workers to express pride in and knowledge of their work helps materially.

The basis for much industrial unrest is that the human and personal touch of the small shop has been lost in the growth of many modern plants. Not only have some plants lost that touch, but many, especially in a young industry which grew rapidly like the automotive industry, have never had it to lose.

A factory starting to manufacture automobiles to-day cannot, for the sake of human relationships or any other reason, afford to start in like the craftsmen of old with one or two skilled workers and a few apprentices. It is often necessary to start on a comparatively large scale. Nevertheless, tradition and habit of the plant begin to grow with the first day's production. Usually the growth is unconscious. Perhaps better results would be obtained if actions were sometimes regarded as being parts of tradition and an effort were made to build that tradition accordingly. It is perfectly possible, though more difficult, to build good habits and good tradition when starting manufacture on a comparatively large scale. It is possible because it involves no other fundamental factors than when starting on a small scale; it is more difficult because these factors are all infinitely larger and more complex.

To examine human relationships in an individual plant from this point of view, however, an example of the growth of a firm from the old to the new times is of value as illustrating the principles involved and suggesting lines of thought for application on the problems of plants whose difficulties differ to some extent. Such an example was described recently in AUTOMOTIVE INDUSTRIES, in telling the story of industrial relationships at the Brewster factory.

A somewhat similar story is recorded in the interesting development at the Rubber & Celluloid Products Company. This company began many years ago to make hard rubber covered harness and coach hardware. The process consists of covering the metal, on door handles, for instance, with a hard rubber coat, which will not chip off and which presents a good appearance while removing the necessity for constant polishing.

The process requires very careful workmanship and consists entirely of hand work. When the business first started, a few men were trained in the work. They were skilled craftsmen and were proud of their knowledge of a trade in which few of their fellows were capable of working.

Shop discipline in the old days was lax; it would probably be branded as utterly inefficient to-day, but this very inefficiency had its part in building up the tradition which has stood the company in such good stead during recent years. The story is told that it was even necessary on more than one occasion for the boss to run over to the neighboring public house and get Bill and John back to work on an order that had just come in.

But Bill and John always came and worked with a will for they were justly proud of their skill, were always fairly treated in the matter of wages, and felt themselves to be very definitely a part of the company for which they were working.

Because the work is so specialized and because it requires personal skill on the part of the worker, it has been necessary to train all the new workers who come to work in this establishment. Consequently, practically every man now working here learned his trade and gained his working knowledge within the plant.

These old workmen, some of whom have been there for fifty years, brought their sons in to work as they grew up, following the usual custom of the old days. As a result, the spirit of good fellowship and co-operation throughout the shop has been preserved intact through all these years. All the foremen were trained in the shop, and consequently take pride and pleasure in instructing and teaching the newcomers.

The labor turnover is very low, despite the fact that hiring is still done by the various foremen. The success of this policy, however, can probably be attributed

to the fact that the foremen understand thoroughly the ideals, policies and requirements of the company—in fact, they themselves create and carry on those ideals to a large extent. For this reason their success in hiring the right men for the right jobs cannot really be taken as a general argument in favor of this method.

Among other desirable labor results that have been achieved is a sound and intelligent attitude among the men on the wage question. Wages were advanced during the war by the management voluntarily to meet the rise in the cost of living. They were not changed violently and rapidly back and forth as was common in many places. The men were satisfied because the tradition behind them taught that fair play had always been a characteristic of wage adjustments there. Tradition gave them no cause for suspicion. This fact should be recognized as important.

In analyzing the factors of interest and importance in the success of this labor development the following stand out:

1. A healthy and favorable tradition, built up from the inception of the company—a tradition built upon fair-play and honesty in every industrial relationship.
2. Steady employment. The working force at this company had not been cut at the time this article was written, some seven months after the beginning of the present business depression, nor during previous periods of a similar nature. The men here know that their job is good as long as they do conscientious work. In depression periods it is often necessary to shift skilled workers from one kind of task to another, but the men understand the conditions and are glad to do their part in alleviating them.
3. Interesting work. The work is of such a nature that skill must be exercised in every operation. The finished product bears the stamp of personal skill on every piece, and the interest of the workman in making the product perfect is accordingly enhanced. Moreover, his interest is constantly kept alive; it is not dulled and blunted by monotonous work.
4. The men know and are made to feel that they are important, individually and collectively, in the business.

An interesting incident occurred in this plant recently which illustrates strikingly the last point mentioned. A shipment of door handles had been covered according to specifications which required working to extremely close dimensions. When the handles were received by the customer and inspected, very slight variations from the desired proportions were noted in inspection—variations not visible to the eye, but apparent when measured with accurate instruments. A complaint was made about the discrepancies.

The company explained to the customer the nature of the process, the difficulty of working in rubber to thousandths of an inch and the necessity of doing the entire process by hand. The customer was not quite satisfied yet and finally sent a representative to the factory.

The company executive, instead of explaining the matter to the customer himself, called in two or three skilled workmen from the shop. He explained the difficulty to the workmen and asked that they explain to the customer just how the process was done, what the difficulties were and what were the entire facts of the case. This was done and the customer satisfied.

The significant feature of the incident, however, is that this executive showed by his action more clearly than he could have done in any other way, the confidence felt by the company in these workmen and the importance which he attached to their intelligence and skill. The incident is unimportant in itself, but it brings to light a policy and an idea of great significance.

A plant with a good personality is likely to have not only harmonious industrial relationships, but an exceptional vigor and interest in production among its employees. A bad personality or "atmosphere" can be as harmful in the case of a manufacturing plant as in the case of a salesman.

Engineers and Commercial Training

SOME interesting suggestions to young engineers were made in the course of a lecture before the (British) Institution of Electrical Engineers by Llewellyn B. Atkinson. Mr. Atkinson said that although a commercial engineer generally obtained more compensation than a purely scientific engineer, he did not think that the latter had much cause for complaint, as he was engaged upon work which gave great mental and intellectual pleasure. He nevertheless urged engineering students to study the principles of business, finance and economics. Some thirty years ago, the speaker said, methods of organization, both inside works and on outside contracting jobs, were in a very crude and chaotic state, and little information was available relative to the cost of doing work or the output of tools and plant. In these days, however, costs were accurately ascertained and checked by a special staff, and young engineers should on no account neglect that side of their profession.

The training which engineers received, Mr. Atkinson said, should lead to accuracy in thought and expression, but there were little lazy habits of thought and expression which often spoiled otherwise useful work. Language was made to express ideas and thought. The English language was not so full of fine shades of meaning as the French, but it nevertheless offered a great choice of words suited to express kindred ideas. The taking of trouble in thinking out and framing expressions was rather out of fashion, but that made it easier to acquire distinction. When writing letters or reports, young engineers ought to read them over several times in order to be sure that each phrase had only one meaning. It was a good plan to consider oneself as being the receiver of the report or letter and as knowing nothing about the matter. Care came with age and experience. He remembered reading in his father's diary in which he wrote of his engineering work: "It is a pity X. is so careless; we had to re-level a whole section of the railway again, owing to his inaccuracy." Such carelessness might easily have lost X. his advancement at some critical moment, but, as a matter of fact, he became a celebrated engineer and a president of one of the engineering institutions.

As far as possible young engineers should make the acquaintance in proper ways of men of ability and position in their own and allied professions. Such men were usually anxious to help young engineers in their profession, especially if they knew that they were working seriously at the problems of science and industry. One of the greatest powers to be cultivated was an unfailing good temper in times of difficulties and annoyance. A good temper not only saved nerve strain and exhaustion to oneself, but it also helped others to accomplish difficult tasks. Few men realized the power that lay in a smile. It was also good to take part in the social amenities of one's work and the activities of professional societies. The latter afforded a means of bringing young engineers into touch with men they might not otherwise meet.

286 Tractors Average 30.8 Full Days Work a Year

Detailed account of farm owned machines by Federal investigators indicates that in actual operation, the farm power plants are not coming up to the advance announcements of what a tractor should do.

DURING October and November, 1920, representatives of the U. S. Department of Agriculture visited 286 tractor owners in Ohio, Indiana and Illinois. A complete record of all the work done during the year both with tractors and horses was obtained from each farmer. Information from which the cost of using the tractor and the cost of maintaining the workstock could be determined was also obtained.

The investigation was made through the co-operative efforts of the Bureau of Animal Industry, Office of Farm Management and Farm Economics and the Bureau of Public Roads, in accordance with plans outlined at the Farm Power Conference at Chicago, in October, 1919. The object was to obtain information in addition to that already available in the Department of Agriculture and the various State Colleges of Agriculture, which would aid in determining advantageous forms of power for different farms and different conditions.

The average size of the farms visited was 258 acres. This is considerably above the average size of all farms in these States. The following tractor equipment was found on the farms:

- 1-plow tractor on 1 farm;
- 2-plow tractors on 174 farms;
- 3-plow tractors on 104 farms;
- 4-plow tractors on 6 farms;
- 5-plow tractor on 1 farm.

Two-plow machines were found on 75 per cent of the farms with less than 160 crop acres, and on 53 per cent of those with 160 or more crop acres.

One hundred and six of the tractors had been in use 1 year, 100 had been in use 1½ or 2 years, 49 had been in use 2½ or 3 years, and 31 had been in use more than 3 years.

On the average the tractors were used for 30.8 full days during the year covered by the investigation. Twenty-three and five-tenths days of this was drawbar work on the home farm, 2.7 days was belt work, and 4.6 days was custom work. Seventy-three of the 286 tractors did less than 20 days work during the year and 26 did 50 or more days' work.

The number of workstock still owned varied from 2 head on 11 of the farms to more than 15 on 5 of the large farms. On the average there were 6.8 head per farm at the time of the survey, and their value was $145 per head. In all there were 1878 head of workstock on the 286 farms and 111 colts less than 1 year of age.

Farm Horse Works One Day in Five

The average number of full days work per year per horse, for all farms was 68.6. On 20 of the farms the workstock did less than 40 full days' work and on 27 they did 100 or more days' work per year.

The tractors did 85 per cent of the plowing on these farms, 73 per cent of the disking, 43 per cent of the harrowing, planking, rolling and packing, 41 per cent of the grain cutting and about 15 per cent of the loading and hauling of hay.

Of 267 men who did spring plowing, 142 did it all with tractors, 121 used both tractors and horses and 4 used horses only.

Of 225 who did fall plowing, 190 did it all with tractors, 27 used both tractors and horses and 8 used horses only.

Of 284 men who did disking, all but 15 used tractors for at least a part of it. One hundred and thirty men used their tractors for cutting grain and 37 for drawing the hay loader. A smaller number used their tractors for any other drawbar operation.

In all, the power for 30 per cent of the drawbar work on these farms, as measured by days of horse labor required for it, was furnished by tractors and the remainder by horses.

The average cost per head of keeping workstock on these farms for the year ending Nov. 1, 1920, was $159, and the average cost per farm was $1,076.

This cost includes charges for feed, at the average price for the year, chores at 25 cents per hour, shoeing, veterinary, harness, interest at 6 per cent and depreciation. A manure credit of $15 per head was allowed.

Feed and Depreciation

Exclusive of grass and stalk pasture, the average ration per horse consisted of 1.3 tons of hay, 1.2 tons of straw, .2 acre of stover, 37.8 bushels of corn and 22.3 bushels of oats. The total cost of feed per head was $134. Based on present prices (March, 1921) the cost of feed per head would be about $80.

The average cost per day of horse labor for the year of the survey was $2.43. Based on present prices the cost on these farms would be not far from $1.50 per day.

The average first cost of the 2-plow tractors was $972, of the 3-plow tractors $1,354, and of all tractors $1,140. The average amount spent for equipment, mostly plows and disks, for use with tractors was about $340. The average value of the horse-drawn implements disposed of after the purchase of the tractors was $12.

The average life of these tractors, as estimated by their owners, is 6.7 years. The annual depreciation of the 2-plow tractors amounted to $164, and of the 3-plow, $217. The annual cost of repairs, including the value of the owner's time spent in repairing the tractors, was $39 for both the 2-plow and 3-plow sizes. The tractors had been out of commission when needed, an average of about 2 days during the year. A little over 50 per cent had not been out of commission at all when needed, and about one in seven had been out of commission five days or more.

The fuel consumption per day for the 2-plow tractors varied from about 18 gallons for fall plowing to about 11

gallons for drawing the hay loader. For the 3-plow tractors it varied from 23 gallons for plowing to 15 gallons for drawing the hay loader. The 2-plow tractors covered 6.6 acres per day in plowing and the 3-plow machines, 8.6 acres. The amount of fuel required per acre by the two sizes was practically the same, 2.8 gallons for the 2-plow and 2.7 gallons for the 3-plow tractors.

Little Difference in Plowing Costs

The average cost per acre of power for the plowing done with 2-plow tractors was about $2 and with the 3-plow about $2.20. The cost of power for the plowing done with horses on these farms was about $2.90 per acre. Based on the present costs of keeping workstock, the cost of power for plowing with horses would be about $1.90 per acre. For most of the other operations the cost of power when furnished by horses was slightly less than when furnished by tractors. The cost per acre of power for disking with tractors was 67c., with horses, 64c.; for cutting grain with tractors, 67c.; with horses, 59c. These figures represent the cost of power only and do not include either the cost of man labor, or that of the implements used.

The average cost per day of 2-plow tractors for drawbar work on the home farm was about $12.65 and of 3-plow tractors about $17.75.

The total cost of power furnished by the tractors for drawbar work at home during the year averaged $341. This drawbar work on the home farm constituted 76 per cent of the total work done by the tractors, and only 76 per cent of the total annual charge for depreciation, repairs and interest on investment, is included in it. No charges for taxes, insurance or shelter are included in the costs for either the tractors or workstock.

Nine of these men had started farming with tractors and the remainder had increased the size of their farms by an average of about 20 acres since the tractors were purchased. There had been no change in size of 172 of the farms, 81 had been increased in size and 24 had been decreased. It is probable, however, that in most cases the tractor was not primarily responsible for the change in size of the farm.

Keeping the Horses

On the 172 farms where there had been no change in acreage the number of workstock had been reduced by 2.2 head, an average reduction of 26 per cent. Forty-four of these 172 men had not reduced the number of workstock, 62 had disposed of 1 or 2 head, 43 had disposed of 3 or 4 head and 23 of more than 4 head. On these 172 farms one horse had been kept for each 28 acres (total acres, not crop acres) before purchase of tractors, and at the time of the survey there was one horse for each 37.7 acres. For all the farms there had been an average of one horse for each 27.6 acres before purchase of tractors, and there was one for each 37.9 acres at the time of the investigation.

On the farms where there had been no change in acreage there had been one horse for each 21.5 crop acres before the purchase of tractors, and there was one for each 29 crop acres at the time of the investigations.

With the tractors doing the bulk of the work of plowing and fitting the ground, the cultivation of corn is the operation which requires the greatest amount of horse labor in the shortest time on most of these farms. However, on only 105 of the 286 farms were all the workstock used for cultivation, and on only 38 of the remainder were they all used for any other one operation. On just half of the farms all the workstock were not used for any one operation.

There were great variations on individual farms in the cost of power furnished by both horses and tractors; and by more careful management many farmers could doubtless reduce this cost. Repair costs and fuel consumption of the tractors could in many cases have been reduced by more careful operation. The cost of keeping workstock could have been reduced on many farms by more careful feeding practices. The facts that on 20 of the farms the workstock did less than 40 days of work per head during the year, and that on half of the farms they were not all used for any single operation, indicate that on some farms there are still more workstock than needed for the system of farming being practiced.

Comparative Cost

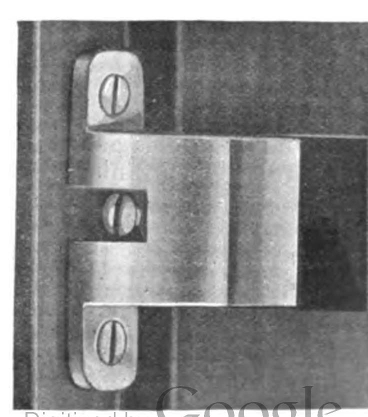
The average annual cost of power for the drawbar work on the home farm which was done with tractors was equal to the cost of keeping 2.1 head of workstock and this is practically the average number displaced per farm. On the basis of present prices, however, the cost of keeping workstock has declined considerably more than the cost of operating tractors.

Since, during the year covered by the investigation, the cost of power on the average farm was no greater than if it had all been furnished by horses, any saving in man labor costs, any gain due to getting a larger amount of work done in a given time and any other advantages connected with the use of tractors which can not be measured directly in dollars and cents might be considered clear profit. It is doubtful, however, if such gains were great enough to balance the cost of operating the tractors on many of the farms where there was no change in acreage and where no workstock were displaced.

An Adjustable Striking Plate

AN adjustable striking plate designed to replace the old non-adjustable plate or catch on automobile doors is manufactured by Franklin Williams, Inc. The old-style catch is made with one or two non-adjustable steps and must be fitted very carefully to the jamb of the door, so that when the door is closed it is held firmly against the rubber bumpers. Any wear of the rubber bumpers, lock bolt or catch permits the door to vibrate or rattle.

The Franzen adjustable striking plate can be fitted after it is in position on the jamb. Any wear which has a tendency to loosen the door and cause it to rattle can be compensated for by means of an accessible adjusting screw. By turning the screw to the left the second movable step of the striking plate is moved in. This adjustment again brings the door when closed into intimate contact with the bumper.



The Franzen adjustable striking plate

Closer Observation in 1921 British Tractor Trials

New regulations provide for the gathering of additional data in tests and require more detail as to the competing machines. Promise that Judge's decision will be promptly published upon conclusion of tests.

By M. W. Bourdon

THE rules and regulations relating to the 1921 British tractor trials embody a number of new features which will have the effect of enabling closer observation to be made of the competing machines and enable the Judge's Report to provide more information for prospective buyers than in previous years. The tightening up of the conditions of the trials should also assist competitors and other tractor manufacturers to make useful comparisons between the performances recorded and those of which their own machines are or should be capable.

The most important addition to the regulations is one which specifies that each tractor throughout the whole of the six hours' continuous plowing test which will occur during one of the allotted days shall have a dynamometer permanently in series with the drawbar, so that a continuous record of work done can be obtained to form the basis of the subsequent report. The dynamometers will be supplied by the organizing body, the Society of Motor Manufacturers and Traders, who will not, as last year, be acting in co-operation with the Royal Agricultural Society.

For Draining Machines

In order to facilitate the measurement of fuel and water used in the plowing, all the competing machines must be fitted with drain cocks not less than 3/8-in. diameter clear bore, and each cock must be provided with a nipple to accommodate a 1/2-in. rubber tubing. It is also specified in this connection that the drain cock must be placed in such a position that the whole of the fuel or water may be drained off without tilting the machine.

Whilst competitors will be allowed to enter two identical machines, but not more, only one machine of each make and type will be under close observation in order that its fuel and water consumption, feed, and width and depth of plowing acreage and negative work at headlands may be recorded. The regulations do not specify whether the trials officials will select the specific machine, or whether competitors will be allowed to indicate which one should have its work recorded in detail.

A modification in the rule relating to fuels states that while the organizing society will provide one grade each of gasoline, benzole and kerosene—the class of fuel to be selected by the entrant at the time of entry—an entrant desirous of running on special fuels may do so, providing the machine be entered accordingly and that the entrant finds his own fuel and sufficient surplus to enable analysis and tests of it to be made.

Among the additional items to be recorded in the report are the best horse-power developed at the declared engine speed, results of tests of winding gear (if fitted), the time required for preparing the machine for plowing, including the fitting and removal of spuds, driving bands, etc., the minimum width of headland required for turning when plowing, and the maximum drawbar effort obtained with the makers' standard spuds or strakes, but without wheel extensions.

A separate report, which will be issued by the Organizers' engineer, will consider the following points in regard to the work done by plows, cultivators and other implements entered independently of tractors: ease of turning; clearance between plow bodies; clearance beneath plow bodies when plow is fitted; range of adjustment to hitch and adjustability to various types of tractors; weight; drawbar pull required per square inch of furrow section, and adjustment for different width and depths of plowing, pitch of body and width of breast.

In order to enable more reliable comparisons to be made between the work done by various machines, tests will be made to ascertain the land resistance in different plots by means of a special plow and dynamometer, while an endeavor will also be made to ascertain the resistance of lands in various fields at varying depths.

Complaints have been made in previous years that, as the trials extended over three or four days, certain tractors were not to be seen at work by the visitors on every day of the trials. To overcome this the organizers will endeavor to keep every tractor at work throughout the whole four days, although they make no guarantee.

As to the Tractor

Besides the points already mentioned to be recorded in the report are the following: weight of tractor; weight per square inch of wheel area bearing on the ground, allowing a sinkage of 1 in.; number of attendants required for plowing; units of work performed during the observed six hours' continuous plowing test; fuel cost per acre per unit of work; water consumption per acre and per unit of work, and price of machine with standard equipment.

The trials this year will have a fresh scene of operations, a point near Shrewsbury instead of near Lincoln. The actual plowing will commence on Tuesday, Sept. 20, though preliminary tests will take place on the preceding Saturday and Monday; Saturday, Sept. 24, will be reserved for final inspection.

Unlike last year, no prizes or monetary awards are offered, the advantage to be derived by competitors whose machines operate successfully lying in the publication of the official report, which will, it is promised, on this occasion be issued within a fortnight of the conclusion of the trials. If this promise can be carried out it will be a considerable improvement, for the Report of 1919 trials required some six months to issue from the press, while the report of last year's trials has not yet appeared.

An Importer's Experiences with Exported American Cars

Much has been printed about automotive export practices and remedies that must be applied, but here we print the effect of bad practice on the man at the other end of the line. How many similar tragedies could be written, due to failure of the manufacturer to follow a definite policy?

By Clyde Jennings

WHAT follows here are the strange experiences of an importer of American cars. It is only fair to say that this man had gained an excellent standing in his own country as an importer long before the comment here was written. It was a fortune of business that circumstances over which he had no control deprived him of the car he had been selling and left him with considerable money, more credit and wide experience to enter the market with another car. He has since been endeavoring to find the proper car for his market.

The experiences here were not written for publication. They are taken from letters to a personal friend in America, with the consent of both parties to the correspondence. For obvious reasons reference to individual firms are omitted.

SOON after this experienced importer began his search for a suitable car he saw the announcement in an American business paper of a car that appeared to meet his needs. He sailed for America and, on arrival in New York, wired and wrote to the factory. He received no reply. It was a long journey to the factory, so he went elsewhere. He found a manufacturer who said he wanted export trade and had a satisfactory car. The importer then returned home.

Imagine his surprise, three months later, when he received a mimeographed letter with his name and address written in ink that differed from that of the body of the letter from the factory he had first communicated with. This letter follows:

> "Kindly pardon our seeming neglect on account of not answering your correspondence, telegrams, etc., more promptly. We have been reorganizing our company here and we are now all ready to do business in foreign countries and have cars to make deliveries. We are painting our cars now ——— and are going to put on the market the classiest —— cylinder manufactured in its class. If you are ready to do business with us and can take cars, we are all set to go.
>
> "We wish to sell our cars f. o. b. ———, and if we make any changes, such as right-hand drive and magneto on the car, we will have to ask an advanced deposit before making any deal whatsoever.
>
> "If interested, we are now ready to take the matter up promptly and your correspondence will have immediate attention."

WE have said that this experienced importer found a manufacturer who said he wanted export trade and was making a suitable car. He returned to his home in fine spirits and prepared to begin an active campaign for the sale of this car at the beginning of 1920. For several months his letters were hopeful, but late in the summer he wrote a letter which contains a review of his situation to that date. In subsequent letters he traces his experiences through to a more or less disastrous finish. Comment on these letters is superfluous. They tell the story:

Sept. 24, 1920

WE started off at the beginning of the year with a tremendous amount of enthusiasm, but our prospects were diminished by the fact that even our first demonstration car did not reach us until June, and finally the first batch of cars for delivery reached us August 13. The situation at that time can be shown by the fact that of the **thirty provisional orders for sample cars that we had for dealers, we were only able to get six of them converted into money, the trade view being that the year was dead and gone,** and it would be hopeless for them to interest themselves in a new car, when, in view of the bad trade situation, they had to fight hard to liquidate their existing contracts.

So there we are to-day, working like Trojans to sell one car here and one car there—a job which would have been delightfully simple if ——— had fulfilled his promise which he made so firmly in person, viz., that he fully realized the importance of early delivery for the export trade. There is no doubt but that we could have had many cars delivered during the spring season of this year. Of course, every factory has its troubles and it is difficult to apportion the blame. All we know is that if the cars had arrived when they were promised we would have had a fine business by now, whereby, on the other hand, we have a load on us which is very hard to carry, and are right at the tail of the procession instead of being well up in the middle, where we expected to be by now.

Equally, too, the non-arrival of any cars and the gradual wasting away of our prospects disgusted the people who were backing me financially, and they have turned their attention to other matters. ——— is astonished at this, but I am afraid in a country like this, where capital

is short and everyone is hard put to it, it is quite unreasonable to ask financial men to sit down with money waiting in the hope of what they style a mythical car turning up some day.

Our attitude is that ——— should take a personal interest in this business until we get started. I have put all my energies and all my money into this business, and have not handled any other vehicle at all (except a few ——— which have just arrived and which were equally such a doubtful starter that we did not include them in our plans), and so it has not been for want of effort that the ——— has not had a good start, **but simply the unfortunate fact of the delivery of the cars to us now, at a time when no one will buy at all.**

American products are not in too great favor. Every importer is full of bitterness with regard to the incomplete condition and bad finish in which the products are shipped overseas, and so, if the American industry is as keen for export business as is commonly alleged, there was never a more important time than now for the American industry to take a collectively and individually strong personal interest in keeping the job going.

Nov. 11, 1920

THE ——— Company has seemed to fail to get a grasp of conditions here. They do not seem to realize the length of time that any new car requires in this conservative market before it can gain popular support. It seems that they expected our public to turn their backs immediately on the Sunbeams and Rolls-Royce and other well-known cars long sold here. Actually the trouble is that there are so many American cars over here that the public will take a long time before they can distinguish between the ——— car, which is obviously good, and all the other nondescript productions which have the advantage over us, in that they have been selling for a year or more and are frequently to be seen on the road.

Obviously it is a case for the American manufacturer to decide whether he believes sufficiently in the future of this market to give whatever measure of temporary support is needed to tide over present conditions. In our own small company we have worked real hard for the past year, we have drawn no salary, we have put all our money into the job and we have marked the cars down to a competitive price level in order to get them established—a price, indeed, which shows us no profit under present circumstances. It is not a case of our having put the price too high that the cars are not selling. We believe that if we can continue in business for another few months we could turn the corner and then go ahead, but we cannot raise any capital here on an American proposition, and we maintain that ———, if he is interested in the export business, should be willing to invest whatever sum is necessary to get this English business established. He would certainly have his full share of profits when they are made, but we tell him strongly that he should meantime take a share of the load.

We maintain what you say in your letter, that ——— is a real fine fellow, but it is impossible to disregard the fact that we would be in a far better position to-day if ——— last November, when he knew that we or somebody else was going to handle his cars in this market, had got some of his staff on the immediate job of getting the right-hand drawings through and getting the necessary parts made, instead of which they were only just starting their experimental work when I visited the factory at the end of January; the sample cars did not leave there until March, and the first batch of regular cars got here in the latter half of August, which meant that this year's business was over before even we got our first cars. On that point I think ——— slipped up.

No doubt the demand for home business was such that the demand at this end became of lesser importance, but that undoubtedly has been our biggest handicap. At the beginning of the year we had the fullest trade support, in the middle of the year the enthusiasm had tapered down, but we were able to get a certain number of provisional orders even on catalogues without seeing a sample car, but when the end of August came dealers' stocks were piled up and they all had to plead that the delay in delivery had spoiled their chance of business. Frankly, I am quite puzzled by the present situation; the factory sales department imagines that we are sitting down at the club drinking tea all day, but it is hardly necessary to remind you that a young and enthusiastic outfit like ourselves, who started in business and put the whole of our personal capital into the job and our reputations as well, we are not going to let the job slip for want of personal energy.

Nov. 25, 1920

WE know that the business has been disappointing to ———, but in addition to being disappointing to us, it has cost us all our capital as well, and it seems now as if his short-sighted action in withholding further advertising support may ruin our plans altogether.

Dec. 1, 1920

OUR situation is as follows: We have had a thin time of it during the past year; we have had many dealers keenly interested and accumulated quite a lot of orders by the middle of summer. As there were no deliveries, these gradually faded away, and when the cars reached us in September, when the year was over, the slump was on, and all our efforts and expenditure of many thousands of pounds only moved half a dozen cars, which was six more than some of the importers moved in the same time. We finally came to the conclusion from undeniable evidence that it was hopeless to attempt to sell at a price which would give to us a reasonable profit.

Unfortunately, just when the clouds are beginning to roll away, ——— has cast us adrift, so to speak, and has withdrawn the advertising and financial assistance which he definitely promised when the writer was at the factory at the beginning of September and on which we banked, because it is quite impossible at the present time to get any financial support for an American car proposition such as ours.

——— has been paid in full for all the cars he has shipped. We, on the other hand, have got all our available capital locked up by the bank which financed the imports, and it seems to us that it is very short-sighted for him to step back now and throw us to the wolves, when we have got the thing just starting to go, and when all that he has promised to do is to reinvest a portion of the money which he has already received from this side in full payment for his cars.

It is no use your manufacturers going into the export business unless they fully understand:

(a) That the export business involves a considerable lot of trouble;

(b) The markets are much more conservative and patience is required, and

(c) When you have got a good dealer, stick to him for a few years.

You cannot change on short notice. For example, in the present instance I am quite sure that ——— does not appreciate that if he lets us go bust on his proposition he will be right out of this market for a long time. The car would have too bad a reputation as a losing proposition for anyone else to take it up.

Cars are not shipped in good condition, and it is very rarely that we get a car of any make but has to be revarnished and the black parts repainted. We unboxed some ——— the other day. (We have not concluded any arrangements with the company—their demands for a contract were excessive and so we are letting the matter simmer until they see daylight.) And, after all their boasted twenty years' experience in export, we find that each car had three separate places where the cross-members of the boxes rubbed up against the panel and not only wore the paint right through, but nearly wore the panel through as well, and so we had a repainting for each of these cars, costing us $120 per car. Also, on two cars the steering gear was so tight that it had to be taken down and the bushings reamed out, showing that the alleged factory test is purely an invention of the publicity manager.

To cut a long story short, the $10 per car which the factory (when basing selling prices here) reckons that we ought to allow to cover the cost of painting up, etc., has been over $170 average on each car, so you can see what a mess this makes of selling prices which have been worked out on a fine limit.

——— shipped us some coupés. When we complained of the paintwork, they put their hands on their hearts and swore to heaven that they had never had a complaint from anybody in all the years they had been doing business. Actually their own representative was with us when some of the cars were unboxed, and he himself was able to pull off the paint a square foot at a time by the simple process of peeling it from the rusty surface underneath. **If the representative had not been here, what a job we would have had to get back the $185 per car which it cost us to repaint and fit up!** The moral is, of course, that if the paint will not stand the sea air, ship them in the gray and make the importer a reasonable allowance, so that the vehicles can be painted over here. As we stand to-day, it is usually a denial of the facts and then an allowance of probably 10 per cent of what it costs to put the job right.

> **I am bound to give my own opinion, as one who has had past experience of dealing direct with the factory and later of dealing with export agencies and branches, that the man in the foreign field derives no advantage whatever from dealing with an export house, but has rather the contrary, since he now has a barrier which prevents free communication with the factory and also the expenses of the export corporation have naturally to be charged to the product and thus become a factor in lessening sales.**

The alleged close connection between the export corporation and the foreign field and the service which it can give to the dealer abroad is more or less a fallacy, and I firmly believe that those factories who establish direct connections with dealers abroad are doing the right thing.

THERE is one other bit of comment in these letters that does not exactly belong in the story that is unfolded above. It is a general observation that is well worth while reading by any exporter of American vehicles, coming as it does from a man who has devoted a number of years of an active and successful business life to the problem. It is quoted below:

> The export trade is going to need a lot more specialization, much more careful handling and some entirely new treatment along the lines of credit. If your people want to have their full share of export business they have got to get away from this cash against document at the factory or at New York. It means that we importers have the whole of our credit locked up for months at New York waiting for shipment, and it is impossible for the business to expand in the way it should.
>
> Take my own case as an example. I have had a large credit established at New York now for eight weeks to take care of cars which were due for shipment; the cars have not materialized and, therefore, the credit is not yet used, but as long as the credit is established at New York it is no longer available here, and so other work that might have been done here **with the same credit has** been standing by. In other words, this means that that portion of my business has been dead for two months.
>
> If, on the other hand, cars were shipped (of course, only to approved persons with all the necessary safeguards) on the 60 days' sight draft or any other form of credit which might be agreed, I could be going on here full speed with the other necessary developments and would have ample time, once I knew that the cars had been shipped, to take care of the payment for the shipment when they arrived.

Certainly there is much in these communications that is worthy of careful reading by American automotive manufacturers who are engaged in or are contemplating the entry into foreign trade. The trader who is wise profits by the experiences of others wherever possible. Certain fundamental mistakes are pointed out here that will make it entirely wasteful for other manufacturers to repeat them.

Imports of Automobiles and Parts into United Kingdom, 1906-1920.

Year	MOTORCYCLES COMPLETE		PARTS	CARS AND TRUCKS COMPLETE		CHASSIS	PARTS	TIRES ONLY MOTORCYCLE	TIRES ONLY CARS	AIRPLANES ETC. AND PARTS
	No.	Value £	Value, £	No.	Value, £	Value, £	Value, £	Value, £	Value, £	Value, £
1906	1755	50,433	30,371 (a)	5776	2,486,337	1,885,323 (d)	....	....	....	....
7	1770	50,650	28,096 (a)	4819	2,080,266	2,472,520 (d)	....	....	....	....
8	1340	36,258	29,182 (a)	3830	1,389,552	1,063,077	1,659,832 (e)	....	....	....
9	1442	41,036	29,416 (a)	3666	1,223,053	1,321,596	1,771,960 (e)	....	....	....
1910	1387	44,297	54,951 (a)	4516	1,439,962	1,671,593	2,023,273 (e)	....	....	56,206
11	1351	42,086	65,716 (a)	6778	1,717,983	1,723,889	2,549,387 (e)	....	....	44,430
12	1363	44,252	192,423 (a)	7373	1,826,678	1,901,829	3,417,420 (e)	....	....	80,120
13	1728	60,332	206,451 (a)	6820	1,738,462	1,894,495	3,777,916 (e)	....	....	244,096
14	2559	93,121	94,540 (a)	7520	1,858,510	1,651,218	2,973,933 (e)	....	....	275,259
15	4531	205,817	52,383	16655	3,118,980	1,135,138	2,183,183	105,123	1,984,563	35,814
16	1192	50,478	52,364	5109	935,618	814,292	1,491,125	93,173	2,207,210	42,120
17	341	16,663	9,741	625	222,088	3,142,028	2,293,948	79,722	1,161,989	409,304
18	6	225	6,085	490	276,368	1,952,165	2,530,667	15,573	602,645	6,859,081
19	1486	79,900	27,672	4442	1,332,451	716,757	3,100,941	37,892	2,053,423	4,173,942
1920	4305	285,820	121,609	33343	10,490,012	4,254,949	8,713,684	(c)	5,577,078 (b)	836,350

(a) Includes tires. (b) Includes rubber tires of all kinds. (c) Not separately classified. (d) Includes parts and tires. (e) Includes tires.

What British Experience Indicates

No economic difficulty in England to-day can be separated from the political program of the British Labor Party. Such a development in this country is very undesirable. But it will not be stopped by fighting it; it can be stopped by making it unnecessary.

By Harry Tipper

A GOOD many years ago, sufficiently long ago for the exact number of years to be unimportant, I was engaged in factory work in the North of England. At that time the trade unionists of the district had just decided to secure their own representative in Parliament and had agreed to pay their candidate his expenses and salary while representing them in Parliamentary Council.

A meeting was called to listen to the man who had been chosen by the trade union officials as the most likely representative. This meeting occurred in the town in which I was located, and as it was a public meeting, I found myself sufficiently interested in the matter to attend.

The hall which was chosen for the meeting was capable of seating five thousand people and it was filled, largely by members of the various unions. The man who had been chosen was a Mr. George Hodges, who became a member of the coalition cabinet during the war, and after he was through with his main speech he was very thoroughly questioned from the floor.

Two things impressed me very definitely about the meeting. First, the intense interest displayed by the audience in the political questions brought up, or rather in the political aspect of the economic questions brought up, and secondly, the keen and practical character of the questions. It seemed to me that these men knew what they wanted, very definitely, and they were prepared to pursue their objects in a practical way with vigilance and with care.

I recognized the fact that meetings of a similar character were occurring in a good many parts of Great Britain and that a definite program, so keenly approached, must develop a large force, influencing the actions of the nation. Since that time it has been interesting to watch the way in which every advantage has been seized upon to secure a little more of the program so definitely begun when the labor unions entered into politics with their own representatives. It was interesting to see the political program itself enlarged in its conception as the power of the labor party defined itself.

The present strike of the coal miners is a case in point. For a long time the nationalization of coal mines has been an important part of the program of the labor party in Great Britain. It is probable that the difficulties imposed by the old land laws and their effect upon the mining towns and villages have had more influence upon the program than the economic differences between employers and employees. The nationalization of mines is not a new desire nor a new platform with the labor party. Every advantage has been seized upon to further this program. In the early part of the war the Government was supported by the labor groups in its program of taking over the control of the mining industry. In the latter part of the war the conclusions arrived at by Sankey Commission were used by the labor party to bring the nationalization of coal mines again to the fore. The strike which occurred since the end of the war, while ostensibly a matter of wages, was in reality another attempt to press the nationalization of mines and bring it more definitely into the foreground.

The present strike is based upon the action of the Government in returning the coal industry to the private owners without giving consideration to the conclusions arrived at by the Sankey Commission and without attempting to confer with the labor party upon the program it constantly advocated.

At the same time the labor party is preparing for the general election, which cannot be avoided much longer. At that time it is likely to put forward a more definite outline of its reconstruction program in the hope of securing the balance of power in the next Parliament.

The condition as exhibited in the present character of the political struggle in Great Britain emphasizes the danger in the complete separation of the workers from the other classes or groups within the population and their cohesion as a separate body in the political groupings within the nation itself. Under such conditions every economic struggle is likely to become a political struggle and every political question is likely to be used to further the economic ends of the party. Instead of being organized more definitely for co-operation, co-operation is made well nigh impossible by the sharp division between the groups and the insistence upon a program of development suitable only to the aspirations of the larger group.

The strong definition of labor aims by the complete trade union organization in Great Britain, coupled with the strong power in the political councils of the country, have gradually developed the allegiance of the individual worker to his union and his party so that it almost overshadows his allegiance to his country.

It is to be observed that the adoption of the Whitley plan of adjustment, the government committees for the settlement of these problems and the willingness of the cabinet to spend time and effort in adjusting economic difficulties have not lessened the number of strikes in Great Britain, nor have they diminished the serious character of the difficulty.

Manufacturers have fought labor unions in Great Britain many times in the past with great severity and they have discarded the elements of co-operation which might have established unity within the individual industrial organization at one time. In this country we should very carefully note the ef-

fect produced by a complete warfare between the wage earners and the owners in developing a more complete state of organization and bringing the questions to a more acute crisis each time difficulties occur.

Our best efforts should be given over to the development of methods of understanding and co-operation within the individual factory so that the trade union would become unnecessary in the individual case.

The completely organized and consolidated organizations in Great Britain, developed on the basis of warfare to seize all the advantages which may be secured, bring the country into the constant danger of anarchy and confusion in the attempt to settle the economic problems by the political action of the labor party.

Under present conditions no economic difficulty in that country can be separated from the political program. The labor organizations are using economic interruptions to force political consideration just as they are using political power to secure economical advantage. Such a growth of organization would be a bad thing for the United States. It will not be stopped by fighting it, but it can be stopped by making it unnecessary.

If confidence and trust in the individual factory is improved by fair dealing and a reasonable measure of discussion and agreement, the program of unionization will become unnecessary to the individual worker and the growth of this cumbersome machinery of development will be prevented from reaching dangerous proportions.

In Great Britain it will require, probably, the advent of the labor party into political power to remove the chaotic condition existing at present and the experiment of a labor government may prove to be almost as expensive to progress as the continuance of the present difficulty.

Causes of Roadside Breakdowns

OUR modern cars have attained such a high degree of reliability that the average automobile owner starting on a trip seldom thinks of the possibility of a breakdown, necessitating a tow to the garage, and it is comparatively rare nowadays that one meets a car stopped at the roadside unable to proceed. Breakdowns, however, do occur, and the necessity of having to be towed home still occasionally confronts the motorist.

In Great Britain the Royal Automobile Club, with a view of being of greater service to its members, has inaugurated a "get you home" scheme whereby it assists stranded motorists to get their cars to the garage and repairs made. It is possible that in Great Britain, where cars were not used much during the war period and where, consequently, a great many machines of early model are still in use, the danger of breakdowns on a tour is a greater bugaboo than it is here. At any rate, it is never pleasant to be compelled to have repairs made in some shop far from home, because of the inclination of repairmen to take advantage of the chance customer in trouble.

In connection with this service the Automobile Club has been keeping account of the troubles causing the breakdowns and has recently issued an analysis of same, which is of considerable interest. In this report the term breakdown refers to a case of mechanical trouble which could not be repaired on the road with the tools ordinarily carried on the car but necessitated the removal of the car to a repairshop.

The breakdowns are classed under seven heads as follows: Power unit, transmission, front axle and steering, road wheels, suspension and brakes, electric lighting failures and accidents. It will be seen from the list that the term transmission includes both the change speed gear and the rear axle. There will probably be no surprise that the first two items together accounted for 77.5 per cent of all the breakdowns. In the great majority of cases when a car is incapacitated, either the motor will not furnish any power or else the power cannot be delivered to the driving wheels. The power unit alone was the cause of 39.6 per cent of the breakdowns, of which ignition failures constituted 13.4 per cent. With one exception this is the highest percentage due to any particular cause. Ignition trouble was very frequent in the earlier cars when the old, crude battery systems of ignition were used. Their frequency dropped a great deal when the high tension magneto with its simplified wiring system and substantial connections became the standard method of ignition, and in view of the fact that British passenger cars almost without exception are fitted with high tension magnetos, the percentage seems abnormally high, especially in view of the high state of technical efficiency which the British magneto industry claims to have attained. The explanation has been offered that the incompetence and feeling of helplessness of the average owner in electrical matters often causes him to give up even though the trouble is of a minor character.

The largest percentage of trouble due to any one cause was due to rear axle shaft breakage—13.9 per cent. It was found that in a great many instances the wheels were loose on the driving shafts, and the play thus created, of course, resulted in the breakage. A further explanation is that it is customary to allow an unusually low factor of safety in the axle shafts, because a slight increase in the shaft diameter means a relatively large increase in the weight of the rear axle. Having a factor of safety of not much over 2 under full load conditions, it does not require greatly abnormal conditions to cause the shafts to snap.

Lubrication failures accounted for 7.5 per cent of the troubles, and undoubtedly the majority were due to neglect of the operator. An equal percentage of breakdowns were due to the universal joints and propeller shafts. These, too, may be largely due to neglect, because the universal joints are mostly rather accessible and their supply of lubricant is not renewed as often as it should be.

Of the remaining cases, the front axle and steering gear were responsible for 5.1 per cent, and road wheels, suspension and brakes for 7.8 per cent. Stoppages at night due to lighting failures accounted for 9.8 per cent, and accidents for 8.8 per cent. This latter figure seems very low, but a logical explanation is that in case of accident to a car covered by insurance the machine is usually hauled to the garage under the terms of the accident policy and no claims are made under the "get-you-home" scheme.

The automobile industry pays the railroads freight charges of $100,000,000 annually.

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Profitable Co-operation

THE interdependent nature of the various units of modern industrial organization has been emphasized on various occasions. The necessity for a recognition of a moral obligation between manufacturers has been discussed as an essential to industrial progress. The term "obligation," however, usually raises in the mind a picture of something to be given up in favor of someone else. This is not always, nor even usually, the case.

There is an obligation on the part of those supplying the automotive industry, for instance, to render to the industry the best service at the lowest cost; to help the automotive industry to make its product of good quality at the lowest cost consistent with such quality. The strange thing is that such service is being offered by many manufacturers but that automotive engineers and designers are not, in some cases, taking advantage of it to the fullest extent.

In the field of castings and forgings, for example, automobile manufacturers have spent considerable money during recent years which might have been saved had the engineers co-operated more fully with the technical staffs of the castings producers and accepted more fully the services which many of them have to offer. Often a casting or forging design can be altered slightly without affecting its essential nature, but in such a way as to reduce considerably the cost of manufacture.

The drop-forging, malleable casting, die-casting, steel casting and other similar concerns have come to the point where, through enlightened self-interest, they are capable of and willing to aid the engineer materially and perhaps save money for him through explaining the various limitations of their individual practice and in suggesting slight readjustments in design to lower production costs without affecting the characteristics of the piece.

Few automotive engineers can be expected to be thoroughly familiar with the details of practice in all of these subsidiary industries, but considerable progress can be made as the constructive co-operation, already manifest to a large extent, is increased and the relations between the engineer or designer and the firms which are to manufacture the parts designed become closer.

Index to S. A. E. Transactions Needed

EVERY member of the Society of Automotive Engineers receives annually two volumes or so-called "parts" of Transactions of the Society containing a large amount of useful engineering data, comprising in fact all matter considered of permanent value which has appeared in the Journal or been presented before meetings of the Society and its sections during the preceding year. Each volume has an index of its own contents, which except in recent volumes is not extensive or well classified, but no general or cumulative index has ever been published by the Society.

As a result it is a tedious and more or less laborious process to locate the information on any particular topic, as this can be done completely only by a search through the twenty-odd volumes.

The Society has recently had compiled in its New York office a complete index covering all its regular publications issued to date. This should be printed in convenient form and be placed in the hands of every member who desires a copy. The need for the index is well recognized. We have yet to hear of an engineer at all familiar with S. A. E. publications who would not be glad to have such an index. The cost of publication appears to be the only reason for not sending the index to press at once, but this cost we feel should not stand in the way for the value of the index will far exceed the cost.

The Society has in the past few years accumulated a considerable reserve fund out of which an appropriation of $30,000 was recently made toward the expense of research work to be fathered by the Society. It is generally conceded that a considerable proportion of this fund can well be spent in making available to Society members existing information on

automotive engineering subjects. A first and very valuable step in this direction would be publication of the index in question. This, however, need not and should not be delayed until the new research work is organized. Now is the time to do it. Funds of the Society are available and simply need to be appropriated for the purpose by the S. A. E. Council.

Factors in Production Costs

THE experience of many workers has been that their wages were maintained only so long as the employer had to maintain them to meet competitive bidding for labor; a cut was made as soon as such competition ceased. This fact has emphasized the theory of perpetual struggle between the employee and employer groups. The result, in such cases, is likely to be unsatisfactory production and financial loss to the employer in the long run, since the type of work produced by grudging workers is never as profitable as that given by enthusiastic workers.

One automobile manufacturer in particular has recognized these facts, although he is not alone in his broad vision of the situation. When the recent depression set in, this manufacturer set his production engineers to work intensively on the task of eliminating small wastes, improving production methods, and thus reducing unit costs. The necessity for such cost reduction was explained to the men, and they were led to understand that the maintenance of their present wage scale depended largely upon the success with which these efforts were rewarded. In this way the assistance and co-operation of the workmen were gained.

The production manager of this concern recently presented to the management a comprehensive report, showing the various ways in which it had been possible to improve production methods and thus reduce unit cost. The wages of the workmen have thus far been maintained without decrease.

At some future time it is altogether probable that this manufacturer, like most others, will find it necessary to reduce wages. But he will be in a position to do so without losing the valuable enthusiastic co-operation of his workmen, because he has already demonstrated in this very practical manner that his honest desire is to keep wages high as long as possible, rather than to lower them on the first excuse that may present itself.

And this ability to maintain wages is obviously due to the saving made possible by production improvements, since the selling price has not been increased. The price of the product has in fact been reduced.

Isolated Plant Battery Rating

A STORAGE battery rating means little unless the basis of the rating is accurately specified. Realizing this fact, the Standards Committee of the S. A. E. has evolved standard rating rules for the various classes of batteries used in automotive practice, namely, lighting batteries, batteries for both starting and lighting and batteries for isolated plants. The necessity for having different ratings for batteries for the different uses arises from the fact that the rating test must, if possible, simulate the operating conditions for which the battery is intended.

The ratings for both lighting and combined lighting and starting batteries have proven entirely satisfactory, but there has been considerable dissatisfaction with the rating standard for isolated plant batteries. This rating standard calls for an intermittent discharge at a 24-hour rate extended by three periods of rest to a total time of 72 hours. The idea in view in adopting this intermittent rating was, of course, to approach in the rating test as closely as possible to service conditions.

Most of the early small isolated plants were sold mainly with a view to their use for farm lighting, but recently the use of these plants as a source of current for heating (sad irons and various electric heating apparatus) and for power has assumed considerable importance. It is evident that where there is sufficient power load on the circuit of the plant to load the battery to capacity, it may easily happen that the battery will be completely discharged in from six to eight hours or in even shorter time. Of course there will always be some plants which carry practically nothing but lighting load, in which case the intermittent rating will more nearly represent the conditions of actual use.

It will thus be seen that the conditions of storage-battery operation in small isolated plants now vary so widely that no single rating rule can possibly parallel all of them, and in view of this fact it would seem advantageous to return to the 8-hour continuous discharge rating standard. To do so would lead to two desirable results: It would be a simpler matter to check up the rating and, owing to the fact that such a rating approaches closer to the conditions of most severe service, there would be less chance of misunderstanding and disappointment on the part of those not familiar with storage battery characteristics.

Business Men Reading Books

THERE is in New York a small and informal club of business executives who have known each other for many years. They meet occasionally and discuss business frankly. At a recent meeting only one of these men was able to say that his business curve was maintaining the proper slope. This man is a publisher of business books. During the recent let-up in many business activities, his products have been in greater demand. He said that especially the younger men in industry are buying and reading books on topics bearing on their business specialty.

This is certainly a good indication.

A BRIEF card from Carlisle P. Winslow, director of the Forest Products Laboratory, brings the welcome intelligence that the appropriation for this institution was increased approximately $100,000 by the last Congress. In addition to congratulations to the laboratory staff itself, AUTOMOTIVE INDUSTRIES wishes to congratulate those of its readers who acted upon the suggestion made some weeks ago that they recommend such an increase to their congressmen.

Willys Takes Field to Force Sales

Carries to Dealers a Fighting Message

Declares He Is Just As Able As Ever to Keep Overland in Front Rank

TOLEDO, April 4—After spending ten days in the company of dealers and bankers in Western and Northwestern States, John N. Willys stopped here to-day on his way to New York, more enthusiastic than since 1916 and assured that "vigorous prosperity" is on the way.

He reported that he had met more than 2000 of the Willys-Overland salesmen and distributers, and that everywhere business is going forward. Reports indicated that the company sales had increased 94 per cent last week over the second week preceding.

"I am returning with greater enthusiasm and more optimism over the future of Willys-Overland than I ever felt before," declared Willys. "Conditions in the West and Northwest are already much improved—far more than I expected to find.

"During the past two weeks I have talked with our dealers gathered in Chicago, Kansas City, Oklahoma City, Dallas, St. Louis, Omaha and Minneapolis. The meetings are the most enthusiastic I have attended since 1916.

"Anyone who has any doubts about Willys-Overland coming back strong after this readjustment is due for a surprise.

"I found that the rumor manufacturers had circulated a lot of wild yarns about my own plans and I took a lot of pleasure in telling my old friends—among them hundreds of dealers who have been with me from the beginning—that I'm just as determined to-day as I ever have been, and just as able to keep Willys-Overland in its front rank position.

Willys Overland First Interest

"Willys-Overland is my first and my outstanding interest. During the past few years expansion and financing have occupied most of my time.

"To-day Willys-Overland, and every other automobile company, needs a reawakening of enthusiasm among its dealers and salesmen along the firing line. So now I'm trying to be useful in the sales department.

"Yes, I'm going to be on the road again in a few days to talk with more dealers. It stimulates me and encourages me more than I can describe to see the wonderful response our dealers give when they know we are all set and our program is straight ahead.

"I believe to-day, as I have for years, that Willys-Overland has the most able group of real go-getting automobile dealers in America. And while I don't expect nor do I predict any rushing return of business, I know that the Willys-Overland sales organization still has its oldtime wallop.

"Every dealer has a lot of hard work ahead, but we all have something well worth working for.

"In both cars we are building now in Toledo, we are putting forth the best product we have ever had in our history. Orders show a steady increase. Last week's retail reports from the field show a gain of 94 per cent.

"I have found, too, that our time payment plan, which is extremely liberal to the public, is a great help to the dealers right now. In short, every factor is helping us now toward prosperity."

VOLUME OF BUSINESS EQUALS YEAR AGO!

NEW YORK, APRIL 5—Sales managers who are mourning because "there is no business" might do well to go off in a corner and quietly consider these facts:

Business today, in spite of all reports to the contrary, is moving at a pace only 20 per cent slower than that of a year ago.

General sales in the United States for January, 1920, amounted to $45,-178,711,000. This was considered a phenomenal showing.

Notwithstanding the "depression" sales in January, 1921, amounted to $38,506,907,000. This was 85 3/10 per cent of the business done a year ago.

Bradstreet's commodity index shows a 43 per cent decrease in prices over the same period a year ago and, since the country is doing 85 per cent as much business in dollars as it did a year ago, the figures indicate an increase rather than a decrease in the number of sales.

Somebody is getting this business. More business is being done by some organizations than they ever did before.

The sales manager who is waiting with folded arms for "better times" and charging small sales to stagnant business conditions, might well adopt this motto:

"Let's Go!"

WAR DEPARTMENT BUYS PLANES

WASHINGTON, April 4—The War Department has ordered 200 pursuit planes and 35 bombing planes for the use of the American army. The pursuit planes will be the Thomas Morse type and will be built by Boeing Airplane Co. of Seattle. The bombing planes will be of Marlin type and will be built by the L. W. F. company of College Point, N. Y.

Car Plants Leading Cleveland Industry

Employment Gains 24 Per Cent for March—Other Lines Show Falling-off

CLEVELAND, April 5—The automobile industry continues to set the pace for business in this city. On April 1 the automobile plants of the city were employing 1500 more men than they were Feb. 28. That is a gain of 24 per cent and outstrips gains by various industries. The survey was made by the Cleveland Chamber of Commerce in cooperation with the United States Labor Department, and the figures are genuine. The eighteen plants in the automobile industry that reported had 8103 employees on April 1, as compared with 6532 on Feb. 28 and 5940 Jan. 31.

Comparing the figures for the automobile industry with the record of all other lines of production in the city, shows the progress made in the automobile industry to be remarkable. There are 97 plants reporting to the committee in charge of the survey. These plants under normal conditions employ approximately 100,000 men. The total number on the rolls April 1 was 59,202. That is 470 less employees in April than were working on Jan. 31 of the present year.

The Stearns factory is being operated at 100 per cent production; Winton, which has been idle for some time so far as production of new cars was concerned, will be in capacity production of 10 cars daily on May 1; Peerless is operating at 50 per cent of capacity, and the Kurtz plant, which is a newcomer in the local field, is turning out five cars a day and selling all of them. Grant has been enjoying a gradual increase in business in the present year; April orders assure production on a larger basis than in March, and this is also true of Chandler, Cleveland, Templar and other cars.

A trip to the dealers disclosed that all are optimistic and are selling cars, although they are hustling harder for business than they did a year ago.

FORD MAY BUILD CARS AT TROY

TROY, N. Y., April 5—After inspecting the site at Green Island on which he will build a large plant, Henry Ford stated to-day it was quite likely the factory would be used for the manufacture of automobiles rather than tractors as has been predicted. He added that Thomas A. Edison would construct a plant adjacent to the Ford factory which will be operated by power taken from the Ford power house.

Would Divert Car Tax to Highways

Senate to Get Bill Changing Fund Plan

Proposal Is Digest of Legislation Long Approved by Industry —Aids Forest States

WASHINGTON, April 4—Senator R. N. Stanfield of Oregon has prepared an amendment to the Federal highway bill providing that the application of receipts from a sales tax on automotive products should be used exclusively for the construction and maintenance of highways. This plan would abolish the present system of making highway appropriations out of general funds as called for under Federal Aid legislation. Briefly, the proposal is a digest of plans advocated by automotive organizations for several years though there is no specific provision for a system of national highways.

Basing calculations on Treasury receipts for the last fiscal year, it is estimated that a sales tax would yield approximately $145,963,035.62. With the various tax proposals calling for a higher rate on automotive products a larger sum would be available under the Stanfield amendment. The Federal Government under the Federal Aid Act has been appropriating $100,000,000 for good roads. The distribution of this fund has provoked widespread opposition and proposal for the national highway system was the outcome.

Senator Stanfield is a newcomer to Congress and is a wealthy sheep-grower. E. J. Adams, his secretary, is largely responsible for the measure, as he assisted in framing the good roads plank in the Republican party platform at Chicago last summer. He was also State Highway Commissioner for Oregon for several years and is familiar with the highway transportation problems.

Apportionment Difficult

One of the great difficulties or inequities of the Federal aid plan has been the apportionment. For instance, New York state with millions of automobile users could obtain but a small portion of the Federal aid. Another amendment in addition to the tax plan provides that after deduction not to exceed 5 per cent for administration, 12 per cent of the funds available annually for the Federal highway activities should be apportioned to Federal Land states in proportion to the number of acres in the reserves of each State and providing that the amount so apportioned shall not be less than 10 cents per acre per annum, these funds to be used for construction and maintenance of roads wholly, or partly, within the Federal Forest reserve and the remainder, or 88 per cent of the funds available annually, to be apportioned to the States in proportion to the number of motor vehicles licensed during each year.

Senator Stanfield says that the apportionment for the Forest Reserves is to carry out the pledge of the Republican party adopted at the Convention which provides that these public lands shall be a controlling factor in the apportionment of Federal highway funds. He contends that it is clearly unfair to withdraw from settlement large areas exempting them from taxation within these States thus preventing their development without providing some adequate means of extending aids equal to what they should but do not receive in taxes.

Approximates State Tax

The 12 per cent is approximately equal to what these lands would pay in state and county taxes if they were privately owned and subject to taxation. The apportionment of the remainder of the funds (88 per cent) is made according to the vehicle licenses used in each state. "If the funds are raised by sales tax imposed on motor vehicles, cars, and accessories," he said "then this method of apportionment is exact and equitable which merely means that the contribution by the manufacturer to the Government at the time the vehicle is sold follows the vehicle into the State and is there used for construction and maintenance of roads for the same vehicle to run on."

In support of this plan, the Senator asserts that "if the funds are raised by an appropriation of the general fund this method of apportionment is still as nearly fair and exact as may be written

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FARMERS FORM LEAGUE TO FIGHT SALES TAX

CHICAGO, April 4—While sentiment in favor of imposition of a Federal sales tax in lieu of imposts which now are a drag on industry is growing steadily in the industrial districts of the country its proponents will have a hard time getting it through Congress. One of the formidable obstacles in its way will be the opposition of the farmers. The Farmers Federal Tax League, with headquarters here, has been organized for the avowed purpose of fighting a sales tax. This organization contends that "powerful interests are preparing to shift further the burden of taxation upon the farmers and the farmers must organize to make felt their influence if this attempt is to be prevented."

N. A. D. A. Strongly Protests Dumping

Congress to Get Nation-wide Appeal for Protection from Unfair Competition

ST. LOUIS, April 4—Harry G. Moock, general manager of the National Automobile Dealers Association, has sent a letter to the secretary of every dealers association, local and State, urging the adoption of a resolution protesting against the reimportation from England and France of American made motor vehicles which are being brought into this country duty free and thereby competing unfairly with dealers in this country.

In his letter, Moock points out that American business needs "stimulation and not further depression; confidence and not doubt; enthusiasm and not apprehension." After telling briefly of enormous quantities of American made automotive equipment which has been purchased for a song by British and French speculators with the expectation of dumping it on American markets, he says:

"Congressional leaders do not fully know how their program menaces our industry. So it's up to us to acquaint them with it. It's up to us to ask Congress to give us such protection as will equalize the prices of these re-imported goods with the prices of American manufactured goods. We want you to ask Congress to enact anti-dumping legislation which will put a tariff on this re-imported material so that it cannot be sold at a half or a third of the value of American products."

To Notify Representatives

Each association is advised to send to its United States Senator and representative copies of the resolution it adopts. The resolution proposed by the national association follows:

"WHEREAS, American business has been seriously stricken during the recent period of post-war adjustment,

"WHEREAS, in addition to the natural depression resulting to the automobile business from this fact, the motor vehicle industry has been an especial target for discrimination, and

"WHEREAS, the automobile industry paid in Federal excise taxes in 1920 the sum of $144,000,000 to the Government, license and registration fees to the state governments of $100,000,000 and personal property taxes of approximately $80,000,000, a total of approximately $325,000,000.

"WHEREAS, the prosperity of the in-

(*Continued on page* 782)

Erskine Not After Studebaker Control

Denies Alliance With Durant and Fish—Company Has Record Business

> **"THE sales of our cars for delivery in the months of April, May and June are far in excess of any previous year in our history and we are trying to increase production at all plants with the expectation of producing and selling 20,000 cars in the second quarter."**
>
> **—Statement by President Erskine of Studebaker Corp. to stockholders.**

NEW YORK, April 5—Official denial that control of the Studebaker Corp. now rests with W. C. Durant, F. S. Fish, chairman of the board, and himself, was made to-day by A. R. Erskine, president of the company, in a statement read at the annual meeting of stockholders held in Jersey City. After referring to newspaper reports to this effect, Erskine said:

"I feel it my duty to inform our stockholders that there is not the slightest foundation for such reports. We know of no interests that are trying to obtain control of the corporation and believe such an undertaking to be extremely unlikely.

"We have not been, nor will we be, interested in acquiring a controlling interest in the stock of the corporation. In fact, such an effort by anyone would, in our judgment, be hostile to the best interests of the corporation, its customers, and its stockholders. We prefer to see the number of our stockholders increase, with the widest possible distribution of our stock, and to this end we shall continue to manage the affairs of the corporation in a manner that we hope will deserve the continued confidence and support of the automobile and security buying public. During the past year the number of stockholders increased from 3000 to 12,000, including 3000 employee stockholders."

Durant Purchases Denied

It has not been denied that Durant has purchased large blocks of Studebaker stock in the open market, but so far as can be learned this has been a purely speculative venture. He bought when the stock was from 20 to 30 points lower than it is now in the firm belief that it was far below its real value, and that there would be a substantial increase in a short time. He also advised his friends to buy for the same reason. It was reiterated by Durant's office to-day that he had no intention of trying to get control of Studebaker or to exert any influence over its affairs. Durant is much gratified, it was stated, at the prosperous condition of Studebaker affairs. The statements of Erskine and Durant seem to dispose effectually of reports which have been current in Wall Street for several weeks. Technical control of the company apparently rests in the hands of the banking house of Goldman, Sachs & Co. where it has been for some time.

Highly significant of the conditions now prevailing in the industry is the statement of Erskine to the stockholders that the company has been able to reduce its bank loans materially and that orders for the second quarter assure the largest three months business in the history of the corporation. In this connection he said:

"It will be gratifying to our stockholders to know that our sales of the first quarter were beyond our anticipation and that our net profits substantially exceeded the dividend requirements of both the preferred and common stock. In March we retired $2,500,000 in bank loans and have now outstanding $7,000,000, with over $5,000,000 bank balances. Our collections are exceeding our disbursements, and outstanding bank loans will probably be liquidated before the summer is over.

"The sales of our cars for delivery in the months of April, May and June are far in excess of any previous year in our history, and consequently we are trying to increase production at all plants with the expectation of producing and selling 20,000 cars in the second quarter which will be our record business for any three months. In June the plants will be operating at capacity of 8500 cars per month, which can thereafter be maintained indefinitely."

Stockholders Propose to Take Over Revere

FORT WAYNE, IND., April 2—An entirely new company will be organized to take over the plant of the Revere Motor Car Corp. of Logansport, Ind., according to the plans of the committee recently appointed to formulate plans for the future of the plant. It is proposed to have the new company purchase the plant at a receiver's sale. This committee consists of Judge R. B. Gentzel, of Chicago; Senator P. S. Armatage, of Owensville, Ind.; H. C. Springer, Garrett, Ind.; L. C. Thompson, Trenton, N. J., and John Miller and H. A. Kraut, of Logansport. Copies of the plans for the future of the company have been mailed to all stockholders of the present company and an invitation has been extended to all to become stockholders in the proposed new corporation.

STINNES BUYS FIAT SHARES

NEW YORK, April 2—A dispatch from Rome says Hugo Stinnes, the German industrial leader, has purchased from the Italian Fiat Corp. 200,000 shares in the electrical works in the Italian Tyrol known as the Alpinen Montan Gesellschaft. Stinnes, therefore, will become a director in the largest Italian electrical works and will exert much influence over the Fiat company.

Truck Sales Heads Plan N.A.D.A. Branch

Will Seek Approval of Organizing Truck Dealers Division of Association

DETROIT, April 2—Plans and policies outlined by the directors of the National Association of Motor Truck Sales Managers, which include active co-operation with the National Automobile Dealers Association, promise a season of activity. The meeting was the first held since the induction of Don Whittaker as secretary, and his recommendations covering future efforts of the association met with unanimous approval.

The subject of co-operating with the N. A. D. A. in the organization of a motor truck division of that organization was recommended by a committee, and the directors instructed Secretary Whittaker to begin negotiations with Harry G. Moock, general manager of the N. A. D. A. In many cities truck dealers now affiliate with the passenger car associations of the city and State, and also are members of the N. A. D. A. The successful efforts of the latter organization in promoting the interests of the automobile dealer are recognized by truck men and are prompting efforts to form a strong division to co-operate. Details of the truck division will be worked out later.

Promotion of motor transport, rural motor express and highway engineering also will be major future efforts, and periodical bulletins will be issued in support of road bond issues for distribution through dealers and distributors, and members of affiliated associations. Educating the public in proper truck operation and in promoting faith in the truck as the proper short haul medium, also will feature the activities.

A research department for the collection of data on sales work, general and territorial requirements, statistics on truck production, registration laws and license fees, road mileage, new loading devices and data on foreign business are proposed, and a legislative department which will co-operate in combating adverse legislation aimed at the motor truck will be maintained.

To Extend Secretarial Work

One of the chief functions of the secretary's office under Whittaker will be the employment clearing house where records of all truck salesmen will be kept. Efforts in that direction will be devoted to elevating the standard of salesmen through searching investigation of their records, results of which will at all times be available to manufacturers seeking salesmen or salesmen seeking positions. Attempts to curb the unscrupulous dealer and eliminate the "trade-in" evil will be made, and a meeting to discuss this matter will be held in New York soon, where a plan for overcoming it will be outlined.

Akron Plants Spurt to Meet New Demand

Goodyear Pushes Schedule to 17,500 Tires Daily—General Production 50 Per Cent

AKRON, April 4—With many automobile factories resuming operations, and with the vast surplus of tires of two months ago almost exhausted, marked improvement is being shown in the tire industry and Akron's many rubber and tire factories have begun to recover encouragingly from the slump which has been in force for the past nine months.

Nearly all Akron factories have begun to increase production and many are re-employing men on a large scale. This week Goodyear will put on 1200 of its former employees, and Firestone will re-employ 1000. Firestone has been adding to its force every day for the past few weeks and for the period extending from March 1 to April 30 will have re-employed at least 2000 men, officials announce.

Goodyear has formally announced a 33 per cent increase in production, effective at once, which will carry production up from 12,000 casings and 13,000 tubes daily, to 16,000 casings and 16,000 tubes a day. Firestone will increase production 50 per cent this month and go to 15,000 tires daily. Both factories are running two eight hour shifts daily, and operating on five-day weeks. Goodyear soon will go to a five and one half day week.

Although Goodyear officially announces a production increase to 16,000 tires a day, unofficially it is stated that the company's production this week will be pushed to 17,500 tires daily, and possibly to 20,000 tires by April 15. This unexpected increase has been brought about by heavy original equipment orders from automobile factories, received since the company announced the increase to 16,000 tires daily on Friday of last week.

Most Companies Report Gains

These two companies unquestionably are leading in the spurt taken by the tire industry. The other large companies of Akron, Goodrich and Miller, have made no formal announcement of production increases or re-employment of former tire builders. Smaller companies however are falling in line and several of them have restored operations to a basis of nearly 100 per cent normal.

In fact everything indicates that the back bone of the tire industry slump in Akron, which threw over 50,000 out of work in this city alone, has at last been broken. It is also significant that unless tire companies plan further production increases, the possibilities of an actual tire shortage this spring will be greatly increased. Vast surplus stocks of tires, stored in Akron and in other cities by Akron companies, have dwindled rapidly, through production being held down though sales have steadily increased. With this surplus exhausted rubber factories are now ready to get back to a basis of conservative production commensurate with demand.

Resumption of operations by automobile factories is perhaps predominantly responsible for the stimulated tire building activity. Goodyear alone reports that original equipment orders for April show an increase of 70 per cent over original equipment business placed in March. Goodyear also is reaping the reward of a very extensive and constructive advertising campaign, for consumer sales are increasing without any added sales effort. Firestone also finds its advertising campaign of the past year being reflected in consumer sales. Goodrich, more conservative in advertising, is not reporting any material increase in production.

Unemployment Dwindling

Through increased activity of rubber plants, Akron's army of unemployed is dwindling, and is now down to under 15,000. With many construction jobs opening up in the city, this number will be less than 10,000 and possibly down to 5000 before May 1. Smaller rubber companies planning material production increases within the next 60 days will help to absorb this remaining number.

All companies in hiring men are showing preference to former employees who are married. At the same time men now in the factories are being weeded out. This is being done to increase efficiency per man in the factory, and also to gain a more stable class of factory operatives, so as to give the city home owners, discourage the transient, floating element of labor from drifting into the city, and hold down labor-turnover when times again are prosperous.

A canvass of rubber factories in Akron shows that all are operating on a general average of 50 per cent normal production. This is a 100 per cent improvement over conditions in January.

The results of this canvass in other plants conducted especially for AUTOMOTIVE INDUSTRIES, show—

Plant Schedules High

General Tire & Rubber, nearly 100 per cent normal with one shift.

India Tire & Rubber, about 65 per cent normal. Orders running ahead of production, which will be increased this month.

Mohawk Tire & Rubber, 35½ per cent normal. Orders double production and 80 per cent higher than in January.

Portage Rubber Co., producing 80 per cent normal. Expects to reach normal operation within 30 days.

Rubber Products Co., operating 75 per cent normal in tire departments, and 65 per cent normal in other departments. This company never dropped below 60 per cent of normal production even at the lowest ebb of the tire industry slump.

Amazon Tire Co., now on basis 80 per cent normal, due to increases in dealer orders.

Star Rubber Co., 65 per cent normal. Plans substantial increases in next 60 days.

Swinehart Rubber Co., 70 per cent normal.

American Tire & Rubber, nearly 100 per cent normal.

Thus it may be seen that with all companies operating in excess of an average of 50 per cent normal production, the tire industry is now being operated on a basis of over $250,000,000 annually or nearly $27,500,000 a month.

Goodyear Enforces New Wage Reduction

Retrenchment Program Calls for Cut of $5 a Tire in Overhead Costs

AKRON, April 4—Although the Goodyear Tire & Rubber Co. has officially announced that it will increase production 33 per cent, going to a basis of 16,000 tires daily by April 15, and will employ 1200 former tire builders, a severe retrenchment program is being continued in the general and factory offices and in many factory departments.

Under the refinancing negotiations for $85,000,000, and under dictation and suggestion of banking interests negotiating the immense loan for Goodyear, the company is attempting to cut actual manufacturing cost nearly $5 per tire, by reducing overhead, by combining jobs and by laying off several hundred office employees, many of whom have held executive and semi-executive positions at commanding salaries. The company will also enforce a 10 per cent cut in wages this week in the factory. Salaries previously were reduced.

The Goodyear "Tire News," said to be the largest corporation magazine in the world, and at times of peak production having a monthly circulation of approximately 100,000, has been discontinued with the April number.

Elimination of this magazine will mean a vast saving to the company it is stated. Whether or not the publication will be revived will depend entirely upon the matters of reorganization of the company and future developments in the tire industry.

In the factory offices, a reduction of 76 per cent has been made. This has compelled the company to dispense with many of its high salaried men in official and semi-official capacity. In the general offices, departments have also been cut to the bone. It is understood the factory and general offices, which have functioned separately and in different office buildings, will be combined.

Wage Based on Living Cost

The matter of contemplated wage cuts, was protested by the Industrial Assembly of Goodyear, composed of employees, and was held in abeyance until the projected reduction was arbitrated. It will become effective this week. According to Vice-President and Factory Manager P. W. Litchfield, the lowering cost of living, and the economic readjustment of prices, makes a wage and salary cut equitable at this time.

Litchfield prepared charts for employees showing that there has been a 25 per cent decline in house rents in Akron, a 50 per cent decline in room rents, and an average general decline of 27 per cent in retail commodity prices. Litchfield assured employees that a 40 hour week would be maintained, and that the factories might go to 45 hours a week.

Syracuse Factories Resume Activities

Whole Colony of Industries Revives As Franklin Production Continues Heavy

SYRACUSE, April 2—With the re-establishment of a 100 per cent operating schedule by the H. H. Franklin Mfg. Co., the entire colony of Syracuse industries interested in automotives has felt a revival during the past few weeks. In addition to the Franklin interests, however, there has been a general, though less active, return to production.

Ever since the middle of February the Franklin company has been operating on what they term a normal schedule of 40 cars per day. Not until very recently, however, have the other plants felt the effects because only now are new stocks being bought for production.

In meeting the 40 car schedule the Franklin company is employing 3000 men, and according to a representative of the company there has not been any reduction in the wage scale, the employees being paid on the same basis used before the shut-down last fall.

There are 2000 men less, on the Franklin roll now, than there were last year, the company operating on a single shift. All equipped operating buildings are in use now, but the million dollar addition built last year is being utilized for storage space. The Franklin company has relinquished leases on seventeen storage locations around the city. Eventually the new building will be equipped for production the company having originally planned on going right into the new area. The operating schedule with 5000 employed on two shifts was 75 cars per day. This figure probably will not be reached very soon, company officials feel.

Present Schedule Oversold

The present schedule of 40 cars per day has been oversold, according to sales department figures. The program for the entire month of March called for 1031 cars delivered. Up to and including March 26, 832 of that number had been shipped. Orders accepted for March delivery totalled 216 in addition. The sales department reported 236 additional March orders which could not be filled until April, and 825 April shipment orders. The normal April production schedule calls for approximately 1050 cars and already more than that have been sold.

The company has installed a conveyor system in the final assembly which will permit of a production of 125 cars per day. Only part of the system is now in use.

Franklin activity is reflected in the business of the Dyneto Electric Co., which is on a 25 per cent basis, about fifty units per day going to the Franklin plant. Several foundries, including the Straight Line Engine Co., S. Cheney & Sons, the M. L. Oberdorfer Brass Co., have felt the effects of the revival. Other Central New York plants which have increased production are the Halcomb Steel Co., the Penn Spring Works, the A. D. Clapp Mfg. Co. of Auburn, and the Brewer Titchener Co. of Cortland.

At the several gear works in town, there is an indication of a generally increased interest. The Brown Lipe Chapin Co. is on a 25 per cent basis, their production going in small quantities to a number of manufacturers. The same situation exists with the Brown Lipe Gear Co., the New Process Gear Co., and the Durston Gear Co.

The Dyneto company is gradually being readjusted as a result of the action of several months ago resulting in the plant being taken over by a friendly committee of creditors.

Senate to Get Bill Changing Fund Plan

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in any legislative act because the number of motor vehicles licensed in each State fairly reflects the wealth, population and total road mileage within the State. If this factor is used in apportioning funds, it is easy and inexpensive to ascertain the size of the factor by merely getting a certificate from the official having charge of the motor vehicle department."

The two amendments will be introduced at the next session probably at the same time that the Senate committee on Post-offices and Post Roads report out the bill for a national highway system. These amendments are expected to wipe out opposition to national highways from Western States.

According to the views expressed by the Oregon Senator, "the users of motor vehicles receive direct money benefits from every mile of road improved, in the form of decreased repair bills, extended life of the vehicle, increased mileage on tires and gas, and increased efficiency. Over poor roads this would be purely a waste. The saving of this waste invested in better roads is economy and good business on the part of motor owners, therefore, a tax imposed on the sale of equipment at its source is more than saved in the reduced cost of operation if the tax so collected is devoted to building more and better roads.

"True, lands and property other than motor vehicles receive benefits from highly improved roads, but lands and other property also contribute to the common cause when they pay direct property taxes for the county market roads which far exceed in mileage both State and National highways."

TO CONTINUE PRESENT PLANT

MOLINE, ILL., April 4—Borg & Beck Co., automobile clutch and service parts manufacturers, will extend their Clearing, Ill., plant, but this development does not mean that the central works will be transferred from this city, officials explained. There have been persistent rumors to the effect that such a change was pending.

Container Car Wins Success in Trial

Store Door Deliveries by Railroads Shown Practical in Test by N. Y. Central

NEW YORK, April 4—Preliminary experiments with its new "container cars" for store-door delivery have been a complete success, the New York Central Railroad announces, and the system will be expanded as rapidly as it is possible.

The freight car, with four portable containers which can be filled and sealed by a shipper in his own warehouse and then loaded on the car truck, has just completed successful trips between Chicago and Cleveland, and a second car of this type will be tried this week on the Boston & Albany for the shipment of shoes. A steel express car, with nine portable containers, has finished successful trips between this city and Chicago with the Twentieth Century and other fast trains, and is declared to be successful.

Experts of the New York Central consider their experiment a radical departure in transportation. It is predicted that wide use of the new car will save not only demurrage and truckage, but clerk hire and large losses by theft.

The new system provides "compartment" service for freight and express by means of specially-devised "containers" and "container cars," which in effect gives to shippers the use of individual traveling safe-deposit vaults of various standard, interchangeable sizes which are carried locked and intact from the door of the shipper to the door of the receiver of freight. The "containers" or huge steel boxes, are readily removable from the car body and are packed and locked at the factory of the shipper, carried by motor truck or electric car to the railroad and hoisted aboard the car, and at destination are carried by truck to the store door of the consignee, where they are unlocked and unloaded at convenience.

Unload Direct to Shelves

Goods may be stowed in the "containers" in cardboard or even paper wrappings, without need for costly wooden boxes or crates, and the shipment travels untouched to the door or platform where the packages may be unloaded directly onto shelves.

"The savings effected by the new system in loss and damage of freight prevented, in wages, in boxing and crating of individual small shipments," says the New York Central, "are expected to be exceeded in amount by the greater use of moving equipment—railroad cars, trucks and draws—as well as of freight-terminal facilities, whose limits of capacity in periods of heavy demands for transportation have restricted the size of the 'peak-load' and adversely affected commerce."

G. M. C. Takes Loss on Its Inventories

Liberal Allowance for Depreciation Cuts Heavily Into Earnings for Year

NEW YORK, April 5—Net sales of the General Motors Corp. for the year 1920 were $567,320,603, which was an increase of $57,643,909 over sales for 1919. The net income was $93,150,308, but $47,766,787, which is slightly more than half that amount, was deducted to cover Federal taxes, to write down inventories, for depreciation of plants, and for operations conducted in assisting employees to buy their own homes. In addition to these deductions, reserves previously set up were utilized to provide for all contingencies and write down the value of inventories and other accounts to a conservative level. The net profit for the year was $45,383,521.

The report shows that the demand for the corporation's products, which had been very urgent during the first part of the year, was sharply curtailed in September. Inventories reached their peak about the middle of October, but by Dec. 31, notwithstanding shrinkage in sales, there had been a net reduction in inventories of approximately $25,000,000. Inventories were further reduced by $25,776,112 at the close of the year by the charging off of all obsolete materials as well as adjusting values to cost or market, whichever was the lower.

While all known losses and write-downs of inventories had been taken care of in closing the books as of Dec. 31, it nevertheless has been deemed advisable to set up a special reserve of $7,500,000 to take care of possible losses in respect to outstanding commitments for materials undelivered and for other unforeseen contingencies.

Taxes Make Heavy Inroads

A table showing the progress of the earning power of the corporation shows that the net earnings of 1918 were $35,285,597, of which practically $20,000,000 went for Federal taxes, $13,504,000 for interest and dividends, and $1,667,000 was retained in the business. Net earnings in 1919 were $91,181,222, of which $30,000,000 went for Federal taxes, $22,713,000 for interest and dividends and $38,468,000 was retained in the business. The net earnings for 1920 were $47,248,383, of which $3,894,000 went for Federal taxes, $29,117,000 for interest and dividends, and $14,236,000 was retained in the business.

The report, which was submitted to the directors to-day, says:

"The officers and directors of the corporation have thought it unwise to undertake the production of materials that do not relate largely to the automobile. Thus, a comparatively small portion of the total tires produced are consumed by the automobile manufacturer, the larger percentage being sold directly to users of cars for replacement purposes; the greater part of the production of sheets and other forms of steel is consumed by trades other than the automotive industry; therefore investment in these fields has not been made. By the pursuit of this policy, General Motors Corp. has become firmly entrenched in lines that relate directly to the construction of the car, truck or tractor, but has not invested in general industries of which a comparatively small part of the product is consumed in the manufacture of cars.

"The rapid development of the industry has called for equally rapid changes in the character of manufacturing plants, but by constant reinvestment and rebuilding, the General Motors Corp.

(Continued on page 782)

CONDENSED COMPARATIVE CONSOLIDATED BALANCE SHEET OF GENERAL MOTORS CORPORATION AND SUBSIDIARY COMPANIES AS OF DECEMBER 31, 1920 AND 1919

ASSETS	Dec. 31, 1920	Dec. 31, 1919
Cash in banks and on hand	$47,608,949.90	$48,231,200.04
United States Government bonds	41,262.21	213,218.49
Marketable securities	34,096.31	989,448.36
Sight drafts against B/L attached	9,534,264.37	10,945,061.06
Due from United States Government on war contracts	....	304,334.80
Notes receivable	13,449,376.90	1,776,104.31
Accounts receivable, customers and others	22,091,095.33	24,668,766.74
Inventories at cost or less	164,684,678.72	128,696,651.70
Prepaid expenses	1,891,854.06	582,355.64
Total current assets	$259,335,577.80	$216,407,141.14
Investments in allied and accessory companies, etc.	$67,985,100.31	$53,398,491.26
Real estate, plants and equipment	248,788,765.63	176,888,467.00
Deferred expenses	6,282,606.27	2,719,357.18
Good-will, patents, copyrights, etc.	22,414,818.11	20,323,888.81
	$345,471,290.32	$253,330,204.25
Total assets	$604,806,868.12	$469,737,345.39
LIABILITIES, RESERVES AND CAPITAL		
Accounts payable and trade acceptances	$30,140,278.35	$37,846,313.36
Notes payable	72,421,451.45	6,812,318.68
Taxes, payrolls, and sundries accrued not due	11,122,197.78	11,521,770.64
Accrued dividends on preferred and debenture stock, payable February 1	1,018,943.73	889,882.00
Total current liabilities	$114,702,871.31	$57,070,284.68
Purchase money bonds	$1,629,070.14	$150,000.00
Purchase money notes, account Fisher Body Corporation stock purchase	9,840,000.00	21,840,000.00
	$11,469,070.14	$21,990,000.00
Reserve for depreciation of real estate, plants and equipment	$33,285,988.04	$23,084,824.58
Reserve for employes' investment fund and sundry contingencies	5,123,100.01	4,041,072.69
Reserve for Federal taxes and extraordinary expenses	4,942,116.42	36,262,472.70
Reserve for bonus to employes	1,558,950.87	505,579.85
Special reserve for unforseen contingencies	7,500,000.00	....
Total reserves	$52,410,155.34	$63,893,949.82
Capital stock:		
Debenture stock 7%	$25,153,500.00	....
Debenture stock 6%	56,366,900.00	$68,339,300.00
Preferred stock 6%	16,183,400.00	16,957,000.00
Common stock no par value 20,284,580 shares issued and outstanding at $10 per share (including 254,764 shares held in reserve account subscriptions not fully paid, at $10 per share, $2,547,640)	205,393,445.25	....
Common stock ($100 par value)	239,500.00	153,411,000.00
Total capital stock	$303,336,745.25	$238,707,300.00
Bonus stock awarded	....	7,848,570.00
Interest of minority stockholders in subsidiary companies, with respect to capital and surplus	1,614,809.08	1,585,343.57
Surplus	121,273,217.00*	78,641,897.32
Total capital stock and surplus	$426,224,771.33	$326,783,110.89
Total liabilities, reserves and capital	$604,806,868.12	$469,737,345.39

Note—The corporation had a contingent liability of $1,416,333.11 on December 31, 1920, on account of sight drafts discounted.

*Included in this amount is $68,332,415.90, covering paid in surplus growing out of the issuance of stock for cash and for acquisition of properties.

Conditions Brighter in Northwest Zone

Business Shows Decided Improvement in Cities—Credit Situation Reported Improved

MINNEAPOLIS, April 5—That the automobile business is looking up in Minneapolis territory is evident. Dealers are beginning to smile and gloom is being dispelled. Business in the larger cities is the first to look up, such as Duluth, St. Paul and Minneapolis. As for the country, not so much can be said as yet. Possibly one reason for the situation is that the driving season in the country will not begin in earnest until winter's mud has been dispelled. The financial situation is not such yet that country dealers can get the cars they want. The truck men feel pretty well because hundreds of road and other contractors are feeling the return of the building season, after a long lapse. The tractor situation is not so bright.

Manufacture of tractors has been resumed by the Minneapolis Steel & Machinery Co. after a long shut down. This month, 200 additional men will be put on with the reopening of the foundry. Tractors have been shipped already to Venezuela and Czecho-Slovakia. All tractors on hand with this representative concern are sold for delivery or future delivery.

Northwest credit conditions have improved in the last six weeks, but are not at normal. Of the total accommodation by the Federal Reserve Bank in the district March 4, loans were largely agricultural, or $41,000,000. There is more unemployment, and a decline in both wholesale and retail prices of commodities is shown from Feb. 1 to March 18.

Crop Season Brings Confidence

Confidence seems to prevail as the Northwest enters the new crop season. In parts of North Dakota and Montana, farmers cannot repay borrowings until the new crop is harvested. In other parts, say South Dakota and Minnesota, farmers can liquidate heavily when they release their present holdings of grain. The new wheat area is reduced some, but the total grain crop average may go above normal. Farmers are slow about paying, and based on $1,000 average loan, they are said to owe above normal, as follows: Minnesota, $200, or $1,200; South Dakota, $250, or $1,250; North Dakota, $400, or $1,400; Montana, $300, or $1,300. These are owings to country banks.

The Pence Automobile Co., one of the first to receive big shipments of cars, the Buick, has received from the new St. Louis factory three trains of 38, 39 and 55 freight cars each. The load is four automobiles per car. Actual offers for more than half of the total have been received already. The first train made the trip from the factory by daylight, stopping as optimism creator, at many points.

75 BUICK PURCHASERS JOIN IN DRIVEAWAY

DETROIT, April 4—Four special trolley cars will convey 75 new Buick owners and friends to the Buick factory at Flint, Wednesday, where, following a banquet at the Durant Hotel, they will be given their cars for the overland journey to Detroit.

The party represents purchasers of cars from the Starkweather Buick Co. at the Detroit automobile show during which C. C. Starkweather and his force of eight salesmen sold 78 cars. Three of the purchasers are out of the city and will not be able to make the trip returning from Flint. The sheriff of Genesee County and staff will escort the procession to the Oakland County line where the sheriff of that county and staff will bring the party to the Wayne County line.

Colonel Harry Jackson the Detroit traffic chief and his staff will meet them at the city limits and escort them through the city to the Starkweather service station where the cars will be washed and turned over finally to the owners. Starkweather will turn over to the factory official, a check for $158,075.67.

Northwest Business on Scale of Last Year

PORTLAND, ORE., April 1—Spring weather burst upon Portland with the arrival of Easter last Sunday, and Portland dealers have more than been satisfied with the resumption of buying. In fact, many of the dealers are comparing the present period with last spring, which was the finest in business history here.

A resume of business during the month of March disclosed the fact that dealers on the whole had an excellent month, and that business has increased steadily from the first to the last of the month. One dealer reported 90 new and used cars sold, while another reported 60, both figures running close to last year's March records. New cars are beginning to experience a strong demand and some of the dealers are forecasting a shortage later in the spring. Many who have been waiting for a possible reduction of price are realizing that indications do not point to a decrease and are getting into the market.

AUSTIN MACHINERY TO REBUILD

CHICAGO, April 4—The Austin Machinery Corp. will rebuild the plant at Winthrop Harbor, Ill., which was recently destroyed by fire. Pending the erection of the new plant, the manufacturing operations of the company will be continued at Muskegon and Toledo. The company has also recently consolidated into its group the plant of the Fairmont Mining Machinery Co., Fairmont, W. Va.

Business Caution Again in Evidence

Chicago Reserve Bank Finds Continuance of Post-War Conditions Hurts Trade

CHICAGO, April 1—The same caution in business in the Middle West that was apparent several months ago has again appeared, attributable, according to the Federal Reserve Bank of the seventh district, to the following factors:

1—Uncertainty on account of a continuance of high retail prices for many articles that make up the daily living budget.

2—Curtailed building operations due to high cost of construction and the consequent shortage of housing and further increase of rentals.

3—The attitude of greater resistance by wage earners to any lowering of the pay scale.

4—The turning of the attention of farmers from marketing to new crop preparations, thus delaying liquidation of farm holdings.

5—The continued heavy demand for money and the high interest rates.

More favorable conditions are reported from the agricultural districts of which Chicago is the center, weather conditions during the past winter having favored increased production although at the same time some apprehension has been created in regard to the forthcoming crops by the scarcity of snow during the past season.

What the mild weather has done for the farmer which is reflected in the continuance of frozen credit as a factor in the liquidation of loans, has been to turn his attention to spring work rather than to continued marketing. There is a feeling among the farmers that the best way to recoup the losses sustained through the decline in prices is to feed their corn and oats to live stock, a more merchandisable product. Farmers are taking a more hopeful view of the situation though there are indications of a 10 per cent falling off in the prospective wheat acreage.

PACKARD DISCUSSES SALES

DETROIT, April 1—Directors, dealers and branch managers of the Packard Motor Car Co. closed a three-day session with factory officials here this week. Those present represented New York, Philadelphia, Boston, Chicago, Baltimore and other large cities. President Macauley and other executives of the Packard organization spoke to the dealers, all of whom expressed the opinion that the improvement noted in the automobile industry in the last two weeks gave every promise of continuing throughout the spring and summer. Sales resistance, and in fact all of the obstacles encountered by the distributing organization, were discussed and plans evolved for overcoming them. Production is starting up strongly, demand being pronounced for the light six.

"Full Speed Ahead," Factory Order

Production Hitting on All Cylinders

Output for March Doubles February—April Schedules Are Increased Heavily

DETROIT, April 5—With all automobile factories in production and the majority hitting on all cylinders, a rapid return to prewar normal is apparent in the remarkable step-up in production for March when the output in Detroit and Michigan totalled 105,245 cars. This compares with 53,040 in February, an increase of approximately 100 per cent.

The real significance of the figures is best seen in a comparison with March of last year which in many factories established a record for production up to that time. The total manufactured last March was 176,831. The total for the month just ended was 59.5 per cent of the March 1920 output.

Further investigation reveals that last month's output was in reality 66 per cent as great as last March for the reason that the Willys-Knight and Overland production last year was 17,700 cars and there was no production at those plants last month. Overland and Knight production was resumed last Monday and while there is no set schedule for April, output is expected to reach around 5000.

While Ford was responsible for 72,000 of the cars represented in last month's figures, the actual increase exclusive of Ford production in March over February was 15,205 or 84.3 per cent.

Schedules for April production in all factories have been increased from 10 per cent to 35 per cent, though executives of the most successful companies contend that the total output for 1921 will be between 50 per cent and 60 per cent of 1920 which was regarded as an abnormal year and a production record that probably never again will be reached.

Speed Up on Parts Making

Many factories were enlarged during the abnormal period in an effort to speed up production. With a prospect of maintaining output at about 60 per cent of last year's figures, or on a basis of close to prewar normal, proper utilization of spare factory space and equipment is a problem. A majority of the manufacturers are solving it, however, by speeding up in the parts manufacturing end. This is regarded as a logical plan and certain to prove of great advantage to the owner in quicker and better servicing.

When not driven to undue haste in turning out spare parts, as was the case last year, parts will be turned out more nearly perfect as to quality and in quantity sufficient to keep all dealer service stations well stocked. Some manufacturers also are contemplating side lines, allied with automobiles, but no definite step in this direction has been taken.

Dodge swung into production in March and while the factory started on a 10 per cent basis, output was increased rapidly each day until the plant now is on a 60 per cent production basis which will be maintained indefinitely. It is significant with all manufacturers that employee forces have been curtailed to a minimum and while many factories now are operating on a 60 per cent production basis and some close to normal, they are doing this with forces cut to from 40 to 70 per cent.

Efficiency Lowers Overhead

Despite the fact that all factories now are in operation, many on schedules close to normal, former employees may be seen loitering about the factory gates and streets without work and with slight possibility of their securing reemployment. A high degree of efficiency reached and maintained, manufacturing executives declare, has lowered the overhead in a great measure and is permitting operation at a profit in the face of the production curtailment as compared with last year.

Sales Managers Too Busy for Convention

NEW YORK, April 6—The meeting of the Advertising Managers Council of the Motor and Accessory Manufacturers Association, which was to have been held at Washington April 14, 15 and 16 has been postponed until some time in May or June. The general subject will be, "How the Wealth of Government Resources Can Be Utilized by the Automotive Advertising Managers" and the meeting will be held in Washington. The chief reason for the postponement is that advertising and sales executives are too busy to attend at this time because of the general business revival. It also has been deemed advisable to wait until the new administration becomes more definitely settled and in a better position to outline a program of assistance.

Goodrich Meeting, April 20

AKRON, April 5—The B. F. Goodrich Co. has issued to stockholders a call for the annual stockholders' meeting on April 20 at New York and for a special meeting of stockholders the same day to ratify the proposed retirement of 11,880 shares of preferred stock of $100 par value each which the company has acquired. Retirement of these shares will reduce the company's stated capital from $108,412,000 to $107,224,000.

N. A. C. C. Committees Press Legislation

Important Conferences Scheduled with Government Department Heads—Trade Improves

NEW YORK, April 7—Pratically all the directors of the National Automobile Chamber of Commerce will be in Washington to-morrow to attend a series of conferences which will be among the most important for the industry since the armistice. Here is the schedule:

Highways committee, headed by Roy D. Chapin, will confer with President Harding and Secretary Wallace of the Department of Agriculture. The purpose of the calls will be to present arguments in favor of the Townsend Federal highways bill.

A special committee headed by H. H. Rice, vice-president of the General Motors Corp. and comprising J. Walter Drake, Alvan Macauley, R. E. Olds and H. M. Jewett, will confer with Herbert Hoover, Secretary of Commerce. This committee was named at the request of Hoover to co-operate with him in the development of foreign and domestic automotive trade.

The tax committee, headed by C. C. Hanch, will confer with Secretary of the Treasury Mellon and Senators Penrose and Smoot in regard to the taxation program outlined by the N. A. C. C. The committee will urge a program of strict economy and a tax on retail sales if additional revenue is needed.

Directors of the Chamber at their monthly meeting here yesterday went on record as opposed to the adoption of legislation for a soldiers' bonus at this time but declared for proper care of disabled soldiers. Opposition to the bonus was on the grounds of economy.

Business Gains General

Reports received by the directors showed that business is improving in virtually all parts of the country with the exception of the Dakotas and in the south, outside of Georgia and Florida. Passenger car sales are much better even in Iowa and Kansas.

Production reports for March showed an increase of 63 per cent over February and that business for the month was 42 per cent of the total for March, 1920, which was the largest single month in the history of the industry. Business in February was 58 per cent greater than in January. Carload shipments for March were about 16,500 and there were about 10,000 driveaways.

President Clifton of the N. A. C. C. will open the service managers convention at Buffalo, May 17.

G. M. C. Writes Off Inventory Losses

Will Complete Construction Program This Year at Cost of $10,619,521

(*Continued from page 779*)

has kept well in advance and its factories may now be considered in satisfactory condition. The great plant of the Cadillac Division, in Detroit, which will be fully occupied in the summer of 1921, is the last large item of reconstruction to be finished. There still remain several small and somewhat antiquated plants that have been relegated to minor manufacturing or assembly purposes, but these items are of little consequence and may be abandoned at a not distant date.

"Constant change has necessitated careful study of customers' demands and possible improvement in the character of product. In addition to the studies conducted by the individual manufacturing divisions of the corporation, there has been organized and established at Dayton the General Motors Research Corp., with complete organization and facilities for systematic experimentation. The corporation has thereby insured the proper checking of all developments of the several divisions and has made possible independent research and study of the problems of the industry, abstract from the routine of manufacturing.

"Rapid increase in production has also necessitated the building of houses for the accommodation of factory employees, notably at Flint and Pontiac, Mich.; Janesville, Wis., and Walkerville and Oshawa, Canada. These houses are being sold to employees, as the corporation does not intend to carry the investment longer than necessary, and already 76.7 per cent have been sold.

"The construction program, inaugurated in recent years, was about completed during the year 1920 by the expenditure of approximately $79,161,951. There remains for expenditure during the year 1921 the sum of $10,619,521."

Directors to-day declared a dividend of 25 cents a share on the common; $1.50 a share on the 6 per cent preferred; $1.50 a share on the 6 per cent debentures, and $1.75 a share on the 7 per cent preferred.

New Cadillac Plant Replaces 77 Buildings

DETROIT, April 2—General offices of the Cadillac Motor Car Co. now are in the new Cadillac plant on Clark Avenue. The purchasing, accounting, manufacturing, sales and advertising departments will begin to function at the new home Saturday.

Some idea of the size of the plant may be gained when it is known that all factory operations which heretofore have required 77 buildings in Detroit, will be carried on in it. There are 8 large buildings, chief of which is the manufacturing building, 800 by 600 feet, with a floor space of 970,000 feet. Raw materials are received at one end and the Cadillac chassis leaves under its own power from the other end.

Conveniently near the manufacturing building is the heat treatment building, 500 x 80 feet. The assembly building, second largest in the row, is 800 x 300 feet, with a floor space of 620,000 feet. The storage building which adjoins the assembly building is 480 by 140 feet and has storage space for 1000 Cadillacs. The factory service department is housed in this building.

Executive offices are in a handsome administration building, 225 by 50 feet, equipped with all conveniences. The power plant is one of the most modern in the country.

Particular thought has been given to comfort and surroundings of the 6000 Cadillac employees in the installation of locker rooms sufficient to give each worker a steel locker, special bridges, walks, etc., that will permit a great saving in time and a minimum of confusion in entering and leaving the plant. The welfare department and First Aid hospital is so located that it can be reached from any part of the plant in a few minutes.

N. A. D. A. Strongly Opposes Dumping

(*Continued from page 775*)

dustry recently has been threatened by the dumping upon the American market of thousands of vehicles and millions of dollars of automotive merchandise salvaged from the war areas of Europe, and

"WHEREAS, the carrying out of such a plan will result inevitably in the demoralization of the automotive industry, thereby further seriously disrupting employment, will cause the loss of thousands of dollars to manufacturers and dealers in automotive merchandise and will deprive the Government of great sums of revenue, therefore,

"BE IT RESOLVED, that the Congress of the United States be asked to enact legislation which will equalize the differences in the marketing of this salvaged equipment. affording protection to the Government as well as the industry and which will afford a much needed stabilization for all American business.

British to Stop Dumping

WASHINGTON, April 4—The Department of Commerce has been informed that the British government has issued formal proposals for the protection of key industries and the prevention of dumping. The plan contemplates the imposition of a customs duty of 33⅓ per cent ad valorem for five years on articles produced by key industries. The list includes magnetos. The government proposal says a further duty of 33⅓ per cent may be added to any other duties on goods offered below the production cost or at prices which, because of currency depreciation, are below production costs in the United Kingdom.

Wisconsin Proposes New Tractor Tests

Will Limit Sale of Machines to Those Meeting Working Requirements

MILWAUKEE, April 4—Agricultural department officials of Wisconsin have worked out a new plan for regulating the sale of tractors and all other forms of liquid fuel traction engines and machines, for the purpose of preventing further distribution of unreliable and untested tractors, and safeguarding the interests of purchasers, more especially the farmer.

Under a bill covering the plan, just introduced in the Wisconsin legislature, no tractors may be sold in Wisconsin without a permit to the manufacturer or assembler, and permits will not be issued until models have been tested by a board of three competent engineers under the control and supervision of the agricultural engineering department of the University of Wisconsin.

The measure is to go into effect Sept. 1 of this year so that as many models as possible may be tested and permits issued for them individually by Jan. 1, 1922. All models offered for test shall be regular, stock models. A permit is required for every model offered for sale. The tests include endurance, horsepower rating for continuous loads, and consumption of fuel per hour or per acre of farm operation. All test results will be open to public inspection.

Results of tests will be certified to the Wisconsin Railroad Commission which will issue the permits.

The commission shall revoke permits or refuse to issue any, if two or more bona fide customers residing in this State show evidence that the tractor manufacturer has failed to maintain adequate service with a full supply of parts and replacements in the state, and within reasonable shipping distance of the customers.

Temporary permits may be issued if by Jan. 1 all tests are not completed, but failure on the part of manufacturers to supply the models for testing shall not be cause for issuance of temporary permits.

Models not admitted may be re-examined after alterations are made. No company shall use the results of the tests for advertising purposes, except the entire report is published, under penalty of permit suspension.

For violations fines of $100 to $500 for each offense are provided in the bill. Hearings will be held on it in April at Madison, before legislative committees.

STUDEBAKER DIRECTORS CHANGE

JERSEY CITY, April 6—The annual meeting of stockholders of the Studebaker Corp. was held here yesterday. All directors were re-elected with the exception of G. M. Studebaker whose place was taken by H. A. Biggs, vice-president in charge of sales.

24 Dealers Exhibit at Automobile Club

Closed Models Predominate at Special Showing — Minerva and Rolls-Royce Shown

NEW YORK, April 4—Twenty-four New York automobile dealers are holding a passenger car show this week at the Automobile Club of America. The stands occupy the grand ballroom, the restaurant, entrace hall and the office of the Touring Bureau. Many of the leading American makes are represented, as is one foreign car, the Belgian Minerva (the Rolls-Royce, also shown, may be regarded as an American product now). As might be expected, there is very little that is new, most of the cars shown having been exhibited either at the Automobile Salon or at the automobile show last January.

An Essex two-passenger cabriolet is a car that is exhibited for the first time, although literature regarding it was distributed at the automobile show in January. This car impresses one by its low build. The Hudson and Essex companies are now enameling their hoods and radiators in addition to their fenders and splash pans, which is a change made since last January. The Hudson company shows a standard touring limousine.

Space is naturally somewhat limited and where only a single car is shown, it is a closed car in the majority of cases. No exhibitor shows more than two cars, and then generally one open and one closed model Both Packard and Pierce-Arrow, for instance, have one touring model and one limousine on exhibition. The only chassis shown is that of the Belgian Minerva.

A new custom built brougham is shown on the standard Mercer chassis. While built low, it gives ample head room. It is a two-passenger brougham and sells for $8,500. Winton shows the same four-passenger sport roadster as at the Commodore some months ago. Two Rolls-Royce cars are shown, one a Salamanca cabriolet and the other a town car of English design, finished in yellow.

Dodge Brougham on Exhibit

A Dodge car with a brougham body is shown by the Stratton-Bliss Co., the New York Dodge agents. It is a rather attractive car and sells at $3,750, f.o.b. New York. Nickeled wire wheels are fitted and two extra wheels, tires and tire-covers are supplied. The wire wheels are of Hayes make. The equipment includes a dictaphone, dome light, individual cast aluminum steps, sliding steering wheel and special windshield; the latter being of square form, nickeled and rather low.

The only entirely new car at the show is the Ambassador, which is manufactured by the Yellow Cab Mfg. Co. of Chicago. It is an assembled proposition, comprising a Continental Model 8A motor, a Brown-Lipe clutch and transmission, Timken axles and Disteel wheels. Later, however, it is planned to use a special Ambassador design of engine, to be built by Continental. Only custom-built bodies will be supplied. The one exhibited was by Racine Body Co.

Among the special features is a double instrument board. That is, in addition to the regular instrument board on the cowl there is an instrument board at the rear of the front seat, for the benefit of the rear seat passengers.

Durant Reincorporates Under Delaware Charter

NEW YORK, April 6—Durant Motors, Inc., has been chartered in Delaware to succeed Durant Motors, Inc., the New York company formed by W. C. Durant to mark his reentry into the automobile field. The capital of the Delaware corporation is 1,000,000 shares of no par value stock.

The first of the Durant experimental cars have come through and are now being given thorough tests on the road. It will be August at the earliest, however, before the factories are put into production. Dealer territory will not be allotted for several months yet.

It has been announced that one of the Durant Motors assembling plants will be located at Jackson, Mich.

Briscoe Motors to Add $2,000,000 to Capital

TOLEDO, April 5—Clarence Earl, elected president of the Briscoe Motor Corp., Jackson, Mich., has told friends here that a new syndicate is to provide $2,000,000 additional capital for his company through a stock issue.

His plant is now employing 400 men and working on a nine-hour basis.

K. R. Jacoby, vice-president in charge of purchases at the Willys-Overland Co. until recently will also go to Briscoe.

Increases Capitalization

DOVER, DEL., April 4—The capital of the Briscoe Motor Corp. has been increased from $16,500,000 to $21,000,000.

LAUSON CUTS TRACTOR PRICES

NEW HOLSTEIN, WIS., April 2—Prices on Lauson tractors have undergone reductions ranging from $100 to $300. The $300 cut applies on models 15-30 and 15-25 farm and road building tractors, and the $100 cut is on the 12-25 high powered farm tractor. The latter model was placed on the market this spring, the sales price, $1,595, being now reduced to $1,495. The company announces that reductions are made possible by the increased quantity of business which is promised.

TO MAKE TRACTOR STEERER

DES MOINES, April 2—A new device, which it is claimed, will eliminate the need for an extra man on tractor drawn farm machinery has recently been placed in production by the Selia Mfg. Co. of this city

Premier Motor Files New Incorporation

Capital Stock Is Reduced from $5,000,000 to $1,000,000—New Directorate Formed

INDIANAPOLIS, April 1—"Closer welding together of all interests of the old corporation and putting affairs of the Premier company in condition to carry out expansions contemplated" is the announced reason for the filing to-day of new incorporation papers of the Premier Motor Car Corp. Reorganization of the company has been going forward for the last two months, since the death of Dr. L. S. Skelton, president. Announcement to-day said the Skelton estate would continue the principal financial group in the corporation.

Statement issued by the company said that the capital stock had been decreased from $5,000,000 to $1,000,000, of which $500,000 is in preferred stock. The directors of the new corporation are B. L. Craig, B. H. Miller, C. B. Reynolds, J. A. Price, A. C. Perrill, J. F. Pancoast, N. P. Hutchinson, James Callans, I. F. Schaeffer, A. S. Beckett, M. A. Whipple. Whipple, Price and Pancoast, are attorney, administrator and representative of the Skelton estate, respectively. The statement adds that "representatives of the merchandise creditors, gold note holders, and minority stock holders have met with the Skelton interests at various times and the formation of this corporation is the outcome of their conferences."

The directors meet to-day and Friday for conferences with other financial interests. Officers will be elected to-morrow. A meeting of Premier distributors Thursday and Friday is expected to bring out some new factory policy announcements.

The new directorate represents varied interests as follows:

B. L. Craig represents creditors. He is owner of R. N. Collins Vehicle Wood-Working Co., St. Louis. B. H. Miller represents creditors. He is associated with the American Foundry Co., Indianapolis, and also represents Fletcher American Bank. C. B. Reynolds, representing creditors, is with B. F. Goodrich company.

A. C. Perrill, representing minority stockholders, is a stock broker, Chicago; James Callans, represents the Philadelphia Finance Co., financer of Premier dealers and owners; N. P. Hutchinson represents gold note holders; I. F. Schaeffer is secretary-treasurer of Premier; A. S. Beckett is assistant treasurer of the company. Schaeffer is the only remaining former director.

ERIE TIRE INDICTED

ERIE, PA., April 2—The Federal grand jury for the Western District of Pennsylvania has returned a true bill against the Erie Tire & Rubber Co. The company is charged with using the mails in a scheme to defraud.

Elections Benefit South African Trade

General Feeling of Business Confidence Follows Vote Favoring Constitution

JOHANNESBURG, SOUTH AFRICA, Feb. 28 (*By Mail*)—The General Election for the South Africa House of Assembly has turned the tide in favor of the existing constitution and the trade can, therefore, look forward with a greater degree of confidence than has been the case during the past few months, to the revival in full of the automobile industry in this country. Despite the fact that the vital issue at stake was decided little more than three weeks ago, signs are being seen of the renewed confidence.

This is especially so in country districts, and salesmen coming in from all parts confirm the fact that dealers are more inclined to buy than has hitherto been the case this year. Car sales do not show any marked tendency to increase, but the general feeling of satisfaction that exists throughout the trade places a very optimistic face on matters.

The Durban municipality has purchased nine Orwell electric trucks for various municipal services and one of these will shortly be operating in this city as a tower wagon. These vehicles are of British manufacture and are from 2 to 3½ tons capacity. They are very fast for electrics and are capable of 20 m.p.h. The year 1921 is going to be a bumper year for truck sales and traders are out to secure good business in this direction.

The commercial vehicle has come to stay. The S. A. Railways are using numbers of Clydesdale trucks in the Cape Province and trials have recently been carried out to test their capability under Transvaal conditions. Overloads were carried, but the trucks negotiated some extremely difficult roads without any concern. Some of the worst conditions possible out here were imposed during the tests which were eminently satisfactory.

The G. P. O. at Johannesburg are using Chevrolet, Ford and various electric models for collection purposes, and the same branch of the Government service at Pretoria has taken over a new Spacke model for similar purposes. It is anticipated that more of these cars will be put to the same purpose.

Consignments of the 1921 model Maibohm and Saxon have arrived. The former, as was expected, does not differ very materially from its predecessors, but the Saxon is very much liked in its new guise.

WASHINGTON TO BUILD ROADS

SEATTLE, April 4—Appropriations for highway work aggregating $12,490,000 were authorized by the Washington State Legislature which recently closed its sessions. This sum, with the $14,000,000 which the state is to receive from the Federal government for road work, gives Washington a healthy amount.

Of the amount appropriated by the legislature, $2,800,000 is for the maintenance of State highways outside the incorporated cities and towns and of streets in cities and towns through which primary highways pass.

The remaining $9,690,000 is to be spent mainly on new work, including grading and paving. While the actual details of how the $9,690,000 is to be spent will be left to the highway board, the bill which appropriated the money set forth the highways to be improved.

Ceylon Motor Exhibit Shows Light Car Trend

NEW YORK, April 5—A report that the Ceylon Motor Show, held in Ceylon from Jan. 22 to Feb. 2 this year was a complete success, has been received from Consul Keiser to the Bureau of Foreign and Domestic Commerce. A fair amount of business was done, although financial conditions prevented a normal sale, the consul states, and the attendance was so great that it was necessary to continue four days extra.

Sixty-nine cars and trucks were exhibited; 27 cars and 5 trucks were American, 22 cars and 8 trucks British, 2 cars French, 1 car and 1 truck Italian, and 2 cars and 1 truck German. American made tractors were the only ones demonstrated during the exhibition. The result of the sales made during the exhibition proves conclusively that the largest market in Ceylon is for a light weight touring model of 4 cylinders, these exhibits having attracted more attention than those of higher power and more expensive cars, the report adds.

Willys-Crossley Works Shows $562,000 Earnings

LONDON, March 11—(*Special Correspondence*)—Because of the acute situation in the British motor and other industries and the fact that many motor balance sheets are on the wrong side, it is noteworthy that the past year's report of the Willys-Overland Crossley works at Heaton Chapel, Manchester, shows a profit of £112,210 (about $562,000) which will enable 5 per cent dividend on the 10 per cent preference stock to be paid and a substantial sum placed to reserve.

TO SPEAK ON FOREIGN TRADE

CLEVELAND, April 1—In the present listing of speakers for the National Foreign Trade Council which meets here May 4 to 7 are these men who are connected with the automotive industries:

J. Walter Drake of the Hupp Motor Co., who will speak on "Government Service to Foreign Trade."

Col. Fred Cardway of the Packard Motor Co., on "Psychology of International Merchandise."

Frederick Dickinson of the Hupp Motor Co., on "Foreign Advertising."

Prices Undergo Cuts On British Market

General Movement Is Seen to Reduce Surplus Stocks—Guarantees Unpopular

LONDON, March 18 (*By Mail*)—The spring season here is being ushered in with some notable cuts in car prices. The American contingent, especially the larger sixes and fours, shows the most decided cuts, in most cases the cause being obviously to clear up the large accumulations of cars left over from the previous season. Many British firms are in the same position and are sacrificing stock to take advantage of expected cuts in material prices.

Price guarantees offered by some manufacturers through the dealers are proving unpopular. Many persons seem to be unsatisfied with this sort of proposition and are holding off buying. There is a good bit of business stirring, however, the real spring season being advanced almost a month by the fine weather obtaining.

The controversy between Harper-Bean Co. receivers and the British Motor Trading Corp., which had the distribution rights of the car, has been adjudicated in the courts, the distributers to sell cars at list prices and refund to the Bean company all but their agreed commission. It is believed in trade circles that the affairs of the Harper-Bean Co. will be straightened out, and it is reported that Sir George Bean has offered a substantial sum on his own account to help stabilize the company.

Business in automobile stocks has been better of late owing to the increased demand for vehicles. Another sign of improvement is the return of activity at Coventry, the Detroit of Great Britain. Among the leading motor stocks are Standard, Calthorpes, Rover, Humber, Singer, Swift. Austin and Star stocks are unchanged. Dunlop stock is steady and the new issue of debentures is selling at the price issued.

OCEAN FREIGHT RATES HIGHER

NEW YORK, April 4—Increases in freight rates on merchandise consigned to several European countries, amounting in some cases to 300 per cent, have gone into effect as the result of the settlement of an ocean rate war. The increases will apply to goods shipped to French Atlantic ports and to ports in Belgium, Holland and Germany. The rate on agricultural implements is increased from $2 a ton to $8.

FEDERAL TO BUILD NEW TRUCK

DETROIT, April 2—Federal Motor Truck Co. is coming through with a new 5-ton which is somewhat different from the present Model XE. The chassis price is $5350 and the engine is a Continental 4-cylinder 4¾ x 6 in. The gear ratio has been made such that the higher speeds are possible.

Arkansas Business Hit by Crop Prices

Little Rock and Hot Springs Report Buyers But Rural Districts Suffer

LITTLE ROCK, ARK., April 1—"Sixty days ago we had no prospects but we have plenty to-day. We sold two new and one used car last week." In these words L. E. Whitmore, local manager of the Cadillac agency, summed up the recent improvement in motor business in this city. Generally speaking the State of Arkansas is 60 per cent normal, if by normal is meant business the dealers and distributors had been counting upon.

Ford business is always a good barometer of the motor trade in a territory, and H. Bale of the Shoemaker-Bale Co., one of the two Ford dealers, says business has picked up unexpectedly in the last few weeks. This company sold 60 cars in March, which was double the sales for either January or February. The company is out of touring cars, and has not had sedans or runabouts for 15 days. Ninety per cent of these sales are in the city, and 10 per cent in the country territory.

The Ford truck business, which has been poor, is picking up, and sales are at the rate of 10 trucks per month. During 1920, Ford truck sales averaged 9 per month. Five have been sold in the last 30 days. The dealers of Little Rock generally agree that in all lines of motor cars business has improved in the last 30 days. Nearly all dealers other than Ford are stocked with cars, but such lines as Marmon, Nash, Paige and Packard have made recent sales.

The country dealer in Arkansas has very largely disappeared during the last five or six months. One distributor of a leading car had five agents a year ago of whom but two remain. Other distributors have but two to four dealers at present in the entire State. There is literally no business in the State outside of Little Rock, Hot Springs, where business has been particularly good during the present season, and a few other towns, notably in the northwest, which is the fruit section of the State.

Must Rebuild Organizations

The Arkansas distributors now face the problem of building up an organization of country dealers, but there is no hurry as the country and small town buyer is out of the market for most of the year, unless Europe should suddenly come into the market and furnish an outlet for cotton and rice. If this does not happen, the country buyer will not be back until the cotton and rice crops are well under way, and then the market price will be a considerable factor.

There is no question but that the oil fields of Arkansas are a certainty. Since the discovery of petroleum on Jan. 10 last, when the first gusher was brought in, 26 good wells have been brought in, and only two failures recorded. This is a record without parallel in petroleum history. The operations are largely in the hands of large oil companies and all Arkansas is agog to see where the next oil wells will be brought in. Drilling is becoming general in many parts of the State.

The highway building movement, which started in Arkansas three years ago, and which has proven a stimulant to the motor industry in the past, has practically ceased due to the shortage of money, caused by the inability to sell highway bonds. The State overstepped itself in this regard. The State Constitution will not permit of issuing State Bonds, neither can county bonds be issued. It has been necessary to create districts in which the farmers along the highways to be improved have issued bonds.

Country Dealers Quit in Southern Districts

TEXARKANA, April 2—One of the results of cotton selling at eight cents per pound, and the lumber business getting to prices approaching the pre-war level, is that this city with 25,000 population has only seven active motor car dealers, five having gone out of business since the boom of a year ago. Practically all of the seven now in business constitute the backbone of the industry here, some of them having been in business 10 to 12 years, in contrast with most of the five firms that have been eliminated that were in business scarcely a year, and some of them not more than four or five months.

This elimination of the small dealer in Texarkana has been greater in the surrounding territory, which largely depends on the cotton farmer. One local distributer, representing one of the best medium priced cars in the country, and who had eighteen dealers a year ago in his territory of 26 counties, has only three left.

As a result, motor car sales in the territory are practically nil, and in the city they have improved slightly within the last month. There is a tendency for the wealthy buyer in the city to hold back hoping for price reductions, and the man with a few hundred dollars is entirely out of the market. Several of the dealers have enough cars on hand to run sixty days, and in some cases ninety days, at the present rate of sales. The Ford dealer is out of runabouts, and expects to be out of touring cars in a few weeks. Too many of the dealers were heavily overstocked last fall. One dealer claims he sold more used cars in one month two years ago than he has sold during the last ten months.

LIFT GASOLINE RESTRICTIONS

NEW YORK, April 2—All restrictions upon the sale of gasoline in Italy have been removed by the Government. Service stations are being re-established in all the important centers on the Riviera, which will make motoring in Italy as popular as ever. Roads are in good condition, especially north of Rome.

METAL MARKETS

STEADY increase in the steel tonnages going forward to automotive plants is noted. The bulk of this material is still on account of releases of orders previously suspended. Interest in the market, however, has quickened considerably in the last few days and, while fresh orders are being placed cautiously and tonnages involved are light, the indifference that was characteristic of the attitude of most automotive purchasing agents a few weeks ago has completely vanished. In fact, with most of the steel producers a law unto themselves, when it comes to prices, the opportunity for securing advantages due to skilled search of the markets is greatly enhanced and astute buyers delight in such a condition where individual ability counts most. Mahoning Valley sheet markets, who a few weeks ago were reported to have withdrawn quotations in expectation of an upward revision, have quoted prices within the last few days that show their eagerness for business even though it be necessary to trim prices to the extent of 10 per cent. Aside from the automotive demand, there is virtually no activity in the steel market and it appears to be generally recognized that a marked increase in demand cannot be expected much before the third quarter of the year. The sheet rolling mills furnish perhaps the best indication to the manner in which the steel industry plans to meet this condition. Some of these mills have shut down entirely while others have reduced operations to approximately one-third of capacity. There are, however, enough mills left which are determined to "carry on" during the present quarter. They will be more than able to take care of the automotive demand and there promises to be a continuance of spirited competition for automotive business among these factors. The market for steel bars although still largely a single-car affair, is growing more active. Wall Street reports that the U. S. Steel Corp. will shortly announce a reduction in prices simultaneously with a reduction in wages, are nothing more than plausible conjecture.

Pig Iron.—Automotive foundries are ordering forward iron more freely. There is considerable talk of extraordinarily low prices in the Cleveland market but it is doubtful if No. 2 foundry has been sold at below $25 and malleable at below $25.50.

Steel.—New inquiries for small tonnages of cold-finished steel bars and cold-rolled strip steel are reported from automotive interests aside from liberal releases of old orders. Cold-rolled strip steel is offered at as low as 5.65c., Pittsburgh. Cold-finished steel bars are quoted at 3.00c.. Pittsburgh. Several large sheet inquiries from Detroit passenger car builders are reported from Pittsburgh. Nothing definite can be learned regarding reported negotiations for the acquisition by the Ford Motor Co. of an Ohio alloy steel rolling mill.

Copper.—In spite of the shut-down of most of the large producers, a certain amount of output continues.

Aluminum.—The market continues quiet and unchanged in tone.

Tin.—The market seesaws fractionally at around 30c.

Lead.—Representatives of Spanish interests owning the Penarroya mines, are offering metal at 4.25c., New York. In the "outside" market 4.50c. is asked for spot dead. New York, which is $5 a ton above the chief interest's quotation.

Zinc.—The market continues dormant with metal obtainable at below 4.65c., East St. Louis, the price nominally quoted.

FINANCIAL NOTES

Kelly-Springfield Tire Co., directors have declared the usual quarterly stock dividend of 3 per cent on the common stock, but decided to omit the quarterly cash payment. The stock payment will be made May 2. The regular quarterly dividend of $2 a share on the 8 per cent preferred stock was also declared and will be paid May 16. Cash disbursements of $1 a share have been made on the common stock in addition to the stock dividend in each quarter for some time past.

International Harvester Co. has no intention of embarking upon a plan of refinancing, according to a statement by President Harold F. McCormick, who branded such reports as deliberate misrepresentations. The financial requirements for the year have been fully provided for, he said, and the maximum 1921 borrowings will not exceed two-thirds of the amount borrowed in previous years. All the foreign plants are being operated and export demand is heavier than usual.

Fisk Rubber Co. balance sheet for Dec. 31 shows total assets of $57,205,725.55, of which $20,888,163.40 is represented in inventories and $2,419,277.12 cash. The surplus of $7,789,085.45 represents a falling off from the surplus of $8,295,821.49 for the year previous. Dividends paid in 1920 totaled $2,561,739 and $235,700 was set aside for Federal taxes. Net sales for the year were $42,345,871.05. Net profits totaled $4,952,681. Inventory and contract losses written off totaled $2,669,117.38.

Perfection Tire & Rubber Co. stockholders will vote on April 13 on the proposition to create $5,000,000 8 per cent participating cumulative preferred stock and on changing the $1,500,000 common stock, par $10, to 150,000 shares of no par to be exchanged for old stock pro rata. Present production of the company is said to be 80 per cent of normal. The company is operating on a basis of $50,000 a month profit.

Timken-Detroit Axle Co. announces a total surplus of $17,820,062.16 and net profits for 1920 of $712,508.87 in its report as of Dec. 31. Total assets were $21,494,863.39, including $671,150.38 in cash and inventories of $10,932,521.39. Land, building and equipment account is given as $8,257,232.52. Current liabilities were $3,574,801.23, including $3,000,000 due in bank notes and $387,480.15 in accounts payable.

Hart-Parr Co., in a balance sheet as of Dec. 31, 1920, show total assets as $3,102,519.13, of which $215,189.76 is cash and $1,144,216.02 merchandise inventories. Loss on contract and purchase commitments will approximate $34,635 for which no provision has been made. A deficit of $131,923.90 is shown. The ratio of current assets to current liabilities is 5.5 to 1.

National Motor Car & Vehicle Corp., is offering through Ford Lambert & Co., New York, an issue of $1,200,000 8 per cent. five-year sinking fund gold notes, due April 1, 1926, at a price of 97½.

Spicer Mfg. Co. reports surplus after interest charges, depreciation, inventory adjustment and Federal taxes of $646,022, equivalent after preferred dividends of $1.29 a share earned on the 313,750 shares of no par value common stock outstanding.

Stutz Motor Car Co. shows total assets for 1920 as $8,052,522, of which $3,049,238 is inventory and $217,043 cash. Dividends payable are placed at $250,000 and reserves for all purposes at $618,238. The surplus shown is $5,404,414.

Moline Plow Co. creditors in charge of the plant have chosen F. O. Wetmore as chairman of their committee. The company has passed its preferred dividend because of the falling off in sales and slow collections.

American Bosch Magneto Corp., at the annual meeting returned all members of its board of directors and the directors reelected all officers.

Goodyear Tire & Rubber Co. of Canada has passed its dividend for the current quarter on its preferred stock.

Liberty Airless Tire Corp. has purchased the Carey Tire & Rubber Co.'s tire plant at Carey, Ohio.

INDUSTRIAL NOTES

Atlas Crucible Steel Co. has moved its general offices, including general sales, to the Hanna Building, Cleveland, effective April 15. The company has extended its facilities and is now furnishing alloy steels as well as tool steels. Frank P. Case will be in charge of tool steels and Harry J. West in charge of alloy steels.

Wheel Trueing Tool Co., importers of industrial diamonds and manufacturers of diamond pointed tools, has moved its western office from Milwaukee to the branch office in Chicago. William J. Sansome will be in charge at the new location.

Gardner Motor Car Co., St. Louis, is now operating on a five-day week basis, turning out between 65 and 70 cars daily and employing 750 men. A total production of 2000 cars was made for the first quarter of 1921.

Kahler Co., New Albany, Ky., manufacturers of bodies for Ford cars, resumed operations this week after being closed down for fourteen weeks. The plant is on a daily production basis of 280 bodies.

Eco Co. has been formed in Boston for the manufacture of piston rings. The new corporation assumes all obligations of the Eco Mfg. Co. and the personnel and management will continue the same.

Miles Piston Ring Co., Chicago, has recently moved into its new factory. The company is adding additional equipment which will enable it to increase output.

Creditors to Decide Standard Parts Plans

CLEVELAND, April 6—Something of a definite nature regarding the future of the Standard Parts Co. is expected to develop at a meeting of the creditors of the company which will be held at the Hollenden hotel in this city April 12. The meeting has been called by F. H. Goff, president of the Cleveland Trust Co., who is chairman of the creditors' committee.

"This meeting has been called for a conference of the creditors of the Standard Parts Co.," Goff said to-day. "Reports will be submitted by Frank A. Scott and J. O. Eaton, the receivers as well as by the creditors' committee. The whole situation will be thrown open for discussion and creditors will be given an opportunity to express themselves as to the proper course to pursue."

It is understood that a plan will be submitted by the creditors' committee for the lifting of the receivership.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, April 7—The outstanding feature of the financial week was the continued marked improvement in the reserve position of both the New York Federal Reserve Bank and the Federal Reserve System as a whole. The shifting of credits in the central gold fund at Washington and the continuous stream of gold imports have favorably affected the New York bank in particular.

Last week the New York Federal Reserve Bank increased its gold reserves by $93,941,000, bringing the total up to $682,233,988, the largest total since June, 1919, and $238,000,000 above the figure of four weeks ago. Cash reserves increased $93,524,000; total bills on hand declined $68,967,000; total earning assets $70,542,000, and total deposits $3,362,000. While Federal Reserve notes in circulation increased $2,721,000, the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 50.3 per cent to 56.7 per cent, the highest ratio attained since 1918.

The week-end statement of the New York Associated Banks reflected somewhat the results of the end-of-the-month settlements. The excess reserves over legal requirements at $14,285,300 marked an increase of $6,624,260, and loans declined $11,804,000, and net demand deposits increased $93,235,000.

A large increase in gold reserves was largely responsible for the improvement in the position of the Federal Reserve banks as a whole, but a substantial reduction in note circulation and in deposits was also an important factor. Gold reserves increased $35,674,000 and cash reserves $39,254,000, while total bills on hand declined $72,608,000, total earning assets $79,252,000, and total deposits $51,654,000. Federal Reserve notes in circulation declined $22,576,000 to $2,908,153,000, or $496,800,000 below the high of Dec. 22, 1920. Federal Reserve Bank notes also declined $5,768,000. As a result of these changes, the ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against net deposits, increased from 60.7 per cent to 63.1 per cent. The ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 50.8 per cent to 52.4 per cent, the highest since the beginning of 1919.

The improved banking situation had no outward influence toward lowering interest rates. Call money was unchanged, with a range of 6 to 7 per cent and a ruling rate of 6½ per cent, with outside money said to be still available at lower rates than those quoted on the "board." A firm undertone, however, was evident near the end of the week—the result, probably, of the end-of-the-month settlement. The time money market was dull with few important transactions.

MEN OF THE INDUSTRY

W. L. Shaffner, for the last nine years connected with the B. F. Goodrich Rubber Co., has resigned to join the Acme Motor Truck Co., at Cadillac, Mich. Shaffner will be in charge of the national account division under the direction of Sales Manager C. J. Helm. Shaffner enjoys a wide acquaintance in the trade. For the last five years he has represented Goodrich in the manufacturers' division of the Detroit district. L. E. De Groat, formerly of Timken-Detroit Axle Co., is now with Acme in charge of dealer promotion work.

Charles S. Crawford has resigned as vice-president in charge of engineering at the Premier Motor Corp., Indianapolis, and has opened a consulting engineering office at 337 North Irvington Avenue, that city. He will consult on all Premier engineering work for the balance of the year. Crawford has been connected with the automotive industry since 1909 when he joined the Cole Motor Car Co. as chief engineer and assistant to J. J. Cole. He had been associated with Premier since 1916.

L. E. Warford, Seattle, well known in Pacific and Western States good roads and touring activities, has become associated with the American Automobile Association touring bureau at its New York headquarters. With his thorough knowledge of Western and Pacific Coast routes, obtained by actual touring contact, Warford will be able to supply first-hand information of especial value to interstate road travelers.

George T. Briggs, formerly in advertising and sales capacities with the Wheeler-Schebler Carbureter Corp. and the Sinclair Consolidated Oil Corp., has been made general manager of the Motorcycle & Allied Trades Association with headquarters at 326 West Madison Street, Chicago. The association has under way a "Do It With a Motorcycle Campaign" which includes national publicity in a number of mediums.

B. F. Jones has resigned as president of the Republic Rubber Co. because of ill health. He has been with the company only about a year and has given such close attention to its affairs during a period which has been critical for tire companies that his physical condition has been impaired in consequence.

W. J. Jamison, who has been superintendent of the Delco Light Co. plant at Dayton for the past five years, has been appointed factory manager of the Kelly-Springfield Motor Truck Co., succeeding L. P. Kalb, who resigned recently.

E. H. Roddy has joined the Barco Battery Company, Inc., manufacturers of the Bearcat storage battery, as general superintendent. Roddy formerly was with the Electric Storage Battery Co. and also the Philadelphia Storage Battery Co.

J. C. Kearns has been appointed acting sales manager of the Republic Rubber Corp., following the resignation of H. J. Woodard as vice-president in charge of sales. L. M. Barton has been appointed manager of pneumatic tire sales.

J. J. Moriarity has been appointed factory manager of the Victor Rubber Co., filling the vacancy caused by the resignation of Frank R. Talbott. Moriarity was formerly connected with Republic Rubber Co. and with Firestone.

Willis T. Behoteguy has been named manager of all tires sales with the Goodyear Tire & Rubber Co., succeeding H. G. Palmer, who retires because of ill health. F. L. Morgan is made manager of automobile tire sales

E. S. Beggs at Long Beach, Cal., has been made sales manager of the Planet Mfg. Co. of Detroit, manufacturers of a carburetor attachment.

F. H. Hearsch has resigned as San Francisco district manager of the Kelly-Springfield Tire Co. His plans for the future are not announced.

J. Harold Kraus, Jr., formerly of San Francisco, has joined the sales department of Bantam Ball Bearing Co., Bantam, Conn.

Nine Manufacturers Affiliate with A.E.A.

CHICAGO, April 6—At the mid-convention meeting of the Automotive Equipment Association a committee was formed to handle the show at the Coliseum in November, which consists of: N. H. Oliver, chairman, Illinois; William Von Elm, vice-chairman, New York; Charles C. Gates, Colorado; W. E. Wissler, Iowa; W. H. Parkin, Michigan.

The following new members were admitted: Jobber—Sheridan Auto Supply Co., Chicago. Manufacturers—Adams & Elting Co., Chicago; Bowen Products Corp., Auburn, N. Y.; Graton & Knight Mfg. Co., Worcester, Mass.; S. C. Johnson & Son, Racine, Wis.; Las-Stik-Patch Mfg. Co., Hamilton, Ohio; Standley Skid Chain Co., Boone, Iowa; Vogt Mfg. Corp., Rochester, N. Y.; F. W. Wakefield Brass Co., Vermilion, Ohio; Western Vulcanizer Mfg. Co., Chicago.

President Robert A. Stranahan was made chairman of a committee to promote trade relations.

A steamship will leave Chicago, June 18 to carry members from tributary sections to Mackinac Island. William Von Elm is handling arrangements for a boat to leave Buffalo, Cleveland or Detroit to carry members from the east.

The question of manufacturers or jobbers entering local shows was covered by a resolution requiring the sanction of the advisory committee or local jobbers.

Franklin Net Profit for 1920, $2,235,625

SYRACUSE, April 4—In the annual report by the H. H. Franklin Mfg. Co. of Syracuse, net profit from sales for the past year is shown as $2,235,625.20. From this total was deducted depreciation of inventory to market value at the close of the year, write-off of development expenses and obsolete stock, and miscellaneous adjustments, which leave the net income of the business at $831,514.99, before Federal taxes. After deducting these taxes, the addition to surplus for the year totals $696,514.99.

Total sales for 1920 aggregate $28,585,398 including cars, spare parts and die castings. This figure compares with $22,811,889 the previous year.

During March, 1005 cars were shipped from the Franklin plant, this being the full output of the factory. Since Feb. 10, the factory has operated at 100 per cent normal (or at the rate of 40 cars per day) and from that date up to April 1 has shipped a total of 1765 cars.

Orders for 843 cars for April delivery were already on hand on April 1.

Edge Would Speed Aid to Export Business

WASHINGTON, April 6—Of the utmost significance to the automotive industry is the proposal of Senator Edge of New Jersey to amend the so-called Edge Act in order that the $100,000,000 Foreign Trade Financing Corp. may operate immediately. The original legislation which the Senator sponsored required that 25 per cent of the capital should be paid in before activities could start.

The Senator proposes an amendment, it is said, which will allow the foreign trade financing organization to function with the requirement to call up their total capital stock at certain specific periods. The proposed amendment would liberalize this proviso yet provide essential safeguards. With the slump in the volume of American export business in automotive products, all efforts to assist market development will have an important bearing on production.

New Tariff Effective When Sent to Congress

WASHINGTON, April 6—While the tariff is not as important to the automotive industry as internal revenue revision, it is interesting to note, in view of increased imports of foreign cars, that it is proposed to introduce a joint resolution making the permanent tariff schedules effective from the day the drafts are reported to the House. This resolution, if passed, would automatically increase the price of foreign cars provided of course, higher rates are enacted.

It is understood that this resolution will be reported from the House Committee on Ways and Means soon as a form of interim legislation. The resolution would be in accordance with recommendations of the Tariff Commission under which duties would attach themselves to imports though the actual rates had not been approved by the Congress. As Chairman Fordney plans to introduce the permanent tariff by May the new schedules would become effective as of that date.

MEETING AGAIN POSTPONED

AKRON, April 4—The meeting of Goodyear stockholders scheduled for Wednesday to definitely ratify the company's reorganization plans and refinancing negotiations for $85,000,000, has been adjourned again until April 11.

Calendar

FOREIGN SHOWS

April 16 - May 8—Bosquet, Algiers; Algerian Agricultural Fair, Motor Cars, Machinery and Tractors.

Apr. 20 - May 5 — Mexico City, Mexican Automobile Show, National Theatre Bldg.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina. Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September — Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

May 24-28 — West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

July 4-9 — Mackinac Island, Mich., Summer Meeting Automobile Equipment Association.

Oct. 12-14, 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Buffalo section—April 19—Paper on "Carbureter Performance," by F. C. Mock.

Dayton section—May 3.

Metropolitan section—April 14—Paper on "Low Grade Fuel Carburetion," by A. H. Beach.

Minneapolis section — April 6—Discussion of repair equipment.

Washington section—April 1—Aeronautical Engineering Session.

N. A. C. C. Questions Paris Show Ruling

NEW YORK, April 4—According to the application blanks just received, certain restrictions have been placed upon prospective exhibitors of American motor cars at the Paris Automobile show next fall which the American manufacturers believe is hardly in line with the co-operative spirit that has been shown on this side of the water, especially following the request of the National Automobile Chamber of Commerce for a reduction in the tariff on foreign cars coming into this country.

The restriction which is felt to aim particularly at American manufacturers reads as follows:

"Manufacturers belonging to allied nations are admitted on the same terms as French firms, provided they have taken part in three previous Paris shows and on condition that their pre-war import duties were not more than 15 per cent ad valorem."

Under such a rule American firms do not have the same choice for space as British, Belgium, and Italian manufacturers.

Not Proper Show Condition

At the N. A. C. C. offices it was said that little objection could be raised to a rule which required all exhibitors to have taken part in at least three previous shows although no such rule is enforced at the American exhibitions to which foreign cars have always been welcomed, the question has been raised whether the question of duty properly comes under the show conditions, especially when such limitation may prevent a fair presentation of American products, many of which have been sold abroad for years.

It was pointed out that at present the tariff on motor cars coming into this country is 30 per cent on cars valued at $2000 or less and 45 per cent on cars selling at more than $2000. The manufacturers of cars and trucks in the N. A. C. C. voted unanimously to request Congress to reduce the tariff to 30 per cent so that all cars may come in on the same basis.

In this connection it was requested of the authorities at Washington to offer this reduced rate in all cases where our products going into a foreign country are treated the same as the cars imported from all other countries.

Sunbeam Builds Special for Indianapolis Race

LONDON, March 12, (By Mail)—The eight-cylinder-in-line 3-litre Sunbeam to run at Indianapolis has commenced its tests at Brooklands. Although no details of the design are yet available, the following general particulars can be given. It has a bore and stroke of 65 x 112 m.m. and is said to develop something like 130 b.h.p. There are four overhead valves per cylinder, and four Claudel carbureters are fitted with their intake pipes projecting through the right side of the hood, matching the exhaust outlets on the left.

No flywheel is used, this item being considered unnecessary in view of the heavy balanced crankshaft. Delco ignition is depended upon, and while only rear wheel brakes are fitted to this particular car, the three sister cars for the French Grand Prix have front wheel brakes in addition. In another respect, also, the Indianapolis and Grand Prix cars differ, for in the former the chassis as a whole is not set centrally on the axles, being appreciably nearer to the left hand wheels than to those on the right, this arrangement having been adopted to assist cornering towards one side at high speeds.

The frame is very considerably upswept over both axles and thus gives the car an extremely low appearance.

FOX OUT AS GUN MAKER

PHILADELPHIA, March 28—Ansley H. Fox, president of the Fox Motor Car Co. has not been connected with the A. H. Fox Gun Co. for several years, although he invented the Fox shot gun.

Argentine Expositions to Be Repeated in 1921

NEW YORK, April 5—The announcement of two important automotive exhibitions to be held in Argentina was made to-day by EL AUTOMOVIL AMERICANO, the Spanish automotive publication of the Class Journal Co. These exhibitions, the first of which will take place the first two weeks in September, will be the annual cattle and agricultural show of the Sociedad Rural Argentina and the second, which will be held later, will be the annual automobile show of the Automovil Club Argentino.

These snowings are perhaps of more importance to automotive manufacturers than any others held in Latin-America. They are both well established, well managed and draw large attendance from all parts of Argentina, Uruguay and some of the other countries adjacent to Argentina. The agricultural exhibition of the Sociedad Rural Argentina takes place in the grounds of the association in Palermo, at Buenos Aires, and the best products of the Argentine ranches are brought there for show. Immense crowds attend, and while not exclusively automotive, it is an excellent opportunity to display passenger cars, motor trucks, tractors, farm lighting plants and other equipment.

Will Be Fourth Car Show

The show of the automobile club was held for the third time in November of last year in a fine building known as the "Pabellon de las Rosas" and the announcement that it will be repeated during 1921 should be of wide interest to the trade. Passenger cars and accessories are shown and the Chamber of Commerce of the United States in the Argentine Republic is authority for the declaration that practically every American and European car represented in Buenos Aires is on exhibition.

The plan of holding automotive shows throughout Latin-America is increasing rapidly, according to EL AUTOMOVIL AMERICANO.

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Importance of Taxes to Automotive Vehicle Sales

The sales resistance must increase as the cost of maintenance increases. The taxes proposed in pending legislative suggestions will mean a levy of $63 per vehicle. Steady increase of taxation is indicated.

By Clyde Jennings

IT IS, of course, repeating a truism to say that the marketing of automotive vehicles has been grossly neglected, as compared with the designing and production of the vehicles. The same statement might be made about any other new industry, at least in the period before it had reached a stage of positive development.

There has been practically no sales research or analysis as regards the automotive vehicles. Many manufacturers have seriously discussed the saturation point, when a few hours of organized study of the possibilities of the vehicle they were making would have convinced them that the saturation point of transportation would come when civilization became fixed.

Even a casual interest in the points of resistance to the sales of motor vehicles would long ago have convinced any one interested that one of the chief points of resistance was

The continual threat of higher taxes upon the vehicle.

Had this point been appreciated years ago the present acute situation would not have arisen. The industry would have been forewarned and prepared for the situation that exists, and it would have been more of a passing incident than an acute situation.

The writer well remembers talking with a member of a Southern State legislature a few years ago when he spoke of a bill that had come quite near passing which would have taxed automotive vehicles out of that State. He was asked who opposed the bill. The answer was:

> **"Chiefly a few members of the legislature who owned cars or trucks and who saw the possibilities of these vehicles. A few private motor car owners came to our aid. A dealer or two showed some interest, BUT NO MANUFACTURERS."**

This was the situation until a few years ago. Beginning with the war period the legislative and tax problem has been given more consideration. When America finally went into the war, the question of luxury or necessity became acute and it was quite seriously debated. On the face of the returns the automotive industry was the victor in that argument. At least trucks gained the right of way, but the passenger car went into the discard—as the cards were written for the next year's program.

The situation was never entirely worked out, thanks to our army in Europe. Then the manufacturers went home and to a considerable extent forgot about that battle over the necessity of the automotive vehicle except on those occasions when reminiscences were the order of the evening. This is not in any way a criticism of those who worked so valiantly and well for the industry in the crisis of that period.

The next move was a logical one—the organization of the Motor Conference Committee.

The idea behind the Motor Conference Committee is a good one and it is working out very well. The only criticism here is that the organizations behind the committee have not seemed to appreciate the need of this work, nor the need of support to be given by personal efforts of work that the Committee might do. The industry has never appeared to appreciate the power of the individual in legislation.

The greatest single step toward a remedy for the situation as it has existed was the writing of the Proposed Uniform Vehicle Law and the concentration upon that law for proposed legislation. Granted that the law is not exactly what any one of the persons interested would write, it is the best that can be agreed upon by the various elements interested in this legislation. A concentration upon a measure of this sort is a constructive effort to regulate taxes from the state, and these have been by far the most important item of taxes.

But now comes the question of Federal taxes, and, because the industry has not been in training in matters of constructive legislation work, it is not prepared to meet the situation. Then, too, even within the industry, the proposed Federal taxation figures take entirely too alarming an aspect.

It is the truth that the bulk of the increases of taxes, fees, etc., made possible in legislation in the several states promises to equal the proposed taxation by the Federal government, yet there has not been centered upon the legislation in the states anything like the activity that is being brought to bear in the Federal situation.

The suggestion is this:

Legislation in Federal, State and municipal governments is working constantly and should be under constant observation. There should be a steady pressure exerted for fair and intelligent legislation. It should not always be mere fighting of legislation. Automotive vehicles are property, and there should be taxes on them, but it should be a fair and consistent taxation, in keeping with the necessity and value of the article taxed.

All states collect fees and licenses on automotive vehicles and many states levy an additional fee upon any person who holds a driver's license. The total of these fees and licenses amount to more than $100,000,000. The tabulation of the registration figures showed in excess of $91,000,000 and in many cases the reports there were not for the full year. Also this tabulation does not include municipal fees, which are collected in many large cities.

In addition there is a very large personal property tax on automotive vehicles in those states where a personal tax is levied. C. A. Vane, general counsel for the National Automobile Dealers' Association, has estimated the personal taxes collected on automotive vehicles at $80,000,000. Vane's estimate is that the state taxes and fees for the last year were about $200,000,000. They will be greater this year. How much greater cannot now be accurately estimated because the legislatures are not yet through with their job of increasing fees.

An increase of taxes means increased sales resistance. This, certainly, will not be disputed.

A man may be perfectly willing to pay $3,000 cash for something and be absolutely **opposed to the idea of assuming an obligation to pay a tax of $75 a year for the privilege of spending that $3,000.**

The present situation is rather acute because many states have been deprived of their revenue from liquor licenses without preparation (such as usually takes place when a state goes dry by its own vote) and the lawmakers are looking for the easiest (not best) method of raising money to replace this loss. As is stated elsewhere in this magazine, in an article by Alvan Macauley, it looks on the surface as though the man who drives a motor could easily pay for this privilege.

Naturally the suggestion of former Secretary of the Treasury Houston that almost $300,000,000 of additional taxes be levied annually upon the motor equipment of this country looked too startling to those within the industry to be true. There was a good deal of astonishment that the new administration showed signs of approving of this tax as outlined by the retiring Democrat.

But the fact remains that these suggestions by Secretary Houston are still being considered seriously. AUTOMOTIVE INDUSTRIES printed the following statement of Secretary Houston's annual report in the issue of December 2, 1920:

IN his annual report, Secretary of the Treasury Houston has made specific recommendations for raising the $5,000,000,000 which the present administration considers necessary for running the Government next year. The part of the tax recommendations which are of especial interest to the automotive industry are:

1. Increase of the sales tax from 5 per cent to 10 per cent, which it is estimated will make an increase of....	**$100,000,000**
2. A Federal license of cars based on 50 cents per hp..................	**100,000,000**
3. A consumption tax on gasoline at 2 cents per gallon..................	**90,000,000**
4. The truck sales tax will be continued at 3 per cent, despite efforts to have it eliminated.	
New taxes from industry.............	**$290,000,000**

The 10 per cent sales tax is applied, as now, to passenger cars, motorcycles, parts and accessories for these vehicles and will include tires.

These recommendations by Secretary Houston are about what those of the industry who are familiar with the tax tendencies expected from his report. They are practically the same as those recommended in the preliminary report of the National Industrial Conference Board. When this report was brought up for hearing recently at a New York meeting of the Board, the National Automobile Chamber of Commerce appeared before the Board and asked that these tax recommendations be revised. It was then shown that the automotive industry in 1919 paid almost $150,000,000 in excise taxes to the national government, as follows:

1. Excise taxes on motor car sales.....	**$77,000,000**
2. Excise taxes on truck sales.........	**14,000,000**
3. Excise taxes on parts and accessories	**52,000,000**
1919 taxes........................	**$143,000,000**
In addition the automotive equipment pays:	
State and municipal registration fees...	**$64,000,000**
State and local taxes on the valuation for personal taxes.................	**50,000,000**
	$114,000,000

When this showing was made to the Industrial Conference Board that body immediately agreed that the industry was paying its share of taxes and they decided to make no recommendations for increased automotive taxes. During the hearing a member of the Industrial Conference Board asked if the industry did not want

Apr

national registration of cars. The answer was that while this might be very desirable, the industry did not want to pay $100,000,000 for such registration.

Taxes in 1920 were much higher than in 1919. Let us assume that they amounted to $200,000,000.

The attempt to show just how a total tax levy of probably $800,000,000 on the automotive industry would increase the sales resistance would be a waste of time. The person who cannot see in a measure the result of this taxation on sales is hopeless. The estimate is arrived at in this way:

State fees and taxes for 1920	**$200,000,000**
Proposed and existing Federal taxes and fees	**500,000,000**
Probable increase in state fees and taxes	**100,000,000**
Total	**$800,000,000**

Let us assume that the registration during the year will be increased 500,000, making a total of cars and trucks registered at the end of 1921 of about 9,500,000. This would make an average of taxes and fees for each vehicle registered in the United States of almost $85 a vehicle.

And we might add here that the N. A. C. C. had said that the average wholesale price of cars sold in 1920 was $897.

At this rate America would soon have taxes and sales problems similar to those of several European countries, and likely a similar decreasing registration of automotive vehicles.

In this connection it must be remembered, always, that every automotive factory, salesroom, garage, and this also includes parts factories and hundreds of machine shops, pays local taxes and fees in large amounts. These taxes are, of course, the same as are levied on other industries.

A Brief Analysis of the Annual Appropriation Bills

IT is of little use to criticise any movement, whether public or private, without a constructive suggestion. It is particularly foolish to make a demand of a government, which is "for the people, of the people and by the people," that it economize without pointing out wherein the people are willing that economy should be exercised.

For many years the people have been going to the Government and demanding economy in one breath and advocating expenditure for their favored enterprise in the next. The board of trade of any particular community is very likely to pass a strong resolution demanding greater economy in government so that taxes may be lowered, or even go to the extent of demanding the removal of a certain tax, and then the next day pass a resolution that their city should be favored with a new public building or that some local improvement should be included in the River and Harbor Bill.

This sort of criticism and demands are certainly not constructive. It is fortunate that the National Automobile Chamber of Commerce this year has adopted a different policy as to their tax communications with the Government. Briefly, the attitude adopted by the Chamber is:

> **That the people are stockholders in the Government; the legislative and executive departments of the Government are merely directors of this business body owned by the people; the Chamber and other business and civic organizations propose to advise the Government.**
>
> **FIRST, to economize, and,**
>
> **SECOND, wherein economy may be practised.**
>
> **It is not the policy of the Chamber to attempt to dictate what sort of taxes shall be levied. The actual levy and collection of taxes is to be left to the judgment of tax experts.**

As preliminary to this rather unusual tax program and as the first step in carrying forward this argument, the Chamber has obtained a graphic presentation of the Annual Appropriation Bill for 1922. This presentation indicates the amount of money asked in each of the bills. This graph is reproduced as a part of this article and as an insert in this number of AUTOMOTIVE INDUSTRIES. A glance at the graph will convince the most casual reader that he has probably had a very inaccurate idea as to the actual expenses of the Government. An analysis of this graph is perhaps necessary:

Post Office Bill. This bill is at the top of the graph. It is really not an appropriation bill in the sense that they are to be considered here. The Post Office is practically self-sustaining and the appropriation by Congress is merely permission to spend its own money. The fact that this bill is considered as other bills is a part of the archaic practice of the Government that has been maintained.

Sundry Civil. This bill is the second in the graphic presentation and the line indicating the amount of the estimate is the longest of all the lines in the presentation. It indicates to what extent the governmental experts and others concerned have desired money for the various enterprises concealed under this meaningless title. The line indicating the current appropriations is just a trifle longer than that for the Navy; the appropriations, as passed, being slightly more than $2,000,000 greater. The Sundry Civil Bill is probably open for attack more than any other of the bills. It includes much that is worthy and perhaps indispensable to the Government. Part of the bureau's expenses which are included in this bill are the Interstate Commerce Commission, the War Risk and Soldiers' Rehabilitation. These are quite heavy items in this bill. There are numerous other commissions, the expense of which is carried in this bill from year to year that are not so indispensable. It is seldom that a Congress adjourns without creating several commissions, the object of which seems to be to provide for the "lame ducks" of Congress. The current Sundry Civil Bill has also been "loaded" with numerous civilian army and navy employees. These are commissions and employees left over from war practice which it is hoped to maintain in office. The Army and Navy estimates were so large that it was necessary to place them elsewhere and they were put into this bill. A discussion of the worthiness of these cases would become a discussion of each individual commission. This bill is one that will bear inspection very closely.

Navy. The next highest appropriation bill is that for the Navy. The Navy Bill was passed only by the House.

Army. The Army ranks third in the amount of money asked and fourth in the amount of money appropriated. It was not signed by the President.

A discussion of these two bills will not be entered upon here. Primarily the amount of money to be appropriated for the Army and Navy in the minds of each individual is merely indicative of his attitude toward the question of national armament. Those who are inclined toward a pacifist attitude advocate much reduced appropriations.

Pension. The Pension Bill represents an obligation that the Government has assumed and should not be a part of this discussion.

The five bills already referred to constitute 90.4 per cent of the Annual Appropriation Bill. Below these come the **Legislative,** which is really a very important bill; its real title is Legislative, Administrative and Executive bill and it includes the expenses of Congress, the judiciary, executive departments and from which appropriation practically all civilian employees in Washington are paid; the **Agriculture,** which includes the wide and profitable activities of this great department; **Fortifications** Bill is camouflage for a part of the Army Bill; **District of Columbia** Bill, about half of which is raised by local taxes and the other half is assumed by the Government because of the great demands made by the Government upon this District.

River and Harbor Bill, commonly known as the "pork barrel" bill, is perhaps more widely discussed in newspapers and other publications than any of these bills. This bill has long been one which carried many appropriations for local improvements. Because it hits in so many states, it is much discussed and, of course, every community criticises every appropriation in it except that for their own local purposes. It is really of minor importance.

It has been necessary on the graph, as presented here, to exaggerate somewhat the lines showing the amounts in the next three bills, the **Indian, Diplomatic and Consular,** and the **Military Academy.** These are such small factors in the expense of the Government that if they were wiped out the decrease in taxes would be so slight as to be unappreciable.

It is usually the case that the amount of the various appropriations and the purpose for which they are intended are entirely lost sight of in a discussion of the kinds of taxes to be levied. During the present tax discussion the sales tax has been the topic of a great deal of discussion. In the question as to whether the sales tax should or should not be levied there have been brought out so many opinions and some rather earnest controversies that the persons engaged have not had time to really discuss the purposes of taxation.

There is no dispute on the part of the automotive industry that the Government needs large amounts of money to recover from the effects of the war and that the automotive industry and automotive vehicle owners must pay a proportion of these taxes. It is only a question of what a fair proportion of these taxes shall be.

It is entirely appropriate that in this discussion the industry should be considered as to whether it is a utility industry or a luxury industry. But that question is one very difficult to discuss, because what is a necessity to one person is not to another. There is no question that in the taxes as levied through the bills of a few years ago much injustice took place. There were also many gross inaccuracies. Due to the fact that many articles escaped taxation by technicalities, there is becoming a serious sentiment among serious persons for a general tax on all articles of manufacture or commerce except the few absolutely necessary staples which enter into every person's life. The sentiment expressed in the N. A. C. C. resolution that the technicalities of taxes be left to the experts is also gaining ground.

Of course, there are other expenses of the Government besides these Annual Appropriation Bills. These include the interest on public debt, sinking funds, expenses of loans and already incurred obligations such as year to year road policy and things of that kind. These appropriations should not be the subject of a discussion of this sort. The obligation has already been incurred.

The entire appropriation program is here presented as printed in the *Congressional Record* of March 4, 1921. This information supplements the figures shown in the graph.

From Congressional Record of March 4, 1921

Table comparing, by bills, estimates of regular, supplemental, deficiency, and permanent annual appropriations for the fiscal year 1922 with the appropriations made for the fiscal year 1922.

Regular Annual Appropriation Bills (Completed)	Regular Estimates Fiscal Year 1922	Supplemental Estimates, Fiscal Year 1922	Total Estimates, Fiscal Year 1922	Appropriations, Fiscal Year 1922	Increase (+) or Decrease (—) 1922 Estimates Compared with 1922 Appropriations
Agriculture	$41,989,384.00	$11,040,000.00	$53,029,384.00	$36,404,259.00	—$16,625,125.00
Army (including Military Academy)	699,275,502.93	....	699,275,502.93	346,703,906.80	—352,571,596.13
Diplomatic and Consular	11,983,848.94	....	11,983,848.94	9,326,550.79	— 2,657,298.15
District of Columbia	25,039,044.99	....	25,039,044.99	19,412,412.99	— 5,626,632.00
Fortification	35,676,533.66	....	35,676,533.66	8,038,017.00	— 27,638,516.66
Indian	11,989,703.67	....	11,989,703.67	9,761,554.67	— 2,228,149.00
Legislative, etc.	136,452,634.97	762,080.00	137,214,714.97	110,345,018.75	— 26,869,696.22
Pension	265,190,000.00	310,000.00	265,500,000.00	265,500,000.00	....
Post office	585,406,902.00	....	585,406,902.00	574,057,552.00	— 11,349,350.00
River and harbor	57,114,915.00	....	57,114,915.00	15,250,000.00	— 41,864,915.00
Sundry civil	803,446,196.86	3,018,749.00	806,464,945.86	384,196,760.41	—422,268,185.45
Total, regular annual appropriation bills	2,673,564,667.02	15,130,829.00	2,688,695,496.02	1,778,996,032.41	—909,699,463.61
Regular Annual Appropriation Bill (Pending)					
Naval (as passed by the House)	679,515,731.47	....	679,515,731.47	396,001,249.23	—283,514,482.24
Total, regular annual appropriation bills	3,353,080,398.49	15,130,829.00	3,368,211,227.49	2,174,997,281.64	—1,193,213,945.85
Permanent and Indefinite Appropriations					
Interest on the public debt	922,650,000.00	....	922,650,000.00	922,650,000.00	....
Sinking fund	265,754,864.87	....	265,754,864.87	265,754,864.87	....
Expenses of loans	....	....	....	....	....
Roads, construction of	1,000,000.00	....	1,000,000.00	1,000,000.00	....
Customs Service, repayment, etc	27,000,000.00	....	27,000 000.00	27,000,000.00	....
Indian funds, and interest on same	23,475,000.00	....	23,475,000.00	23,475,000.00	....
Miscellaneous	60,896,496.00	....	60,896,496.00	60,896,496.00	....
Increased compensation to certain employees ($240 bonus)	35,000,000.00	....	35,000,000.00	35,000,000.00	....
Total, permanent and indefinite appropriations	1,335,776,360.87	....	1,335,776,360.87	1,335,776,360.87	....
Miscellaneous, including $18,600,000 for hospital facilities	....	....	....	20,000,000.00	+ 20,000,000.00
Grand total, exclusive of deficiencies and including naval bill as passed by House	4,688,856,739.36	15,130,829.00	4,703,987,588.36	3,530,773,642.51	—1,173,213,945.85
Deficiencies, 1921 and prior years	555,527,986.24	....	555,527,986.24	275,256,005.21	—280,271,981.03
Grand total, including naval bill as passed by the House	5,244,384,745.60	15,130,829.00	5,259,515,574.60	3,806,029,647.72	—1,453,485,926.88

A Sane Statement of the Necessity of the Automobile

It probably is not necessary to argue the necessity of the automobile with an audience of men who create motor cars but Mr. Macauley has made such a straightforward argument that we suggest it as a model for your conversations. He discusses unwise taxes and methods of meeting them.

By Alvan Macauley*

"WE have in the United States more than eight million passenger - carrying automobiles. Practically every one is a luxury," said Chairman James W. Good of the Committee on Appropriations of the House of Representatives recently. He then proceeded to outline plans to impose a special tax of $500,000,000 a year on the automobile.

Secretary Houston of the Treasury, in his annual report for 1920, recommended special taxes on the automobile to run close to $400,000,000.

"Any man who can afford to run an automobile can afford to pay a stiff tax," is the slogan that went around the Capitol when the new Congress began hunting new sources of revenue.

So, from all sides in Washington, comes the demand that the automobile owner be marked down for special mulcting. He has money, is the claim; the fact that he is an automobile owner proves that he is spending it for luxury.

There is no question that the automobile owner should pay his full share of the cost of running the nation, according to his wealth. He has to do that, anyway. He, like all of us, pays income taxes, excess profits taxes, excise taxes, stamp taxes, property taxes, road taxes and all the other taxes. But this demand is to make him pay a special and distinct tax beyond that which is paid by other people of his own financial class.

It would be fruitless to raise the question whether this is fair. Taxes have to be raised, and since they must be collected from people who can pay them it is not always possible to assess them with complete abstract justice. Any tax system that has ever been devised, or probably that ever can be devised, will have serious weaknesses, and it is possible to offer a good argument against almost any of them.

Unwise Taxes

But it is usually possible and always desirable to settle the question whether a given tax is economically wise. Unwise taxes have an amazing and terrifying power to destroy progress and prosperity. The welfare of a nation is often as much dependent upon its tax system as upon any other one thing. Taxes which place a burden upon production, upon progressiveness, upon decent living, upon thrift—all these taxes have long since been proved unwise.

There was a time when England imposed a tax for every window in a house. It was a luxury, if you please, to have a window. But England has long since learned better. We have recently had vigorous and successful agitation against the excess profits tax, on the ground that it hindered and limited business. In general, the rule by which wise tax leviers guide their conduct is not to impose any burden, more than is absolutely necessary, upon activities or equipment which are in themselves beneficial to the country as a whole. In other words, the rule is that there shall be no tax burden laid on prosperity or progress.

It is obvious, from the remarks quoted, that more than a few men in Congress do not feel that in taxing the passenger automobile we will be making a levy on either progress or prosperity. They feel that they would be taxing a luxury—a very different thing. If these quotations are not enough, the attitude is very definitely shown in the list of articles offered by Secretary Houston for special taxation. This list included, along with the automobiles, such things as tobacco, musical instruments, chewing gum, toilet soap, perfumes, cosmetics. These, in Mr. Houston's mind and apparently in the minds of many members of Congress, have the same general value to the community as the automobile. So, if it can be shown that the automobile is not a luxury, then the plan for special taxation is self-condemned.

What Is a Luxury?

A luxury is something extravagant, something rather exclusive, something lacking in permanent usefulness and good only for the pleasure or ease that it gives. Undoubtedly there was a time when the automobile came under this definition of a luxury. That may, perhaps, have been true even up to five years ago. Certainly at that time automobiles were comparatively exclusive, for in 1914 there were in America only 1,700,000 cars as against the eight million which are running to-day. In those days the automobile was more or less a "rich man's toy."

No one who stops to see what is going on around him can seriously claim that the same situation has lasted until to-day. The very fact that there are eight million automobiles running shows that luxury has become a very every-day affair, or else that the automobile has achieved some place outside the luxury class.

During the last year, certain investigations have been made which for the first time have presented a clear picture of the actual status of the automobile in American life. These investigations were conducted by the National Automobile Chamber of Commerce, which sent to many thousands of automobile owners scattered throughout the country a questionnaire asking for their own statement of the place the automobile fills in their lives. These replies were carefully tabulated, and showed:

*President of Packard Motor Car Co.

That 90% of all automobiles are used chiefly for business purposes.

That 64% of all mileage run by passenger cars is for business purposes.

That the average automobile, including those cars which are used purely for pleasure purposes, has increased the earning capacity of its owner 56.7%.

Let us translate these figures into what they mean in actual life. If we assume that the car which is not used for business purposes is a luxury, then we have in America to-day 800,000 automobiles which can be considered luxuries—a large figure; but there are 7,200,000 which are not luxuries. To tax the "luxury" cars it will be necessary also to tax nine times as many cars which are not luxuries.

If we consider that all automobile mileage which is not for business purposes is a luxury, then there were run in the United States in 1920, on a conservative estimate, 25,920,000,000 passenger miles that were for luxury. But there were 46,080,000,000 passenger miles that were for business purposes.

Earning Capacity

Most startling of all are the figures in regard to the increased earning capacity of men who used automobiles. These mean that the eight million cars have added to the productive force of America the equivalent of four and a half million men. This is an increase of 10 per cent in the working power of the country.

Take the same figures from another point of view. In 1920 there were approximately two million passenger automobiles manufactured. These give the country, as long as they last, an increased productive force amounting to more than 1,000,000 men. Since they will last an average of five or six years, and some of them three times that long, the country benefits from their production by something over five and a half million years' work. There were at no time engaged in the automobile industry in all its branches, including the manufacturers of cars, of parts, of accessories and tires, in selling or in service, more than one million persons. So that the automobiles manufactured last year will give back to the country between five and six times the labor that it cost to make and maintain them.

It must be confessed that these facts surprised many men in the automobile industry who had believed that they realized the essential part that the passenger car was playing in modern life. But further analysis of the situation only increases the evidence of the situation.

For example, surveys that have been made by several different agencies agree that about one-half of all passenger cars are owned to-day by farmers. Even more important from the point of view of taxation is the fact that about two-thirds of all cars manufactured went to the farmers. So the bulk of the sales tax is being paid from the farms, by men who are seldom accused of indulging in luxuries.

Another class that has found the car invaluable is salesmen. There are no figures to show how many salesmen own or use automobiles, but if anyone will stop to think how many of the cars within his own knowledge are used by such men, he will realize how important a part of our selling organization the passenger automobile is.

Multiplies Doctors

Then, there are the doctors. More than one hundred thousand physicians in the United States are using automobiles. Their cars not only increase greatly the number of patients that they can reach, but they make it possible for the doctor to get to the bedside in times of crisis far more promptly than of old. This saves both life and suffering, but perhaps should hardly be counted as an economic factor. But the increased number of calls each doctor can make is a saving that can be figured in dollars and cents.

There is, also, the direct use of the car in public services. An example of this may be seen in the big telephone companies. The New York system keeps on hand more than 700 passenger cars for the use of its line men and "trouble shooters." Philadelphia has about 500, and so it is throughout the continent. National, State and City governments also are using thousands of passenger cars for various purposes.

Something of the way in which the car is making money by saving time for its owners may be seen from the following list, compiled from the questionnaire mentioned, which shows by classes the increase in capacity as a result of using automobiles.

Real Estate and Insurance	113%
Doctors	104%
Salesmen	103%
Clergymen	98%
County Superintendents	72%
Farmers	68%
Contractors	51%
Manufacturers	33%
Bankers (including rural)	33%
Merchants	25%
Lawyers	23%

These facts give us the first true picture that has been drawn of the place of the automobile in American life. In drawing this picture, everything except the dollars and cents value has been carefully excluded. This picture proves that the automobile to-day is no longer a luxury but a tool, that it is an essential part of modern industrial life. It shows what those who have watched it closely have known, that the glory of the automobile in the last five years is that it has ceased to be a "rich man's toy" and has become the common servant and companion of people of all classes.

It is clear, then, that the plan now before Congress is to tax not a luxury, but a tool. There is no question whatever that such a tax would decidedly limit the use of this tool and hamper the economic progress that we could otherwise expect from its aid. What will this mean?

Civilization can fairly be said to have begun when some savage discovered that by sharpening a crooked stick for a hoe he could increase his crop of corn without increased labor. From then until to-day civilization has progressed through making machinery that increases the productive power of the individual man without increasing the effort that he has to exert. Particularly, we have learned that the things which pay us most are those which save our time; and in our complex modern society the greatest of the time savers is transportation.

No one would think of putting a punitive tax upon railroad travel, although it is often for pleasure. Yet the automobile to-day is carrying a heavier passenger mileage than is the railroad. It is as a transportation agent, as a time saver, that the automobile is performing its great services and paying its immense profits to the people of America to-day.

These savings and profits are matters shown by statistics and are beyond dispute. But there are other economic services, giving high value, on which it is impossible to compile figures but which are just as definite and just as important.

The Greatest Service

The greatest of these, perhaps, is the service that the automobile is giving in making farm life more tolerable. It has long been known that one of the things that has

been driving young people from the farms, and that has now turned America into a country where the majority of its population is in the cities, has been the isolation and the dreariness of most American farm houses. The farmer's car is, first of all, a time-saving productive instrument, but in addition it has destroyed the distances and the isolation of the rural communities, and brought neighbors closer together so that with a car the farmer and his family can enjoy a neighborhood social life and the benefits of community life in a way that was never before possible.

In the second place, the automobile is definitely acting as an offset to the congestion of the cities. Scores of thousands of people of all classes have found in their automobiles, during the recent crisis, the answer to their housing problem. A glance at the map showing settlement around New York City indicates this. There have been almost no new traction lines built in the suburban area within the last ten years. A map of ten years ago shows a narrow strip of settlement, seldom more than a quarter of a mile on each side of the tracks, along these traction systems.

Workers' Cars

To-day the spaces between the systems have been filled or are filling rapidly. Men would not walk more than a quarter or, at the most, a half mile to the stations; their cars carry them four or five miles in the same length of time and in far greater comfort. The tremendous increase in New York's suburban population, with all that it means of relief in the congestion that would have occurred had these hundreds of thousands of families been poured into the actual limits of the city, and all that they now have in comfort, fresh air, sunlight and quiet, is distinctly due to the automobile.

Nor is this a benefit that is monopolized by the rich or even the middle classes; it is one that is shared and shared largely by the manual workers in all of our industrial centers. It was noted last fall, when the depression struck Akron, for example, that the great exodus of rubber workers from that city took place almost entirely in automobiles, in these cars they scattered to city and town and country within a radius of several hundred miles and found work in places where the depression was not yet felt.

Around Detroit we have seen the same thing in another impressive way. All through the country, within fifteen miles of the city, there have sprung up in the last few years literally hundreds of little groups of cheap houses. Many of them are mere two-room shacks. Some are more pretentious and a few are extremely comfortable six or eight-room cottages. Most of them have one feature in common—a garage.

Commutation

These are the homes of workers. Many of them they have built with their own hands, and during pleasant weather it is no uncommon thing to find on Saturdays and Sundays an entire family—father, mother and children—busily at work putting up their homes. Around the houses spring up little gardens and the men who have adopted the "flivver commutation" pour into the city in the morning along a dozen highways and pour out again at night. They have found fresh air, quiet, sunshine, cleanliness and health for themselves and for their children. And these are distinctly men to whom the payment of an extra tax will be nothing less than a calamity.

With many of the "rubber tire commuters," too, there is a saving in rent and in general living expenses. People who have put their housing problem on wheels, so to speak, and moved it out of town, certainly have far greater comfort and far more healthful surroundings than can be purchased in the city for the same money. Special taxation on the automobile will have a definite effect in limiting this movement, which is one of the most healthful and promising of modern times.

There is no need to dwell upon the social services that the automobile gives, of the kind that cannot be reckoned in cash; the fact that it provides healthful, inexpensive recreation for millions, that it puts the outdoors within reach of the city dweller and the city within reach of the country man, that it is a successful competitor of the dance hall and the pool room—these latter two being without doubt luxuries and, therefore, may be held to be justly taxable.

Who Will Pay

One of the questions to be considered in planning intelligent taxation has to do with what class of people will pay. Those who are urging heavy taxes on the automobile haye assumed an answer to this question. They believe that it will be paid by those who can most easily afford it, that is, by the rich.

Of course, rich people have cars, but it is no longer true that the majority of cars in the United States are the property of wealthy people. The average retail price of passenger cars manufactured in 1919 was under $1000 each. It is obvious, therefore, that a great majority of motor vehicles in this country are not of the class of luxurious products which customarily go into the hands of rich folks.

There are, of course, high priced cars and there are considerable numbers of them. The total output last year of the various automobiles that fall into this class was between 3 and 4 per cent of the total output for the year. At first glance, it would seem reasonable to say that the owners of these are people who could very easily pay the heavy taxes proposed, but it should be remembered that these are the people who are already carrying the great bulk of the taxation of this country. At any rate, the other 96 per cent of the cars are in the hands of people who cannot possibly be considered rich or even well-to-do.

Tax on Production

So we find that in imposing the heavy discriminatory tax on the automobile, beyond the 5 per cent it already carries, our legislators are advocating exactly the kind of tax which economists agree has everything against it and very little to recommend it. They are advocating a tax upon production, a tax that puts a penalty upon thrift and business efficiency. It is a tax, too, on good health, on comfort and on sane recreation. It is distinctly not a luxury tax.

Moreover, it is a tax on progress. No one who's memory goes back twenty years needs any proof of what the automobile has done in bettering living conditions for the great body of the American people. No one with any foresight can doubt that this improvement is only beginning, and that if unhampered the automobile in the next few years will provide more comfortable homes and better living conditions for millions, in addition to continuing to serve as a powerful productive agent.

In the coming years the automobile will be the greatest factor in breaking up the fetid congestion of our great cities and toward destroying the isolation of the farm. It will be of the greatest possible help in bringing to people of all parts of the country in all walks of life an equality of enjoyment and opportunity in many of the most essential of those things that go to make up our American democracy.

It will do these things in proportion as it is not hindered. The proposed tax will definitely check all these beneficial tendencies and will set progress back just so much. Of course the tax cannot stop it. But it can do incalculable harm.

The Two Programs

Let us look for a moment at the two principal programs which have been offered for taxing automobiles. The first came from former Secretary of the Treasury Houston in his annual report for 1920, when he recommended that the following taxes should be levied:

	Million Dollars
A Federal License Tax (50c. per hp.)	100
A Tax on Gasoline (2c. per gallon)	90
A Sales Tax (10%)	200
A total of	390

Chairman Good of the Committee of Appropriations of the House of Representatives, who will have a powerful influence in framing the tax bills under the present Congress, has a much heavier program. He would levy:

	Million Dollars
A Horsepower Tax of	200
A Wheel Tax of another	200
And retain at least the present tax of	100
Or a total of	500

He has not yet stated whether he would tax gasoline according to Secretary Houston's proposal.

What this tax may amount to will be seen if we consider one of the cheaper cars costing, say, $500, having 24 horsepower and running 8000 miles a year on 15 miles to the gallon of gasoline. This would give the following:

Sales Tax	$50.00
Horsepower Tax (Mr. Good's plan)	24.00
Gasoline Tax	10.66
Wheel Tax (Mr. Good's plan)	24.00

This would make a total for the first year of $108.66, or more than 20 per cent of the purchase price of the car. It would make a yearly total thereafter of $56.66.

It is almost unthinkable that such a burden should be laid on a man whose only offense is that he owns a flivver, yet that is the proposal.

A 1-Ton Bevel Gear Rear Axle

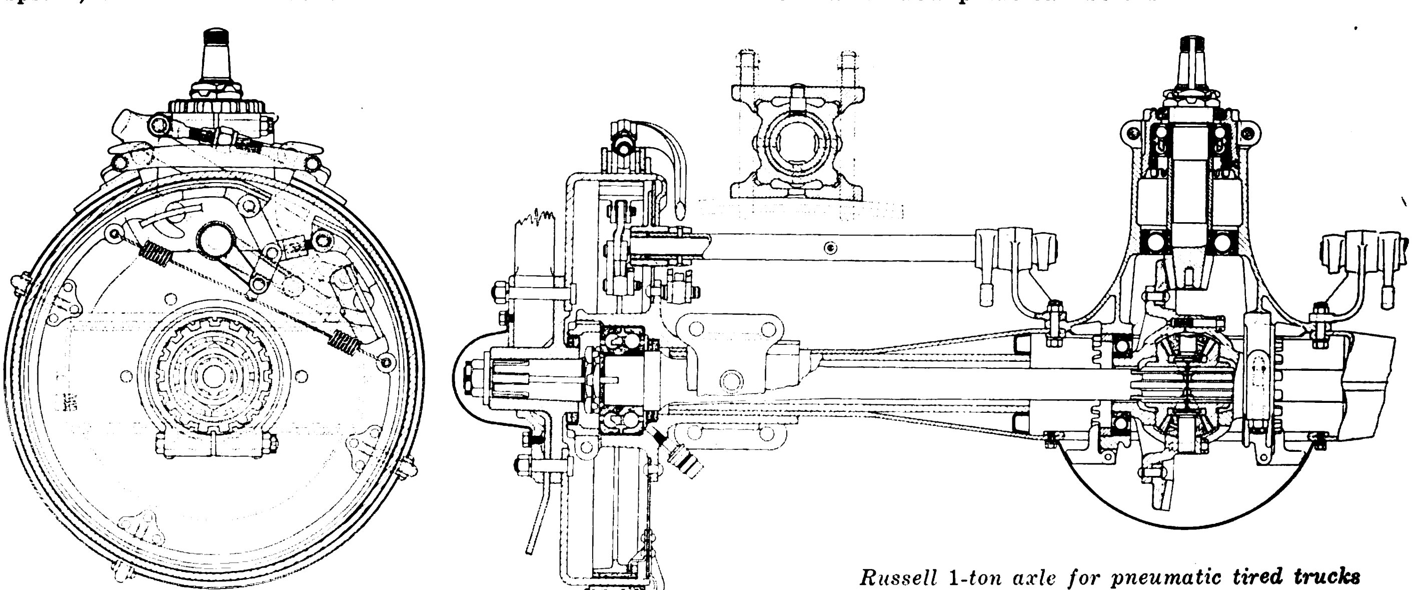
A BEVEL gear driven rear axle designed for use on pneumatic tired speed trucks of 1-ton capacity is manufactured by the Russell Motor Axle Co. The maximum load on the spring pads is limited to 4200 lb. The brake drums for both the inside and outside brakes are of 18-in. diameter, the brakes being of the full wrapping type. The inside brakes are actuated by a toggle linkage and the brake levers are conveniently arranged for inside hookup.

The axle housing is of 3/16 in. material, reinforced by a chrome nickel steel tube of 5/16 in. wall thickness. At the present time this axle is available with a gear ratio of 6 1/3:1, but other ratios can be furnished. Ball bearings of ample size are used.

The driving pinion, which is of the spiral bevel type, has six teeth of coarse pitch, insuring more than one pair of teeth in contact at all times, to enable quiet operation. The differential is of the four pinion type. Its gears and pinions are mounted upon the differential spider, which carries all of the load. The differential cases are free from any bending action caused by shaft deflection.

This axle has been designed strictly for truck use. The maximum torque input permissible is 9000 lb.-in.; that is, the axle can be used with a 4 x 5¼-in. motor developing 2100 lb.-in. torque, with a transmission reduction of 4:1. All parts are so designed as to be able to withstand the stresses created when the tires are slipped. These stresses are greatly in excess of those set up under driving conditions, even when the clutch is "dropped" in. Provision has been made for mounting either wood or disc type steel wheels on the axle.

THE two motor car routes which are being constructed from the Kilo goldfields, Northeastern Congo, to the Nile at Redjaf, and to Lake Albert at Kaseny, are said to be nearing completion. The latter road will facilitate the transport of heavy machinery to the mines, the output of which will, it is expected, be greatly increased when new plant can be installed.



Russell 1-ton axle for pneumatic tired trucks

Cause of Cracking of Rubber Insulation on Ignition Cables

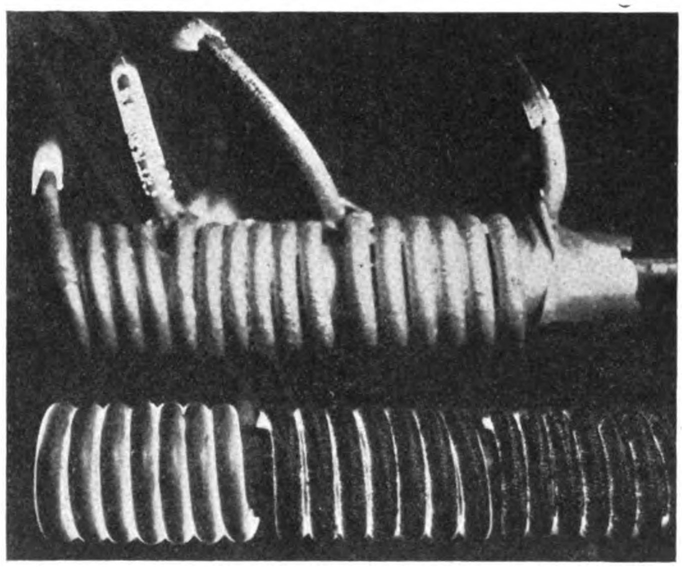
Tests at Bureau of Standards show that cracks are due to chemical attack on rubber by ozone formed as a result of electric discharge. Can be materially reduced by using braided cable and avoiding sharp bends.

EXPERIMENTS conducted at the Bureau of Standards by F. B. Silsbee and J. B. Dempsey show that the cracking at sharp bends, observed in the insulation of high tension ignition wires after service, is due to a chemical attack upon the rubber by the ozone of the electric discharge which takes place at the surface of the cable. This cracking does not occur if the insulating material is not under tension, or if the cable is surrounded by some medium other than air; but does occur even if the insulation is not subjected to electric stress, provided the atmosphere near the cable contains ozone. The extent of this cracking varies greatly with the insulating material used; and can be materially reduced by using braided cable and by avoiding sharp bends.

It appears from the experiments that cracking is produced in substantially the same manner, but somewhat more rapidly, when the samples are tested on 10,000 volts alternating current, than when tested on a magneto. The amount of the cracking is very materially reduced by the presence of a braid and is much less in material with Kerite insulator than in that with rubber. The cracking is entirely absent if the sample is left straight, or if no electrical stress is applied, or if surrounded by water or paraffin. The cracking is evidently a progressive phenomenon, requiring a combination of several factors, i.e., mechanical stress, electrification and the presence of air.

The theory of this action, which successfully explains nearly all of the phenomena, was originally suggested by Mr. Harris of the Kerite Company as follows: The electrification produces a brush discharge at the surface of the cable, which in turn produces ozone and oxides of nitrogen. This is shown by the noticeable odor after the endurance test has been run for some time and the visible glow surrounding the wires when in the dark. This glow is more prominent on the alternating current test. The accompanying photograph is taken with about 15 minutes' exposure at 13,000 volts. The electrical stress in the air at the surface of the cable, as computed from the dimensions of the wire and the dielectric constant comes out much in excess of the breakdown strength of air, and indicated that corona is to be expected.

It is well known that ozone actively attacks rubber; and when the rubber is under mechanical stress the products of the reaction are pulled apart, thus exposing at each incipient crack a fresh surface of rubber, which is in turn attacked. This effect doubtless is responsible for the fact that the action is localized in definite cracks when the material is under tension, but does not penetrate the material when the rubber is unstressed.



Corona on ignition cables on 1-inch arbor. Exposure to corona only fifteen minutes at 13,200 volts A. C. and to artificial light 5 seconds to show location of discharge
Upper mandrel from left to right: Kerite bare, mineral rubber, kerite uncovered
Lower mandrel from left to right: Kerite bare, kerite covered, mineral rubber

A possible remedy for this trouble would be to cover the cable with a closely adhering coating of conducting material, such as conducting paint or water soaked braid. This will prevent the tendency to form corona, as is shown in the photographs. It is, however, objectionable on account of the increase in the electrostatic capacity of the leads which results in a reduction of the maximum voltage produced by the ignition system and also because most forms of conducting paint are liable to crack and produce at the cracks an excessive amount of corona. The use of an insulator having as small a value as possible for the dielectric constant is advisable, as the voltage gradient in the air outside the cable is thereby reduced. There seems to be considerable difference in the rapidity with which different insulations are attacked chemically by the ozone. The ordinary impregnated braids help very materially in preventing cracking, probably because they are nearly air tight and prevent the ozone from reaching the rubber. After much bending, however, they will probably lose their efficacy. The importance of carefully avoiding sharp bends in the wiring is very obvious.

The experiments referred to in the foregoing are fully described in Technical Note No. 32 of the National Advisory Committee for Aeronautics.

A New Four-Cylinder Engine of Conventional Design

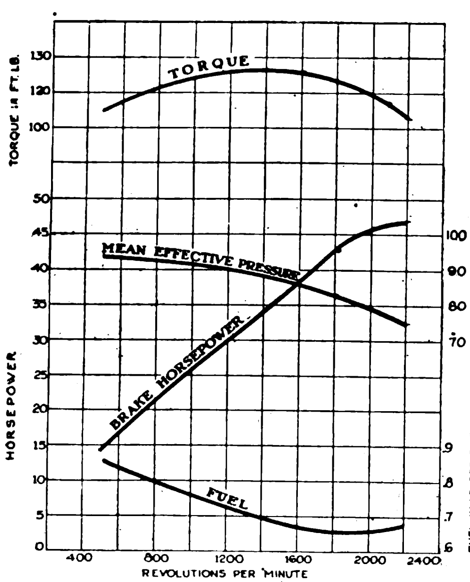
Is intended for passenger car or light truck applications. Four 3¾ by 5 in. cylinders develop a maximum of 47 hp. at 2200 r.p.m. Full pressure feed lubrication and ample water jacket space are provided.

By J. Edward Schipper

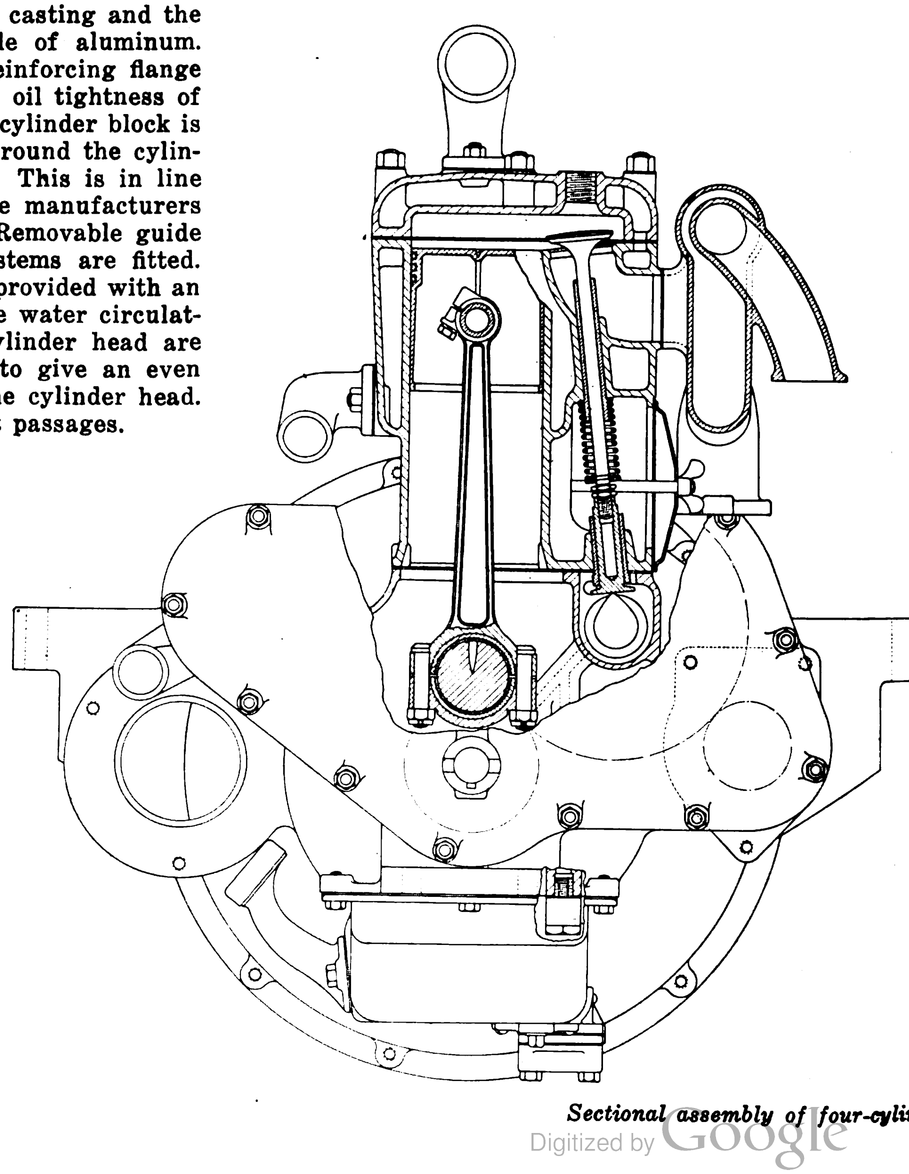
AMONG the engines recently placed on the market is one known as the Turmo. It is of the four-cylinder L-head type and is adapted for either light truck or passenger car work. It develops its maximum horsepower (47) at 2200 r.p.m., according to tests made at the laboratory of the Zenith Carburetor Co. The maximum torque is reached at about 1400 r.p.m. This new powerplant does not depart from established L-head practice, but differs from most of the stock engines of that type in that it has a full pressure feed oil system without splash.

The 3¾ by 5-in. cylinders are cast in a block of semi-steel. The cylinder head is a separate casting and the crankcase is also separate, being made of aluminum. The oil pan is pressed steel, with a reinforcing flange around the top for ease in maintaining oil tightness of the gasket. One of the features of the cylinder block is the extra large water space provided around the cylinder walls and around the valve seats. This is in line with a growing tendency among engine manufacturers to provide more liberal water space. Removable guide bushings for both tappets and valve stems are fitted. The demountable cylinder head is also provided with an unusual amount of water space and the water circulating holes between the cylinder and cylinder head are drilled instead of cored, which tends to give an even distribution of water to all parts of the cylinder head. The cylinder head has two water outlet passages.

Semi-steel pistons of the full skirt type are provided. The pistons are 4 in. in length and provided with three rings, all above the piston pin. Just below the bottom ring there is an oil-collecting groove and from this groove there are drilled oil holes to the top side of the piston pin. This insures oiling of the piston pin on the up-stroke. The pistons are finished by grinding. The piston pins are tubular steel, carbonized, hardened and ground. They are held stationary in the rods by clamping with alloy steel, heat treated bolts. To prevent the piston pins from working against the inside of the cyl-



Characteristic curves of new Turmo model H engine



Sectional assembly of four-cylinder

inder walls, a slot is cut in them through which the clamp bolt passes.

Drop-forged, .40 carbon steel, I-beam connecting rods are employed. These are 10 in. in length, center to center. The caps on these rods are held in position by nickel steel bolts with slotted nuts and cotter pins. The crankshaft is a three-bearing type, also of .40 carbon steel, heat treated and ground at the bearing surface. The crankshaft is 1⅞ in. in diameter. The bearing lengths are given in the table of specifications herewith. The crankshafts are all given a static as well as running balance and the end thrust on the crankshaft is taken care of by flanges provided at the center bearing.

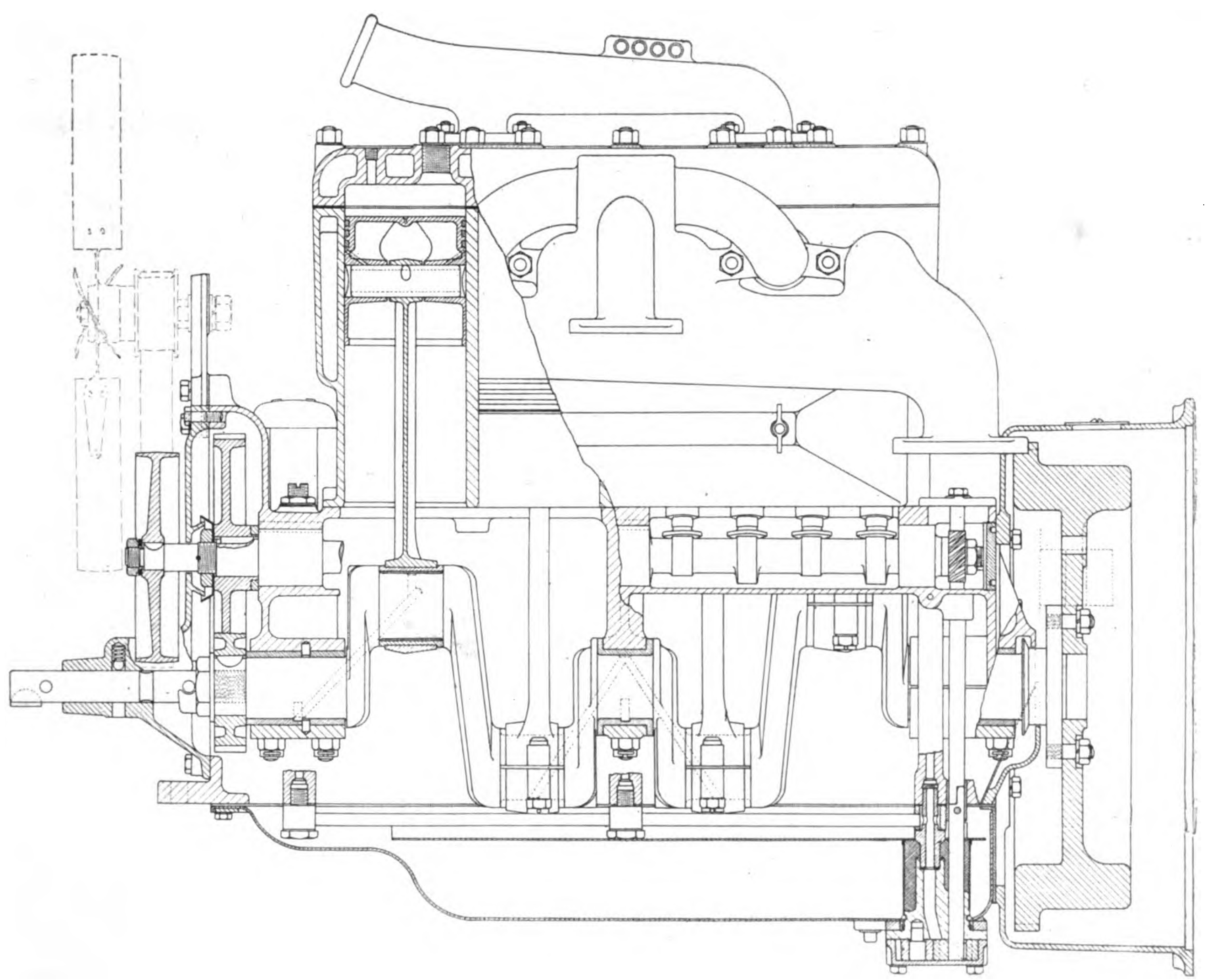
The integral camshaft is 1¼ in. in diameter, and is supported in three bearings. The camshaft and tappets are carried in a tunnel in the crankcase and are always submerged in oil. The three camshaft bearings are of cast iron, the shaft being hardened and ground. Camshaft lubrication is by the pressure system, which is claimed to result in particularly long life. The other bearings of the engine are of nickel babbitt. In order to obtain a good fit, the engine is placed on a special burnishing machine which removes all high spots in the bearings and gives a high percentage of bearing surface. Laminated shims are provided on all of the crank and connecting rod bearings.

Pressure lubrication is utilized for all of the engine bearings. The gear oil pump is attached to the bottom of the oil pan at the rear. The oil pump together with the oil screen can be removed for cleaning and inspection by the removal of four nuts. The pump is operated by a vertical shaft which is driven by gears from the rear end of the camshaft and the top end of this shaft also drives the distributor when one is used. From the pump the oil is carried through the three main crankshaft bearings and from the crankshaft bearings to the connecting rods through the drilled crankshaft. Leads are drilled in the crankcase from the main crankshaft bearings to the camshaft bearings. An oil relief valve

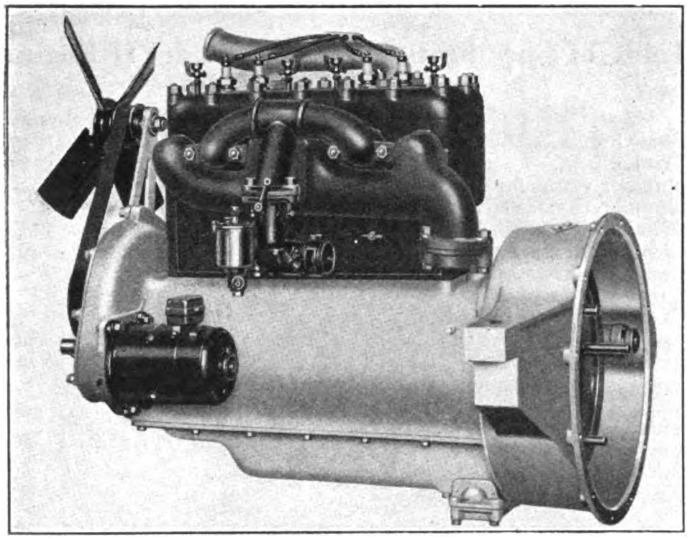
Table of Specifications Turmo Model H Engine

(All dimensions in inches.)

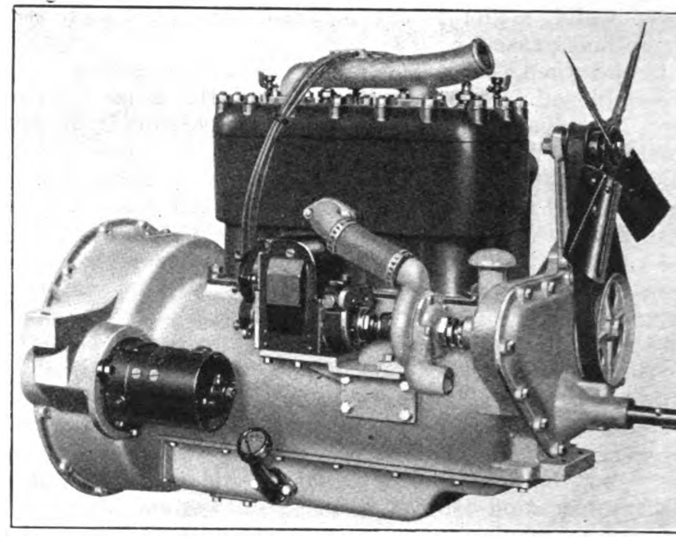
	Diameter	Length
Bore, 3¾ in.		
Stroke, 5 in.		
Number crankshaft bearings, 3.		
Number camshaft bearings, 3.		
Crankshaft front bearing,	1⅞	3⅛
Crankshaft center bearing	1 15/16	1¾
Camshaft rear bearing	2	3¼
Camshaft front bearing	1¾	2
Camshaft center bearing	2	1½
Camshaft rear bearing	2 1/32	1⅛
Piston pin bearing	1	2⅛
Valve outside diameter, 1 29/32 in.		
Valve clear opening, 1¾ in.		
Valve stem diameter, ⅜ in.		
Valve lift, ⅜ in.		
Carbureter flange, 1¼ in. S. A. E. 2 bolt.		
Weight of engine, 465 lb.		



L-head, 3¾ by 5 in. Turmo model H engine



Manifold side of Turmo Model H engine



Right side of Turmo Model H, L-head engine

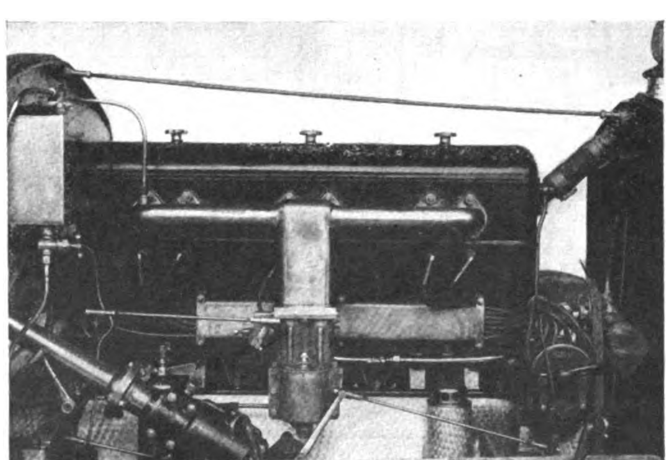
for regulating the oil pressure is located at the front on the top side of the crankcase. The overflow from the relief valve lubricates the timing gears. The cylinder walls are lubricated by oil mist from the main and connecting rod bearings. The piston pins are lubricated by special oil grooves in the pistons, as noted above. An oil level gage is located on the right side of the oil pan.

Practically all of the fittings used are S. A. E. standard. For instance, the generator mounting is the No. 1 S. A. E. flange type; the starting motor mounting, the No. 2 S. A. E. flange type, and the starter is fitted with an 11-tooth inboard Bendix gear. The distributor mounting is S. A. E. type B and the bell housing the No. 3 S. A. E. Any standard magneto can be fitted, the rotation being clockwise, looked at from the driving end. The fan is left hand and is driven from the camshaft. Either pump or thermo-syphon cooling can be provided. The engine is manufactured by the Turner & Moore Mfg. Co.

Racing Practice Employed in New Sporting Type Delage

By W. F. Bradley

A GUARANTEED speed of 80 miles an hour, with sporting body and full touring equipment, is given with the new sports type Delage just placed on the market. This car is not an entirely new job, for the standard touring car chassis is employed except that a new overhead valve engine is fitted. In order to keep the cost of production down and to simplify supplies, the old crankcase, crankshaft, connecting rods and pistons are used. The cylinder block is special, comprising six cylinders of 80 by 150 mm. (3.1 by 5.9 in.) bore and stroke, in one casting. For the first time use is made of a detachable head, in which are mounted two vertical valves per cylinder. These have a diameter of 42 mm. and a lift of 11 mm. The valves are mounted directly in the head without the use of cages, and unlike the touring model the intake manifold is external. Valve operation is by means of a camshaft mounted in the base chamber, pushrods carried through the cylinder casting and overhead rockers. The whole of the overhead mechanism is inclosed by an aluminum housing, and the compression cocks are carried inside this. Lubrication is on the same lines as the touring model, with the addition of a special lead to each of the overhead rockers. These latter are fitted with wicks which, after feeding the pins, carry the lubricant to the pushrod end of the rocker and then by the guides back to the base chamber. As on the touring model, a cross shaft drives the water pump and the magneto from its two extremities. A double magneto is used, however, and this fires twelve plugs mounted horizontally immediately below the intake valves, on opposite sides of the cylinder.



Carbureter side of new Delage overhead valve sporting type engine

On the touring type Delage two independent carbureters are used. The sporting model has one Zenith dual carbureter connected up to the intake ports by a six-branch copper manifold, the vertical passage of which is heated by means of a by-pass from the water circulating system. Bench tests show 88 hp. at 2380 revolutions, and as a road speed of 80 miles an hour is easily obtainable with this number of revolutions, it is not intended to carry the power curve any higher. The Delage engineers believe that most purchasers of a sporting type car are satisfied with a maximum of 80 to 84 miles an hour, providing it is coupled with a wide range of power at low and moderate engine speeds. With the standard gear ratio of 3.1 to 1 the car will pull away easily on top with very rapid acceleration.

Improvements in a Line-Driven Tractor

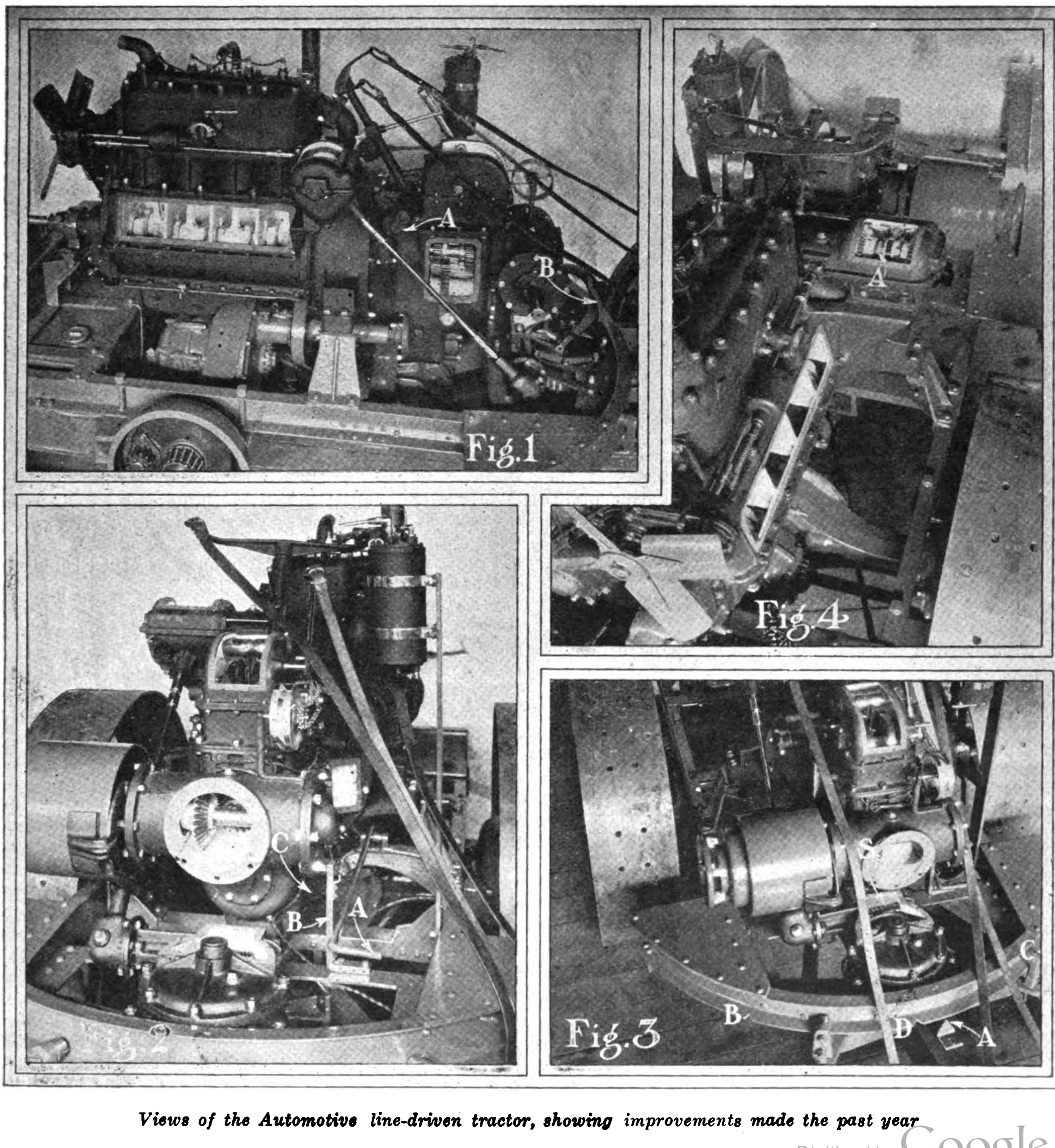
AT the recent Columbus tractor show two models of the Automotive one-man, line-controlled tractor were exhibited, one being a cut away model. Several improvements have been made in this tractor since last year, which are briefly described in the following.

The tractor is now provided with two sets of brakes instead of one, and the actuation of the brakes is somewhat different. The new brake is a belt pulley brake, and serves three purposes: First, to stop the tractor transmission immediately after the clutch is released; second, to stop the tractor when the transmission is in gear; third, to stop belt-driven machinery. The third object is accomplished by an extension from the two clutch operating lines to the driven machine and this feature is said to appeal very much to the user, as he can stop his belt-driven machine instantly without going to the tractor.

The belt pulley is connected with the engine clutch throw-out cam, so that the brake action follows the clutch action, and it is stated that gearshifting is accomplished with absolutely no clashing of gears. Fig. 1 shows clutch throwout cam A and brake shoe B. The brake rod and the pulley are not shown in this photograph, but the simplicity of the arrangement is apparent.

The second brake is now actuated by hand instead of by the gear shift lever as formerly, and is used to hold the tractor stationary when the transmission is in neu-

(*Continued on page* 817)



Views of the Automotive line-driven tractor, showing improvements made the past year

The Influence of Various Fuels on Engine Performance

This is the first of a series of articles describing what is believed to be one of the most thorough and important investigations of engine fuels ever conducted. It has been definitely proved that the tendency of a fuel to detonate is by far the most important factor in determining its value for use in engines. Power and efficiency not increased by use of "dopes." Proportions of aromatics, naphthenes and paraffins important.

By H. R. Ricardo*

IN the latter part of 1919 the author started extensive research work on hydrocarbon fuels, including a thorough investigation into the behavior of the working fluid in an internal combustion engine cylinder and the influence of the composition of the fuel upon its behavior.

Before any actual experimental work was started a careful analysis was made of the existing information with a view to indicating in what direction research was likely to prove most fruitful, and at the same time a preliminary investigation was made both as to the requirements which an ideal fuel should fulfill and as to the possible variations which might be expected as between fuels of different chemical composition.

The analysis of existing information proved, for the most part, somewhat disappointing; although much valuable data relating to the theoretical side were found, particularly in the publications of the Journal of the Chemical Society, and in various other scientific publications, the actual experimental data available proved to be of very little value. It was found, on close scrutiny, that the results would not agree among themselves; such data had to be set aside as unreliable. The outcome of this analysis was that, so far as engine test results were concerned, there appeared to be no information sufficiently accurate or reliable to be of much practical value.

After much thought it was decided:

(1.) To make a thorough investigation into the factors controlling detonation, since the tendency to detonate determines the degree of compression which can be employed, and therefore both the power and efficiency of an engine.

(2.) To determine accurately the total internal energy of each fuel when mixed with the quantity of air required for complete combustion, for when burnt with equal efficiency it is clear that the power output obtainable with each fuel is directly proportional to the total internal energy. It is well to emphasize that the internal energy has little or no connection with the heat value of the fuel, in terms of its weight.

(3.) To determine the losses due to change in specific heat and dissociation at high temperatures, and to ascertain how far these losses vary with different fuels.

(4.) To investigate the available range of burning of different fuels.

(5.) To investigate the factors controlling distribution and ease of starting.

(6.) To determine accurately the calorific value of different fuels.

(7.) To determine accurately both the self-ignition temperature and the process of combustion, when different fuels are ignited by adiabatic compression in a large cylinder.

Of these factors, it was already realized that the first was likely to prove by far the most important. It was known in a very general way that certain fuels, such as benzole and other members of the aromatic group, also alcohol, will not detonate readily even under very high compression pressures, and that detonation can be kept in check by the addition of benzole to ordinary gasoline. A fair amount of data was available also as to the phenomena of detonation. Very little information of a quantitative nature was, however, available, nor was anything known as to the influence of other fuels upon detonation.

With regard to (2), (3) and (4), very little information was available, at all events in a form readily applicable by engineers. Sir Dugald Clerk, Professor Hopkinson and other members of the Gaseous Explosions Committee of the British Association, had, before the war, made a very extensive investigation of these factors in relation to coal gas, but it has long been realized by many investigators that the conditions are widely different when applied to the volatile hydrocarbon fuels which contain no inert constituents. It is, of course, evident that any variation either in the total internal energy, in the losses due to dissociation and change of specific heat, or in the range of burning available, will influence very powerfully both the power output and efficiency obtainable, even with the same compression ratio.

With regard to (5), it is clear that the distribution and ease of starting must necessarily be dependent to some extent at least on the chemical and physical characteristics of the fuel, and it was clearly of importance to determine how far it was so dependent, and to ascertain what are the practical limits as to range of boiling point, vapor tension and other such considerations.

With regard to (6), the published data as to the heat value of different fuels were found in many cases to be contradictory and unreliable.

*Condensed from a preliminary report concerning extensive research work conducted by the author for the Asiatic Petroleum Co., Ltd., and published in *The Automobile Engineer*.

As regards (7), a somewhat elaborate piece of apparatus has been designed and constructed for research in this direction, but little data are as yet available.

Before proceeding to details either of the apparatus employed or of the experimental or theoretical results obtained, it will perhaps be well to outline very briefly the definite practical conclusions which have already been arrived at, and to deal later and in more detail with the reasoning and the experimental results by which they have been deduced and confirmed.

The general conclusions, expressed as briefly as possible, are subject, as such conclusions always must be, to minor qualifying conditions which will be dealt with later. With the exception of alcohol and certain other fuels, these conclusions can be taken as applying to all volatile liquid hydrocarbons practically available and all combinations thereof. Alcohol and other fuels containing oxygen atoms in the molecule differ in certain important characteristics, and therefore cannot be included without some reservations.

General Conclusions

(1.) It has been proved that the tendency of a fuel to detonate is the one outstanding factor in determining its value for use in an internal combustion engine. Compared with this, all other considerations are of secondary importance.

(2.) There appears to be little doubt as to the correctness of the view, now generally accepted, that detonation is less the lower the rate of burning of the fuel.

(3.) In all cases it seems that a low rate of burning is advantageous. No fuel has yet been found whose rate of burning is too low to permit of maximum efficiency being obtained in the highest speed engine yet tested.

(4.) Fuels capable of standing a very high compression will operate in a low compression engine as efficiently as those whose normal rate of burning is high—provided that there is a reasonable degree of turbulence in the combustion chamber.

(5.) Apart from the limitations introduced by detonation, the power output obtainable from all volatile liquid fuels, with the exception of the alcohol group, is the same at the same compression to within less than 2 per cent. Such variations as occur within this range are due rather to variations in the latent heat of evaporation than to any other circumstance.

(6.) Owing to the high latent heat and low boiling point of alcohol and certain other fuels, the weight of charge per cycle is greater and a higher power output is obtained in consequence.

(7.) The efficiency with which all volatile fuels, other than alcohol and the others previously referred to, are burnt is the same, at the same compression ratio, irrespective of rate of burning, provided the compression is low enough to avoid detonation under any circumstances. In the case of alcohol, the efficiency is very slightly higher, for reasons which will be considered later.

(8.) The useful range of burning is to all intents and purposes the same for all volatile liquid fuels.

(9.) The unavoidable losses due to dissociation and change of specific heat at high temperatures are substantially the same in all cases.

(10.) All the experimental results indicate that, with certain trifling exceptions which will be considered later, the performances of any combination of hydrocarbons as regards detonation, and therefore the power output and efficiency obtainable, is the mean performance of each of the components. The performance of any complex fuel such as gasoline can therefore be predicted, once the nature and proportion of its constituents are determined, or conversely, a fuel can be prepared to give any required performance, within the limits available.

(11.) No increase in power or efficiency has been found or need be expected from the use of "dopes." A large number of these were investigated and tested, but, as might be expected, the improvements in all cases proved to be practically negligible.

(12.) The highest useful compression ratio for, and therefore the power output obtainable from, any gasoline is governed by the relative proportions of aromatics, naphthenes and paraffins it contains—the smaller the proportion of the latter the better from almost every point of view. The influence of olefines has not yet been investigated.

(13.) To judge the quality of a fuel by its specific gravity is entirely misleading. If naphthene and aromatic fractions are present in any large proportion (as is sometimes the case), then a high specific gravity is a substantial advantage.

(14.) Owing to the very rich mixture delivered normally by pilot jets, and the still further enrichment effected by flooding, only a relatively small proportion of highly volatile constituents appears to be required for starting.

(15.) There is considerable evidence to indicate that in the case of most "natural" gasolines the more valuable constituents are those whose boiling points lie between the range 80 deg. C. (176 deg. Fahr.) to 180 deg. C. (356 deg. Fahr.). It is therefore often quite as undesirable to restrict the final boiling point of a fuel to 150 deg. C. as it is to permit it to exceed 200 deg. C. So much, however, depends on the actual composition of the fuel, and so great are the variations in this respect that this conclusion must be regarded only as a broad generalization.

The apparatus constructed or requisitioned for these experiments included:

(1.) A special variable compression research engine. This engine has been described in a paper presented by the writer at the British Association meeting at Cardiff and reported in full in Engineering of Sept. 3 and 10, 1920.

(2.) A research engine provided with means for supercharging the cylinder.

(3.) A special machine for determining the self-ignition temperature and pressure of fuels under adiabatic compression.

(4.) A single-cylinder experimental engine with crosshead piston, used chiefly for experiments on fuels of high boiling point.

(5.) Engines of various commercial types, mostly four-cylinder, used for tests on starting, check tests, etc.

(6.) Several motor cars of different types for road testing.

(7.) A miscellaneous collection of auxiliary apparatus.

It will be shown later that the standard of accuracy obtainable with both the research engines, and more particularly the variable compression engine, is exceptionally high; extreme variations extending over a year's running have been found to be less than 1 per cent, while the mean results obtained during any one group of tests can be taken as accurate in most respects to within one-quarter of 1 per cent.

The absolute accuracy of all the figures given later as test results can safely be accepted as being within one-half of 1 per cent, while the relative accuracy is about twice as high.

The accuracy of tests on the various commercial engines is not of a very high order. While the accuracy of observation is comparable with that obtained on the research engines, the mechanical and thermal efficiency of such engines is, for the most part, so low that varia-

tions in the efficiency or power output obtainable with different fuels are frequently completely obscured by much larger variations in the friction losses, distribution, carburation, etc.

Little was hoped for from road tests on cars, and indeed they proved to be practically valueless for indicating small differences. It was found impossible to assess and allow for the variations due to road surface, wind, tire inflation and many other variables, all of so large a magnitude as completely to mask any but well-marked differences.

It soon became apparent that the only conclusions of any value from road tests would be those drawn from the mean results of a large accumulation of data obtained from the behavior of many vehicles operating over a long period on each sample of fuel. Such a test was not practically possible.

One of the most serious difficulties which had to be contended with was that in many cases it was altogether impracticable to obtain chemically pure samples in sufficient bulk. It would, of course, have been desirable to use a pure light fraction—preferably of the paraffin series—as a standard basis of comparison, but to obtain a pure fraction, such as hexane, in the quantity required for calibration and check testing, was altogether out of the question. After much consideration it was decided to employ as a standard basis of comparison a comparatively light gasoline containing a fairly high proportion of paraffin fractions, and from which all, or almost all, of the aromatic members of the series had been removed by sulphonation. For this purpose the Asiatic Petroleum Co., Ltd., set aside some 5 tons of suitable gasoline and treated it by sulphonation until the aromatic content was reduced to less than 2 per cent. This fuel, which was used throughout the whole series of experiments, both for calibrating the engines and for comparative purposes, will be referred to in future as standard aromatic free gasoline. Its general characteristics are given in Table I, from which it will be seen that it consists almost entirely of members of the paraffin and naphthene series. Since the whole quantity was drawn from one tank and treated by sulphonation at one operation, it follows that its uniformity does not vary—a very important consideration in view of the fact that the research was expected to occupy not less than two years, and any change in the composition of the standard fuel would have involved endless complications and the possibility of serious errors.

It was found that the minimum quantity of fuel required for any individual test was about two gallons, and this, of course, left no margin for retests or for checking discrepancies, such as are inevitable when working to within such fine limits. While every effort was made to obtain chemically pure samples of the various members of different series, it was by no means always possible to do this, and in several instances serious errors were introduced due to the presence of impurities in what purported to be chemically pure samples. Of the paraffin series, reasonably pure hexane was obtained in sufficient bulk to permit of extensive tests. Of the naphthene series, samples of cyclohexane, hexahydrotoluene and hexahydroxylene were obtained in sufficient bulk, but, although the first of these purported to be chemically pure, subsequent analysis indicated that it contained so considerable a percentage of paraffins and aromatics as appreciably to modify the conclusions drawn from the earlier experimental results. Of the aromatic series, samples of benzol and toluene of great purity were relatively easily obtained. The greatest difficulty was experienced in obtaining ethyl alcohol.

Considerations of the chemical and physical properties of ethyl alcohol made it clear, not only that it would prove highly interesting in itself, but also that its behavior might be expected to throw a good deal of light on several questions relating to other fuels, such as the very important one of the influence of the latent heat of evaporation. Fairly early in the course of the research the necessity for running tests on alcohol became evident, and means had therefore to be found for obtaining sufficient quantities of this most interesting fuel. The samples ultimately obtained proved to be of a very high degree of purity.

Of the olefine series no really pure samples have yet been obtained in quantities sufficient to run engine tests.

Of the sulphur compounds, both carbon bisulphide and methyl mercaptan were obtained in sufficient quantities, but the influence of thiophine has not yet been investigated.

With the other miscellaneous samples, such as ether, acetylene, acetone, etc., no difficulty was encountered in obtaining sufficient supplies of reasonable purity.

For the most part the impurity of the samples has not had any very important influence on the deductions to be drawn from the test results, but their presence has rendered the tests far more arduous, since it was necessary in each instance to determine the nature and proportion of the impurities present and to arrive by independent tests at their influence. Once these factors had been determined the influence of their presence on the behavior of the fuel as a whole could be allowed for.

The close agreement between the theoretical deductions arrived at by Messrs. Tizard* and Pye* and the actual experimental data has been throughout a very striking feature. The influence of sulphur compounds of low ignition temperature upon the tendency to detonate, and the somewhat eccentric behavior of heptane, have been the real surprises, while the very important influence of the latent heat of evaporation upon the power output obtainable was not appreciated at first, nor does it appear to have been realized by any other investigators.

Table I. General Characteristics of the Standard Aromatic Free Gasoline

Net calorific value (minus latent heat of the evaporation of the fuel)				19,080 B.t.u. per lb.
Latent heat of evaporation				133 B.t.u. per lb.
Specific gravity at 15° C				0.718
Chemical composition	Paraffin series			63% by weight
	Naphthene series			35% by weight
	Aromatic series			1.7% by weight
		Deg. C.	Deg. F.	
Engler distillation	Boiling below	60	130	1%
	Boiling below	80	176	16%
	Boiling below	100	212	49%
	Boiling below	120	248	72%
	Boiling below	140	284	85%
	Boiling below	160	320	93%

The series of tests may be divided broadly into two sections:

Section 1.—A series of comparative tests carried out on a large number of different samples of gasoline with an immediate view to determining the best mixtures for blending, and indirectly with a view to exploring and determining the most fruitful avenues for further research. This series was carried out during the earlier stages of the research, while the more accurate

*Who conducted the theoretical portion of the investigation.

and intricate apparatus was in the process of design and construction, and while the theoretical investigations were in progress.

Section 2.—A much more accurate and analytical series of tests carried out with apparatus designed specifically for the purpose, using pure, or relatively pure, samples of all the different ingredients of the various volatile liquid fuels, conducted with a view to

(1.) Checking and proving the accuracy of the theoretical determinations.

(2.) Ascertaining the individual characteristics of samples of each of the various leading groups and the influence of the presence of such samples on the performance of a composite fuel.

(3.) Determining accurately the influence of compression ratio, temperatures and pressure, upon the power output and efficiency of an engine.

(4.) Determining the influence of the addition of gases, both active, such as acetylene, and inert, such as nitrogen, CO_2, etc.

The tests, which are still in progress, have involved to date about 1600 hours running on the three engines set aside purely for this research and several hundred hours running in other engines on the test bed and on the road. So far over 8000 readings of fuel consumptions have been taken with various fuels or mixtures of fuels under various conditions as to temperature, compression, etc., etc.

In view of the large number of readings taken it is impossible to give actual individual results, except in the cases of certain more or less isolated experiments. For the most part, the curves and tables which will be given represent the mean results of many hundreds of readings.

Table II gives a list and the leading characteristics of the various samples obtained in sufficient bulk to permit of fairly extensive tests. Besides those given in this list, a large number of other samples of gasoline and a number also of relatively pure substances were tested, but these have been omitted here.

With regard to the various samples of gasoline, these are selected either because they are fairly representative or in some cases because they afford extreme instances either as regards their specific gravity, aromatic content, naphthene content, etc. The different gasolines include samples of well-known commercial gasolines of all grades, ranging from the lightest aviation spirit to the heaviest mechanical transport gasoline.

Of the so-called pure substances, the degree of purity is denoted by the figures in brackets.

(To be continued)

Table II.—Fuel Data for Some of the Samples Tested.

Fuel	Spr. Gr. at 15° C. (59° F.)	Engler Distillation, Per Cent, at— 60° C. (130° F.)	80° C. (176° F.)	100° C. (212° F.)	120° C. (248° F.)	140° C. (284° F.)	160° C. (320° F.)	180° C. (356° F.)	Final[3] Boiling Point °C.	°F.	Vapor Tensions 760 mm. Hg and 0° C. (32° F.)	Viscosity at 20° C. (68°F.) C.G.S. Units	Latent Heat of Evaporation B.t.u. per Lb.	Calorific Value, Exclusive of Latent Heat (Lower Values) B.t.u. per Lb.	B.t.u. per Gal.
Gasolines															
Aromatic free	0.718	1	16	49	72	85	93	..	...	...	..	0.004	133	19,080	114,200
"A" gasoline	0.782	..	..	15	54	83	96	..	164	327	28	0.005	142	18,450	120,200
"B" gasoline	0.723	4	37.5	79	99	..	..	..	126	259	86	0.005	140	18,890	113,700
"C" gasoline	0.727	..	11.5	47	79	92	98.5	..	160	320	54	0.005	135	19,000	115,000
"D" gasoline	0.760	..	..	13	66	89	97.5	..	166	331	18	0.005	132	18,770	118,700
"E" gasoline	0.719	2	14.5	43	71	86	96	..	170	338	70	0.005	133	18,970	113,700
"F" gasoline	0.704	1	27	65	86.5	94.5	..	..	153	307	68	0.004	134	19,130	112,200
"G" gasoline	0.750	..	7	24	47	67	81.5	91	210	410	44	0.005	...	.....	......
"H" gasoline	0.767	..	..	7	55	83	94	..	176	349	17	0.006	145	18,790	120.000
Per Cent at		320°F. 160°C.	356°F. 180°C.	392°F. 200°C.	428°F. 220°C.	464°F. 240°C.	500°F. 260°C.	536°F. 280°C.							
Heavy Fuels															
Heavy aromatic	0.885	8	30	50	65	77	90	..	275	527	..	0.007	136	17,900 (approx.)	132,000 (approx.)
Kerosene	0.813	..	22	36	50	63	76	86	300	572	..	0.010	108	19,000 (approx.)	128,700 (approx.)
			Boiling Range Deg. C.				Boiling Range Deg. F.								
Paraffin Series															
Hexane (80%)	0.685		40 to 88				104 to 190				45	0.003	156	19,250	109.800
Heptane (97%)	0.691		98 to 98				208 to 208				11.5	0.004	133	19,300	110,700
Aromatic Series.															
Benzol (pure)	0.884		80 to 80				176 to 176				26	0.006	172	[2] 17,330 17,302	127,600 127,400
Toluene (99%)	0.870		110 to 110 (approx.)				230 to 230 (approx.)				9	0.006	151	17,580 17,522	127,400 127,000
Xylene (91%)	0.862		84 to 143				138 to 289				..	0.006	145	17,800	127,800
Naphthene Series.															
Cyclohexane (93%)	0.786		80.8 to 81				177.5 to 177.8				27.5	0.006	156	18,800	123,100
Hexahydrotoluene (80%)	0.780		95.5 to 101.2				204 to 214				..	....	138	18,760	121,800
Hexahydroxylene (60%)	0.744		103 to 123				217 to 253				..	....	133	18,770 (approx.)	116,300 (approx.)
Alcohol Group.															
Ethyl alcohol (98%)	0.798			78				173			12	0.012	406	11,450 11,480	76,200 76,300
Methyl alcohol (purified wood naphtha)	0.829			..				..			..	....	...	.....	......
Acetone	0.798			56				133			..	0.003	239	12,350	82,000
Methylated spirits	0.821			..				..			..	0.010	454[1]	9,850[1]	67,500[1]
Miscellaneous.															
Acetylene	....			..				..			Gas	....	...	21,010	......
CS_2 50% Aromatic free 50% (by volume)	0.994			..				..			..	....	145	10,620	88,000
Ether (dilute)	0.735			35				95			185	0.002	(229)	(13,350)	81,700 (approx.)

NOTE.—(1) These figures are estimated from approximate composition.
(2) Where two values are given bracketed, the one underneath is the more recent, and is probably the more accurate determination.
(3) Final boiling point of gasoline is always a somewhat uncertain quantity.

How Current Practice in Body Design Differs from Earlier Practice

Changes are less rapid and less radical as industry becomes more stabilized. Great majority of purchasers are unable or unwilling to pay the large difference in price between open and closed body. Wider use of all-season top predicted. Many new models use cast aluminum step.

By George J. Mercer

BODY design is not, as in the early days, changing by leaps and bounds. Changes are slowly evolved in much the same way as chassis changes are evolved. Now any forward movement is consistent with the normal movement of a stabilized industry.

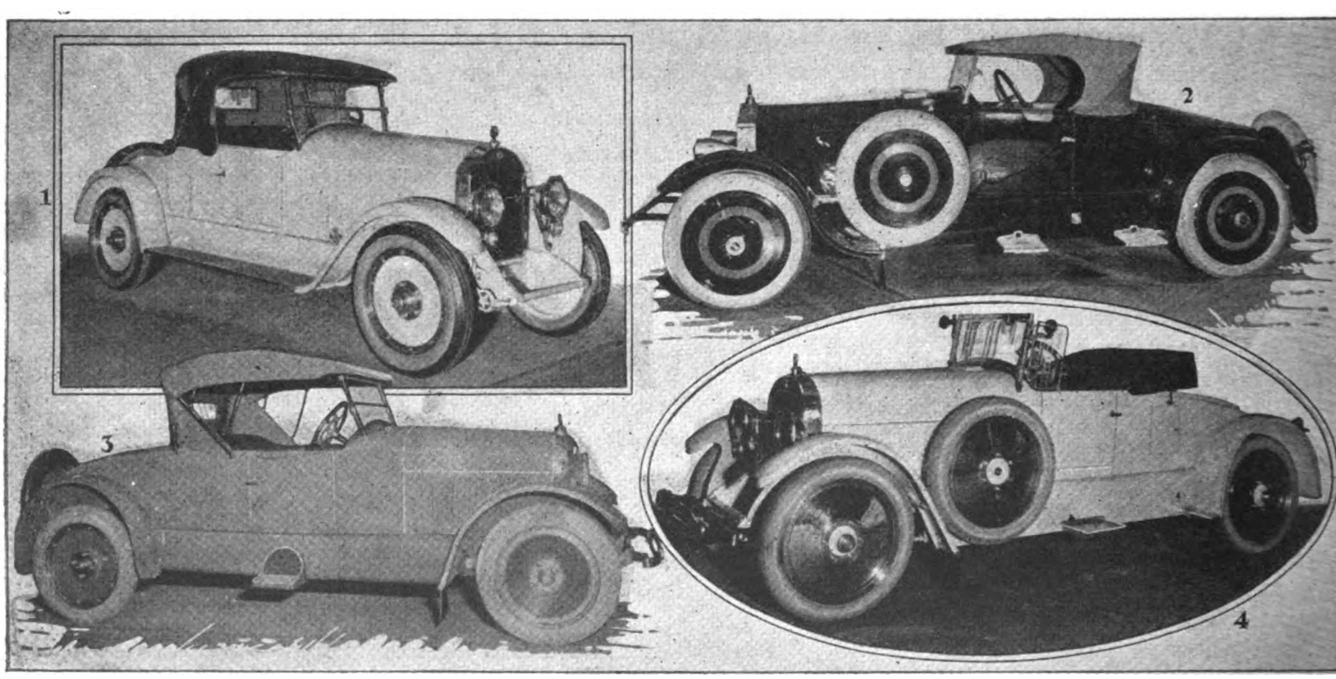
When changes are made they are generally confined to some one body model. The period that has just passed was based on the belief that the public wanted a closed car and were willing to pay for it. However great may have been the need for closed cars, the great majority of actual buyers are either not able or not willing to pay the difference and decide to purchase the open car. Hence prominence is given to the open models.

A general effort to make open cars more attractive is apparent. The runabout has been an uncertain factor for several years and has been made in sizes that ranged from the two bucket seats on a platform to a four-passenger that was virtually a touring car. This year's designs are neither extremely large nor small. In the new models the trick side, the folding seats and all combinations for carrying more than two passengers are eliminated. The body sides average as high as those on the touring models. The rear carrying compartment has been enlarged and covers all the space between the rear mudguards. The seats are low and seat-backs have plenty of slope, and as the body sides are high in relation to the cushion, the seats are, on the average, more comfortable for the driver than in any other body model.

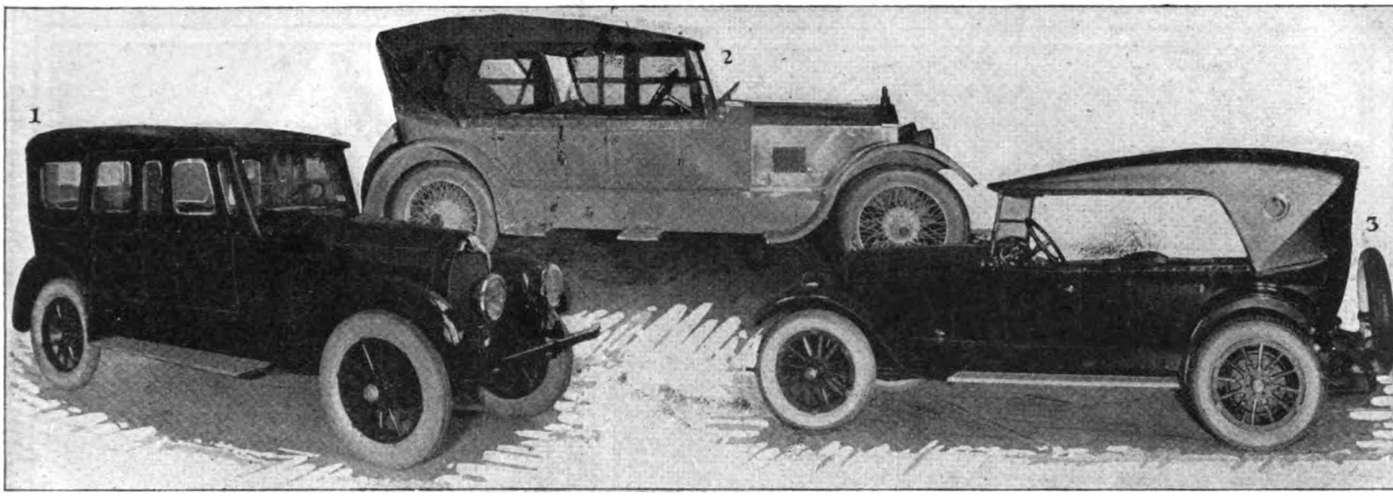
There is a tendency to show and use these cars with the tops up. This is in line with the current practice on other open cars. Many tops are snug-looking. The Cole, Roamer, R. & V. Knight and Haynes runabouts here illustrated are good examples of present practice. Windshield wings are desirable when the top is up, as they help to deflect air currents which otherwise pocket under the roof.

A rather radical change is in evidence on a number of open cars which have dispensed with the runboard and have, instead, cycle mudguards and steps. Disk and wire wheels are also quite popular. More makers are using disk wheels, and of these a number have the wooden disk type for the first time.

The touring bodies share equally with the runabouts in the addition of attractive features, but do not show



Four examples of up-to-date design in runabout bodies. (1) Cole, with well designed top. (2) Roamer, with low good appearing top, striped disk wheels, etc. (3) R. and V. Knight, showing cycle type mudguard and cast step. (4) Haynes, showing windshield wings, side wheel mounting, disk wheels, etc.



Three types of touring car tops. (1) Holmes, fitted with Artcraft all-season top. (2) Roamer, with novel back curtain, and body with leather covered top edge. (3) Stephens, with semi-Victoria top.

the same amount of redesigning. Most touring bodies are of conventional design, but brighter color combinations and an increased use of nickel parts is in evidence. The use of nickel on radiators is becoming quite general. Windshield standards also have the same finish in many cases and, where steps replace runboards, they are often cast in metal that permits the edges to be finished bright. Outside and inside door handles are the rule. Small cowl lamps are generally fastened to the base of the windshield post and these lamps, as well as the headlights, are often nickel-plated.

In some new models the bevel surface and the extreme straight line all the way through is being abandoned. The rounded radiator, hood and body shroud are of such height as to make these parts look large and substantial. When so made, they harmonize with the straight line on the top of the body, providing the body is of the flat-top type with slightly rounded outer edge. The tendency is toward this design, and it seems likely to become popular because the effect is pleasing and the manufacturing costs are not high.

The sport touring model, which has come in as a division of the touring type, has become well established. It is not required to be so comfortable as the larger touring body, hence the straight lines and angular surfaces will, on account of their advertising value, be continued longer on this type.

Much attention has been given the question of tops. The regulation touring top with emergency side curtains has reached a sensible state of development, but the need to converting the open body into a comfortable car for all-season use has necessitated the development of a top differing from the folding type.

The Artcraft all-season top, applied to the Holmes car shown in the accompanying cut, is a step in this direction. Other tops similar in appearance and apparently effective in securing the results desired are also being marketed. These tops are much superior in appearance to those designed heretofore for the same purpose. It is fair to predict, now that the time of inflated prices has passed, that competition will force the car manufacturers to incorporate this or a similar type of top as regulation equipment on one touring model.

Most of this year's touring bodies are of the five-passenger size. This, in fact, seems to be the size best suited for the majority of users. Seven-passenger models are, of coure, available, but they are not in the majority, as in previous years. In time the conventional type will probably be regularly equipped with some form of all-weather top, while the sport model will no doubt retain the lighter folding top.

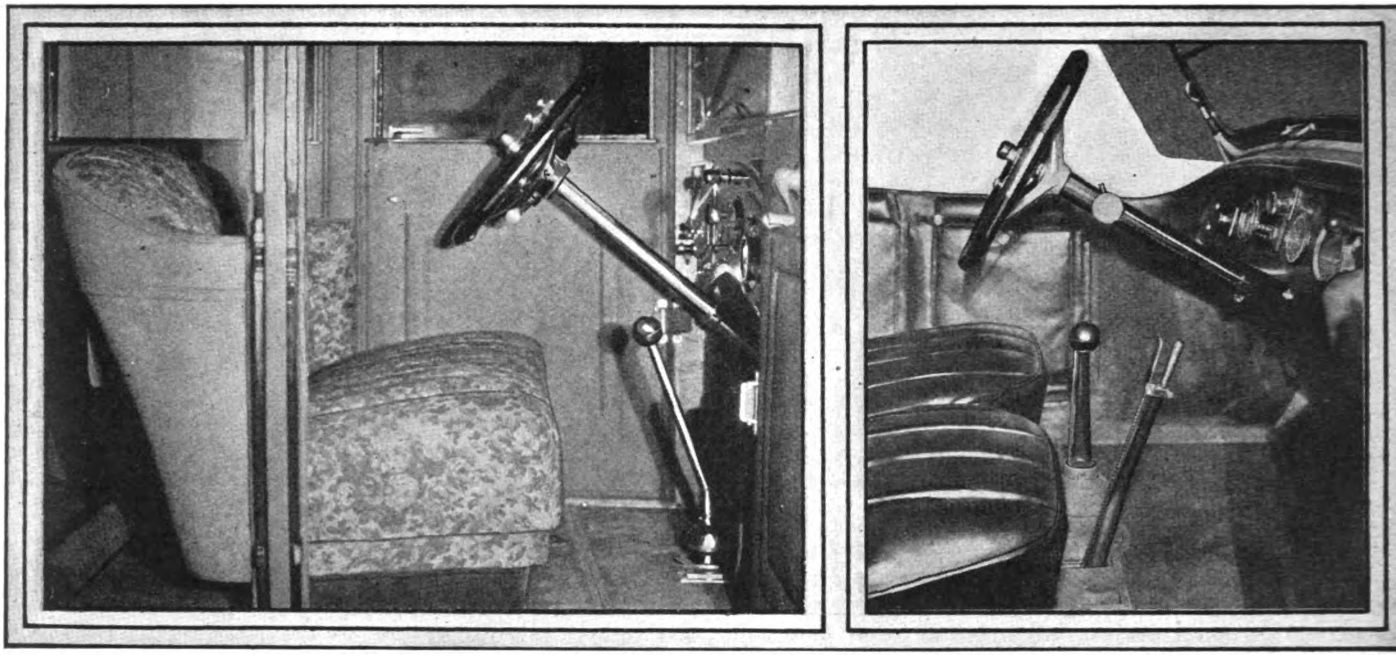
The top on the Stephens car, shown in the cut herewith, is an example incorporating the semi-victoria curtain with the back curtain, while that on the Roamer, shaped to come slightly around the corner, eliminates the gypsy quarter curtain.

The writer feels confident that the gypsy quarter will be superseded by the semi-victoria type. The objection to this type has been the cumbersome bulk that it forms when folded down, and the necessity of using a small triangular curtain to square the front up with the door curtain when the door opens from the rear. This latter objection can be satisfactorily provided for by making the triangle a part of the large curtain and simply folding it inward, buttoning it onto the bow when not needed. This eliminates a curtain that is irregular in shape, is not convenient to attach and adds weight in the curtain pocket.

The gypsy curtain has been used because it provides additional comfort by covering the quarter formerly left open. It leaves the impression that something is wanting, that part of the top is naked. The better appearance that the all-weather top presents when the side panels are removed, because the space above the seat is filled in, will, I believe, ultimately necessitate the use of a similar curtain on all tops.

The Roamer sport model has the unusual feature of a leather border about 5 inches wide entirely around the top edge of body. This matches the Spanish-finished trimming leather. This border extended across the shroud as far forward as the windshield and a flap buttoned tight at the base of tonneau windshield. In practice this may have the same objectionable feature as, at times, the flaps on doors have—that is, moisture collecting under the edges and running down in streaks. If fastened on with cement, this can be overcome and the effect made very attractive. Occasionally an entire car is covered with imitation Spanish leather, which, when well put on, is said to be durable.

In the touring, more than other body models, the rear must balance with the forward end of the car. This body is virtually a continuation of the hood and radiator, and, while a good low top with slanting windshield helps greatly on the side appearance, the real test of a well-proportioned design is the three-quarter front view, as this is the one that emphasizes comparative proportions. We have had in the past such an extremely rounded side that it gave the impression of a barrel ready to roll over,



Two methods of locating brake and gear levers in such a way as to facilitate access to driver's seat from the right door. Left, Jackson, right Mercer

and then again there has been the bevel edge that is not parallel with the top edge of the body, making the car look as if it is nosing down. There is less chance of making inharmonious effects with moderately rounded surfaces, and, for that reason, when experimenting with new proportions the results are apt to be more satisfactory where such surfaces are used.

A bird's-eye view of the car should always show an unbroken, rounded taper from the dashline back to the center of the rear wheel. The straight line of the hood to radiator should be tangent to this curve. If the dash width is narrow, so that a reverse curve must be used, the front has a "starved" look and shows something wanting. On the new runabouts the bottle-neck appearance which the extreme reverse curve gives is eliminated, for back of the seat these new bodies are now continuous with the body side, and fill the space between the mudguards, as well as being high enough to carry the body top line.

One real criticism of many of the touring models is that the seat does not look as comfortable as the old bodies, with higher sides and thick trimming rolls around the rear top edge. On the seven-passenger bodies, when the side heights were reduced, the extra seats prevented spreading out, and the height of cushions from the floor and slope of same was not proportioned to conform with the drop in the panel height. Now that the five-passenger body is the rule, there is no reason why the front seat-back cannot be set further toward the rear, the steering column be made a little longer, both cushions made with at least three inches slope and the seat-backs made to conform to the back of the passenger. The runabouts, as noted above, show a better average in this respect than most of the touring bodies.

The location of the front door on both open and closed bodies, to facilitate getting to the driver's side from the right, is important, as is also the position of the change gear and brake levers with respect to the front of the seat.

Two views, one on a Mercer and one on the Jackson, show how this has been provided for in different ways. On the Mercer both levers are short and work within a depression in the front of the seat and are sufficiently low to enable a man to slide over them. On the Jackson the levers are so well forward as to permit going behind them.

Trimming designs show little changes over last year. The French pleat is the style used, and the cushions are without facings. Black leather is used on seats and backs and imitation leather on the doors, back of front seats and other flat places of the touring and runabout models.

The commercial welt makes a neater finish on the doors and edges than was formerly the case with the home-made article. The usual number of bodies use fancy colored leather. These are always soft tones and in keeping with the color scheme.

The robe-rails are the strap kind. Very few use tonneau light or natural wood finish at the rear of front seat. Foot-rests are not considered as necessary as formerly. In fact, when the form of rear cushion is right, the need for foot-rests decreases. Instrument boards, even when of metal, are generally finished to imitate natural wood, but some few are dull black.

Mudguards show changes only when used with steps. At times these cycle guards come lower down at the front end than usual. The steps used are nearly always large and substantial looking and are generally cast of white metal so as to wear and finish bright. More lamp brackets than ever are fastened to the front guard with a tie-rod between.

The value of a high radiator was never more emphasized than this year. Changes in this respect made over last year are toward more expanse. The Pierce-Arrow is an illustration of this.

All the color combinations are sensible and, except in rare cases, the striping adds to the harmony. The disk wheel is an exacting unit in the color scheme. Striping on the disk must necessarily be a circle, and if this is overdone it gives the appearance of a target. Those that look best are of plain color, and, except in the white or yellow cars, the disk color is a lighter shade than the body. Aluminum painted rims better the appearance of the wheel.

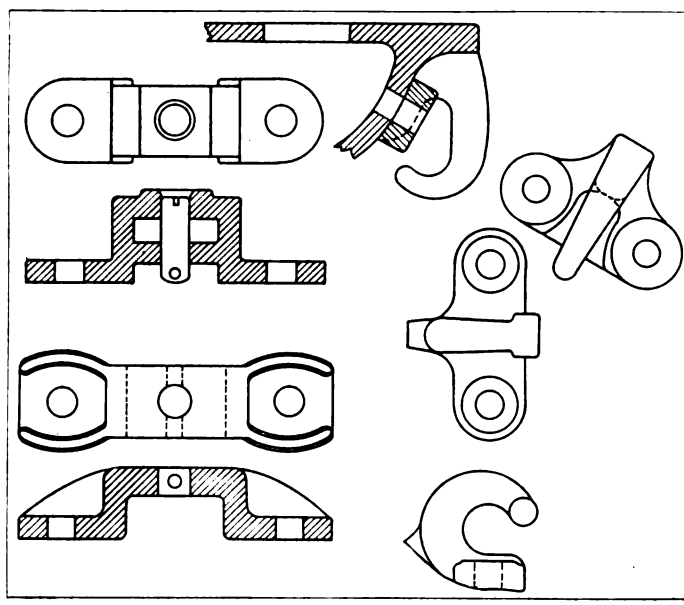
Color combinations are similar to those used in former years, but there are more cars using the bright colors.

The blues, as usual, are most used, at times with white striping. The stripe just below the top edge of the body and parallel thereto is used less than a year ago. In a few cases this line is continuous from the body and on the hood to the front. When the hood is rounded, a continuous line from the body does not look right. One of the best jobs of striping that has come to our notice is a blue touring car with white stripes in each door panel about 1 inch from the door edge all round. The colors most used on closed cars are lake and black, maroon and black and bronze green and black.

Wool fabrics are used more than last year for trimming of the closed bodies. Many of these fabrics have a smooth finish and some of them a pin stripe. Fewer two-compartment bodies are used. Vanity cases are usually the small visible type and these are used on a minority of cars only. Cowl lamps are not used on the closed cars as much as the open types.

Skid-Chain Fastening for Cast Steel Disk Wheels

IN connection with an editorial printed in AUTOMOTIVE INDUSTRIES of Jan. 6 relating to lack of means for applying anti-skid chains to cast steel disk wheels, our attention has been called to the fact that the Clark Equipment Co., who manufacture wheels of this type, have long been providing such means. The first steel disk wheels manufactured by the concern were for the Nash Quad. This was a single disk wheel, and 1-in. holes were drilled through the web of the wheel through which fastening means for the chain could be passed. There are several methods of fastening the chains when the wheel webs are thus drilled. The simplest method consists in the use of a bolt and nut. One end of the chain is then threaded over the bolt, the bolt is passed through the hole and the other end of the chain, and the nut put on. Nash and other manufacturers, however, use a special fastening. The bolt and nut method of fastening the non-skid chains is probably the quickest in operation.

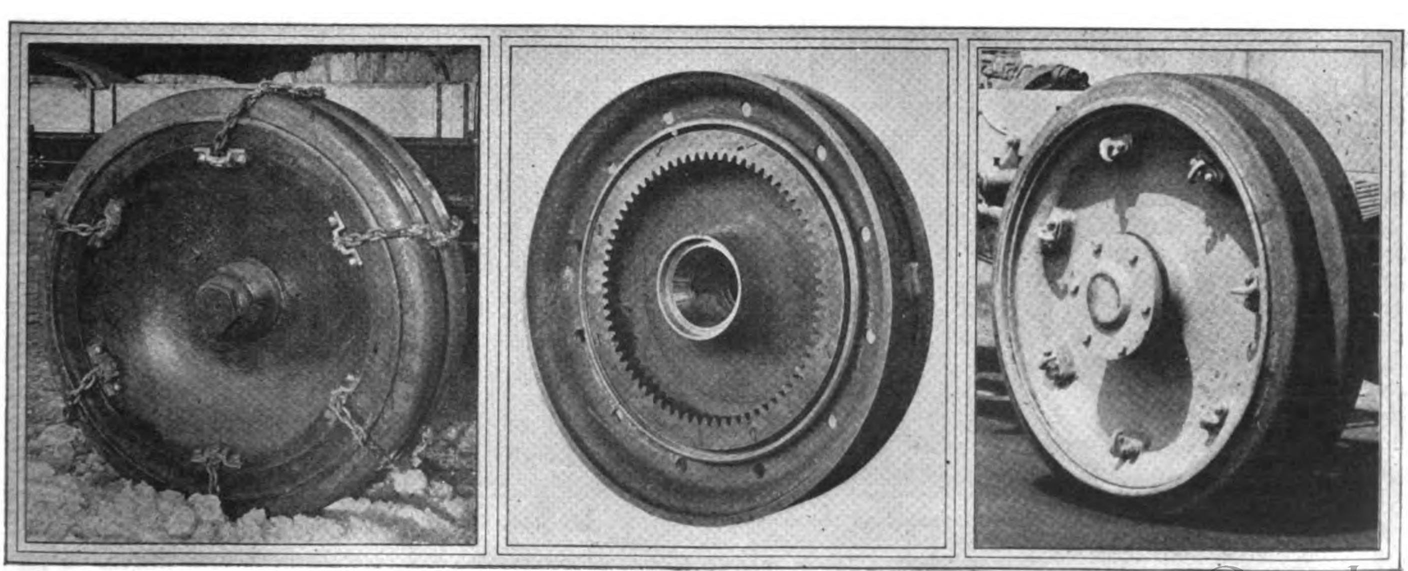


Methods of attaching anti-skid chains to cast steel disk wheels

On the larger double disk wheels of the Clark Equipment Co. with old style box section rim, the rims were drilled from the end. Several types of clamp have been designed by the Clark company and hooks are also used in connection with these wheels, the Titan Motor Truck Co., for instance, having designed a hook bolted to the rim of the wheel which it uses on its trucks. On a White truck used by the Clark company the clamps are bolted to the under side of the rim.

This box-rim type of wheel is now obsolete, however, having been superseded by the French type of rim. All wheels of this type made by the Clark company are cast with bosses on both sides of the web, through which holes are drilled. This permits of the application of any type of hook the manufacturer may desire. Some designs of wheels made by the Clark Equipment Co. and the hooks used are herewith illustrated.

The Engineering Subcommittee of the Empire Motor Fuels Committee, under the chairmanship of Dr. W. R. Ormandy, is conducting tests and experiments on the design and operation of internal combustion engines running on alcohol fuel and on alcohol-benzol-ether mixtures.



Cast steel disk wheels with provisions for fastening non-skid chains

Future Development of the Motorcycle in England

Two articles recently published in AUTOMOTIVE INDUSTRIES discussed the future development of the American motorcycle. It is interesting, in the light of those articles, to read this analysis of the English situation, written by a man who has closely observed the industry over there.

By M. W. Bourdon

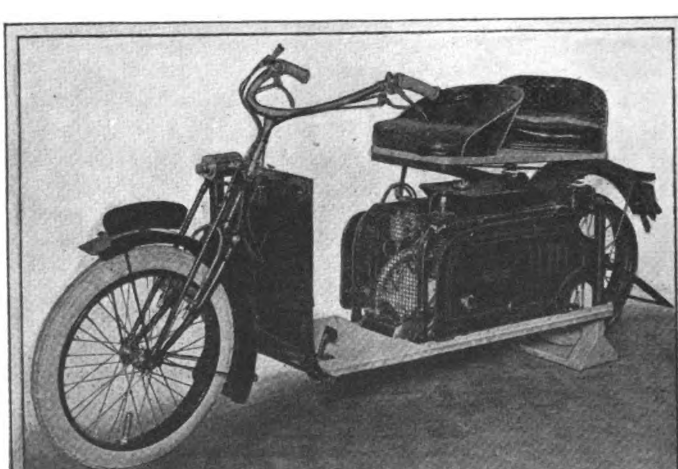
IT has been suggested that the present type of motorcycle in England has reached a stage of gross overdevelopment, and that it will be necessary, in order to tap the wider market which awaits it, to strike out on new lines of general design.

Speaking broadly, the 1920 type of motorcycle in its elaborately equipped and highly powered forms has not been designed at all; it has been merely evolved from the stiffened-up pedal cycle of 1900 with a 1 to 1½ hp. engine attached to a cumbersome and unsightly projectile still exhibiting some of the most obvious failings of its forerunners. The whole efforts and ingenuity—one hesitates to say engineering ability—of its makers have during the past 20 years been directed mainly toward making it faster and a better hill climber by piling on more power, causing it to become a more and more unsightly entity from both the esthetic and engineering points of view. Subsidiary endeavors have been concerned with making it more reliable and, in some cases, more comfortable for the rider.

But in the way of protection for the rider and his clothing, ease of upkeep, certainty of lubrication, cleanliness of outline, simplicity of control, quietness of running, fuel efficiency and other features there is evident little if any improvement over the machines of the early years of the century—in fact, in some of these points it does not equal the earlier models.

There is an engineering saying, the truth of which is admittedly open to argument at times, that "when a thing is right, it looks right." But no man with engineering instinct will suggest that the present day English motorcycle satisfies him visually.

Take the average frame as an example. There is a great deal to be said in favor of the tubular construction with its rigidity combined with low weight; but as usually applied to motorcycles it is a mere conglomeration of tubes of various sizes and shapes, adapted or arranged mainly to fall in with the whims of the moment as to engine size and type, with additions or variations made apparently as afterthoughts to accommodate other components and accessories.



A development of the scooter; the Reynolds Runabout. Has a 2½-hp. two-stroke engine, seat platform on quarter elliptic springs, 24 in. x 2¼ in. wheels, two-speed gearset, and chain and belt transmission

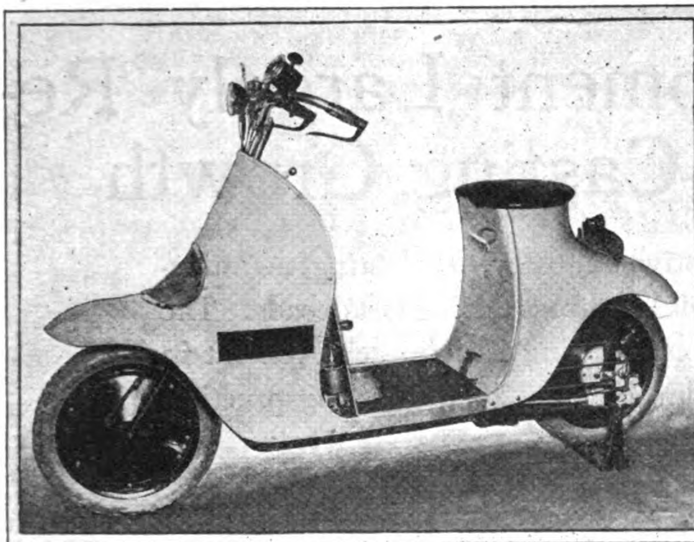
It has a tank of some nondescript shape clipped on here, a battery box with an outline that clashes with every other item strapped on there, a gearset bolted somewhere else and a multitude of control levers, wires and rods, oil pipes and fuel pipes, and the connections for other fittings running in every direction and at all angles with no particular shape or curvature.

"A mass of bits" goes a long way in describing a modern motorcycle, but to this should be added "exposed to mud, rain and the effects of vibration, and encouraging formation of rust and failure in operation."

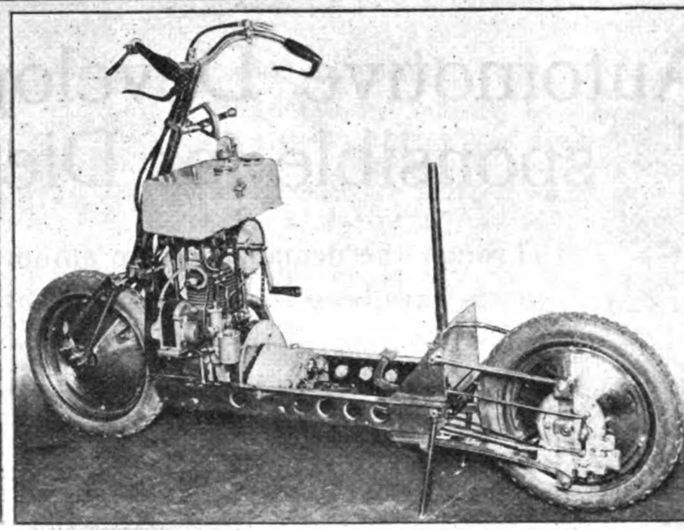
No wonder is it that the best engineering and automobile firms and the brains they could apply with advantage to the industry have, most of them, refrained from associating themselves or allowing their names to be associated with motorcycle production in the past. There are signs, however, that such firms are now inclined to allow their resources to move in this direction. Among British firms, Beardmores have since the war taken interest financially and otherwise in the industry, and now we have Vickers undertaking the production of engines for an existing firm; whether the latter implies a Wolseley motorcycle in the near future remains to be seen.

British car manufacturing firms who have long been motorcycle makers as well, were nearly all originally pedal cycle makers (e.g. Rover, Humber and Sunbeam). Their motorcycle departments are run by men still connected with the pedal cycles and the atmosphere of the latter still prevails.

There are, nevertheless, clear signs that in the motorcycle industry there are brains in plenty; but they appear to be misapplied or at all events limited in their application. No maker of renown has yet seen fit, or has had courage, to get out of the rut into which motorcycle design has fallen. Post-war productions do not



The Unibus with its engine, mud shields and seat fitted. The addition of side panels suggests itself to afford greater protection for the rider



Unibus chassis has a pressed steel frame, 2½-hp. single-cylinder two-stroke engine, two-speed gearset, open propeller shaft and worm drive

depart from pre-war practice to any marked extent and then only in detail.

The piling up of "refinements" on the existing structure is leading nowhere and development where it occurs—as in the lightweight section—is mainly a matter of recommencing the circle.

All this leads to a consideration of possible developments, and in the writer's opinion—confirmed by that of men known for their breadth of view and associated with motorcycle production, though held in check by the interests they serve—the fundamental requirement is a fresh design of frame.

It cannot be denied that the existing type of machine appeals almost entirely to men below 40 years of age, the majority being enthusiasts below 30 who desire speed above all else. The sidecar combination certainly attracts men of small means, but they have to take a machine of the type produced for the speedman.

They would much prefer one which afforded them more protection and greater comfort, and did not necessitate the use of special overall clothing to keep them warm and clean. They really need an ultra-lightweight car on two wheels for solo work, and two seats for passenger work, either tandem fashion or with the second seat in a side attachment, and in their desires they have with them innumerable potential purchasers who will not at any price buy or use either a solo or sidecar on existing lines.

Such a new type of machine clearly necessitates a fresh design of frame, roughly a looped pattern with a low platform in front of the seat allowing the use of normal warm overcoats for cold weather riding.

The next requirement is more protection for rider, engine, transmission and controls from rain, mud and dust. This implies better mudguarding, a panel in front of the rider, partially enclosed engine, and a completely enclosed transmission.

Two machines at the Olympia Show contain the germ of the type in mind, so far as their general arrangement goes. These are the Unibus and the Reynolds Runabout, illustrated herewith. It is not suggested for a moment that these two machines as they stand are practical general purpose or touring mounts, but they appealed to many far-seeing men at Olympia as having very distinct possibilities for development.

The Unibus, in particular, is of interest in this connection. While it now has wheels far too small (16 in. diameter) and an engine also on the small side (2½ hp.), it has all the elements of a successful type. A general description of it is as follows: Pressed steel frame supporting the engine under a detachable hood in front with the clutch and gearset arranged car fashion in the frame; open propeller shaft drive to worm gearing alongside the back wheel, the latter connected to the frame by a pair of quarter elliptic laminated springs and a pair of parallel radius rods; two sets of expanding brake shoes within the worm wheel; articulated front forks with quarter elliptic springs almost parallel with the tubular members; a pedestal seat having below it a detachable hood forming the rear mudguard; a hinged panel in front of the rider gives immediate access to the engine. Through this panel projects the starting crank with chain connection to the clutch on the crankshaft. Both wheels are readily detachable and could easily be made interchangeable.

In the Reynolds runabout a simple frame of tubular construction, with duplicated and parallel side members, has two side arches between which the engine and transmission are located and on the top of which is a platform on quarter elliptic springs for one or two bucket seats. Engine and transmission are screened by detachable side panels and by a wire front to admit air, each side panel having a scoop to direct more air onto the cylinder. In this case a chain and a belt form the transmission. These could with advantage in some respects be superseded by a shaft and worm or helical bevels. Again, the wheels are easily detachable for tire repair and both engine and gearset can be removed from the frame without difficulty.

Both these machines sell at approximately £100 (say $500) at present. The first is being made by an airplane plant established during the war and the other by a quite small concern. Neither has yet attained any considerable output. Both machines could be made little or no heavier than a present-day motorcycle of similar power.

The rider's seat would have to be such as to afford him more "grip" of the machine for steering on rough surfaces and at speed. But there are the fundamentals for a new type, with the economy, reliability and most of the speed of the present day machine.

Automotive Development Largely Responsible for Die-Casting Growth

Through the demands of the automotive industry, die-casting manufacturers have been forced to do "impossible" things during last decade. The commercial perfecting of the aluminum casting is main achievement in this period. Here is a story of the development of die-casting practice.

DIE-CASTING owes its technical and commercial development to its contact with the automotive industry more than does any other type of casting or forging. The thirtieth birthday of the first die-casting plant has not yet been passed, but the manufacture of die-castings now reaches an annual production of about three million pounds a year. More than fifty firms are producing die-castings at the present time, although a large percentage of the total tonnage of the industry is produced by some five or six firms.

Though the die-casting industry is almost thirty years old, its growth was not uniform throughout this period. Die-casting manufacture was begun by H. H. Franklin in 1892, but the growth of the industry during the first twenty years of its existence was not nearly so rapid as during the last decade. During this last ten years die-castings came to be used extensively for automobiles and trucks, so that the die-casting industry was enabled to partake to the fullest extent of the benefits incident to the rapid growth of the automotive industry.

During the first decade of its existence, the die-casting industry was concerned with the production of castings for phonograph, telephone, cash register and similar parts, and it was not until 1904 that die-castings were used in automobile construction. H. C. Skinner, general manager of the Franklin Die-Casting Corporation, states that:

"As far as the writer knows, the die-castings were first used in the automotive industry on the Franklin automobile. The first die-cast part was a connecting rod bushing for the 1904 engine. This took the place of bronze, and the results were so satisfactory that bronze bushings were eliminated except in the case of the small end of the connecting rod."

The Doehler process came into commercial being about 1906 and since that time other firms have been organized, some dying after a short life, others still in successful operation. The progress of the industry as a whole, however, has closely paralleled that of automotive development.

Technical Phases

The general principles underlying die-casting manufacture are familiar to automotive engineers. The process may be defined as "metal castings made by forcing molten metal, under pressure, into a metallic mold, known as a die."

The types of die-castings manufactured readily divide into these classes:

1. Aluminum base alloys.
2. Zinc base alloys.
3. Tin base alloys.
4. Lead base alloys.
5. Brass and bronze.

The lead base alloys find a very limited use in the automobile industry, since the castings produced from these materials do not have the qualities necessary to make them suitable for extensive automotive use. The tin base alloys are used in making babbitt bearings, but their use is practically limited to such castings so far as automobile work is concerned. There is a very large tonnage absorbed by the automobile industry, however, for this purpose.

Before 1914, probably 90 per cent of the die-castings produced were of zinc base alloys. Since that time, however, the development of aluminum die-casting has made the zinc base castings of less importance. At the present time aluminum base castings constitute probably 30 per cent of the total die-castings production, zinc base castings about 22 per cent.

The zinc base castings are considered adaptable to such parts as magneto housings, switch locks, switch handles, self-starting devices, oil pump parts, speed indicators and windshield nuts. The tensile strength of zinc base castings often runs as high as 20,000 pounds, but at least one authority states that they cannot be depended upon for more than 10,000 lb. when used in any vital part.

The die-casting of aluminum became commercially possible about 1914. Experimental work had been going on for many years before this, but it was not until the beginning of the war that the process was perfected so that its use would be profitable in a commercial way. Since that time, however, the aluminum die-casting has become very widely used and now constitutes a large percentage of the total production of the industry.

The chief properties of the aluminum casting which give it popularity as opposed to the zinc base castings are:

1. Freedom from the crystalline, a structure which characterizes zinc base castings. This property makes the aluminum casting more permanent and more reliable.
2. Greater strength.
3. Lower specific gravity.
4. Higher melting point and greater resistance to varying temperatures.
5. Greater ductility.
6. Lighter weight for any given strength.

The disadvantage of the aluminum casting, of course, is its high price due to the greater difficulty in casting this metal as well as to the higher original cost of the metal itself.

Brass and Bronze Die-Castings

There has recently been some discussion between various die-casting experts concerning the possibility of die-casting brass and bronze in such a way as to make the product commercially practicable. Thousands

of dollars have been spent during recent years in attempts to produce dies capable of standing up under the relatively high temperature necessary to melt and cast brass and bronze. Charles Pack, production manager of the Doehler Die-Casting Co., states that it has been technically possible to produce brass and bronze die-castings for ten years, but that up to the present time no die material has been discovered which would withstand the casting process for a sufficient length of time to render production on a commercial basis economically possible.

In making this statement, Pack calls attention to the definition of die-casting as being "the production of metal castings by forcing molten metal, under pressure, into a metallic mold." Several of the well known die-casting companies are producing bronze castings at the present time, but by a pouring, rather than a pressure, process.

Aluminum bronze die-castings, however, are being produced by the Buffalo Bronze Die-Casting Co. by a pressure process, conformable to the definition of die-casting given above. This company claims to have found by long experiments a die material capable of standing up under the necessities of aluminum bronze die-casting production. Castings are being produced by this method for some of the best known automobile companies.

There are certain limitations to aluminum-bronze die-casting, however, according to T. W. Jeacock, president of the Buffalo concern, which are not experienced in connection with the aluminum casting. Certain intricate shapes can be cast in aluminum which are not yet possible in bronze. On the other hand, the bronze casting is specially adapted to parts requiring more strength than the aluminum casting can give. Moreover, this concern does not claim to be able to die cast all bronze and brass alloys, but simply an aluminum-bronze alloy.

The following list covers the aluminum-bronze castings which are being made at the present time by the Buffalo concern:

- Windshield Parts: Sash Pivots, Upper and Lower.
  - Glass Retaining Clips.
  - Sash Pivot Clamps.
  - Sash Pivot Clamp Thumb Screws.
  - Sash Corner and Connecting Brackets.
- Steering Arm Ball Sockets.
- Shaft Lever Ball Sockets.
- Gasoline Control Gears.
- Spark Control Gears.
- Spark Control Levers.
- Gasoline Control Levers.
- Instrument Board Brackets and Fixtures.
- Door Handles.
- Door Locking Bolts.
- Door Hinges.
- Door Strap Holder Plates.
- Door Window Adjusting Levers or Cranks.
- Door Strikers.
- Hub Cap Latches.
- Carburetor Body Plug.
- Carburetor Float Balance Weight.
- Carburetor Air Valve Cam.
- Gas Tank Shut-off Handle.
- Elbow Gas Tank Outlet Cock.
- Elbow Oil Pressure Gage.
- Chamber Plugs.
- Cap Oil Pump Driving Shaft.
- Battery Box Cover Dowel.
- Worm Driving Gear: Teeth cast in Truck Driving Gear.

It has not been our purpose to enter into the technical details of this discussion, but merely to present to engineers the discussion itself, in giving a brief statement of the claims made by the various parties interested.

Influence of Automotive Industry

Not only has the automotive industry been largely instrumental in the commercial growth of die-casting, but it has influenced strongly the technical development as well. As the demands of the automotive industry became more varied, the die-casting manufacturers were spurred on to greater technical and research efforts and many times within recent years it has been found possible to die-cast certain pieces which had previously been considered impossible of manufacture by this method.

Rapid progress has been made during the last five years, yet it is the universal opinion among die-casting experts that the art of die-casting is still in its infancy. The die-casters have been able to do so many things recently that at one time they thought impossible that they hesitate to predict any limits for future possibilities.

There are certain rather definite limits, however, to the commercial possibilities of the die-casting art at present. These should be considered by the engineer in making up his designs and he should bear in mind that there is a real difference between technical limitations and commercial limitations. In other words, the die-casting manufacturers may be able, by the exercise of considerable ingenuity and some extra work, to die-cast a specially difficult part, but the cost will be in proportion. On the other hand, it might be possible, through a recognition of the limitations of die-casting practice, to simplify the design of that part in such a manner that its production would be cheaper and its fundamental characteristics preserved without essential changes.

Benefits of Consultation

The best results can usually be obtained if the die-casting manufacturer is consulted regarding production possibilities before the design is so far along that change of a specific part will necessitate major changes elsewhere. Practically all the leading die-casting producers are glad to render such service to customers or prospective customers, and regard it as an essential part of their merchandising policy. If they can make suggestions leading to a reduction in cost of the product, it is to their advantage since their percentage of profit is the same in any case, and the reduced cost means a satisfied customer.

The die-casting manufacturers can undoubtedly be of great assistance to the automobile designer if they are consulted in the early stages of design concerning parts which the designer would like to have die-cast. The die-casting manufacturers seem to understand fully and to admit frankly the limitations of their practice and for this reason are worth while consulting. One prominent executive of the die-casting industry said recently that "the die-casting industry has suffered from over-enthusiasm." Engineers have sometimes tried to get die-castings for parts not suited to this form of manufacture and the result has been unfortunate for all parties concerned. This sane view of their own industry is rather characteristic of die-casting manufacturers.

The advantage of the die-casting, of course, lies in the small amount of machining necessary, the rapidity of production and the adaptability to the manufacture of parts in large quantities. Die-casting limits vary from plus or minus .0005 in. to .0025 in. per inch of diameter or length. Bronze castings, made by the regular die-casting method, can be made in most cases to limits of plus or minus .002 in. per inch of length or diameter;

in many cases to closer limits, according to the Buffalo Bronze Die-Casting Co.

Die-Casting Output

General statistics concerning the die-casting industry are difficult to obtain, since there is no association of die-casting manufacturers. It would not be surprising to note the formation of such an association in the near future, although there is not an undivided sentiment in favor of an association among the various manufacturers. Approximate figures, however, based upon the "educated guess" of some man connected with the industry for many years give some indication of its size and growth.

If business had continued normal throughout the year the production of the entire die-casting industry for 1920 would have amounted to nearly 3,000,000 lbs. Of this total the percentage of each of the chief types may be roughly estimated as follows:

1.	Aluminum base	35%
2.	Zinc base	25%
3.	Tin base	27%
4.	Lead base	8%
5.	Brass and bronze	5%

This total of nearly 3,000,000 lb. for the 1920 output would indicate that the die-casting industry has multiplied about 10 times since 1913, before the war boom, followed by the increased demand of the automotive industry, enabled it to grow to its present proportions. In 1913 practically no aluminum die-castings were produced commercially, while to-day aluminum castings lead the field. The improvement of the process of aluminum die-casting to the point where it was commercially practicable accounts to a large extent for this enormous growth.

Making estimates on the basis of the approximate figures already used, it is possible to estimate the percentage of this output which is now absorbed by the automotive industry. Of the estimated output for 1920, approximately the following percentages went to the automotive industry. Of the output of

1.	Aluminum base die-castings	75%
2.	Tin base die-castings	90%
3.	Zinc base castings	50%
4.	Lead base castings	1%
5.	Brass and bronze castings	90%

Utilizing a weighted average on the basis of the figures presented, then, it may be said in a general way that the automotive industry absorbs about 67 per cent of the total output of the die-casting plants in this country.

To a very large extent die-casting may be said to occupy a special field. It comes into competition with the forging and the malleable and steel casting only in a few instances, since, with the exception of the bronze alloys, the very material from which it is made confines its use to parts where great strength is unnecessary.

Suggestions for Designers

As the die-casting industry has been so closely bound up with the automotive industry, in the past, so future developments bid fair to make closer that relationship as time goes on. Through the co-operative activities of the two, distinct advantages apparently lie ahead for both parties concerned. Some practical suggestions in regard to such co-operation are contained in a booklet issued recently by one of the prominent die-casting concerns. Under the heading, "Suggestions for the Designer," appear the following:

"In designing for die-castings, there are certain points which, if borne in mind, will aid in their successful use.

1. In dealing with steel cores, as is necessary in a process producing finished parts, undercuts or recesses in the castings should be avoided. In many cases it is, of course, possible to use collapsible cores, but this increases the cost of both dies and castings.
2. To give added strength, pins, rings, and other bushings made from brass, bronze or steel may be inserted in casting.
3. No allowance for shrinkage or machining should be included in making drawings except where the limits are such that a special operation is desired, when it should be clearly noted.
4. Parts which require little or no machining after being sand cast or which can be economically produced by stamping or screw machine methods are not usually adaptable to die-casting.
5. It is cheaper to cast raised than depressed letters or figures, but both are practical.
6. Small fillets added at sharp corners greatly strengthen the casting and increase the rate of production.
7. The cost of die work can sometimes be reduced by our knowing the important dimensions, both where accuracy is required and where it is not essential.
8. The following limits should be borne in mind in designing for die-casting:

(A) Limits—Maximum Weights for Casings.
Aluminum—3 pounds.
Tin Base—8 pounds.
Lead Base—10 pounds.
(B) Limits—Minimum Wall Thickness.
Lead—1-32 inch.
Tin—1-32 inch.
Zinc—1-8 (on small castings 1-16 inch).

List of Automotive Parts That Are Being Made by the Die-Casting Process

Air shutters
Ball bearing retainers
Bearing bushings (crankshaft, camshaft, connecting rod, starter, generator, gear shift lever, clutch pilot, oil pump, shifter fork guide, speedometer drive shaft)
Bracket support (accelerator)
Brush holders
Body trimmings
Brush holder covers
Butterfly valves
Camshaft bearing cap
Carburetor float valve parts
Carburetor needle valve pointer
Carburetor float chamber cap
Circuit breaker parts
Foot button guide (accelerator)
Front axle yoke cap
Generator end plates
Gears for control mechanism
Gear cases (small)
Governor weights
Hub caps
Ignition distributor head
Instrument parts
Lamp bodies
Lamp doors
Lamp guard holders
Magneto bases
Magneto bearing plates
Magneto oil reservoirs
Motometer frames
Oil pump bearing caps
Oil pump gears
Oil pump bases
Pedal shanks
Piston pin retainers
Radiator caps
Rim lugs
Rotor hubs (magneto)
Radiator emblems
Switch levers
Spark coil heads
Spark and throttle levers
Spark and throttle sectors
Speedometer parts
Steering wheel spiders
Thermostatic devices
Tire brackets
Tire mould parts
Vacuum tank parts
Vibrator spring supports
Water pump housings
Windshield fittings
Wire control cable clamp
Wire wheel parts

Aluminum—1-8 inch (for small castings 1-16 inch).

(C) Possible Variations from Drawing Dimensions Per Inch of Diameter or Length.

Lead	plus or minus .001
Tin	plus or minus .0005
Zinc	plus or minus .001
Aluminum	plus or minus .0025

Where the distance involved is several inches these may sometimes be reduced.

(D) Maximum Number of Threads.

Lead, external	24 per inch
Zinc, external	30 per inch
Tin, external	34 per inch
Aluminum, external	20 per inch

In the case of aluminum, where close fit is required, thread should be cast oversize and chased.

Where economical, internal threads can be cast in parts made from zinc, tin or lead base alloys, but this is not possible in parts made of aluminum.

(E) Holes.

Lead, Tin, Zinc—1.32 inch minimum.

Regulated by depth of hole and thickness of casting.

Aluminum—3.32 inch minimum.

Size of hole is dependent on its length and the general design of castings. Holes not cast can usually be spotted to facilitate drilling.

(F) Draft.

Lead and Tin—Cores, .0005 per inch of length and diameter. Side walls .001 per inch.

Zinc—Cores .001 per inch of length and diameter. Side walls .001 per inch.

Aluminum—Cores .015 per inch of diameter and length. Cores less than ¼ inch diameter to have .005 per inch of length and diameter. Side walls .005 per inch.

While the above draft is desirable, it is sometimes possible to modify these limits where they would interfere with the service required.

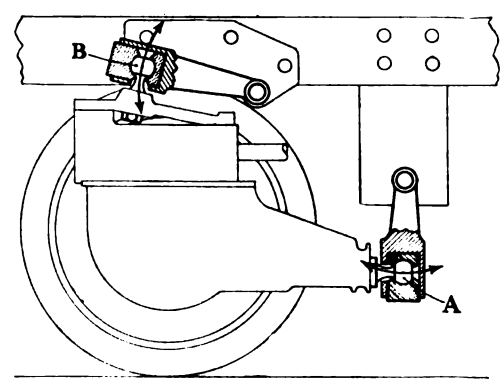
The accompanying chart comprises a composite list, made up from the suggestions of several leading firms, covering those parts which the die-casting manufacturers believe can profitably be made for automotive use by means of die-casting.

A Helical Spring Suspension for Motor Vehicles

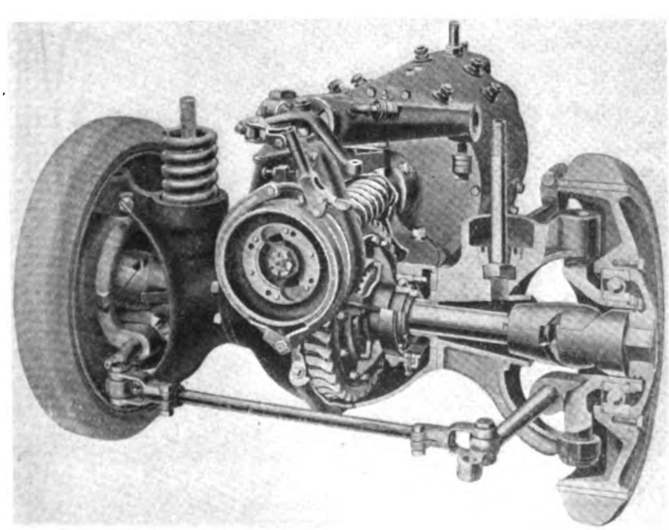
A NEW construction for taking up driving and braking strains is found in the Duplex compensating suspension for motor vehicles incorporated in the new series C Baker electric industrial tractors and trucks. The frame of these trucks and tractors is supported on double concentric helical springs providing the necessary cushioning effect, but the principle involved is adaptable also to other forms of motor vehicles with more conventional springing.

The helical springs referred to above are loosely mounted in pockets cast in the chassis and axle members respectively and support the chassis load only. Swivel studs, free to oscillate in their retaining sockets, hold the springs under proper compression when the vehicle is light, and resist the tendency of the chassis to rebound off the springs when traveling over a rough surface. These spring studs, thus tying together the chassis and the axle, are free in their seats within limits fixed by the torque resisting devices.

Referring to the drawing, the forward torque member, supported in trunnions from the chassis frame, takes all driving strains through a large ball and socket A attached to the motor supporting cradle which forms an extension of the axle housing. A second similar construction B, mounted in a horizontal plane above the power unit, holds the axle in alignment and resists all axle thrusts resulting from forward or backward motion.



Baker R. & L. duplex compensating suspension



Baker R. & L. industrial truck axle

Improvements in a Line Drive Tractor

(*Continued from page* 803)

tral, as for belt work, and stopping on grades. The operating lever A, Fig. 2, is held by spring clips on its quadrant B in both the on and the off position. The brake drum C is still mounted on the universal joint just behind the front drive axle.

As an aid to the operator the tractor is now furnished with a steering indicator A, Fig. 3, and notches B, C and D to indicate the extreme steering range and the straight ahead position. This enables the operator, who always drives the tractor from the implement seat, to steer rapidly and accurately.

The steering clutches A, Fig. 4, are now plain cones, metal to metal, instead of the expanding ring type, in order to eliminate the need for adjustment for wear during the life of the clutches.

The photographs show clearly the essential parts of the mechanism, namely, the steel steering worm with its bronze gear (at S, Fig. 3), the cam arrangement for gear shifting (at A, Fig. 1), the steering clutch assembly (at A, Fig. 4), the transmission, the Torbensen tractor axle, and the five bearing crankshaft in the Hercules engine.

Machining Cylinder Blocks on Drum-Type Continuous Miller

HERETOFORE the top and bottom faces of cylinder blocks have generally been faced off in horizontal milling machines with long tables to which a considerable number of the castings could be strapped at the same time. The illustrations herewith show a machine of the drum type specially designed for handling cylinder castings. This machine is quite compact, and it is also continuous in operation, loading of the drum going on while the machine is in operation.

One of the illustrations shows the milling operation on the top and bottom faces of the cylinder block and the other the same operation on the end surfaces of the block. By performing milling operations on opposite sides of a casting at the same time, one handling is obviated and the surfaces are bound to be parallel.

In milling the top and bottom of the block, two small cutters are used for roughing and one large cutter for finishing. The two small cutters are not operating on the same section simultaneously. Moreover, the roughing and finishing cuts do not occur upon the same casting simultaneously.

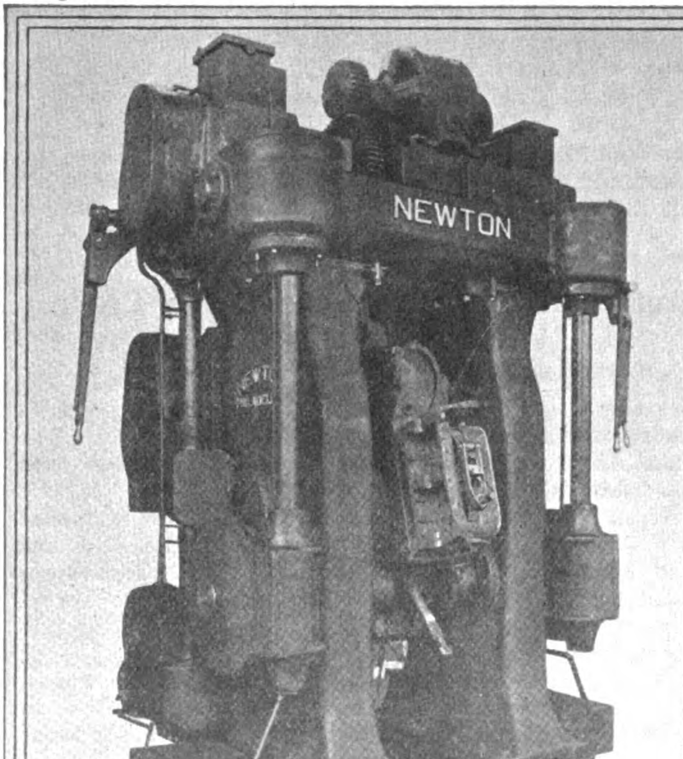
All spindles have individual adjustment and are driven by worms and worm wheels, the cutting speed of the finishing cutters being 20 per cent less than that of the roughing cutters. Different cutter speeds can be obtained by means of pick-off gears. The drum is rotated by herring-bone gears and worm and worm wheel, and its speed can also be changed by means of pick-off gears. The drum spindle is of the double taper bearing type, with very fine adjustment to prevent end motion. The other bearing of the drum spindle is provided with a take-up bushing of the split taper type.

All gearing, splined shafts and revolving parts are inclosed and run in a bath of oil. There are oil reservoirs on both sides of the machine and oil is constantly circulated by means of pumps. All slow running bearings, such as the spindles, are provided with special means of lubrication, so they will not become flooded.

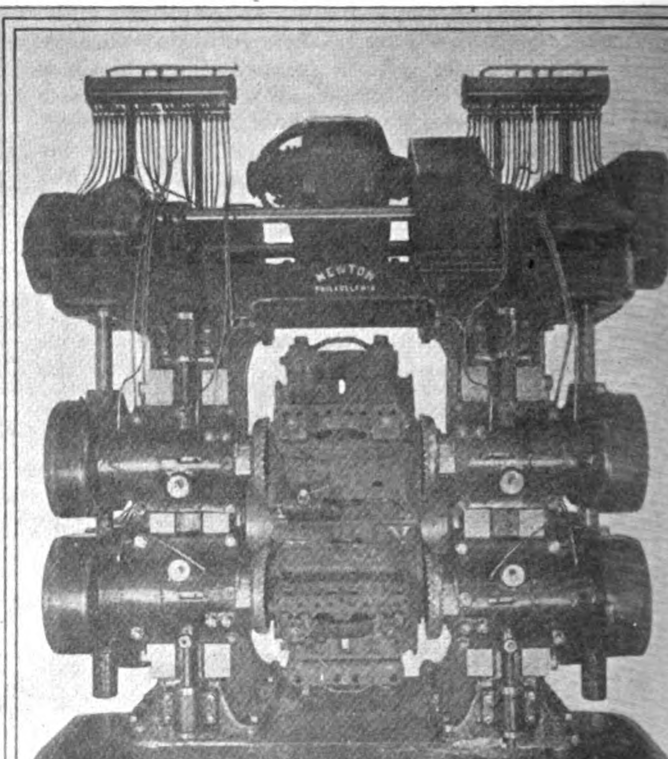
In chucking the cylinder block, use is made of a clamp with double bearing, which simplifies the handling. Machining the top and bottom of the four-cylinder block, as shown in the illustration, is accomplished at the rate of 25 per hour, in regular operation, we are assured. The rate of production in milling the end surfaces of the cylinder block, as shown in the other cut, is 35 per hour.

The advantages claimed for the method of cylinder machining here illustrated are that much floor space and much labor cost are saved. The machines are manufactured by the Newton Machine Tool Co.

THE announcement is made by the Secretary of the (British) Department of Scientific and Industrial Research that the Research Association for the Cast Iron and Allied Industries has been approved by the Department as complying with the conditions laid down in the Government scheme for the encouragement of industrial research.



Facing top and bottom of engine block



Facing ends of engine block

Exports of Automobiles and Tires for February, 1921

COUNTRIES	—Commercial— Complete Cars		Chassis		—Passenger— Complete Cars		Chassis		Parts	—Tires— Casings	Inner	Solid
Europe												
Austria	1	$ 520	...	$......	2	$ 1,450	...	......	$ 942	$......	$......	$......
Azores and Madeira Is.	...	......	...	......	...	......	...	......	13	......	......	......
Belgium	...	......	...	......	11	24,198	...	......	3,361	33,158	6,697	......
Bulgaria	...	......	...	......	10	4,887	...	......	......	......	......	......
Denmark	...	......	...	......	5	7,759	...	......	44,627	12,148	36	150
Finland	...	......	...	......	4	5,490	...	......	2,869	......	......	671
France	...	......	...	......	9	32,910	...	......	30,852	30,250	12	......
Germany	...	......	...	......	2	2,200	...	......	4,168	300	12	......
Gibraltar	...	......	...	......	...	......	...	......	1,020	......	......	......
Greece	4	7,922	...	......	7	19,981	...	......	8,902	4,540	130	......
Iceland and Faroe Is.	...	......	...	......	2	2,700	...	......	541	......	......	......
Italy	...	......	...	......	2	7,000	...	......	13,224	6,606	......	......
Malta, Gozo, etc.	...	......	...	......	9	3,744	...	......	568	910	......	......
Netherlands	7	3,566	2	8,000	27	32,515	...	......	34,029	11,679	5,525	......
Norway	2	7,747	...	......	10	16,158	2	$ 2,666	14,526	6,634	301	68
Poland and Danzig	...	......	...	......	2	3,329	...	......	......	......	......	......
Portugal	...	......	...	......	12	31,094	...	......	5,194	2,629	227	40
Roumania	...	......	...	......	3	11,500	...	......	781	148	......	......
Spain	2	5,160	...	......	50	106,292	3	3,207	78,966	27,363	5,271	2,391
Sweden	24	49,111	...	......	38	52,986	...	......	22,489	29,699	2,194	......
Switzerland	...	......	...	......	9	20,352	...	......	6,701	2,814	......	......
Turkey in Europe	...	......	...	......	1	2,646	...	......	5,738	3,495	......	......
England	...	......	21	38,500	6	13,448	12	14,318	409,356	89,193	8,740	3,143
Scotland	...	......	...	......	...	......	...	......	953	......	......	......
Ireland	...	......	...	......	1	750	...	......	10,224	......	......	......
Yugoslavia, etc.	...	......	...	......	...	......	...	......	429	......	......	......
North and South America:												
British Honduras	...	......	...	......	...	......	...	......	863	265	78	......
Canada	68	124,356	12	16,495	168	313,085	3	4,246	749,408	93,818	9,059	496
Costa Rica	...	......	...	......	...	......	...	......	823	......	11	......
Guatemala	...	......	...	......	...	......	...	......	3,244	4,870	1,052	408
Honduras	...	......	...	......	...	......	...	......	4,560	754	96	595
Nicaragua	...	......	...	......	1	1,200	...	......	2,379	1,303	1,022	......
Panama	3	1,864	1	615	33	32,550	...	......	18,377	23,386	1,781	747
Salvador	...	......	...	......	...	......	...	......	639	2,327	572	......
Mexico	209	293,153	12	26,729	452	339,822	...	......	143,144	105,987	22,192	12,696
Newfoundland and Labrador	...	......	...	......	...	......	...	......	2,947	97	29	......
Barbados	...	......	...	......	9	7,580	...	......	1,547	3,512	261	......
Jamaica	5	10,348	3	1,289	28	18,038	...	......	16,897	2,092	121	913
Trinidad and Tobago	...	......	...	......	1	1,500	...	......	15,710	10,359	1,232	2,768
Other British West Indies	1	510	...	......	1	433	2	4,400	9,885	2,601	305	231
Cuba	41	54,476	11	26,575	154	193,733	...	......	308,981	59,055	11,072	16,697
Virgin Islands of United States	2	1,122	...	......	1	510	...	......	1,777	371	161	......
Dutch West Indies	...	......	...	......	2	923	...	......	1,433	2,045	287	......
French West Indies	...	......	...	......	2	1,020	...	......	9,392	......	......	138
Haiti	2	899	...	......	6	6,000	...	......	7,598	1,214	208	......
Dominican Republic	...	......	...	......	2	2,163	...	......	23,214	7,810	1,875	97
Argentina	6	18,097	4	10,127	128	191,515	5	7,008	104,964	109,478	8,917	2,278
Bolivia	...	......	...	......	1	2,536	...	......	4,825	739	......	......
Brazil	2	15,395	...	......	41	75,521	2	3,880	127,080	14,368	519	380
Chile	...	......	...	......	24	45,258	...	......	27,014	6,471	1,059	623
Colombia	...	......	7	10,854	4	6,394	...	......	17,465	7,883	695	451
Ecuador	1	4,800	...	......	6	4,945	...	......	1,462	2,942	682	201
British Guiana	...	......	...	......	...	......	...	......	2,444	3,908	390	......
Dutch Guiana	...	......	...	......	...	......	...	......	737	616	96	......
Paraguay	...	......	...	......	...	......	...	......	3,851	......	......	......
Peru	13	10,050	9	13,587	7	33,378	...	......	50,736	23,663	2,908	788
Uruguay	...	......	...	......	11	16,830	...	......	14,600	23,367	658	......
Venezuela	...	......	...	......	46	49,511	...	......	10,489	7,021	923	......
Asia and Far East:												
Aden	...	......	...	......	2	1,490	...	......	381	2,520	200	......
China	5	11,030	7	7,400	95	97,397	8	6,300	32,866	13,304	635	......
Kwantung	1	3,600	...	......	...	......	...	......	80	......	......	......
Chosen	...	......	...	......	...	......	...	......	2,389	1,918	562	......
British India	5	11,939	3	12,375	40	60,476	...	......	117,239	26,949	6,432	18,332
Straits Settlements	20	47,467	29	80,206	72	104,722	...	......	36,296	31	......	3,475
Other British East Indies	...	......	...	......	6	6,000	...	......	3,156	......	......	445
Dutch East Indies	62	175,501	53	128,047	154	243,790	...	......	143,275	67,312	6,167	6,657
French Indo China	2	3,046	...	......	12	11,400	...	......	9,762	......	......	......
Hongkong	5	18,586	3	4,000	13	15,015	...	......	3,336	3,131	......	102
Japan	31	17,400	51	16,550	63	91,257	103	44,612	87,900	3,996	1,000	500
Persia	...	......	...	......	...	......	...	......	517	......	......	......
Russia in Asia	...	......	...	......	...	......	...	......	2,793	......	......	......
Siam	...	......	...	......	15	19,263	...	......	3,877	220	20	......
Turkey in Asia	10	6,957	...	......	26	33,990	...	......	23,641	31,836	3,043	408
Australia	9	15,555	216	396,432	88	134,233	136	170,309	194,696	38,622	2,353	931
New Zealand	57	116,493	9	25,532	120	142,017	4	13,250	75,963	96,798	1,359	8,266
Other British Oceania	...	......	...	......	1	835	...	......	475	......	......	320
French Oceania	...	......	...	......	...	......	...	......	......	67	......	......
Other Oceania	...	......	...	......	...	......	...	......	......	......	......	334
Philippine Islands	3	6,000	42	55,681	42	61,218	...	......	89,289	68,348	8,987	21,978
Africa:												
Belgian Kongo	...	......	...	......	...	......	...	......	1,126	......	......	......
British West Africa	2	2,160	...	......	7	10,920	1	400	24,404	52,506	7,023	......
British South Africa	7	19,420	...	......	42	58,093	4	7,015	103,890	17,969	4,235	1,730
British East Africa	...	......	...	......	10	12,632	...	......	2,513	3,579	527	226
Canary Islands	1	1,351	...	......	...	......	...	......	2,497	3,107	25	......
French Africa	5	2,598	...	......	9	6,155	2	734	28,298	70	9	......
Kamerun, etc.	1	449	3	1,046	2	841	...	......	2,171	......	......	......
Madagascar	...	......	...	......	...	......	...	......	30	......	......	......
Morocco	...	......	...	......	...	......	...	......	1,243	......	......	......
Portuguese Africa	...	......	...	......	8	7,305	...	......	2,065	......	......	50
Egypt	3	4,048	...	......	28	15,942	...	......	41,301	2,369	32	......
Total	622	$1,072,696	498	$880,040	2,205	$2,882,825	287	$282,345	$3,426,517	$1,248,540	$140,115	$110,724

Foreign Trade Financing Plan Makes Material Progress

Nine States have altered the banking laws to permit the banks within the State to invest in export trade funds. Credit to be apportioned in proportion to support in the financing plan. Other foreign trade information.

MATERIAL progress is being made by the Foreign Trade Financing Corp., the bank promoted institution, which proposes to establish a $1,100,000,000 long term credit for American manufacturers in foreign trade fields. An evidence of the advance made in this promotion is that nine states have changed their banking laws sufficiently to permit banks in those states to invest in this corporation.

The plan being worked out is that after $100,000,000 of stock has been subscribed, debentures will be issued for the additional billion dollars. These debentures will be sold to investors. The time of this credit will be sufficient to permit the foreign buyer to turn his goods into money. Also it will give time for the recovery of exchange values.

There is one very interesting point about the present plan of placing these securities which appears to be eminently fair to all concerned. The men who originated the plan of this corporation make no secret of the fact that the money made available to any industry will be in proportion to the financial support given by this industry. In other words, if the automotive industry wishes to avail itself heavily of the advantages of the long term credit arrangement provided by this corporation, it must support the organization of the corporation. The address of the Organization Committee of the Foreign Trade Financing Corporation is 66 Broadway, New York.

RECENTLY in an account of the spark plug sales in Argentina, AUTOMOTIVE INDUSTRIES referred to the Hauquaire plug. This name was taken from the Consular Report. The plug referred to was the Macquaire, a French plug.

Automotive Vehicles in Finland

THE fact that the car population of Finland had reached 1500 at the end of 1920 is related in a Commerce Bureau report by Consul Leslie A. Davis of Helsingfors, who states that two-thirds of these are in Helsingfors and that no other city has more than fifteen or twenty cars. The trucks in operation are given as 300 to 400, a larger proportion of which are used in the country and smaller towns.

During the first nine months of the year the imports of cars and trucks was 631, of which 100 came from the United States and the remainder from Germany, which, because of exchange conditions, is in a favorable position. American cars, because of their higher power, are said to be popular, the preference being for light seven passenger cars with six-cylinder engines, standard tread and wheelbase of from 118 to 124 inches. A high-tension magneto was said to be necessary equipment and the left-hand drive is desirable, although the German cars are being sold with right drive. A good truck market for both industrial and agricultural use exists in Finland, the Consul states, the demand being for a four-cylinder job from 1 to 2½ tons, equipped with pneumatics and the 1 and 1½-ton sizes.

Consul Davis added that there was a difficulty in obtaining import licenses, but that these were given freely, however, on parts of cars to be assembled within the country.

The exports of passenger cars from the United States to Finland in 1920 was 82, valued at $123,859, while 104 trucks, valued at $202,719, were shipped from this country.

Arabs Study Tractors

BAGDAD, in Mesopotamia, held its first agricultural tractor competition for fifteen days during January, with Austin, Fiat, Fordson and Saunderson machines as the principal performers. The trials were followed with great interest by the Arab farmers, who were very quickly converted to the advantages of mechanical traction and who placed orders for these machines without waiting for the final and technical results of the competition. The sight of these modern agricultural machines being driven and cared for by the natives was picturesque in the extreme.

The competition was carried through very successfully, all the machines doing good work. The trials were attended by the High Commissioner, Sir Percy Cox, by various ministers, and other officials, all of whom expressed their satisfaction at the results obtained.

TRACTOR trials will be held in Bulgaria this month under the direction of the Bulgarian Ministry of Agriculture. According to a British trade report, "a small, strong tractor, capable of dealing with rough ground and able to operate within confined spaces, is the type likely to meet with success."

Trucks in England

THE steady growth of motor truck traffic on British roads is shown by two facts of recent date.

First—The large and old firm of jam and food condiment purveyors, Crosse & Blackwell of London, are removing to a disused new five million dollar Government factory near Burton-on-Trent, whence they intend to deliver the goods by motor truck, of which they have made a preliminary purchase of over 150 vehicles.

Second—The big housefurnishing company of Maple's of London are starting a motor truck collecting and distributing service as a cheaper alternative to railway carriage of goods. More than 100 trucks are being employed as a start.

A development of this sort finds response in the railroad interests' seeking to attach to themselves control of the proposed road motor traffic services. Consequently, as there is legislation on the matter pending, feeling runs

high and automotive dealers are being asked to oppose the reported intention of the Government to entrust highway motor truck enterprise to the railways under the auspices of the Ministry of Transport. The latest reports are that the Ministry itself may be scrapped as being too costly for the present financial state of the country and probably as much, if not more, because of the drastic opposition to certain of its program by the rail and transport services at large.

British Automotive Trade

FIGURES for the foreign automotive trade of Great Britain in 1920, recently announced by the Bureau of Foreign and Domestic Commerce, show that 5325 motor cars and commercial vehicles, with a value of £3,929,455, and 3121 chassis, with a value of £2,474,877, were exported during the year. The comparison with previous years, as well as the totals for other automotive equipment, is given as:

	1913	1919	1920
	7,595	1,514	5,325
Touring cars and commercial vehicles	£2,396,369	£1,056,720	£3,929,455
	1,234	678	3,124
Chassis for motor cars...	£465,283	£471,585	£2,474,877
Motor cars, other parts...	£788,239	£1,068,627	£1,986,410
	16,850	8,368	21,304
Motorcycles and tricars..	£733,269	£577,343	£1,672,903
Motorcycles and tricars, parts	£217,330	£321,834	£667,654
Airplanes, airships, balloons and parts	£46,756	£712,784	£1,918,740

Service Competition In Britain

THERE is evidence of an increasing, not to say an accelerated, interest by British auto firms in service facilities. Among the factors responsible for this new zest are fear of the effects of American firms by contrast with British service methods, restricted number of paid drivers, and the increasing use of cars by business men for business ends. All this makes for recognition of the fact that the car—irrespectively of first cost—having the minimum of idle working hours is really the most useful and economical. Just now and for some time a section of the motor press has been discussing standard charges for overhauls, with the result only to expose the chaotic state of the issue and to concentrate attention on the absolute need for standard parts and good stocks of them available at short call.

As an instance of individual service enterprise may be noted the scheme just announced by the Hillman Company of Coventry, one of the smaller British producers of cars. This company is issuing with each car a specific guarantee against mechanical breakdown for one year and seven days from the date it leaves the works. Should a breakdown occur, the repairs may be executed by any competent firm selected by the owner, the bill being paid by the company. Further, the company will pay the owner $5 a day for the hire of another vehicle while his own is out of use up to 30 days. In addition every car sold will carry with it a full insurance policy against all ordinary risks.

These attractions are good in themselves, but they take no account of the cost of such repairs, and although it matters less to the user than it does to the makers what the cost may be during the first year of its use, the scheme makes no stated provision for the cost of repairs when they are usually first needed, namely, after (not during) the first year's use.

Another firm—the Austin Company of Birmingham—has thrown a bomb into the repairing trade by stating in its monthly house organ that its car can be "overhauled" by four men in one day (i.e. eight hours) at a cost of $30. To realize on British garage labor at present pay rates one must charge not less than $1 an hour all round, so that the above sum is quite inadequate, not to mention the ambiguity of the term "overhaul" as used in a connection which is probably meant to imply nothing more than internal cleaning, adjusting screw-adjustable parts, de-carbonizing the cylinders and a generally rapid survey of conditions diagnosed rather by the ear than by the vision.

N. A. C. C. Foreign Trade Policy

THE National Automobile Chamber of Commerce has recently published a booklet, printed in four languages, which is regarded as an international statement for the purpose and aims of the Chamber. The following excerpts from this booklet pertain to foreign trade activities of the Chamber:

"Realizing the growing importance of the automobile as an essential to international progress, the Chamber recently organized a Foreign Trade Department which functions under the directions of a Committee composed solely of manufacturers who are thoroughly conversant with export matters. Among the policies already advocated by this Committee may be mentioned the application to the United States Congress, for a lowering of the duty on automobiles imported into the United States from abroad. At present the United States duty is 45 per cent for automobiles costing at place of origin more than $2,000, whereas those of a lower value are assessed 30 per cent ad valorem. The enactment of a uniform tariff law of 30 per cent on all automobiles, regardless of value, was urged by the American manufacturers despite the fact that foreign manufacturers already enjoy special concessions because of exchange rates in their favor, the manner of determining the dutiable value of imports into the United States at the current rate of exchange rather than at the normal as was done prior to 1919, and the savings in customs charges resulting from the American practice of using the F. O. B. value of the imported product as dutiable basis rather than the C. I. F. value, which abroad mostly serves for such purpose.

"Appreciating that many foreign countries do not benefit in trade by a duty reduction on automobiles imported into the United States, especially if the exports therefrom consist of entirely different commodities, the National Automobile Chamber of Commerce has also urged the negotiation of reciprocity treaties which, by affording better marketing facilities for the products of the nations concerned, also offer assurance of mutual prosperity.

"A further aim of the National Automobile Chamber of Commerce is to promote the construction of highways. A special department is maintained to compile and disseminate gratuitously data on the most modern and economical methods of building roads not only in the United States but in foreign countries also. Because of this provision, governments or individuals abroad may be assured of a spirit of co-operation equally as spontaneous as that extended to those concerned with the solution of road problems in the United States."

Swiss Automobile Exhibit

THE date for the International Automobile Exhibition at Basle, Switzerland, has been fixed for May 28 to June 6. The showing will be made under nine classifications, which are: touring cars and chassis; lorries, tractors and other industrial automobile vehicles; automobile vehicles; agricultural machines and engines, industrial, aviation and motor boat engines; motor cycles and bicycles; parts for automobiles, engines, motor cycles and bicycles; wheels, rims and tires; tools and machines for manufacturing automotive equipment, and sports articles.

Constructive Possibilities of the Open Shop Movement

Intense bitterness has been engineered among many workers by the open shop movement. This has come about because they believe it to be an attempt to take away the power collective action has given them. The movement must be accompanied by fairness and patient understanding.

By Harry Tipper

TWO men were talking in the waiting room at the railroad station the other day. Evidently they had just finished their shift at work and were on the way home. Part of their conversation reached me and it was sufficiently interesting to get me to listen in without respect to the propriety of the matter.

The first man, the taller and quieter of the two, was talking about the new developments in the shop and wound up with a remark, which was the occasion of my attempt to hear the rest of the conversation. The remarks have been censored a little for obvious reasons.

"Yes, that's a fine proposition; they think they can put it all over us now because work is scarce. They talk about the American plan and all that bunk, but what they are trying to do is simply to throw us union fellows out. That's what they mean by the open shop."

"Sure," said the other fellow, who was more aggressive in his attitude. "Remember what Bill said about spies at the last meeting. Remember what happened to Bill a week later, when he was laid off. They said he was laid off because he was not a good worker. He was just reported and laid off on account of what he said at the meeting. Besides, didn't they lay off three men out of the tool room last week; and it's funny that all those three men were on union committees."

The conversation went on; it was pretty bitter and it was too emphatic to be censored readily, so that it could be included in any report of the circumstance. The remarks which have been mentioned were indicative of the attitude of these men and the point of view which they had on the open shop as far as their particular place was concerned.

I have stated a number of times in these articles that the open shop under proper conditions is the ideal arrangement for co-operation, but we are not dealing with the ideal in industry, and in most of the establishments the suspicion, the prejudice and the opinions on both sides are far from ideal.

The leaders of the unions are pointing out continually that the employers did not give up their own co-operative organizations, and in trades where the employers' organizations have been very active in fighting the labor organizations, a careful propaganda of information has been given to the workers concerning these activities. As a consequence, a great many of the union workers believe, like the two men who were talking, that the open shop movement is intended first of all to destroy the union and to fasten upon the worker the old control against which the unions have been fighting.

They believe that this is an attempt to take away the power which collective action has given to them, and a good many of them cannot speak about the open shop movement without displaying a bitterness which is not any less than that displayed by a good many employers.

Warfare is a poor way to secure co-operation and increased suspicion does not lend itself to the establishment of any unity. As the advantage is secured by one side or the other, that advantage is used only to press their control and their demands with the consequence that these demands become more and more incompatible and result in a greater division and a larger measure of disagreement.

Out in the Middle West one of the biggest plants in an industry which is very closely organized has been running a non-union shop for years, for more than the lifetime of the original workers. In that time this plant has not had a strike which assumed any serious proportions and no attempts to unionize the shop have succeeded, although some of the most skillful workers in the business are a part of the personnel of that organization. The owners of this establishment are known far and wide in the business as being on the square, as taking care of their working people and as thoroughly honorable in their dealings with workers. As a consequence, they have secured a family spirit and a unity within the organization which has not deteriorated in the growth of the establishment.

It is possible to make the open shop a valuable advance in American industrial organization, provided that it is accompanied by a spirit of patient understanding and of fairness which does not countenance any spy systems of information, any discrediting of union members because they are union members, or any unscrupulous advantage of the workers in rewards or conditions, because they are not organized into powerful co-operative bodies.

Wherever open shops have been established on this basis, they have succeeded in retaining the allegiance of their workers in the midst of strikes and through all kinds of adversity. This is not only true in this country, but there are some notable examples of this in Great Britain, where the organization condition is far more serious. If the open shop, however, is seized upon as a means of retaining the control of the worker and fighting the union without any desire or patient development of the ideals of fair play, the results will embitter the worker and in the course of time increase the strength of the various types of workers' organizations.

There is no other possibility. The manufacturer must be ahead of the union in his understanding of human nature, and what is involved in co-operative unity and har-

mony, or his objection to organization as it is at present constituted, will have no other effect than to increase its value in the eyes of his employees. There is very little discipline in employers' groups. Employers who have a sane knowledge of the fundamentals of human relations are harmed in their work by the aggressive and belligerent attitude of the man who sees in the present movement only the opportunity to recover control of his employees.

The short sighted manufacturer is the man who leans back complacently with the statement that he has licked the unions because he has secured the advantage for the moment, and believes he can go back to making them do what he thinks, instead of agreeing with them on what should be done.

The average worker is interested in his employment, his local conditions and his own living, far more deeply than he is in the progress of union organization. He will respond to the sincere effort of the manufacturer to establish methods of discussion and agreement if these are effected by a persistent effort which arises out of a desire for fair dealing.

The job cannot be done without patience and a considerable measure of understanding on the part of the manufacturer, because there is a large amount of suspicion to remove, and a new attitude of co-operation to institute. It needs a strong leader to establish an open shop which will be admittedly in advance of the present method of organization, and needs a measure of study which very few executives have given to the human side of the question.

The open shop can be made the best basis for agreement and unity. It will not serve its purpose, however, if the worker, because of ignorance, or because of the character of the attempt, reacts to it as did the two men mentioned at the head of this article.

Personnel Work Necessary in Dull Times

THE relatively great decrease in personnel departments and their functions since jobs became scarcer than workmen naturally brings up the question as to whether or not such abnormal decrease is justified. Manufacturers have given a number of reasons for cutting out such activities.

To find out what there is to say from the other side, a successful and intelligent personnel manager was asked this question the other day, "What is the use of a personnel department or industrial relations activity at this time anyhow? What is your excuse for living?" A brief digest of his remarks is of interest as presenting the other side of the case. His statement was something like this:

In the first place, safety work must be continued, whether the force is large or small. The records of our company show an actual saving of many thousand dollars a year since the institution of safety work, simply in compensation money and similar expenditures. Primarily for that reason our safety work is being continued during the present depression.

Health supervision also comes under our personnel activities. Even with a curtailed working force, the company wants the lowest possible unit cost of production, which, turned around, means the greatest quantity and quality output per man. This can be maintained only through a continuance of health supervision, both as regards accident and medical cases for the men left on the job.

In almost every plant there is considerable job analysis work to be done, which the personnel or employment department has been too busy to complete during the high tension period through which we have recently passed. This work must be completed before the hiring and placing of men can be done on an intelligent basis. The present inactivity in hiring gives the employment manager sufficient time to take up work of this nature, make further research into the various jobs, the conditions surrounding them and the human factors involved in the various production activities.

The task of laying off men properly calls for nearly as much intelligent effort as that of hiring them. When business picks up again every firm will want to rebuild its working force. The firm which has sent its men away with a friendly feeling toward the company will be in the best position to re-employ its former workmen. Where this can be done, thousands of dollars will be saved that otherwise would have gone toward breaking in new men to an unfamiliar plant. In the meantime the employment manager can keep in touch with the best of these men in one way and another, and thus insure their return when they are needed.

Assuming, of course, that the personnel department is pared down to a minimum along with the other administrative divisions of the organization, there appears to be a very definite field for its activities even during times of depression such as the present.

Cartoon from New York Tribune referred to on page 5 of last week's issue of AUTOMOTIVE INDUSTRIES

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Stimulating Individual Effort

THE ultimate success of the open shop movement will rest fundamentally upon the fairness and patience exhibited by employers. The fact that an open shop is established and the power of the union eliminated or even diminished is in itself only an incident in the solving of the labor problem. The maintenance of a belligerent attitude on the part of employer or employees can have even a greater deleterious effect on production than union domination.

The ultimate futility of the fighting attitude was voiced recently by Herbert Hoover when he said: "We cannot attain equality of opportunity or maintain initiative through crystallization of economic classes or groups arraigned against each other, exerting their interest by economic and political conflicts. We cannot attain it by transferring to governmental bureaucracies the distribution of material and intellectual products.

"We can attain it by . . . the stimulation of individual effort in the whole mass."

Methods of stimulating individual effort over long periods of time have not yet been well worked out. Study and analysis of the factors involved and a determination of possible methods are the chief activities which lie ahead of those seeking a solution to the complex problem of human relationships in industry.

Thoroughgoing Fuel Research

IN England where the automotive fuel problem is more pressing if not more serious than in this country, one of the prominent petroleum companies has undertaken what promises to be the most exhaustive and thorough research into the inherent characteristics of liquid fuel and their effect upon engine operation ever undertaken. This research is being conducted not by a petroleum chemist or even by the engineering staff of a company in the oil business, but by a group of engineers, physicists and chemists including several of the foremost investigators in these lines which England has produced. The work is in charge of Mr. Ricardo, one of the most progressive automotive engineers in Great Britain, but a man whose training and experience is not primarily in fuel matters, but in engine design and the relations existing between design and performance as affected by the character of the fuel.

This is significant as indicating that the investigation will not be primarily of a theoretical nature—though the theory involved will quite properly be fully investigated and developed and the results checked from this standpoint—but rather that practical conclusions will be drawn. In short, it appears that the underlying purpose is to learn, first what fuels are best suited for efficient use in internal combustion engines, and second what inherent qualities render them superior to other fuels.

With such information in hand, and only then, will it be possible for fuel producers to intelligently proceed in making the fuel supply go furthest and be used with greatest convenience and satisfaction.

Thanks very largely to one or two progressive American investigators allied with the automotive industry we have come to learn in recent years some few facts—or at least some reasonably plausible theories—regarding the advantages and disadvantages of certain classes and grades of domestic fuel; something about the important effect of detonation upon the utility of fuel; and something about means for preventing or mitigating detonations by the use of "dope" and otherwise. Most of the information is vague and incomplete. Some of it appears to be of doubtful value if not actually misleading as judged by the results of the British investigation announced to date. All of which points to the need in this country of just such thorough and comprehensive research as our British contemporaries are undertaking.

There has been much talk about and there is great need of co-operative research in which the automotive and fuel industries should join, but little has yet been accomplished in this direction. When will those whose interests are so vitally concerned awaken to a full realization of the importance of getting to the bottom of the matter?

Fortunately the results of the British investigation referred to are to be made public. Some of them are given on another page of this issue. Is it too much to hope that some American fuel producer will see the light and take action similar to that taken by the Asiatic Petroleum Co.? Or will the matter be allowed to drift until a national emergency forces governmental action?

Thus far the initiative in fuel research in this country has been mostly from the automotive side, but even this has been limited to a small percentage of those who should be interested. There is a great opportunity for those willing and able to grasp it. It should be seized and turned to good account. Patriotic motives should rule, if self interest of the industries concerned is not sufficient.

A New Phase of Service

SERVICE of the vehicles now in the owner's hands is the most important problem before the automotive industry. Service means a lessened sales resistance; it means a greater respect for the products of the industry, and a much wider use of these products. It is an axiom that a chain can be no stronger than its weakest link. Certainly the automotive industry can never be stronger than is the acceptance of its service by the owners of the vehicles.

Just at present the interest in service is centered in a new plan for the distribution of service parts. Some parts manufacturers have already established stations in various sections of the country where dealers, independent service shops, and business organizations which are on the factory list as national buyers can obtain parts. This plan is favored by some manufacturers and opposed by others. It is looked upon as a solution of some existing problems by some parts manufacturers and by others it is utterly condemned. Indeed, this division of opinion exists within the executive staffs of some of the organizations chiefly interested. One sales manager openly favors this plan of distribution of parts, but says that other factory executives have overruled him and propose to let the vehicle manufacturer distribute the parts.

AUTOMOTIVE INDUSTRIES holds no brief for either plan. Both are subject to all of the human weaknesses that will appear in the organization that must be maintained for the carrying out of the project. The present plan of the vehicle manufacturer distributing parts to his dealers has developed certain defects which must be cured. These defects are too well known to need discussion here. What may be the defects of the new plan cannot now be discussed.

AUTOMOTIVE INDUSTRIES does, however, hold a brief for the best possible service. This proposition permits of no discussion. The attainment of better service is vital to the industry and to each factor in the industry. The service responsibility is growing faster than any individual manufacturer's business. At the beginning of 1920 the registration shows that in 1919 there were 7,596,503 vehicles in use and thus needing service. In 1920 there were 8,932,458 vehicles, an increase of 15.65 per cent in the service end of the industry. There is no adequate measure of the service facilities during that period.

With a business growing at the rate the need for service is growing, and will continue to grow as the number of vehicles increases, some wise steps must be taken. As the industry has grown there has been a constantly increasing number of orphan vehicles, and the lack of service facilities for these vehicles is a blow at the industry as a whole. Not every buyer is discriminating enough to realize that it was a mistake in his own judgment that caused him to listen to false promises. He is very likely to judge the industry by the experience he has had with the individual manufacturer.

There should be a distinct effort on the part of someone to see that the owners of orphan vehicles get service.

There is one point on which we believe that a distinct improvement could be made in the present service system. There is no disputing the fact that some manufacturers regard their sale of parts and service too selfishly. Sales have been spread over a very large territory, and it is physically impossible in some instances to maintain adequate service stations at certain points. It has sometimes happened where the vehicle was not properly represented in a service way, that independent service firms, fully competent to give this service, have been refused permission to buy the required parts at a trade price. Such narrowness in a service plan is almost unbelievable, yet it exists.

It is entirely safe to assume that the proper service has not yet been worked out, but the business is becoming of such volume and importance that it will, in time, assert itself and will override those who place selfish interests before the natural objective of service. We do not believe it is within the realm of business prophecy at present to say what form this service will take.

There will be experiments, there will be disappointments, but justice to the vehicle user and a reasonable business policy within the industry will prevail. Service is too big and too important for any individual or organization to much longer delay an equitable solution.

Conflicts and Co-operation

ANY close analyst of our industrial situation must recognize that, for the present at least, there are definite conflicts of interest between employer and employee. But at the same time there are numerous ways in which their interests lie along the same path. The progress of human relationships in industry depends largely upon which of these bases are taken as the starting point for industrial relations.

Better advancement can be made if both sides can come together for consultation upon the basis of those factors in which they really have a community of interest. From that point constructive progress can be made. When they come together on the basis of their differences, the probability of the growth of co-operation is not great.

Harding Endorses Highway Reforms

President Greets N. A. C. C. Committee

Likely to Support Townsend Bill —Conferences Held With Cabinet Officers

WASHINGTON, April 9—The Harding administration will maintain a sympathetic attitude towards the principles of highway transportation enunciated by the National Automobile Chamber of Commerce.

This was made clear in an announcement by President Harding after a conference yesterday with the highways committee of the N. A. C. C. While the President did not commit himself directly to the proposed Townsend bill providing for a commission to supervise a system of interstate highways, he declared he would advocate expenditure of Federal funds for highway building when adequate provision had been made by the States for maintenance.

The conference was the most important of a day devoted to meetings with Cabinet officers and Congressional leaders. Practically the entire directorate of the N. A. C. C. was in Washington for the conferences, probably the most important since the armistice, and they were accompanied by representatives of the Motor and Accessory Manufacturers Association, the Rubber Association of America and the National Automobile Dealers Association. As a consequence, virtually the entire industry was represented. The spokesmen of the industry were cordially received and the results of the day's work were considered fairly satisfactory.

President Harding openly denounced the present system of Federal aid, and statements he made to Senator Townsend as well as the highways committee indicated strongly that his support of their program was highly probable.

Must Study Permanent Effect

The President stressed the fact that hereafter Federal road money would not be expended with a view to the immediate and temporary effect, but always by its permanent and ultimate effect. The declaration that the present system was nothing short of criminal because no thought was given to permanency in construction could be interpreted in no other way than as warning to Congress to change its plan of distribution of highway funds. Though sectional interests will undoubtedly attempt to force the Federal aid bill through, the attitude of the President shows that it will fail through a veto, provided Congress ignores the desires of the Chief Executive.

The effect of the highways committee's conference was aptly illustrated when the President, in regular conference with Washington correspondents, expressed himself very clearly on the road-building program. His statements, in general, were in harmony with the utterances of George N. Graham, vice-president of Pierce-Arrow Motor Car Co., and Roy D. Chapin, president Hudson Motor Car Co., who had spoken on behalf of the industry. The President declared it was monumental folly to permit local communities to build roads which benefited a few and would deteriorate before the bonds issued for the construction matured. He pointed out that no Federal aid could be expected in the future unless States guaranteed maintenance.

In addressing the President, Graham said in part:

Graham Discusses Industry

"As representatives of the second largest industry in the United States, with sales of cars, trucks, tires and accessories in 1920 to a wholesale value of $3,578,000,000, we value the chance to direct your attention to the commanding place our industry has assumed in the nation's transportation.

"Our possibilities extend beyond National boundaries, for we now export cars and trucks to 114 countries, including 56 motor vehicles to Iceland in 1920.

"Less than a decade ago the European car was the standard of the world outside of the United States. To-day American cars are preferred to all others. American manufacturers must now meet the aggressiveness of the French, British and Italian governments who are striving to win back their automotive export trade by liberal credit extensions. The complications of exchange further handicap the American manufacturer. We welcome the efforts of the State, Treasury and Commerce departments to overcome these obstacles and will co-operate in every way possible.

"All transportation demands a proper measure of credit. Makers of motor vehicles and their distributors are entitled to just and liberal treatment both on part of the Federal Reserve banks and financial institutions in the various States.

"Happily our situation is much improved by the fact that we are one of the first industries to experience symptoms of returning prosperity, a result we attribute to the fact that business and individuals must have cars and trucks or be handicapped in efficiency.

Federal Consideration Needed

"At the present time our industry is so much exposed to the application of State rights that it peculiarly needs federal consideration. Every State, through control of its highways, can force motorists and truck operators to pay whatever proportion of its total taxes may be desired, regardless of equity.

"We concede the necessity of revenue, State and national, but urge that our burden should not be out of proportion to that of other forms of transportation.

(*Continued on page* 830)

Iowans Storm Good with Tax Opposition

Express Hope He Was Misquoted in Proposal of New Federal Wheel Tax

CEDAR RAPIDS, IOWA, April 9—Declaring that the automobile industry is "already overburdened with tax," automotive men of Cedar Rapids, the home town of Representative James W. Good, have risen in protest against the wheel tax measure proposed by their congressman. The action against the bill has been taken both under the banner of the Linn County Motor Trades Bureau and individually by automobile men. The trades bureau has written Good taking exception to the wheel tax and asking for further information from him concerning the proposed legislation. In addition, every garage owner, automobile or truck dealer, and other motor-interested men in Cedar Rapids and Linn county has written the local congressman a letter of protest against the proposed measure.

As soon as Good's plan to levy a wheel tax that would yield $200,000,000 a year revenue was brought to light here, a meeting of the Linn County Motor Trades Bureau was held and E. K. MaKibben, president, was instructed to communicate to Good the fact that his plan met with united disapproval of local men in the automobile field. To augment this, the motor dealers pledged themselves to write individual letters to Good in protest against the measure.

Contest "Luxury" Assertion

"We wish to take exception to a statemen attributed to you in the New York *Times*, issue of March 25," declared MaKibben in his letter as president of the Linn County Motor Trades Bureau. "This quotes you as saying that we have, in the United States, more than 8,000,000 passenger carrying automobiles, and practically every one is a luxury. This also quotes you as stating that you are in favor of a wheel tax that would yield $200,000,000 a year."

The remainder of the letter reads as follows:

"We do not think it possible that anyone at the present time would consider the automobile a luxury.

"We are very much opposed to a tax of this nature, as the automobile industry is already overburdened with tax.

"You, being an Iowan, must realize what a value automobiles are to Iowa farmers, and what a wonderful blessing they have been to Iowa farmers' families.

"We sincerely trust that you were mis-

(*Continued on page* 830)

Motor Cars Essential, Harding Says

Takes Up Highways in First Message

Declares Automobiles Indispensable—Demands Reforms in Present Road Work System

"The motor car has become an indispensable instrument in our political, social and industrial life."—PRESIDENT HARDING.

WASHINGTON, April 12—Essentiality of the motor vehicle has been recognized by the President of the United States.

President Harding, in his first address to Congress, proclaimed that the motor car is indispensable in every phase of American life. After discussing the problems of the railroads and the need for reduced rates to increase traffic, he took up the question of highway transportation, expressing complete accord with the arguments presented to him at a conference Friday with representatives of the National Automobile Chamber of Commerce. On this subject he said:

"Transportation over the highways is little less important, but the problems relate to construction and development, and deserve your most earnest attention, because we are laying a foundation for a long time to come, and the creation is very difficult to visualize in its great possibilities.

"The highways are not only feeders to the railroads and afford relief from their local burdens, they are actually lines of motor traffic in inter-state commerce. They are the smaller arteries of the larger portion of our commerce, and the motor car has become an indispensable instrument in our political, social, and industrial life.

"There is begun a new era in highway construction, the outlay for which runs far into hundreds of millions of dollars. Bond issues by road districts, counties, and States mount to enormous figures, and the country is facing such an outlay that it is vital that every effort shall be directed against wasted effort and unjustifiable expenditure.

Can Influence State Policy

"The Federal Government can place no inhibition on the expenditure in the several States; but, since Congress has embarked upon a policy of assisting the States in highway improvement, wisely, I believe, it can assert a wholly becoming influence in shaping policy.

"With the principle of Federal participation acceptably established, probably never to be abandoned, it is important to exert Federal influence in developing comprehensive plans looking to the promotion of commerce, and apply our expenditures in the surest way to guarantee a public return for money expended.

"Large Federal outlay demands a Federal voice in the program of expenditure. Congress can not justify a mere gift from the Federal purse to the several States, to be prorated among counties for road betterment. Such a course will invite abuses which it were better to guard against in the beginning.

"The laws governing Federal aid should be amended and strengthened. The Federal agency of administration should be elevated to the importance and vested with authority comparable to the work before it. And Congress ought to prescribe conditions to Federal appropriations which will necessitate a consistent program of uniformity which will justify the Federal outlay.

"I know of nothing more shocking than the millions of public funds wasted in improved highways, wasted because there is no policy of maintenance. The neglect is not universal, but is very near it. There is nothing the Congress can do more effectively to end this shocking waste than condition all Federal Aid on provisions for maintenance. Highways, no matter how generous the outlay for construction, can not be maintained without patrol and constant repair. Such conditions insisted upon in the grant of Federal aid will safeguard the public which pays and guard the Federal Government against political abuses, which tend to defeat the very purposes for which we authorize Federal expenditure."

Elwood Haynes Appointed Education Commissioner

INDIANAPOLIS, April 9—Governor Warren T. McCray of Indiana announced to-day the appointment of Elwood Haynes, president of the Haynes Automobile Co. of Kokomo, Ind., as a member of the State Board of Education for a period of four years. Haynes will succeed A. M. Hall of Indianapolis as the manufacturers' representative.

C. G. COMPANY STOCK SELLS

KALAMAZOO, MICH., April 12—Former stockholders of the old Kalamazoo Spring & Axle Co. have subscribed for $120,000 of the 8 per cent preferred stock and 1200 shares of common stock of the C. G. Spring Co. The stock is to be issued to them in a period extending over some 18 months. The newly acquired automobile bumper industry is now being moved to Kalamazoo and will be installed in the local plant. The head bumper sales office will also be located here.

U. S. Rubber Sales, $256,150,130 in 1920

Inventory Write-Off of $11,151,444 and Reserve of $6,000,000, Cuts Income

NEW YORK, April 11—A new high record for net sales was established by the United States Rubber Co. in 1920 when the total turnover was $256,150,130, compared with $225,589,465 for the preceding year. Net profits for 1920 after interest charges were $21,220,983, as compared with $17,730,237 in 1919. The balance for the common stock was $16,002,265, which was equivalent to $19.75 a share, compared with $24.18 in 1919.

Samuel P. Colt, chairman of the board of directors, in his remarks to the stockholders said, in part:

"To meet the heavy decline in prices of certain materials, notably cotton fabrics, inventories have been written down $11,151,444 below cost, thus bringing the inventory valuations down to a conservative basis. This reduction was charged against reserves previously created in anticipation of such a decline in prices. In addition to this write-off of $11,151,444, there was appropriated out of the income for the year 1920 and set up as a reserve, the sum of $6,000,000 to take care of any contingencies that might arise hereafter.

"There has been expended upon the plants and fixed properties of the company during the year 1920, $28,316,616, notably in the enlargement of our tire plants at Detroit, Hartford, Providence and Indianapolis. The work is practically completed and paid for.

The general balance sheet as of Dec. 31, 1920, showed net current assets of $187,128,205 as compared with $161,875,058 at the close of 1919. Cash on hand at the end of last year was $14,534,846, against $20,037,646, and inventory was valued at $123,403,029, against $87,633,699. Accounts receivable were $46,329,738, as compared with $40,770,428 the year before. Net current liabilities were $67,373,547, against $26,971,737.

NEW JERSEY INCREASES FEES

TRENTON, N. J., April 11—Increases in motor vehicle fees to bring the State additional revenue of about $1,200,000 a year have been authorized by the legislature.

It was provided that the minimum fee shall be $4 for a car of 10 h.p. or less. From 10 to 30 h.p. the fee will be at the rate of 40 cents a horsepower, and above that, 50 cents a horsepower. The fees for trucks will be based upon capacity, the smallest fee to be $10.

Maxwell President to Sell Off Plants

Action Part of Preliminaries to Consolidation with Chalmers —Working Capital Ready

NEW YORK, April 11—Reorganization and consolidation of the Maxwell Motor Co., Inc., and the Chalmers Motor Car Co. entered upon its final stage when simultaneous decrees were handed down Saturday in United States District Courts in Detroit, Dayton and Indianapolis, appointing W. Ledyard Mitchell, president of the Maxwell company, receiver for that corporation.

This action followed the filing by creditors of petitions in bankruptcy and means a temporary and friendly receivership. The step was decided upon some six weeks ago by the reorganization committee headed by Walter P. Chrysler. It is preliminary to the sale of the assets to a new company to be known as the Maxwell-Chalmers Corp. of Detroit. It will forestall action by disgruntled creditors and minority stockholders which might have embarrassed the reorganization committee.

All the property of the Maxwell company in Michigan, Ohio and Indiana is ordered sold. According to the Indianapolis decree the minimum bid to be considered is $10,915,000. It is expected that the sale and reorganization will be completed within 40 days.

The decree handed down by Judge Tuttle in Detroit contains the provision that the sale shall take place when such a step would appear to be advantageous. Judge Tuttle finds that the debts of the Maxwell company amount to $16,000,000. He appointed William S. Sayres, Jr., a special master to conduct the sale. The special master will receive bids for the property as a whole and for each nine parcels of it. It will be sold in blocks or in parcels, whichever is more advantageous to the creditors.

The reorganization of the two companies will be the largest in the automotive field since the war. Ninety-nine per cent of the bank creditors and 98 per cent of the merchandise creditors have approved the proposed consolidation. The proportion of stock of the two companies deposited with the reorganization committee is virtually the same.

To Take Over All Properties

All properties of the two companies will be taken over by the new corporation. This includes the Maxwell and Chalmers factories at Detroit, the Maxwell plant at Newcastle and the Maxwell body plant at Dayton. The Maxwell and Chalmers cars will be manufactured and sold as heretofore, except that there will be a largely increased production of an advanced type of motor vehicle. The other plants will be operated as they have been in the past.

The only surprise in the court proceedings to those who have followed the situation closely was the appointment of Mitchell as receiver. It had been understood that a new executive was to be appointed for the company but Chrysler, who has been directing the reorganization, is said to have been much pleased with the way in which the present president has conducted the business since affairs reached a critical stage many months ago. There is now a strong possibility that he may remain at the head of the company, although numerous changes in the executive personnel are expected when the reorganization is completed.

Will Have $15,000,000 Cash

When the reorganization is completed the new corporation will have available $15,000,000 in cash which has been underwritten by a syndicate of banks headed by the Chase National. The bank debts of the Maxwell company aggregate $12,000,000, and the merchandise debts about $4,000,000. The obligations of the Chalmers company are placed at approximately $5,000,000.

This statement in regard to the court proceedings was issued by the reorganization committee:

"The reorganization of the Maxwell Motor Co., Inc., to-day entered upon the final stages leading toward successful completion.

"This is the meaning of the initiation of a temporary and friendly receivership in the United States District Court. The primary purpose of the receivership, which was agreed to by all the interests concerned, is to establish title to the properties under the reorganization.

"The court appointed as received W. Ledyard Mitchell, president of the company, who, with Arthur E. Barker, general sales manager, has been in active direction of the Maxwell business during the period of the reorganization.

"Members of the committee said that this appointment is evidence of the continuance of the policies which have had so much to do with the recent upbuilding of the properties.

"They said further that the receivership clears the way for carrying out the larger plans which has already been put into operation on a limited basis. Strengthening and expansion of the factory and dealer organizations will proceed along the lines recently followed.

"The sale of the properties in accordance with the order of the court will no doubt be advertised almost at once, which will clear the road for the discharge of the receivers and the consummation of the reorganization plan, thus rendering available the new $15,000,000 of cash which has been held ready for months for the use of the company."

F.W.D. PRICE DOWN $700

CLINTONVILLE, WIS., April 11—The Four Wheel Drive Automobile Co. announces that effective April 4 the price of F.W.D. trucks was reduced from $4,900 to $4,200. The cut was made after a thorough survey of existing conditions, meetings with dealers all over the country and conferences with many fleet owners.

Efficiency of Labor Reaches High Point

High Production in Detroit Now Reached With Minimum Number of Men

DETROIT, April 9—With all factories at work in Detroit, many of them nearing the 100 per cent production stage figures on the labor situation give some idea of conditions as they will exist for some time in the future. Of 75 factories reporting to the Employers' Association, the total number of employees listed at work now is 132,858, or 57 per cent of the number employed the same time in 1920.

This, taken in connection with the fact that factories are maintaining a production ratio of from 50 to 100 per cent, indicates that there will be many left overs among the labor element when all factories have filled their quota.

Labor to-day in Detroit is as near 100 per cent efficient as is believed possible, and the turnover is giving employers little concern. Many idle men are hanging around the gates of the different factories and on the streets. This is particularly true at the plant of the Ford Motor Co. When the Highland Park plant went down in December more than 50,000 men were employed and the factory was turning out around 4000 cars a day. While there is no authoritative information on the number of men on the Ford Highland Park payroll now it is believed to be approximately 31,000. This in face of the fact that the plant is turning out an average of more than 3000 cars daily indicates that the factory can reach maximum or peak production with the addition of but a few thousand more men.

It is apparent, therefore, that thousands of former employees, who still are waiting patiently for the postal cards summoning them to work, will be disappointed. In fact, hundreds of men who have appeared at the Ford gates each morning have come to the conclusion that there is no chance of their resuming their old jobs and are looking elsewhere or leaving the city.

Clerks Not Replaced

The big force of clerks which was let off early in January has not been replaced and will not be. Many of those clerks were given opportunity to accept jobs in the factory and some did so. Others have refused to go into the factory, and were compelled to seek employment in clerical lines elsewhere.

Another feature at the Ford plant is that all foremen now are working—that is, foremen instead of walking around the different departments looking after the men, are assigned themselves to a task and keep busy at it, at the same time keeping an eye out for the men under them.

Practically the same situation exists in all other plants where production is being maintained with forces of from 50 to 75 per cent of the normal quota.

Wisconsin Factories Increase Production

Nash, Mitchell, Kissel, Ogren Report Gains—Parts and Truck Plants Active

MILWAUKEE, April 11—A marked revival of passenger car as well as motor truck sales in all sections of the country is being reflected into the automotive parts and equipment industries of Milwaukee to the extent that these industries are now in the lead in percentage of operations among all manufacturing groups. Especially since April 1 has it been necessary to extend operating schedules and re-employ men to meet the growing demand for parts and equipment. It is now confidently predicted that normal will be reached before midsummer.

B. W. Twyman, general manager of the 4-cylinder car division of the Nash Motors Co. at Milwaukee, said this operation is now on a 100 per cent production basis, and shipping 20 cars daily. Additions now under construction and contemplated for the summer will bring the capacity to 50 cars a day. The main Nash plant at Kenosha, Wis., increased its force by nearly 300 men in the last week and is operating at 66 2/3 per cent of capacity. Production will be on a 75 per cent basis by the end of the month. Normal production is 160 cars a day.

John Tainsh, general sales manager of Mitchell at Racine, says that the plant is operating at between 50 and 60 per cent of capacity, and with the demand picking up in all sections, save some parts of the South and Northwest, production is gradually being enlarged.

Kissel at Hartford, Wis., is producing on a basis of 60 per cent of normal, and is adding men every day as the spring demand for cars becomes more and more pronounced.

Fred L. Good, factory sales manager of the Ogren Motor Car Co., Milwaukee, said the plant is sold up to June 1 and new business is being received at a rate guaranteeing capacity production beyond that date.

Forge Plant on Three Shifts

The Interstate Drop Forge Co., Milwaukee, specializing in automotive forgings, is the high light among local manufacturers, as it is operating 24 hours a day in three shifts and employing the full capacity, with eight hammers. It is filling orders from Ford, Hudson, Scripps-Booth and other factories, reflecting renewed activity in motor car plants at Detroit and other centers.

Herbert A. Githens, sales manager of the Federal Rubber Co., Cudahy, suburb of Milwaukee, says the tire business has entered a new period of prosperity, and that within five or six weeks it probably will require full capacity. The Cudahy works extended operations from three days a week to five days during the past week. The early spring and mild weather are responsible for an unusual demand for tires for replacement as well as for equipment of new cars at the factories.

J. L. Sinyard, general production manager of the Parker Motor Truck Co., Milwaukee, said that early summer will find the plant working at full capacity, judging from the present development of demand. The Parker company specializes in trucks for highway construction and a healthy demand is now beginning to appear.

Truck Plants Feel Activity

J. C. Millmann, general manager of the Titan Truck Co., Milwaukee, said that within 30 days the plant will be operating at 100 per cent. Orders at present amount to about 80 per cent of new business a year ago.

It is regarded as significant that in their public expressions retail merchants generally are pointing to the automotive industries as taking the lead in a new era of activity and that with motor car trade once more getting into a healthy swing other business will follow. Predictions of general trade revival almost invariably lay stress on this point. It is frequently said that the passenger car business was the first to feel the depression and is the first to overcome its effect.

Retail sales by Milwaukee dealers during the first 10 days of April were the largest of any similar period of time within the last six months, and it is apparent that only a beginning has been made in the penetration of the resistance which buyers have been offering since last summer.

HASSLER FACTORIES ON OVERTIME WORK

INDIANAPOLIS, April 8—Officials of Robert H. Hassler, Inc., announced to-day that business had improved to such an extent during the past month that the factory had gone to working overtime. The first overtime worked was on April 4 and the company now is averaging about three hours a day overtime. Officials say there has not been a time in the last six months when prospects were as bright as now. Shock absorbers are manufactured at the plant. According to present plans the company will continue to work overtime until production catches up with orders.

PILOT AND DAVIS BUSY

RICHMOND, IND., April 8—Plants of the Pilot Motor Car Co. and the George W. Davis Carriage Co., are operating on about 80 per cent capacity, according to information obtainable from both factories. The Davis company expects to have full capacity operations underway soon to accommodate a good increase in business recorded in the last ten days. Many sales have been developed in territory adjacent to the plant.

Spring Starts Sales Humming on Coast

Dealers Report 60 and 90 Car Businesses in March—April Better

PORTLAND, ORE., April 9—The final advent of spring, which was ushered in on Easter Sunday with the sky radiant with sunshine, was the signal for the arrival along automobile row in Portland of the real spring buying. For months the dealers have been marking time, a little more than holding their own against a current of business depression, waiting for the weather to break so that the call to the open road would be strong enough to bring prospective motorists to a definite decision with regard to buying.

Warm weather and sunshine did just these things, for the dealers along the row report that their business Sunday far exceeded any previous day this year, and the following days of the week have lived up to the precedent set by Easter Sunday.

The numerous inquiries and the actual business done shows that there are any number of buyers who are simply awaiting their time to get the cars they want, dealers say. Some have been waiting for prices to fall, but with spring motoring fast coming on and every indication pointing to no further decreases in price they are giving up their waiting and are becoming actual buyers.

Business for many of the Portland dealers was excellent in March, judging from a cursory investigation among the dealers. In fact, every dealer reported that business has been rapidly improving for the last four or five weeks. One dealer reported the sale of 90 new and second-hand cars, while another reported 60. In both cases business had been nearly as good as in March last year, when Portland experienced phenomenal buying activity.

Another dealer reported five sales of new cars one day this week, and stated that he had orders for more of the same model far in excess of those on hand. Reports such as the above were heard on every hand along automobile row, indicating a decided improvement of business, and an approach, in fact, to the conditions of last spring.

DETROIT ADDS 6649 MORE MEN

DETROIT, April 9—Report of C. M. Culver, general manager of the Employers Association of Detroit, shows 6649 more men employed this week than last. The 79 firms affiliated with the Association reported yesterday a combined working force of 95,221. While this is far short of the number employed a year ago, factories reporting to the Association rapidly are nearing normal, both as to men employed and production. More men are being taken on daily, but the total when all factories are at 100 per cent will be considerably less than a year ago.

Harding Endorses Highway Reforms

President Greets N. A. C. C. Committees—Likely to Support Townsend Bill

(*Continued from page* 826)

"At present we are the most taxed of industries. We now have five main levies as follows:

"1. National and State income tax, common to all industries.

"2. Sales taxes, limited to ourselves and a few other industries.

"3. Taxes on repair parts, a permanent charge on the life of all vehicles, a tax specific to our industry.

"4. State license and registration fees, a virtual monopoly to us.

"5. Scattering municipal and personal property taxes.

"There are no federal sales tax on other units of transportation, as for example, steamships, locomotives, trolley cars and horse-drawn vehicles.

"The theory that the tax on motor vehicles is a tax on wealth is disproved by the fact that two-thirds of the nine million motor vehicles now in use in this country are owned in homes whose total income is $4,000 per year or less.

"It is right to reach the profits of the automobile manufacturer through the same taxes that apply to other kinds of business.

"We now accept without complaint State automobile taxes sufficient to keep all roads in repair. Thus we pay not only for the damage we inflict, but for that of all vehicles. Further we should not be called upon to go.

"More than one billion dollars are now available for road construction. Fifty-nine per cent of the national public works budget is devoted to highways. No single domestic activity of the United States Government and its civil sub-divisions predicates such large expenditures. Obviously the direction of such an effort should not be left as a subordinate detail in a department all of whose bureaus combined expend but one-third as much money annually as does the Bureau of Public Roads.

"Fundamentally the highway problem is not one of engineering but of economics. The first question is the determination of the economic reason for its location. Engineering is the detail of construction and maintenance. After that remains the paramount question of transport over the highway. For this reason road construction should be lodged under the direction of a body which has a broader vision than that of construction alone. For this reason, too, the lodgment of highways under a Department of Public Works would be to subordinate the end to the means.

Logical to Plead for Commission

"If it is logical to plead for a highway commission in the State, is it not logical that the National Government should follow the same policy? Most of the States adopted the commission plan at the suggestion of the Government when State highway departments were created.

"What is needed is a National Highway Commission—empowered to administer the Government's highway activities—to lay out and have constructed the inter-county roads of national importance, and to be responsible for the sound development of transport over the highways."

Later the highways committee conferred with Secretary of Agriculture Wallace and explained the problems relating to highways and pending legislation. As the Bureau of Roads is under Wallace at present and would be absorbed by the proposed commission, it is apparent that the President will ask for his views on the subject. The secretary stated that he had an open mind on the question and would consider it carefully.

Discuss Foreign Trade

The Foreign Trade Committee, with J. Walter Drake as chairman, talked over current problems of trade promotion with Secretary of Commerce Hoover. The conference was brief but satisfactory to the representatives of the industry for they obtained an insight into the plans of the new secretary and in turn showed him how the Department of Commerce could aid the automotive industry through extension of co-operative effort.

The conferees agreed that better results could be obtained through direct contact with the department here. As a result, it was decided to have President Clifton of the N. A. C. C. select a small committee for this work. Other industries will have similar representation, but the automotive leads the way. In addition to Chairman Drake, the industry was represented at the Hoover meeting by H. H. Rice, vice-president of the General Motors Corp.; H. M. Jewett, president Paige-Detroit Motor Car Co.; C. C. Hanch, vice-president N. A. C. C. and chairman taxation committee; Alfred Reeves, general manager N. A. C. C., and George F. Bauer, secretary foreign trade committee N. A. C. C.

Hanch and members of the taxation committee conferred with Senator Penrose, chairman of the Senate Finance Committee. The Senator advised them that it was impossible to advocate removal of excise and consumption taxes at this time or to take a stand on the sales tax plan. It was indicated, however, that he would accept the sales tax if Congress passed the soldiers' bonus bill. Senator Penrose stated that enactment of a soldier bonus would require heavy levy as disbursements would amount to $5,000,000,000 or more.

Mellon Not Committed on Tax

The committee discussed the same taxation principles with Secretary of Treasury Mellon to-day. The secretray would not commit himself to any specific plan other than join in the universal suggestion that excess profits taxes be removed.

In addition to representatives already mentioned, the other participants in the conferences were A. J. Brousseau, president International Motor Car Co.; E. S. Jordan, president Jordan Motor Car Co.; E. H. Broadwell, president Motor and Accessory Manufacturers Association and vice-president Fisk Rubber Co.; C. A. Vane, representing National Automobile Dealers Association; W. O. Rutherford, Rubber Association of America and vice-president B. F. Goodrich Co., and Pyke Johnson, manager Washington bureau of the N. A. C. C.

Motorcycles Bulk of Camp Jesup Sale

Only 400 Trucks and Cars in Lot—Buyers Come from Distant Points

ATLANTA, April 11—Twelve hundred motor vehicles were sold in seven hours Thursday, April 7, at Camp Jesup, Ga., near Atlanta, by a corps of auctioneers representing the United States Government, who are making a tour of various army camps throughout the country disposing in this way of motor vehicles used by the Government during the war. Most of the automobiles sold at Camp Jesup were in rather poor condition, prices paid ranging from less than $100 in a few cases to as high as $1100.

The sale included about 300 motor trucks, all of well-known makes, ranging in capacity from ¾-ton to 5-ton. There were about 100 touring cars and roadsters, 800 motorcycles and 500 sidecars.

Buyers were present at the Camp Jesup sales from some of the Northern and Eastern states, and from all over the South. They represented in some cases persons in quest of individual bargains for their own use, but there were also several speculators present and a number of dealers.

Dealers in the Atlanta territory do not believe that the sale will affect their business to any material extent, for many of the purchases were by men outside this section, only a comparatively few of the sales being to local dealers and buyers. The only effect on business that the sale would be likely to have will doubtless be of used cars, and it is not believed that its effect in this regard will be of serious consequence for so many of the cars sold at Jesup were in a very poor condition.

Iowans Storm Good With Tax Opposition

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quoted and that you do not believe in a tax of this sort. We would appreciate very much hearing from you concerning this."

Of a similar nature are scores of other communications sent out by the automobile men of Cedar Rapids and Linn county. An example of the sentiment expressed may be found in the letter, which went to Good from the MaKibben Motor Co., Inc., as its protest against the passage of the wheel tax measure:

"We are vigorously opposed to this measure and consider that the automobile industry, at the present time, is overtaxed. We sincerely hope that you will give this question further careful consideration."

Local automobile men say that they feel the next steps in this matter should be taken by Representative Good and that they will wait further word from him in reply to their communications before taking any other action.

Find Concrete Roads No Longer Economic

Wisconsin State Highway Commission Seeks Right to Use Gravel Construction

THE comparative and final saving of a concrete road has entirely disappeared in many locations, with the increased costs of all types of roads.

Total abandonment of concrete surfaces is not urged. Many roads must be built of concrete or equally durable material, regardless of differentials.

The main motto in any road building project must be "to furnish transportation service to present day traffic." Neglect at times of primary rules of road building is defensible, with concentration on maintenance.

The day labor or force account plan in state road building enterprise has been found superior over contract building at least to the extent of getting actual costs and experiences.

MILWAUKEE, April 11—These are features which will be emphasized in the next annual review of the Wisconsin State Highway Commission, which is building a 7500 state trunk highway system in the Badger State, in connection with a number of pieces of legislation desired to further advance the work. For one thing, remedial legislation will be asked to permit counties which bonded themselves to build concrete roads, to use their funds for other types of construction.

The records of the commission show that in 1914 an 18-foot surface of concrete could be built for $12,000 a mile. In 1921, the cost will be about $25,000 per mile. In 1918, an 18-foot surface of gravel could be built for $3500 a mile; in 1921, $6,000. These figures do not include grading, culverting and bridging. Accepting it as a fact that a concrete highway is worth one-half of its cost at the end of fifteen years, and a gravel road one-half at the end of five years, the probable annual cost of concrete in 1914 was:

Figures Show Saving

Interest on investment, $600; depreciation, $400; maintenance, $100; total $1,100 per mile. For gravel, according to the commission's figures the costs are: Interest, $175; depreciation, $350; maintenance, $175; total, $700. The 1921 costs are estimated as follows: Concrete: Interest, $1,250; depreciation, $833; maintenance, $175, and total $2,258. Gravel: Interest, $300; depreciation, $600; maintenance, $250; total, $1,150.

Gravel in 1914 was cheaper than concrete by $400 a mile per year; in 1921, gravel will be cheaper by $1,108 a mile per year.

"These figures do not pretend to be exact for all roads and will change with locations, available materials and traffic to be served," said A. R. Hirst, state highway engineer, "and they only emphasize that the comparative and final saving of a concrete road in many locations has entirely disappeared since 1914." The economic positions of concrete and gravel are untenable to-day on many stretches, said commission members, where economy was undoubted six or even two years ago. Therefore the commission urges counties be given permission to use bond money provided specifically for concrete roads, under the state aid plan, for other and economically available materials. It is recognized that many miles of highway in Wisconsin must be built of concrete.

Try Out Construction Costs

The commission having found certain irreconcilable differences of opinion between contractors and the members as to fair prices for road building, the commission prosecuted a small part of Federal aid construction with day labor forces. It is the hope of the commission that each year a minor fraction of its work will be done under this system to keep in touch with actual cost situations, "and thus be able to deal fairly with contractors and the taxpayers."

The state law which limits county bonds to paying 5 per cent, is to be amended to permit 6 per cent rates.

A more intensive system of maintenance is demanded. The report will say, in substance: "It may be expected, despite the temporary depression in the sale of motor vehicles, that their use will constantly tend to increase, thus magnifying the difficulties of maintenance." The present patrol system is to be reinforced and more power is asked for state commission regulation of the county patrols. The commission also believes it must have complete control and direction over the highway marking system, now up to the counties.

Receiver Is Appointed for Lockwood Company

KANSAS CITY, April 11—The Lockwood Mfg. Co., making automobile tops, seat, tire and radiator covers, filed a voluntary petition in bankruptcy, April 8, in the Federal Court here. Schedules showed about $342,759 in unsecured obligations and $269,207 of assets, represented in stock and equipment in the Kansas City factory and warehouses, and the Buffalo factory. The Lockwood company has now no connection with the Baker & Lockwood Mfg. Co.

Albert Newman of the National Bank of Commerce was appointed receiver for the Lockwood Mfg. Co. He will continue operation of the plants, and it is expected that a sale will enable operation to proceed uninterruptedly.

GILLETTE RUBBER ADDS MEN

EAU CLAIRE, WIS., April 11—The Gillette Rubber Co., Eau Claire, Wis., has added more workmen in order to cope with increased orders and expects to reach a daily output of 500 casings by the end of the month. It has more than $1,000,000 worth of orders on its books and prospects for a 1921 business of at least $5,500,000. The daily capacity is 1000 tires and 2000 tubes besides mechanical rubber goods and specialties. L. A. Fosse is general manager.

Exporting Methods Are Found Improved

Mexican Dealers Gain More Favorable Impression of American Merchandise

WASHINGTON, April 9—American firms, including automotive interests trading with Mexico, are extending more credit and longer than during the war period, are shipping better merchandise with a greater assortment, and most of them have learned how to pack and ship for export. Consul J. B. Stewart at Chihuahua reports that these important facts have been obtained by inquiry from a number of Chihuahua merchants of all nationalities engaged in various lines of business.

During the war probably 90 per cent of the goods shipped from the United States were sold on a cash with order or cash against document basis. To-day reliable firms which do not wish to take advantage of the 30 days' cash discount (10 days is not attractive to merchants in Mexico) are being granted 60 to 90 days and some old customers are receiving as much as 120 days. And, as it always takes European goods from six weeks to two months longer to arrive than American goods, the 120 days' credit is as good as the six months' European credit about which so much has been said and written.

The war made it impossible in many cases for the American manufacturer and jobber to send out the quality and assortment of goods which he desired, any many foreign merchants, who up to that time had made most of their purchases in Europe, obtained a wrong impression of the standard of American-made goods. That impression is now giving way to one much more favorable to American merchandise which many in Mexico admit is as good as, and in many cases better, than European-made goods.

But notwithstanding, the statement adds, it cannot be denied that there is a quiet, persistent propaganda on foot which has for its base the theory that once European firms are again seriously competing for the Mexican market, merchants then will be able to buy goods on very long credit terms, that the merchandise from Europe will be of a higher quality than they now are receiving, and that it will be packed in a highly satisfactory manner.

OAKES BUYS MATHER PATENT

INDIANAPOLIS, April 11—The Oakes Co., manufacturers of radiator cooling fans and other automobile parts, has acquired the sole license to manufacture and market automobile tire carriers under the Mather patent, No. 1324461. The Mather patent covers the demountable feature of the tire carrier on a standard type of support bracket. The chief advantage is the interchangeable feature of the bracket.

Earl Reorganizes Briscoe Personnel

New Division Sales Managers Are Named as Preliminary to Sales Campaign

DETROIT, April 11—With the company on a sound financial basis, C. A. Earl, newly elected president of Briscoe Motors Corp., has perfected the reorganization of the company's personnel and formulated plans for speeding up production in the factory at Jackson. The Tilden and Swift interests of Chicago, which control Briscoe, have issued 100,000 shares of stock at $20 a share for the use of the company as working capital. Rules of the stock exchange and other technicalities necessitate waiting a certain number of days during which time present stockholders are given preference in subscribing to the issue before the money actually can be turned in and the stock taken over by the financial interests in control.

A representative of the Chicago financiers said Saturday the interests behind Briscoe had full confidence in the company's, product, and with Earl in control had every assurance of a bright future ahead. Ample financial backing is assured the company, he said, to carry out policies and plans formulated by Earl.

As the first step in putting the plant on a quantity production basis, and at the same time perfecting a sales organization that will put the car in the forefront, Earl announced the selection of K. R. Jacoby, former director of purchases for Willys-Overland, as the new director of sales. J. R. Findlater, a veteran at Briscoe, continues as vice-president in charge of Pacific Coast distribution. H. F. Wardwell, who was succeeded as president by Earl, remains as vice-president.

Other officers are: John Fletcher, treasurer; L. C. Allen, assistant treasurer; L. E. Latta, secretary; E. R. Cowham, assistant general sales manager; D. M. Shaw, advertising manager; Victor Jantsch, chief engineer; J. C. Cunningham, general superintendent; T. W. Tinkham, assistant general superintendent; J. L. Blyth, director of service; W. M. Zerby, traffic manager.

Look for Extensive Business

New division managers also have been named by Earl as follows: J. A. Garrity in the Western Division; F. A. Bixby, Northwestern Division; H. G. L. Campbell, Eastern Central Division; C. E. Rollins, Western Central Division; J. C. Baggott, Eastern Division, and A. H. Jones, assistant to J. R. Findlater, on the Coast. R. M. Chapman, who has been associated with Earl for several years, is made assistant to the president.

The factory has started on a production of 20 cars a day, which will be increased gradually, according to Earl, until it is hoped to reach a daily output of 75. This, of course, is contingent upon market conditions and sales requirements. Earl, however, feels assured the present rapid improvement in sales will continue, and with confidence in the Briscoe, as a leader in its line, he is certain there will be a ready market for as many cars as can be produced under present factory conditions.

"When I accepted the presidency," said Earl, "I did so because I was convinced Briscoe had no superior in its field. It is not nearly so well known as it should be owing to the fact that the company has been content with moderate production nearly always oversold. The car itself has met competition succesfully wherever it has been introduced. The financial resources of the company are ample for any expansion that may be desired, and I took the presidency with the stipulation that we would go out after business on the scale which the car and the standing of the company justified. Readjustment of the executive organization by the addition of several strong men is the first step."

Texas Motor Creditors Would Operate Plant

CHICAGO, April 11—L. S. Maremont, president of the Maremont Mfg. Co., one of the principal creditors of the Texas Motor Car Assn., has sent a letter to creditors of the Texas company, which is now in receivership, urging concerted action which will permit continued operation of the plant in such a way that creditors will realize a substantial sum on their claims. In his letter he asserts that unless operations can be continued there will be no equity in the plant for the creditors. The only assets are the plant, equipment and inventory. The investment in the factory aggregates more than $1,000,000, but there are mortgages against it amounting to $250,000. The liabilities are something over $500,000.

Maremont says in his letter that a tentative plan for continued operation of the plant has been submitted to the receivers, the court at Fort Worth and the bank which is by far the largest creditor. All of them have approved it as the only means of realizing anything for general creditors. Financial interest familiar with reorganizing and operating automobile plants are said to be willing to advance sufficient funds to continue work at the factory in order to use up the large stock of parts, units and accessories, a considerable part of which are of special design and which can be made of value only by assembling them into finished cars. Creditors are asked to give Maremont their approval of his proposal.

SALES MANAGER SUES COMET

DECATUR, ILL., April 11—G. Vernon Beck, former sales manager for the Comet Automobile Co. of this city, is suing the company for $40.000 for alleged breach of contract. Beck claimed that under his contract he was to receive a number of shares of stock in the Comet in addition to his salary. He said he had been unable to secure fulfillment of this contract and his resignation followed.

Harvester Notifies of Work Suspension

Lack of Foreign and Domestic Demand Cause—Lower Costs Must Develop

CHICAGO, April 11—The International Harvester Co. has sent a circular to the employees in its tractor works informing them that on May 1 the company will have on hand all the tractors it can reasonably expect to sell this season and that it will be necessary to curtail production to such an extent that it will amount virtually to closing the plant.

After explaining the reasons for the lack of foreign and domestic demand for tractors, the company says it already has reduced prices on large lines of its output at a heavy loss under present prices for labor and material. Lower costs of material and labor must develop, it is asserted, before industry can hope to get back to normal production.

The circular says that according to the best judgment of the company it is improbable operations will increase for several months, although it is hoped they may be somewhat better in the early fall. Announcement of the proposed shutdown is made now to give employees every opportunity to obtain employment elsewhere.

"Operations have already been continued in spite of heavy cancellations of orders and at serious risk of overproduction so that the maximum employment might be afforded during the winter months," says the circular. "It is hoped that employees will realize that the conditions which make suspension necessary are beyond the company's control. Cancellations of orders for domestic trade are due to the severe drop in the price of farm products, which took place last fall after work had already begun on the schedules of manufacture at this works. As a result, farmers generally have been compelled to sell their products at prices far below what they had hoped to receive and frequently below the cost of production. Therefore they have been and are in no position to buy farm machinery in any such quantity as in normal times.

"The foreign trade, which before the war furnished nearly half the company's volume of business, has been heavily reduced on account of the difficulty of many of the nations and the fall in exchange value in the moneys of other countries."

OHIO GASOLINE DOWN TO 27c.

TOLEDO, April 11—Joyful news to motorists this morning was announcement of a drop in price of one cent a gallon for gasoline, naphtha and varnolene by the Standard Oil Co., making a retail price of 27 cents for gasoline. One cent price declines have been coming every three or four weeks since the first of the year.

Car Finance System Approved by Banker

Vice-President of Irving Finds Development Logical Sequence of Industry's Growth

NEW YORK, April 11—The system used by automobile financing companies was approved by Charles Elliott Warren, vice-president of the Irving National Bank, in an address at the Automobile Club of America. In a discussion of the automotive industry he said:

"The dealers who relied upon local banks before the peak of restriction in credits, turned with a rush to the automobile finance corporations, acceptance corporations and others. There are now more than 110 of these corporations operating in the United States—some local, some state wide and some national. Between 45 and 50 per cent of all cars being sold to-day are marketed on some form of a deferred payment system. Without doubt the methods or system used by these companies in financing both the wholesaler and the retailer are a logical financial sequence and eventually place automobile paper in the same class with any other commercial paper—but back of it must be analyzed the integrity of the company and the dealer.

"Briefly speaking the meaning of the automotive industry is first *Transportation*, involving the use of the truck for the short haul and for the long haul and the saving to the railroads. Second—*The Family Automobile* for the saving of time and the carrying of supplies and the pleasure vehicle. Third—*The Development of the Farm*, the tractor, haulage of supplies and product—the economic value to agriculture.

"Now as to the future of the industry, the war opened the eyes of the world to quick transportation in which the motor played an important and prominent part. It developed transportation in out of the way places and brought about the application of American export of machinery units for the automobile and it must necessarily follow that the manufacturer, dealer and retailer will place the automobile as an American product in foreign countries as was done with the sewing machine. These ends, if brought about, will develop the market.

Must Enforce Economy

"May I say the health of this great automobile business depends upon the stabilizing of the industry by a better production, by economy in manufacturing and selling and by more capable salesmanship, and by dependability and integrity of those interested in the business.

"To sum up, let us say then the outlook is encouraging and while the world is not yet well again, and care and prudence must be exercised in all matters, business men realize that forced action based on artificial optimism may lead to unwise action and produce further embarrassment."

SALES RUN TO $750,000 AT INDIANAPOLIS SHOW

INDIANAPOLIS, April 11—John Orman, manager of the Indianapolis Automobile Trade Association, has compiled a report for the board of directors on sales made by dealers and distributors at the recent spring automobile show at the State fair grounds. The report was submitted at the regular meeting of the board and shows that $660,840 was the total of sales, but conditional sales run the figure far above $750,000. Orman would not count verbal reports of about fifteen exhibitors. Twenty-three firms reported their retail sales numbering 219 jobs as amounting to $553,349.88 and wholesale orders for sixty-three jobs reported by the same dealers amounted to $107,490.

Southern Indiana Sales Show Steady Increase

INDIANAPOLIS, April 9—Every evidence of a sharp increase in motor vehicle sales throughout Indiana in the last week bears out the many predictions of the first quarter of the year. Weather of the last week has been ideal and the increased business is generally credited to the sunshine.

In the southern half of the state sales have been picking up steadily for the last three weeks but took a sudden jump with the first of April and distributors here say that stocks will be heavily depleted if buying continues through another ten days in the ratio of the last half of March.

The automobile show in Terre Haute, this week, was graced by a fair opening attendance, which increased heavily the second and third days and by mid-week buying was generally reported, although sales were not recorded in the first two days of the show. The Vigo county tradesmen believe that the show would have started a renewal of buying without the good weather.

FORT WAYNE INDUSTRIES BOOM

FORT WAYNE, IND., April 11—From all reports the unemployment in Fort Wayne is rapidly vanishing. With the labor situation taking such a decided turn for the better, local business men are feeling more optimistic than they have for some time. There are only one or two factories running full time, full pay, but some of the factories which have run but a week or two since the first of the year are announcing a resumption of business and the building operations are increasing rapidly. Dealers report business is on the increase and the majority of them are quite optimistic over the outlook, although it is expected that business will be slow during the summer.

British Makers Try Trade Experiments

Wolseley Reduces Refinements to Cut Price—Humbers Introduces Larger Car

LONDON, March 24 (*By Mail*)—Two announcements made by prominent British motor manufacturers this week are of interest as showing entirely diverse policies in respect of light cars. Wolseley has put forward a popular rendering of the 10 hp. two-seater, stripping the standard model of non-essential refinements, such as electric light and engine starter, leather upholstery and superfine exterior finish, and is selling this "utility" type at $400 less than the standard.

Humbers, on the other hand, has introduced an enlarged edition of its 10 hp. chassis, fitting an engine with 3 mm. larger bore (68 x 120 mm. in place of 65 x 120), far better and roomier bodies, longer wheelbase, many important detail chassis improvements and a more complete equipment. This new model—for so it may be viewed—displaces two hitherto standard chassis, for until now the chassis of the two-seater has differed widely from that of the four-seater; in future the same will serve for both.

Wolseley, therefore, is appealing to the market with a "short purse" by offering an abbreviated equipment. Humbers, also, with a light car is putting forward something better for the same price as hitherto for the four-seater ($3,500) and at $300 more for the two-seater. The Wolseley Ten has a smaller engine (1260 c.c.) and chassis than the Humber (1783 c.c.), and the former is not fitted with four-seated bodies; but both represent the really high-grade British light car.

Developments of prime importance are anticipated in other directions before the end of the year; one firm hitherto making only "super-grade" cars of over 30 hp. has half a dozen experimental cars running, these consisting of two-cylinder, air-cooled engined runabouts with friction drive, while another high-grade car maker is designing a popular type on entirely different lines. The "economy wave" is undoubtedly making itself felt in many directions and will have an important effect upon the industry.

The British trade has livened up very appreciably during the last two or three weeks and most plants are on full time again with, admittedly, a more or less abbreviated staff.

TO RESELL REYNOLDS' ASSETS

MT. CLEMONS, MICH., April 11—Resale of the assets of the Reynolds Motor Truck Co. has been ordered by Circuit Judge Tucker for April 26. The original sale by Charles J. Reimold, the receiver, for $26,000, was not acceptable to the court.

Parts Service Decision Hangs Fire

Committees to Try to Reach Settlement

Truck Makers and Parts Men Adhere to Positions—Prices Discussed

DETROIT, April 12—Following several hours' discussion here to-day of the national parts servicing plan proposed by unit makers, it was apparent the contending factions were as far apart as ever. A joint committee of ten men representing truck assemblers and parts manufacturers was named to conduct further negotiations looking to a compromise plan.

General Sales Manager A. J. Whipple of the Republic Truck Co. brought the discussion to an end with a motion for appointment of the committee "to discuss ways and means for co-operation and to formulate plans looking to our mutual benefit." An amendment authorizes the committee to invite representatives of the National Automobile Dealers Association or others interested, to participate if they see fit. The committee will report back to a joint meeting of the Motor Truck Manufacturers Association and the parts manufacturers, to be called upon notification of the committee that its report is ready.

The committee is composed of M. L. Pulcher, general manager of the Federal Motor Truck Co., chairman; M. Cook, general manager of the Service Motor Truck Co., J. W. Stephenson, vice-president of the Indiana Truck Corp., Col. F. F. Smith, vice-president of the Republic Truck Co., E. A. Williams, representing the Truck Association, and L. M. Viles, vice-president of the Buda Co., William Mack, sales manager of Borg & Beck; Fred Glover, vice-president of Timken-Detroit Axle Co., H. L. Horning, general manager of the Waukesha Motor Co., and G. W. Yeoman, vice-president of the Continental Motors Corp., representing the parts manufacturers.

"Harmony Didn't Mean Anything"

It became apparent at the outset that both sides were determined in their stand and while there was an evident inclination to get together the point of contact could not be reached. Despite the surface harmony there was always apparent an undercurrent of determination to stand pat and the result of the meeting is best summed up in the statement of a prominent parts manufacturing executive, that, "there was lots of discussion and lots of harmony but it doesn't mean anything."

The outstanding feature is that everyone interested is determined to give full consideration to the problem of proper service which means satisfied customers and increased truck sales. The matter of price standardization also was a theme for much discussion indicative of growing conviction that a uniform price list must be made effective.

The strength of the "wild-cat" manufacturer was stressed by Estel Scott, general manager of the General Automobile Parts Co. of Kansas City, who declared the present conditions were responsible for his success.

Service Requires Capital

Emphasizing his point, Scott said he carried a $62,000 stock of parts and contended every dealer must be equipped similarly to properly service his line. Service, he said, was the vital problem to-day and if it is not adequately furnished the business will be killed. Scott made a plea for a systematic campaign of investigation among individual users to get their idea of best methods and insisted they would be a unit in demanding the plan that assures service, no matter by what name designated or by whom maintained.

Whipple, opposing the plan, said the real question is who is going to conduct the parts servicing business. He asked if it was presumed the men who built up the business were going to turn it over to the parts makers, virtually admitting they were incompetent to conduct it. "We want to conduct the business along proper servicing lines and we are asking only co-operation," he said.

Harry G. Moock, general manager of the N. A. D. A., made a strong plea for the dealer who, he declared, was struggling in desperation to keep his head above water. In the final analysis, he declared the dealer is the one to be considered as the point of contact between the truck manufacturer, the parts maker and the consumer. "Educate the dealer and show him wherein his duty to his manufacturer and his customer lies but don't take away his profit and force him out of business," said Moock. He cautioned his audience to take the dealer into its confidence lest it run against a wall of opposition when the time for settlement comes.

Service Man Gives Views

R. C. Rognan, president of the Automotive Service Association of New York, said the truck manufacturer had not given consideration to proper servicing. If he had he would now be servicing his product and the present conditions would not have arisen, he said. Rognan cited cases of many fleet owners now servicing themselves and said many others were contemplating similar efforts because of the inadequacy of servicing by dealers. He said if central stations were maintained fleet owners could buy more

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Price Fixing Bill Offered in Senate

Labor Organizations Included in Provisions—Owen Would Regulate Bank Interest

WASHINGTON, April 12 — An amendment offered by Senator King of Utah would tighten the Sherman anti-trust law. The amendment would include labor organizations under the act. Section one of the King amendment practically covers open price plans and other forms of information relating to prices. The section reads:

"Every contract, combination in the form of corporation, trust or other form of association, agreement, arrangement, meeting, conference, understanding or conspiracy for purpose of monopolizing, dominating or controlling the trade or commerce in any commodity between two or more states, or for the purpose of fixing or determining the price or prices, charge or charges, at which any commodity may or shall be sold for transportation in trade or commerce between two or more States, or for the purpose of including, or preventing, or impeding any person from buying or selling, procuring or disposing of, dealing in, producing, manufacturing or fabricating any commodity for transportation and commerce between two or more States is hereby declared to be illegal."

The penalty ranges from a fine of $5000 to one year in prison.

Senator Edge of New Jersey, author of the so-called Edge Act, which was designed to stimulate foreign trade, has offered an amendment to the act intended to expedite the operation of the law. The amendment liberalizes certain sections so that operations may begin when corporations organized with capital stock of not less than $2,000,000 have paid in 25 per cent of the stock. The remainder of the capital stock may be paid in installments of 10 per cent of the whole amount at intervals of two months.

Alleges Banks Profiteered

Senator Owen, of Oklahoma, introduced a bill to-day amending the Federal Reserve Act in order to prohibit excessive rates of interest charged by bankers to industry. The bill would prohibit a rate of interest in excess of 6 per cent on loans secured by stocks or bonds as collateral. The Senator insisted that the Federal Reserve Banks have profiteerea shamefully while legitimate industry suffered during the depression.

Congressman McArthur, of Oregon, to-day introduced in the House a bill providing for the appropriation of $75,000,000 for highway construction.

Congress Will Bar Truck Dumping

Reimportation Evil to End, Smoot Says

Will Insist on Specific Provision in Any Anti-Dumping Bill Passed

WASHINGTON, APRIL 13—No anti-dumping bill will be allowed to pass in the Senate without a specific provision covering reimportation of army trucks and other surplus war supplies sold abroad.

This statement was made to-day by Senator Smoot in an interview given the correspondent of AUTOMOTIVE INDUSTRIES. The anti-dumping measure which Representative Young of North Dakota introduced in the House Monday did not carry this proviso.

Senator Smoot feels that the anti-dumping measure is for the protection of domestic markets from foreign competition and that it must embrace all phases of the problem. He is prepared to draft an amendment to the Young bill if it passes the House without the provision essential to the protection of American manufacturers and dealers.

Representative Young told AUTOMOTIVE INDUSTRIES that his bill was designed to cover every form of dumping but admitted that the question of reimportation had not been considered specifically. When it was pointed out to him that a heavy burden was placed on the American automotive industry by the reimportation of American made vehicles, duty free, and their sale here at prices below production costs, he indicated that this condition could be corrected by amendments offered from the floor when the bill is before the House.

It is expected that dealers in California and other states who have felt the effects of the sale here of surplus war supplies by foreign agencies will appeal to their congressmen for action.

STAGE TRUCK DRIVEAWAYS

DETROIT, April 9—Truck manufacturers throughout Michigan have been taking advantage of the open roads for truck driveaways in the last week. Acme Motor Truck Co. of Cadillac has staged driveaways to Grand Rapids, Detroit and many other points in the southern part of the state. Last week a fleet of four trucks consisting of three 2-ton gravel dump jobs and a 1½-ton chassis were driven to Grand Rapids.

CONGRESS GETS TRACTOR BILL

WASHINGTON, April 13—Senator Ball, of Delaware has introduced a bill providing for the transfer of 1000 five-ton caterpillar tractors, complete with spare parts; 500 ten-ton tractors, and 200 Mobile machine shop units, from the War Department to the Bureau of Roads for use in highway construction.

Senator Pittman has introduced a bill providing for a national license system for automobiles. This measure has the support of automobile organizations and is designed to force reciprocity on states which have special requirements for automobile owners.

Goodyear Refinancing Definitely Completed

AKRON, April 14—The special meeting of stockholders of the Goodyear Tire & Rubber Co. to ratify the reorganization plan is being postponed from day to day pending the completion of preliminary details. Negotiations for the refinancing have been definitely consummated, however. It is understood that Goldman, Sachs & Co. of New York will head a syndicate which will offer $25,000,000 in 20 year 8 per cent first mortgage bonds while Blair & Co. will head a syndicate to offer $25,000,000 in 10-year 8 per cent debentures.

The company has filed with the secretary of State of Ohio articles reducing its common capital stock from $100,000,000 to $1,000,000. This is said to be merely one of the steps preliminary to refinancing.

Interest Law Revision Asked

COLUMBUS, April 11—Legislation by the state of Ohio is necessary to enable the completion of the refinancing of the Goodyear Tire & Rubber Co. of Akron, the General Assembly of Ohio was told to-day after the introduction of a bill by Senator W. H Chatfield to permit any corporation to borrow money without regard to the rate of interest. Ohio at present limits corporations to 8 per cent.

Exclusive Sale Move Is Denied by Dodge

DETROIT, April 13—Denial is made by the Dodge Bros. Motor Car Co. that it has informed all dealers that they must handle the Dodge line exclusively or forfeit their contracts. Recent changes in representation in two or three large cities are responsible for the report. When new dealers are appointed, the company asserts, it is simply because of local conditions and not the result of a general policy.

ERSKINE N. A. C. C. DIRECTOR

NEW YORK, April 14—A. R. Erskine, president of the Studebaker Corp., has been elected a director of the National Automobile Chamber of Commerce to succeed C. W. Churchill of the Winton Co. who has engaged in other business.

Endorse New Plan for Standard Parts

Creditors Accept Reorganization Proposal—Would Retain Control of Company

CLEVELAND, April 12—An assemblage of creditors representing $7,500,000 of the $9,500,000 outstanding obligations by unanimous vote to-day accepted a reorganization plan for the Standard Parts Co. The vote was taken after an all-day session during which representatives of the largest creditors of the company spoke in favor of the proposed plan.

Frank Scott, one of the receivers, who withheld approval of the proposal when it was first broached to him, said he did so because some of the creditors had expressed to him their discontent with it. Scott said that he felt these objectors had been appeased to an extent and he said he was now ready to present the plan to Federal Judge Westenhaver should it be ratified.

In brief the reorganization plan provides for the sale of the Standard Parts Co. property to an individual representing the creditors. This purchaser is to resell the plant to a new corporation to be formed in consideration of $6,500,000 of mortgage notes bearing 8 per cent interest, all of the management stock and 110,000 shares of the common stock The management stock consists of $1000 of preferred stock, consisting of ten shares of $100 each, and it is to elect a majority of the new company's directors. This stock is to be under the control of a managing committee, the members of which are to be made up of the Creditors' Committee. Through this plan the creditors would retain their hold on the corporation and if the stockholders did not carry out their part of the plan, the creditors could go through with some other proposal.

Stock Worth $35 a Share

It is estimated that the common stock will be worth $35 a share. It is to be sold to old stockholders of the corporation and the proceeds of this sale, together with the income from the $6,500,000 of mortgage notes, will take care of the total indebtedness of the corporation.

The plan has the approval of the preferred stockholders and the reorganization committee in addition to the creditors. Efforts are to be made to obtain the consent of creditors who were not represented at to-day's meeting and speakers voiced the hope that petition for sale of the property would be filed within 30 days. It was estimated that from $1,200,000 to $3,000,000 would be

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Unemployment Light in French Factories

Situation Far Less Serious Than in United States or England, Report Says

WASHINGTON, April 9—According to Monsieur Laurent, secretary of the Confédération Générale du Travail (General Confederation of Labor), there is a great deal less unemployment in France, proportionately, than there is in the United States or in England, and it is of a much less serious character. A report on the labor situation received by the Bureau of Foreign and Domestic Commerce from Eugene A. Masuret, clerk to the American trade commissioner in Paris, says that Mr. Laurent estimates the number of unemployed workers in the various trades throughout France at between 120,000 and 150,000.

Unemployment in the metallurgical trades affects mostly the laborers and the semi-skilled workers. Many men were taken on in this industry during the war from other trades, and, although not efficient, did not return to their former trades. The skilled worker is generally retained, unless, of course, the plant is completely shut down.

In Paris the total number of unemployed is between 50,000 and 60,000, principally in the metallurgical and furniture trades. The proportion of unemployed in the latter trade is 50 per cent, due mainly, it is stated, to American competition in this line. Unemployment on a large scale is anticipated within the next month in the textile trade at Lille, Troyes and Rouen, because of overproduction. In the shoe industry at Millau (Aveyron) there are now 2000 unemployed, 1200 men and 800 women.

M. Laurent explained that there are two kinds of unemployment in France—unemployment caused by a real lack of work, and preventable unemployment—the latter being temporary in nature and for the purpose of forcing a reduction in salaries. For instance, some employers, it is stated, close down their plants for a period of a week or so, and then re-engage their employees at, say, 20 francs per day instead of 25 francs per day which they formerly paid them.

M. Laurent further stated that there is little probability that unemployment in France will reach a critical stage. The number of unemployed is constantly varying; while some workers are being laid off, others are being taken on. At no time, M. Laurent said, is there a complete cessation of work in any one line of industry throughout the whole country.

JAPANESE LIKE LIGHT CARS

WASHINGTON, April 8 — Consul Hawley has advised that 98 per cent of the passenger automobiles in the Nagoya (Japan) Consular district are of American manufacture. The prices asked for such cars range from $1,000 to $3,000, while half-ton motor trucks are from $3,500 to $4,000. Trucks of 1 and 1½-ton capacity seem most suited to local requirements. There are about 100 trucks and 700 passenger cars in the district. The better class of trade prefers the 6-cylinder car as being the most efficient. There is no specific requirement as to location of steering wheel; a minimum of two headlights is required.

German Exports to England Total £31,126,088 in 1920; December Quarter with £10,494,000 Largest Since War

WASHINGTON, April 9—The total value of imports from Germany into the United Kingdom in 1920 aggregated £31,126,088, of which £8,743,000 was received in the September quarter, and £10,473,881 in the last quarter, according to official monthly returns of the trade, but in Parliament, on Feb. 21, 1921, the value in the December quarter was stated to have reached £10,494,000. Figures showing items imported have been received by the Bureau of Foreign and Domestic Commerce from Alfred Nutting, clerk in the American consulate in London. Copper, iron and steel, dry goods, motor car parts, machinery and other items imported in the fourth and third quarters are as follows:

	Quarter Ended Sept. 30, 1920		Quarter Ended Dec. 31, 1920	
	Quantities	Values	Quantities	Values
Copper, in bars, etc., electrolytic, tons	203	£22,023	1,416	£143,386
Cotton gloves and mfrs.' small wares, doz. pairs	22,024	373,445	37,168	50,065
Dyes and dyestuffs from coal tars, cwt	23,732	1,010,546	59,366	3,041,798
Iron or steel tubes, pipes and fittings, tons	599	29,546	1,066	47,012
Jute piece goods, cwt	4,439	27,788	6,727	33,698
Pig lead, tons	1,762	66,873	3,884	136,251
Dressed leather, cwt	104	17,727	164	27,461
Machinery for printing, bookbinding, etc., tons	125	24,556	206	33,615
Motor car parts and accessories, except chassis	...	48,793	...	74,180
Steel bars, rods, angles, etc., tons	162	6,866	1,276	43,786
Woolen and worsted tissues, cwt	534	40,755	891	56,624
Zinc, crude, tons	1,664	67,356	7,671	314,612

In the above the total in the December quarter is about 140 per cent greater in quantity and 157 per cent in value contrasted with the earlier period and inasmuch as the gross increase in value was only £1,751,000 or 20 per cent, there obviously must have been certain classes of imports which decreased, but there is no information available as yet to denote which they were.

The statement was officially made that 1627 German bicycles were imported from Germany during 1920 valued at £7,081, and that "there is no doubt whatever they can be imported at considerably less than the price at which they can be manufactured" in the United Kingdom. A further official comment was that "Imports from Germany have doubtless contributed to some extent to the depression of the labor market in this country."

French Tariff Bars German-Austrian Cars

PARIS, April 11—(*By cable to* AUTOMOTIVE INDUSTRIES)—A special import tariff applying only to Germany and Austria has been adopted by the French government. It stipulates a duty of 180 per cent ad valorem on imports of passenger cars and 200 per cent on trucks.

Jean Chassagne has entered a Peugeot in the Indianapolis sweepstakes.

Ralph DePalma has drawn No. 1 position in the French Grand Prix.

TO BUILD PLANES IN JAPAN

WASHINGTON, April 9—A group of British airplane construction experts has arrived in Nagoya, Japan, reports Consul Hawley, under a three-year contract with the Mitsubishi Co. to supervise the construction of airplanes in all details. It is expected that a complete airplane manufacturing plant will be organized, capable of turning out airplanes of the most approved type for all purposes.

Fiat Plant Again Faces Serious Labor Troubles

NEW YORK, April 11—Dispatches from Turin, Italy, say that the situation resulting from the dismissal of workmen in the Fiat works is becoming increasingly serious. The Prefect of Turin has made a futile attempt to mediate. The tension has been increased by the fear that the men may again occupy the works.

The problem of the Fiat company is similar to that of other establishments in disposing of superfluous labor since war orders ceased. The Fiat motor car plant carriage works and cylinder foundries have been closed, making idle 12,000 employees. The directors posted a notice stating that their position was a result of the "systematic opposition of workmen's organizations to a practical understanding." The clerical and expert staffs have been retained on holiday leave. The factories are occupied by troops.

Michelin Closes Down Plant

The Michelin Tire factory in Turin also is closed as a result of an attempt to reduce the number of workers to 1200. The employees protested against this decision and declared that instead of reducing the number of employees the factory should be worked only three days a week. The directors refused to agree and the factory was closed.

INDUSTRIAL NOTES

Handley-Knight Co., Kalamazoo, Mich., will soon install in its plant a complete finishing department and in the future all bodies will be bought in the rough and painted, varnished and upholstered in Kalamazoo. The new departments will give employment to about 50 additional hands.

Code Mfg. Co., Chicago, has been incorporated under the laws of Illinois to manufacture ratchet wrenches, visors and oilers. The company has been in production for the last six months. J. R. Oyott is president; William E. Code, vice-president, and A. L. Rousseau general manager.

Auto Specialties Mfg. Co., St. Joseph, Mich., in addition to its line of Bair top holders, automobile jacks and malleable iron castings, has acquired all patents and manufacturing rights on the shock absorbers for Ford cars, formerly known under the name "Burgess."

Sandusky Tractor Co., Sandusky, Ohio, has been chartered with an authorized capital of $100,000, to manufacture and sell tractors of all kinds. At first the tractors will be designed for agricultural purposes, and it is proposed to go into other lines.

Edward Valve & Mfg. Co., in order to centralize control of its industry, promote economy and better serve its customers, has moved its general offices from Chicago to its factory located at East Chicago, Ind.

Hughson & Merton, Inc., San Francisco and Los Angeles has been appointed sales representative for the Lane Bros. Co., Poughkeepsie, N. Y., manufacturers of sliding door hangers and H-C jacks.

Thomart Motor Co., Kent, Ohio, has been endorsed by the Kent Chamber of Commerce after an investigation into the management and financial standing of the company.

Victor Rubber Co. will establish general offices in the downtown section of Springfield, Ohio, instead of maintaining the offices at the factory as formerly.

TERMAAT-MONAHAN SOLD

OSHKOSH, WIS., April 11—The International Cultivator Corp., New York, has bid in the property of the Termaat-Monahan Mfg. Co., this city, at receiver's auction and intends to reopen the plant for the manufacture of gas engines, farm power units, lighting systems, etc. The purchase involves about $90,000. The International corporation has filed articles and been granted a charter to do business in Wisconsin.

RECEIVERS OPERATE PHELPS

COLUMBUS, April 11—The Phelps Mfg. Co. of Columbus, makers of the Phelps wire wheels for automobiles, which has been in the hands of J. H. Weisenback and Thomas W. Pickard as receivers for several months, is resuming operations. For a time the plant was shut down but now with a revival in the demand for wheels production is starting up under the receivers. Some of the machinery is being disposed of.

WITHDRAW OFFER FOR PLANT

LOUISVILLE, April 11—Withdrawal by the Collapsible Wheel Co. of its $172,500 offer for the property of the bankrupt Kentucky Steel & Iron Co. marked proceedings Saturday in the court of Referee George Du Relle. The case was passed to Tuesday. The offer of the Collapsible Wheel Co., a Delaware corporation, was made by L. Culbreath, Asheville, N. C. The bid was withdrawn, it is understood, because representatives of the wheel company feared possible litigation on the part of creditors who had objected to the sale. The wheel company is capitalized, it is said, at $2,000,000.

Labor Statistics Show Car Increases Steady

WASHINGTON, April 9—Increased activity in the automotive industry is reflected in the report of the United States Employment Service showing a gain of 28.1 per cent in the number employed during March. The amount of increase listed from reports under "Vehicles for Land Transportation" was 31,342. Of the total reported employed in 14 groups on March 31, the relative weight of the vehicle industry was 8.9 per cent. Though slight increases were reported in the employment situation in 4 other industries, the gain was not comparable to that registered in the automobile industry.

Reports from 1424 firms, usually employing 501 or more, showed that 1,587,786 workers were employed on March 31 as against 1,612,611 on Feb. 28, a net decrease of 24,825, or 1.5 per cent. The net decrease in employment since Jan. 31 has been 40,348, or 2.5 per cent.

While agents of the Labor Department in Detroit reported that automobile manufacturers were proceeding with caution, it was pointed out that the situation indicated permanent movement and steady increase in the working forces.

Throughout the States of Ohio, Illinois, Indiana, Michigan and Wisconsin the automobile and textile groups are in increasingly better condition but no other group shows appreciable improvement.

EQUIPMENT SELLS IN TEXAS

FORT WORTH, April 11—The recent business depression in the automobile business in the Southwest is over. So the guests of the Equipment Co. of Texas were told by President H. R. Shedd. As evidence, he declared the March business had been the best in the firm's history and April was starting off equally well. The guests were salesmen of the company in the Texas territory, and the meeting an annual affair. Plans for extending the 1921 business were mapped out.

KANSAS CITY CONTINUES GAINS

KANSAS CITY, April 11—March was for several distributors of standard makes of passenger cars, a better month than March 1920 in Kansas City and territory. The chief gain was in retail sales. All cars, both standard and less well known makes, moved better at retail in March than in several months past.

METAL MARKETS

As for its effect on the steel market, Tuesday evening's long expected announcement by the United States Steel Corp. of a reduction in its prices which practically brings them to the independents' level, one need but recall the fact that the news was given out after the close of the stock market and this circumstance is more noteworthy than any of the price adjustment details.

Attention has been previously directed in these reports that the most significant feature of any price changes by the Corporation lies in the generally accepted theory that when the Corporation promulgates price changes they are almost invariably predicated upon fairly precise knowledge of orders for representative tonnages that have been hanging fire and that can be booked immediately following the price change. If there be any such latent business overhanging the market, they are from the structural, railroad and other lines of steel consumption. Whatever the future may bring forth, however, the fact remains that the automotive industries so far furnish the staff on which iron and steel producers lean for support. Compared with war days, the tonnages involved in new business emanating from passenger car builders and automotive parts makers may be light, but the impressive feature is the steadily growing number of orders and, perhaps still more so, the broadening of this demand over departments of the market heretofore entirely neglected. Builders of low-priced passenger cars are figuring prominently in the market for tubular goods, and about the only worth while sale of ferromanganese that has been made of late was one in which a Detroit passenger car and tractor interest figured as buyer. It is gratifying to note that Mahoning valley sheet makers are setting up a vociferous plaint, because nothing but absolutely perfect sheets pass muster in automotive plants these days and that rejections for defects have never been so numerous as at the present. The sheet mills themselves will in the end be the greatest gainers from this exacting method.

Pig Iron—With two-thirds of the stacks blown out and production cut to the lowest level in many years, a steadying tendency is in evidence; at $25, valley, both malleable and foundry may even be called firm.

Steel—While one of the Corporation's regular automotive customers is said to have recently placed an order for 5,000 tons of steel bars at 2.35c., Pittsburgh, other interests have booked business in the last few days at 2.10c. Cold-finished steel bars are offered at as low as 3c. Detroit passenger car builders continue to release suspended tonnages for specialties. Strip steel is also moving in carload lots to the automotive trade. Orders for several hundred tons of sheets are reported to have been placed in the Pittsburgh and Chicago markets.

Aluminum—Most of the resellers and importers are now asking 24c. for virgin ingots, 98@39 per cent pure. German metal is still being offered at bargain prices, but purchases involve undesirable terms of payment.

Copper—The shutdown of 75 per cent of the mines will not be felt in refinery output until June.

Tin—Speculative ups and downs continue with consuming demand light.

Lead—Quiet and of a routine character.

Zinc—Slightly more demand from galvanizers; brass mills still apathetic.

FINANCIAL NOTES

Wright Aeronautical Corp., for the year ended Dec. 31, reports net profits, after charges and Federal taxes, of $411,349, which is equivalent to $1.83 a share on the 224,890 shares of capital stock of no par value outstanding. Total sales for the year were $1,486,124, while the costs of sales were $1,124,058, leaving a profit of $362,066.

Mullins Body Co. directors voted to pass the dividend payment due on common stock. Heretofore the company has been paying at the rate of $1 quarterly on common. The regular quarterly dividend of $2 a share on preferred stock will be paid May 1. The passing of the dividend is said to be due to the lockout which has closed the company's plants for more than a month.

Packard Motor Car Co. is issuing $10,000,000 in coupon bonds in interchangeable denomination of $1000 and $500, registerable as to principal only. The bonds are to be redeemable at the option of the company on any interest date, on 60 days notice as a whole but not in part, at 107½ per cent on or before April 15, 1926, and at 105 per cent thereafter. The company covenants to set aside quarterly sums equal annually to one-tenth of the largest amount of these bonds which has ever been outstanding, such sums to be used as far as possible, for the purchase of bonds in the open market at not exceeding 105 per cent and interest.

French Battery & Carbon Co., Madison, Wis., is being reorganized on a larger and broader scale to take over the manufacture of a battery under patents owned by the Federal Battery Co., Cleveland. The French company will start work shortly on a large factory addition. Its new capitalization consists of $300,000 of common stock, $700,000 of first preferred and $1,000,000 of second preferred, both 8 per cent stock. It is understood that the Federal Battery Co. becomes owner of a large block of the first preferred.

Spicer Mfg. Corp. reports for 1920 sales amounting to $17,862,929.94. Net profits after depreciation and deduction of interest were $1,448,752.79, with reduction of inventory to present prices and provision for Federal taxes, net profit was $646,022.08, equivalent to $21.33 on the preferred stock. Despite unfavorable conditions, the company has paid the regular preferred dividends, a 50 per cent dividend on the common and retired the first series of five year 5 per cent notes amounting to $600,000.

Independent Pneumatic Tool Co., Chicago, earned $1,308,457 in 1920 before dividends and charges, compared with $1,439,376 the previous year. Dividends and charges required $418,874 from the surplus in 1920, where in 1919 the surplus was increased by $727,694. Total assets of the company are shown as $5,618,546, cash totaling $655,041 and inventories $623,435.

Federal Rubber Co. in a balance sheet as of Dec. 31, 1920, shows total assets of $19,618,321.21 and a surplus of $1,245,826.25. The assets include inventories totaling $7,836,123.58, of which $5,061,625.06 represented finished product at factory and warehouses. Cash in banks and on hand is shown as $432,605.08. Net sales for the year were $13,911,993.22.

Ohio Body & Blower Co. for the year ended Dec. 31, 1920, reports net sales of $2,737,250. Expenses, depreciation and inventory adjustment amounted to $2,967,153, leaving an operating loss of $229,903. After payment of interest and dividends there was a net deficit of $596,629 for the year. The surplus was reduced to $1,576,100.

Stutz Motor Car Co., in a comparative balance sheet as of Dec. 31, shows assets of $8,032,522, in which is included cash of $217,043 and an inventory of $3,049,238. The surplus of $5,404,414 is $368,544 less than the 1919 surplus. On Dec. 31, it is declared, the net tangible assets applicable to the capital stock, amounted to $6,404,414, or $32.02 a share.

Keystone Tire & Rubber Co. reports net loss after expenses, interest and taxes in 1920 of $317,704. Profit and loss deficit on Dec. 31 was $384,623. The company reported total assets of $4,650,135, which included cash of $105,032 and inventory $860,921. Accounts receivable totaled $2,243,912.

Stewart Warner Speedometer Corp. directors, after their meeting in Chicago this week, declared that the quarterly dividend would be cut from $1 to 50 cents a share April 20. The company reports retail trade back to normal.

Sewell Cushion Wheel Co., Detroit, has paid the regular quarterly dividend of 2 per cent on preferred stock and 8 per cent on common. At the annual meeting of directors April 5 all of the old officers, headed by H. J. Sewell, president, were re-elected.

Service Motor Truck Co., Wabash, Ind., has changed the par value of its common stock from $100 a share to $10 a share, and the number of its shares from 35,000 to 350,000.

United States Rubber Co. has declared regular quarterly dividends of $2 a share on common stock and $2 a share on preferred, both payable April 30.

Kelsey Wheel Co. has declared the regular quarterly dividend of 1¾ per cent on the preferred stock payable May 2 to stock of record April 23.

United States Motor Truck Co. paid the regular 1¾ per cent dividend of preferred stock on April 10.

Wisconsin Truck Merger Awaits Stock Action

KENOSHA, WIS., APRIL 13.—Consolidation of the Winther Motor Truck Co., the Kenosha Wheel & Axle Co. and the Marwin Truck Corp. will be announced April 29 if the stockholders ratify the action proposed by the directors and they are expected to give their assent.

There is a strong probability that this combination will be expanded later by the addition of a half-dozen representative truck manufacturing companies. Under the plan proposed each factory would manufacture a truck of one capacity.

The chief obstacle thus far to the larger combination has been the question of financing. The bankers approached on the subject are understood to have given it their approval but have advised waiting a few months until conditions improve in the money market.

CREDITORS ASK NEW RECEIVER

INDIANAPOLIS, April 9—Three Indianapolis firms, creditors of the Van Briggle Motor Device Co., filed papers in Federal court April 7 against William R. Hirst, receiver of the company, asking that a receiver in bankruptcy be appointed in Federal court.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, April 14—The attention of the financial community last week was directed, in the main, toward prospects for easier money. Continued liquidation in the industrial and commercial fields, the steady improvement in the reserve position of the Federal Reserve System, the continued stream of gold imports, and rumors of possible lowering of official rates abroad lead many to think that a permanent lowering of money rates was at hand. While the industrial situation in England practically prohibited the expected lowering of the Bank of England's official discount rate, the National Bank of Switzerland was the one bank on the continent which did lower its discount rate, which had been in effect since August, 1919. The rate now is 4½ per cent as against an old rate of 5 per cent; and the Bank's rate for advances against security was lowered to 5½ per cent.

While money was easier in New York there was no assurance of a lasting change. Call money ruled from 5 per cent cent to 7 per cent as against 6 per cent to 7 per cent the previous week. The renewal rate on Monday of last week was 6½ per cent and thereafter did not get above 6 per cent until Monday of this week, when 7 per cent was quoted.

The Federal Reserve Banks as a whole last week gained $17,571,000 in gold reserves, making an increase of $204,677,000 since Dec. 30, 1920. Total gold reserves at $2,264,010,000 were at the highest point in the history of the Federal Reserve System. Rediscounts were $213,698,000 less than they were four weeks ago and are at the lowest point since Jan. 23, 1920. Federal Reserve notes in circulation at $2,893,964,000 are at the lowest point since Feb. 9, 1920, and are $14,189,000 less than a week ago.

Total earning assets declined $75,580,000 and total deposits $43,917,000. Total bills on hand were also less by $78,727,000.

Bank clearings for 193 cities in March were $31,600,363,064 as against $41,338,259,6991 in March, 1920, making a decline of 25 per cent. For the three months ended March 31, clearings were $91,245,362,890 or 21.6 per cent less than for the corresponding period of 1920. Bank clearings for New York showed the same tendency. March clearings were 25.3 per cent less than for March a year ago, and clearings for the three months were 21.8 per cent less than for the first three months of 1920.

PLAN QUICK SALE OF IMMEL

COLUMBUS, April 11—The reorganization plans of the creditor's committee of the Immel Co. are working out satisfactorily, according to A. G. Gilmour chairman of the committee and it is likely that the receiver, Robert H. Schryver will offer the plant and assets for sale within 30 days.

Men of the Industry

Joseph L. Bardig, advertising manager of the motor bearings division of the Hyatt Roller Bearing Co., has joined the staff of the Campbell-Ewald Co. to assist in sales promotion work. Previous to his appointment as advertising manager of the motor bearings division of the Hyatt Roller Bearing Co. he was assistant advertising manager of the motor equipment division of the General Motors Corp. In this capacity he directed advertising of the Remy Electric Co., the Klaxon Co., the Harrison Radiator Co. and the Jaxon Steel Products Co.

John E. Tracy, who served four years as general sales manager of the Sterling Motor Truck Co., Milwaukee, has resigned, to accept the position of vice-president and director of sales of the Hicks-Parrett Tractor Co., Chicago, a new $3,500,000 concern which is manufacturing heavy duty truck units and fire apparatus. Tracy was the first president of the National Association of Motor Truck Sales Managers, in the organization of which he took a leading part. He assumed his new duties April 4.

S. M. Williams, chairman of the Federal Highway Council, announces the election of four new members to the executive committe of the Council: W. J. L. Banham, general traffic manager, Otis Elevator Co.; David Beecroft, president, Society of Automotive Engineers, and directing editor, Class Journal Co.; H. W. Alden, vice-president, Timken-Detroit Axle Co., and S. P. Leeds, president, Atlantic City Chamber of Commerce.

R. C. Hawley has rejoined the sales staff of the Remy Electric Co. About a year ago Hawley resigned from the Remy sales department to take up an electrical engineering project of his own. Prior to that time he was a member of the Remy organization since 1918, coming from the Mitchell Motor Car Co., where he was engineer in charge of electrical installation.

Stanley E. Knause, who has been closely connected with the sale of commercial aircraft since the war and who for the last two years has been sales and advertising manager for Continental Aircraft, Inc., has been made sales manager of the Stout Engineering Laboratories, Inc., Detroit, and will assume his new duties immediately.

George D. Wilcox, director of sales and advertising for Commerce Motor Car Co., Detroit, has been promoted to general manager. Wilcox has been in charge of sales for the last seven years both in America and the export field. O. D. Coppock, who has been assistant to Wilcox, becomes sales manager.

C. M. Bunnell, for the past ten years in charge of sales of automobile lamps for the Edison lamp works of General Electric Co., has accepted the position of director of branches with the Splitdorf Electrical Co., with headquarters at the general offices of the company, Newark, N. J.

Worth Colwell, who with Edward F. Korbel has handled publicity for most of the automobile exhibits in New York in recent years, will sail for Europe the last week in April to study exhibits abroad. Colwell is also president of the Rowland Advertising Co., Inc.

W. E. Baker has been appointed assistant general sales manager of the I. J. Cooper Rubber Co., Cincinnati. He was formerly sales manager of the Cincinnati Time Recorder Co. and prior to that was sales manager of the E. A. Myers Co., Pittsburgh.

C. N. Eason, vice-president of the Hyatt Roller Bearing Co., has become associated with the Samson Tractor Co., Janesville, Wis., division of General Motors, as assistant to President J. A. Craig and supervisor of the engineering department.

Elwood Haynes, president of the Haynes Automobile Co., Kokomo, Ind., together with three brothers, has donated to the city of Portland, Ind., a large tract in the northwestern part of that city to be used as a public park.

Harry Doty, formerly branch manager at Chicago for the Haynes Automobile Co., has been appointed sales manager for the Premier Car Corp., with headquarters at the factory in Indianapolis.

L. E. DeGroat, formerly of Timken-Detroit Axle Co., has joined the Acme Motor Truck Co., Cadillac, in charge of dealer promotion work.

Herbert Y. McMullen, formerly connected with the Trackless Transportation Corp., New York, has resigned his position.

H. D. Minchin, formerly sales manager of Lewis Searing & Co., is now general sales manager of the Field Body Corp.

Robert I. Erlichman resigned as president of the General Utility Co. and was succeeded by A. H. P. Leuf.

H. W. Scholl has resigned as sales manager of the Splitdorf Electrical Co., Newark, N. J.

N.A.C.C. Names Committee to Confer with N.A.D.A.

NEW YORK, April 12—Arrangements were completed to-day by the National Automobile Chamber of Commerce, for the first of a series of conferences with the National Automobile Dealers Association, at which problems of the industry affecting both manufacturer and dealer are to be discussed. The initial session will be held at the Detroit Athletic Club, Detroit, May 9.

The following committee was appointed by President Clifton to represent the N. A. C. C. at the conference:

W. C. Sills, sales manager, Chevrolet; C. B. Voorhis, sales manager, Nash; C. W. Matheson, sales manager, Dodge; Hal B. Boulden, sales manager, Selden Motor Truck Co., and F. E. Connor, sales manager of Chandler.

Southern Money Easier, Farmers Pay Off Loans

ATLANTA, April 12—Business conditions over the South continue on the upward trend with the result that there is a much better feeling as regards the outlook for the future in industrial and commercial circles than the section has known for months.

The Federal Reserve Bank of Atlanta reports that the farmers in the sixth district, which comprises most of the states of the Southeastern area, are still holding between 50 and 60 per cent of last year's cotton crop, and that approximately half of this is pledged as collateral for loans. Just how long this cotton will continue to be held depends to a arge extent on what Southern producers do this year in the way of acreage reduction. A drastic reduction would serve to increase cotton prices and result in the sale of considerable of the staple now being held. This, naturally, would still further improve the financial condition of the section. There is every indication that the acreage will be reduced from 30 to 50 per cent.

Governor M. B. Wellborn, of the Federal Reserve Bank of Atlanta, said that "if liquidation of borrowings in the Atlanta district continues as it has the past three months, the directors of the bank will consider lowering the discount rate."

Ford Orders, 102,000; Look for Million Year

NEW YORK, April 13—The average production at the Ford plant is now about 3300 cars a day and the plan is to increase production until it reaches approximately 4000 daily. No definite schedule has been fixed for the year but the total is expected to approximate 1,000,000. Actual sales in the domestic market for March were 87,221 cars and 4708 tractors. Orders on hand for cars total 102,000. The number of men employed is about 32,000.

Henry Ford is entirely satisfied with the present outlook. Bank notes to the amount of $24,000,000 will be due April 18 and it is understood he expects to pay at least 25 per cent of them and is confident he will encounter no difficulty in paying the remainder.

Theft Protective Bureau to Issue Radiator Disks

NEW YORK, April 12—The Automobile Protective and Information Bureau of Chicago, representing a large number of insurance companies handling automobile lines in the Middle West, plans to distribute to policy holders brilliant metal disks to be placed on radiators reading "This Car is Protected by the Automobile Protective and Information Bureau of Chicago." The William J. Burns Detective Agency, Inc., in conjunction with the Rent Renton Auto Recovery service in this city, has been planning a similar device. Detectives assert that such placards on automobiles are found to be worth while deterrents to thieves.

PAIGE STAGES NATIONAL WEEK

DETROIT, April 9—Paige Motor Car Co. dealers throughout the United States are participating in a national demonstration week which began Monday. With all of the larger shows past factory executives decided that the time was most opportune for a spring salon and a real Paige show in each city at the Paige salesrooms.

The Paige factory is working practically full time at close to 100 per cent production in anticipation of demand resulting from the week's efforts.

Calendar

FOREIGN SHOWS

April 16 - May 8—Bosquet, Algiers; Algerian Agricultural Fair, Motor Cars, Machinery and Tractors.

Apr. 20 - May 5 — Mexico City, Mexican Automobile Show, National Theatre Bldg.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars. Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland. Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina. Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September — Buenos Aires, Argentina. Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais. Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

May 24-28 — West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

July 4-9 — Mackinac Island, Mich., Summer Meeting Automobile Equipment Association.

Oct. 12-14, 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Buffalo section—April 19—Paper on "Carbureter Performance," by F. C. Mock.

Dayton section—May 3.

Parts Service Problem Referred to Committees

(*Continued from page* 834)

cheaply and would naturally be heartily in favor of the plan. Service must be put on a commercial basis if the industry is to live, Rognan asserted.

Otto Armleder, president of the O Armleder Co., took the parts makers to task for not fulfilling their obligation to the manufacturer and his customer in their attitude on replacements.

"We stand behind every unit of our product," said he, "and when you send out an improper product it is your duty to replace it and assume all expense. It is the great evil of the business. You parts makers must start right. We owe our customers an obligation and you owe the same to us."

In support of the plan of the parts makers, Yeoman recited the history of it dating from the first station established five years ago which he said was brought about by continued complaint from customers that they could not get service. With reference to the plea for the dealers, Yeoman said the dealer profit on parts was so small as to be of virtually no consideration and he cited numerous figures to sustain his contention. He insisted the only reason Continental was operating the service station plan was to insure service to users of Continental engines.

Underselling Market

Independents, Yeoman said, were selling to the dealers as cheaply as the parts makers can sell to the truck assembler. He said the parts makers felt that the plan was a big asset to the assembler and declared it was the earnest desire of the parts makers to co-operate with the assembler in convincing the consumer of the advantage of the assembled truck, thereby increasing the demand. The parts stocks in the stations now operating, Yeoman added, varied in values from $20,000 to $90,000, and he contended that many men had heavy building investments in addition.

He said it was the unanimous opinion of the parts makers that the truck manufacturers were unable to find dealers who could assure proper service, the inference being that there would be no inclination to recede from the present position.

Pulcher, who opened the discussion opposing the service station plan, said he had a grip full of communications from dealers opposing it. He declared the parts makers had done nothing for the dealers, whereas the truck manufacturer had taken care of them. The serious problem from the manufacturing standpoint, Pulcher said, was in keeping the dealer organizations intact and he declared the dealer's only profit in the last six months was from service. He asserted the manufacturer lost contact with his customer when that customer was able to go to a parts station for new parts rather than to the dealer.

Prices Vary as High as $40

Pulcher said prices varied as much as $40 in some instances and urged the need of standardization and printed price lists. He told of the trouble in getting dealers and in holding them and in citing concrete instances where his company had helped a dealer financially, demanded to know if the parts maker would have done that. If an inferior part goes out in a truck, Pulcher said, unless it comes back to the dealer the manufacturer knows nothing about it and the truck gets the blame. He said his company was ready to help the small assembler who was unable to maintain a large dealer organization, by giving him discounts and in every way. Pulcher declared his company was unalterably opposed to the stations operated by the parts maker.

The meeting, which had been transferred from the Detroit Athletic Club to the Wolverine Hotel for convenience of the large crowd expected, was called to order by President B. A. Gramm. Armleder read the resolution adopted by the truck association committee two weeks ago expressing unalterable opposition to the service station plan as detrimental to the interests of all concerned. On motion of Pulcher committees of six parts makers and six assemblers were named to formulate separate statements for presentation at the afternoon meeting and the morning session adjourned.

Endorse New Plan for Standard Parts

(*Continued from page* 835)

paid in for the benefit of creditors within 90 days. Dismissal of the receivers would follow success of the proposal.

Scott made it plain that the present status of the Standard Parts was brought about by an internal fight. J. O. Eaton, general manager of Standard Parts, and one of the receivers, is in California, and he was unable to attend the gathering.

It was pointed out that while debts aggregate $9,500,000, the assets are more than $20,000,000. Cash and accounts receivable aggregate $2,200,000; inventory $4,000,000; stock in the Bock Ball Bearing Co., $2,000,000; plants were appraised at $11,700,000; holdings in the Eaton Axle Co., $1,200,000.

It was brought out in the discussion that while earnings of the company had at times dropped to $250,000 a month, the figure for April will approximate $800,000. Under normal conditions the company can earn $3,000,000 a year, and $6,000,000 under more favorable conditions.

Big Dirigible to Fly 8000 Miles to Coast

NEW YORK, April 12—The ZR-2 formerly the R-38, which the United States Navy is having constructed in England and which is the largest airship ever built, will be flown to the United States in May or June. It is planned, if possible, to fly the great dirigible direct to the Pacific Coast, thus making in its maiden flight a non-stop record of approximately 8000 miles.

The ZR-2 is almost one-third larger, far more powerful and with twice the cruising radius of the R-34, which in 1919 made the round trip of the Atlantic Ocean after laying over several days on Long Island. It is being rushed to completion at the Royal Airship Works, Cardington, Bedford. Its engines are being built by Sunbeam. Dimensions of the craft are 700 ft. long and 85 ft. diameter.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XLIV. NEW YORK—THURSDAY, APRIL 21, 1921 NO. 16

Balancing Factory Equipment for Efficient Manufacture

Team work is as necessary in a factory as in a ball team. Only by cooperation of all units can production costs be properly adjusted. In the production scramble many stars were bought. Now comes the era of specially equipped all-star factories.

By J. Edward Schipper

NOW that automobile manufacture has reached a production basis again, with factory output ranging from 25 to 100 per cent of capacity, machine problems are coming to the front. In many plants the production manager finds his machine tool equipment out of balance. This is due to the accumulation of new machinery during the past year or two in some departments, while in other departments, in the same plant, older machinery is relied upon. The result is that the shop is not producing uniformly, or up to profitable efficiency.

To put the situation in a nutshell:

The next year in the automobile industry must be one of intensive retooling if automobile manufacturing costs are to be adjusted to the general business trend. From the present outlook, there is not much to be hoped for in any material reduction in labor costs. Wages are apt to remain indefinitely about where they are, and if manufacturing costs are to be cut it must be on a production side, or, in other words, by the use of better machinery adapted to manufacturing at higher speeds.

It may astonish some manufacturers to know that, from the machinery standpoint, their plans are practically obsolete. It would be perfectly possible with up-to-date tool equipment to manufacture a greater number of automobiles in the same space and time by the use of new machinery. **Naturally, a manufacturer equipped with this machinery would be in a position to undersell the concern with the older tool equipment.**

This is clearly brought out by a visit to factories which have been partially re-equipped with machinery.

> **There is one particular engine which the writer has in mind in which it is necessary to run one machine only two hours in order to keep production up with the rest of the shop. This either means that the manufacturer had no right to buy the improved machine, or he is losing money by not re-equipping his factory to the production schedule of his most advanced machine. A machine cannot pay its carrying cost by two hours' work.**

There is another, and a very important, advantage in the purchase of improved machinery to replace older models. **This is in the greater accuracy of the new machine and the consequent saving, not only in the matter of rejections of partially machined parts, but also in the inspection department.**

The problem in retooling a plant is broadly economic in the many angles it presents for consideration. Between the time a piece of raw material enters the plant and the time it leaves the factory, as a finished product, this piece of material is costing the manufacturer money. Naturally, the shorter he makes this period, the less his cost of production will be. He will have saved money by shortening the labor charges; by increasing the rapidity of turnover and by reducing the amount of money tied up in parts in process.

The efficiency of the machinery in the plant has a direct bearing on the ratio of output to process parts. Consequently it is a direct factor, not only in the cost of the finished article, but in the amount of working capital required to run the manufacturing business.

When these factors are taken into consideration and when it is considered that a great many of the automobile plants in successful operation are using the machinery purchased from 5 to 10, and in some cases 15 years ago, this question of retooling becomes one of the biggest problems within the industry.

Now that the cost of machine tools is back on a basis where purchase is readily justified when the economic consideration of the plant demands it, the time has come when every manufacturer should ask himself if his machine tool equipment is such that he is getting as large a return for the money invested in manufacture as his new competitor, who is tooled up along more modern lines.

If it is true that a new manufacturer could enter the field with a new plant and make the same or a better product at less cost, there is something wrong with the tool equipment of the older concern.

It has been stated before in these columns that there are certain automobile manufacturers who are admittedly giving a greater value to the public on a dollar per dollar basis than other manufacturers. A study of the reason entering into this shows that it is largely a question of manufacturing equipment. Manufacturers whose plants have been developed and maintained at a modern standpoint can turn out a greater quantity of cars at a less price and with a smaller amount of floor space than plants using older equipment.

Drill presses are a good example of this. It would not be far wrong to state that the drill press equipment of the automotive industry is about 30 per cent behind times.

In other words, if the entire mass of drilling operations for the entire industry were considered in bulk, it would be possible to drill the same number of holes in the same length of time with only 60 per cent of the number of machines now utilized and in 60 per cent of the space. This is an arbitrary figure, but well within what machine tool men know to be a fact.

The advance in the machine manufacturers' art during the past three years has been far greater than the advance in engineering in the automobile field. From a performance standpoint, the automobile of to-day is fairly satisfactory from the viewpoint of the consumer. To-day an automobile is discarded, not because it ceases to respond to the demand for transportation, but because it becomes noisy, somewhat more expensive to operate and chiefly because of the pride of the owner. This being the case, we must not look to the designer for the big improvements in the automobile industry during the next few years. These improvements will be rather in the manufacture of the product and in the material chosen than in design engineering.

It is hardly likely that any revolutionary engineering discoveries will be made within the next few years that will entirely shake the foundation of the art, so far as performance is concerned. **On the other hand, it is entirely possible to look for revolutionary improvements in the matter of manufacture and, as a matter of fact, these revolutionary improvements have largely taken place during the last three years.**

New machines available to the automobile manufacturer, if he studies the machine tool market, are further ahead of the tools which he has had in his plant for the past 5 or 10 years, than the cars of to-day are ahead of those of 10 or 15 years ago.

The long pauses between cutting operations have been eliminated and on many of the tools now on the market, particularly for milling and grinding operations, there is hardly an instant during the working day when the tool is not cutting. A tool reaches its maximum earning capacity **when it is cutting at the highest possible cutting speed during the entire working day.** This ideal, of course, has not often been attained, but is so nearly accomplished on some of the newer machines that the advance in manufacturing efficiency is surprising.

It is not difficult to look through the cost figures of the automobile manufacturer and find where such machinery will save money. **Furthermore,** unless new tool steels are invented which make it possible to cut at a faster rate than is now possible, the manufacturer is assured that just as long as he has machine tools which are continually cutting at that rate, he will be in a position to manufacture that particular piece with the greatest efficiency.

Accuracy of manufacture has come with the new machinery for a variety of reasons.

One example is in the simplification of locating points which has been rendered possible by the ability of machines to operate at several points on the piece at the same time. With the older equipment, it was necessary to twist and turn the piece so many times during the process of machining that location from secondary locating points was often required. The impossibility of maintaining accuracy under such conditions is readily recognized by all manufacturers.

Furthermore, the machinery which is capable of the greater number and the greater rapidity of cuts has been made far more rigid than the older machinery, which is another factor in the increase in accuracy.

As a third factor in promoting accuracy, the machinery is very often adapted to much simpler and better forms of jigs, and furthermore, particularly in the case of the drilling operations, the same jig can often advantageously be passed from one machine to the next, so that not only is time saved in eliminating the necessity for removing the piece from one jig and placing it in the next for succeeding operations, but also absolute accuracy is assured in the spacing of drilled holes and in their location.

There is no intention here to go into the detail of improvements which have been made in the various classes of machinery, but it is desired to point out the fact that manufacturers who are not keeping themselves fully posted on improvements in machine tools (which can improve the speed and accuracy of manufacture of their products) are leaving an opening for their competitors.

Buying a machine tool is very much the same sort of problem as that of buying a truck to solve a transportation problem. The purchaser must not consider that he is buying a mere piece of machinery. He must take the view that he is buying the service which it renders. As a man buys a truck to trans-

port goods from one place to another, he naturally overlooks the first cost of the vehicle and figures it in the transportation costs over the period during which the truck is in action. This, of course, is the only logical basis upon which the truck should be bought.

In the same way, the manufacturer must not forget that in buying machinery he is buying manufacturing ability, with the cost of the machinery spread over period during which the machine will serve him.

Now that engineering and design have reached a basis where the fundamentals of a design are unlikely to be radically changed for several years, the matter of tool equipment can be approached in an entirely different attitude than it could have been during the period when the manufacturer was forced to bring out practically a new model every year in order to keep pace with the engineering. In those days the manufacturer looked askance at a single purpose piece of machinery. He knew that such a machine would have to be discarded, or at least converted at a high cost at end of the year.

To-day the proposition is entirely different. When a model has been designed and approved after exhaustive laboratory and road tests, and the manufacturer is sure that what he has is the best that modern engineering brains and skill can produce, he knows that he has to equip his factory to manufacture that particular model over a period of years.

For this reason he can afford, in these days, to purchase machinery which will enable him to get the utmost in production for any given period. Where a special machine will do better than a stock product, he is justified in purchasing such a special machine because of its better ability to handle a particular part efficiently.

Any student of the industry knows that we are entering a period of sharp competition. Sharp competition naturally means that price will be a deciding factor. The manufacturer with the best machine tool equipment is in a position where he can furnish the best possible article at the lowest possible price. All other things being equal, this means that he is going to get the business.

An American Floatless Carbureter

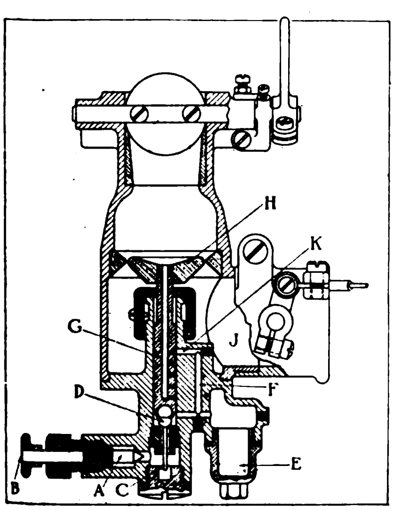
FLOATLESS carbureters seem to be the object of some interest in Europe, to judge by the recent article on German carbureters in AUTOMOTIVE INDUSTRIES. The accompanying illustrations show the LaFehr floatless carbureter, which is now being manufactured in Detroit, where tests of it are now going on in various laboratories. This carbureter depends almost entirely upon velocity head for its operation. It does not use hot air, but tests already made are said to indicate unusual starting ability in cold weather with ordinary present day fuel.

Referring to the sectional drawing, it will be seen that the fuel enters the passage *A* from the tank through the usual type of connection. A needle valve with milled head *B* controls the flow into the passage *C* below the jet. Cranking the engine relieves the ball check *D* which is part of the metering pin *G*. Gasoline flows past the ball check valve, now lifted off its seat, into the chamber *E* and also into the passage *F*. If the engine is running at high speed and the suction is sufficient, the fuel in chamber *E* is exhausted and all of the fuel passes up through the chamber *F* at very high velocity. On shutting off the motor, the chamber *E* is again filled, the function of this chamber being to prevent pumping of the gasoline, due to the rising and falling of the metering pin *G* and to furnish a starting and acceleration supply.

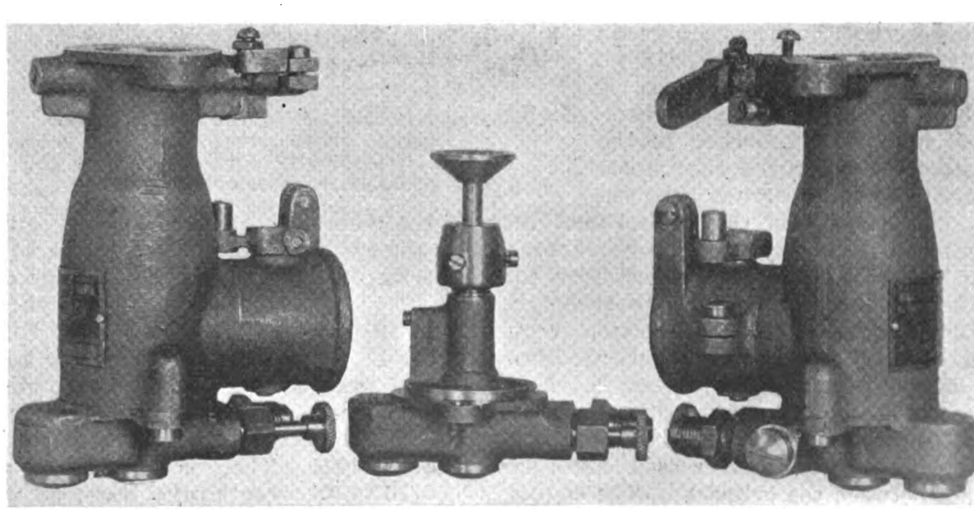
In normal operation, the fuel makes right angle turns at *C*, at the point of leaving the ball check, at the point of entering the passage *F*, at the top of the passage *F*, and again after entering openings in the metering pin *G*. There are a number of these openings which register with the passage *K*. As the suction of the engine increases, the cone *H* at the top of the metering pin is lifted higher, allowing the graduated jets to register successively with the port *K*. This increases the fuel supply in proportion to the demands of the engine. Air enters through the passage *J* and passes the cone *H*, which gives it a whirling or vortex effect. The metering pin *G* is grooved at each of the openings so that if it turns on its seat there is no interference with the flow from the port *K* into the proper opening in the metering pin *G*. The fuel issues from the center of the metering pin and the mixture occurs immediately above the cone *H*, where the fuel is picked up by the air stream.

The atomizing effect, due to the extreme velocity of the fuel and the right angle turns in the direction of flow; together with the sudden change in pressure on leaving the jet is claimed to be very considerable.

The LaFehr Floatless Carbureter Sales Co. is to handle the retail sales. The manufacturers' equipment business will be taken care of by the Detroit Carbureter Corp.



Vertical section through LaFehr carbureter



The LaFehr floatless carbureter, showing in the center the detachable metering unit

Non-detachable Head Used in New Stock Engine

Has four cylinders, 3¾ by 5 in., and develops a maximum of 48 hp. Both halves of crankcase and water jacket cover are aluminum castings. Valve caps are screwed into cylinder head. Full pressure lubrication employed.

By J. Edward Schipper

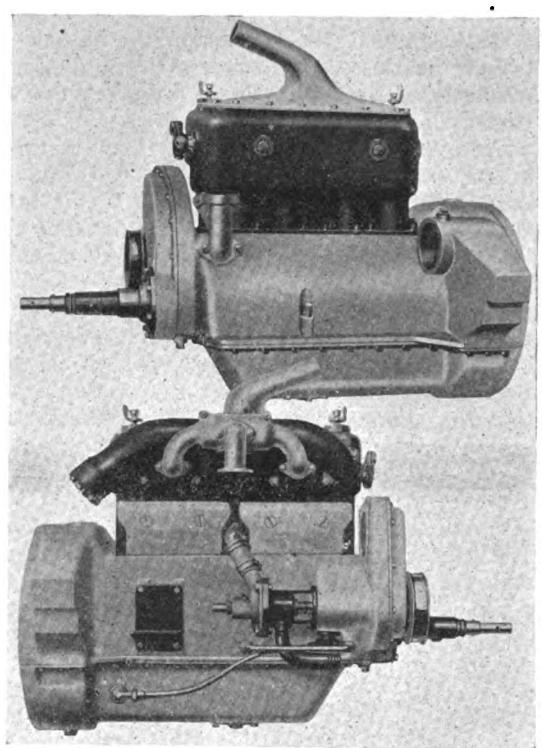
THE engine here described and illustrated is of the four-cylinder L-head type suitable for light truck or passenger car work. It has a bore and stroke of 3¾ by 5 in., giving an S. A. E. rating of 22.5, but develops a maximum of 48 hp., or about 1 hp. for every 4.6 cu. in. displacement, the total being 221 cu. in.

The engine is a universal type in that it will take any standard equipment. For ignition any standard make of magneto or distributor can be fitted, the carbureter flange is a 1 in. S. A. E. standard vertical type, the generator mounting a No. 1 S. A. E. flange, the starter mounting an S. A. E. standard barrel type for Bendix drive.

In construction, the engine follows along straight L-head lines with the four cylinders cast in a single block of semi-steel. The upper and lower halves of the crankcase are cast separately, both parts being of aluminum. The cylinder head is non-detachable, but the jacket cover is detachable and is of aluminum. The extensive use of aluminum in this engine gives a fairly light weight design, the total weight of the entire powerplant being 425 lb.

The pistons are of the three-ring type, all three of the rings being above the piston pin. They are grey iron castings 3¾ in. in length. The rings are 3/16 in. in width. The piston pin is 1 3/32 in. in diameter, of seamless steel tubing, locked in the piston pin boss by a special set screw. This set screw is locked in such a way that there is no possibility of the piston pin becoming loose and coming in contact with the cylinder bore. The piston pin bearing in the connecting rod is bronze bushed and is 1½ in. in length.

The connecting rods are I-section drop-forgings, 10½ in. long, center to center. The lower rod bearings are 1⅞ in. in diameter by 2 3/16 in. in length. As a means of securing compactness, the center line of the big end connecting rod bearing is offset from the center line of the rod, thus compensating for the increased length due to water jacket space between the cylinders. The engine is 35 3/16 in. in length from the end of the front support to the rear face of the bell housing.

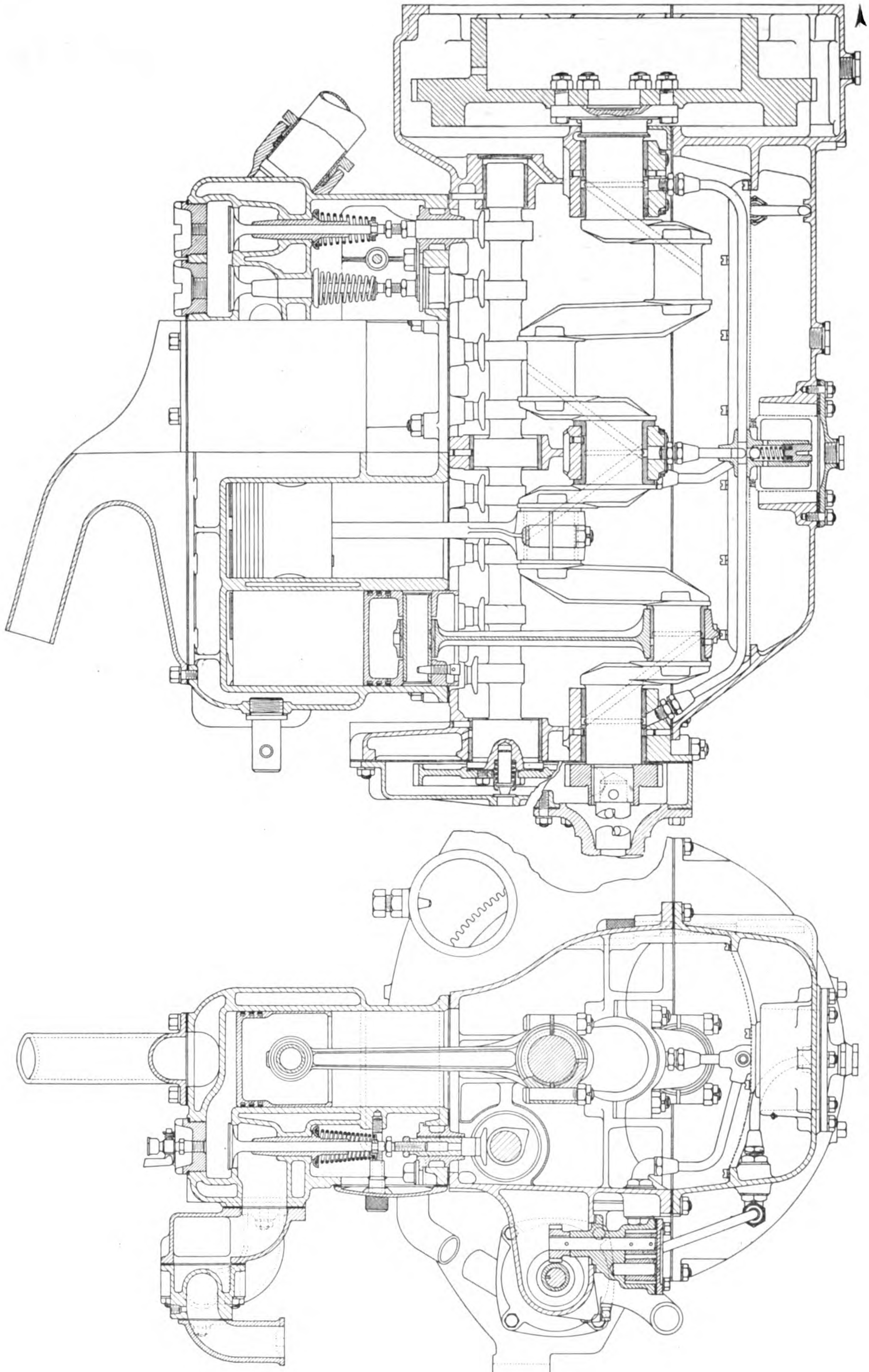


Right and left sides of Highway engine, showing the pump drive, manifolds, standard S. A. E. starting motor mounting and large diameter water outlet

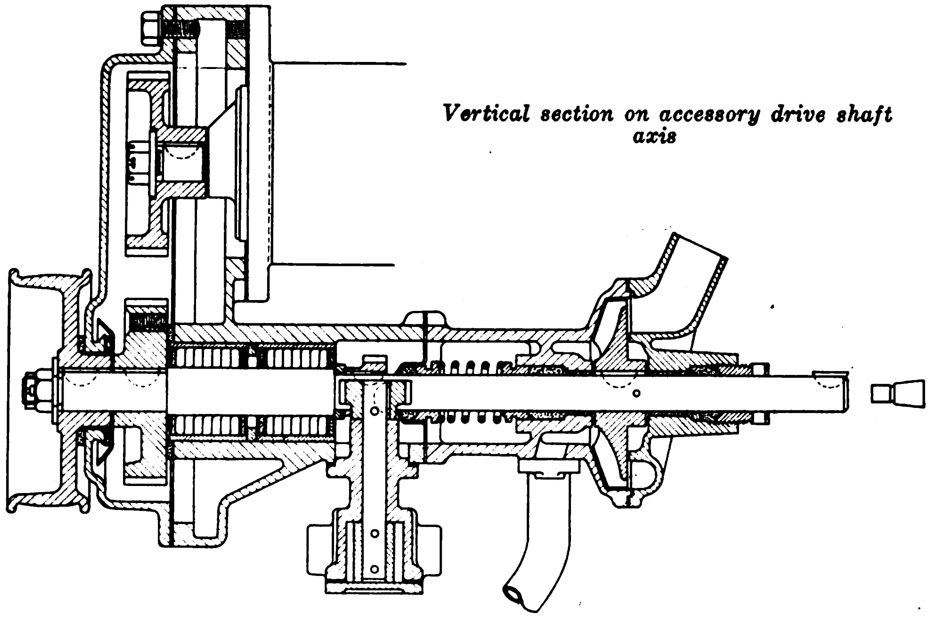
The crankshaft is carried on three main bearings which are supported in the upper half of the crankcase. The crankshaft bearing dimensions are (front to rear): 2 3/16 in. diameter by 3 in. length; 2 7/32 in. by 2½ in., and 2¼ in. by 3 in. This is an exceptionally large shaft diameter for the size of the engine and the shaft has sufficient rigidity to practically eliminate noticeable periodic vibration. The end thrust on the crankshaft is taken by flanges on the center bearing. The main bearings are bronze backed with babbitt lining, the white metal being doweled into the bronze. There is an oil thrower ring on the rear main bearing, working in a recess in the bronze bushing and an aperture in the crankcase, allowing the oil to drain back to the pan.

The timing gears are of the helical type, with ⅞ in. face. The camshaft is an integral forging mounted on three bearings. The dimensions of the camshaft bearings (front to rear) are as follows: 2 19/32 in. by 1⅝ in.; 2 9/16 in. by 1⅛ in., and 1½ in. by 1¾ in. This tapering in the size of the camshaft bearings permits of withdrawal of the camshaft endwise by removing the aluminum timing gear case at the front end of the engine. The camshaft end thrust is taken up by a spring and button attachment in the front end of the shaft. The valves are operated by flat, mushroom type tappets, the push rod guides being pressed in from the top. The valves have exceptionally long guides, which extend a considerable distance below the valve pocket. The clear valve diameter is 1⅞ in. They can be removed through valve caps screwed into the cylinder head.

The oiling is by full pressure to all of the crankshaft and rod bearings by a gear driven oil pump. The oil pump is in direct communication with the main bearings and thence by drilled leads with all of the lower rod bearings. The balance of the lubrication is taken care of by spray. There is no splash to any of the bearings. Cooling is by centrifugal water pump, the pump shaft being driven from the timing gears. The water spaces are exceptionally large, the inlet diameter being 1¼ in. and the outlet 2 in.



Transverse and longitudinal sections through new Highway 3¾ by 5 in. four-cylinder engine



Vertical section on accessory drive shaft axis

The intake and exhaust manifolds are bolted together to form a hot-spot construction and are mounted on the right side of the engine. The exhaust manifold bore is for a 2¼ in. outside diameter pipe. A ring gear is fitted on the flywheel.

The engine here described is shortly to be manufactured by the Highway Engine Co. in its own plant. Heretofore it has been manufactured in another plant.

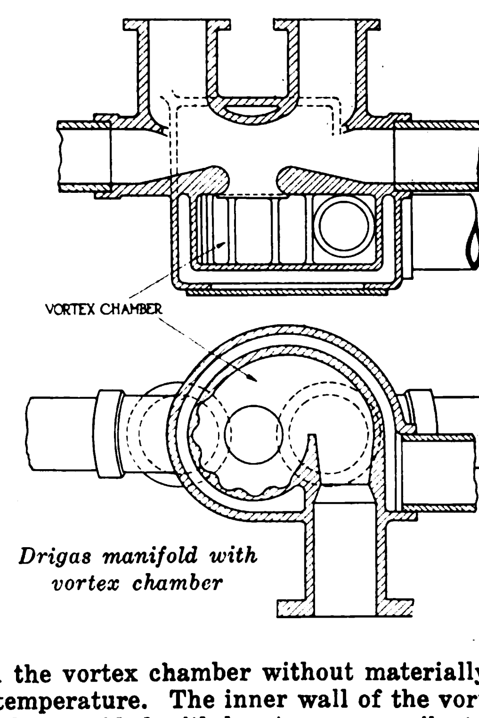
EXPORT figures for 1920 show an increase of 29 per cent in the number of American motorcycles sent to Spanish speaking countries. In 1919, there were 2780 motorcycles exported to these countries, while the 1920 total went to 3579. Spain was the largest consumer in both years, its 1920 consumption being 1416. Argentina ranked second with 597.

Exhaust-Heated Manifold Patents

ROBERT W. A. BREWER, an English engineer, has developed an induction system for internal combustion engines making use of relatively heavy fuel. Patents have been issued to him on this system, and the trade name of Drigas has been registered in Washington.

Brewer's first British patent was applied for on Dec. 1, 1913, and accepted Aug. 27, 1914. The specification shows a four-cylinder inlet manifold substantially of T form, in which the volume near the joint of the branches is increased with a view to damping out the fluctuations in charge speed due to the suction. Another feature is that there are no sharp edges at the junctions of the several parts, the inlet passage being relatively high at the center and sloping down toward the ends, but in order that any unvaporized fuel may drain back to the carburetor, there are provided two narrow channels having a slope toward the vertical part of the manifold. The upper side of the inlet manifold is in metallic contact with the wall of the exhaust manifold and therefore forms a sort of hot spot. As an alternative the upper side of the inlet manifold may be formed integral with the wall of the exhaust manifold.

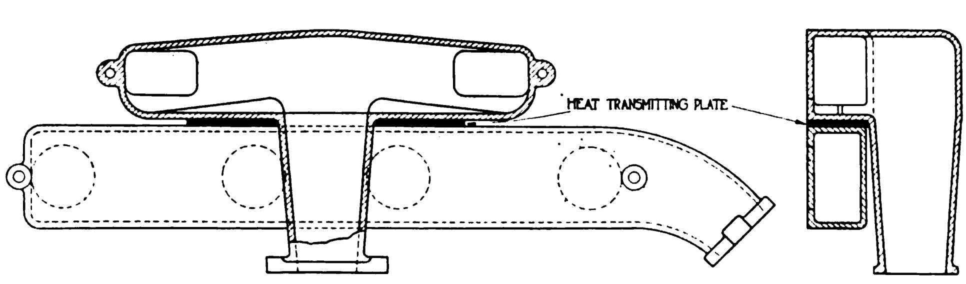
The other patent referred to was applied for on Jan. 27, 1920, and issued on Dec. 23, 1920. The object of this invention is to provide a comparatively large heating area for the charge from the carburetor in a limited space. The charge enters a so-called vortex chamber, that is, a short cylindrical chamber with tangential inlet, which is completely surrounded by an exhaust jacket. The tangential inlet gives the gases a whirling motion in the vortex chamber, throwing any unvaporized particles against the cylindrical, exhaust-heated surface. The outlet from the vortex chamber is either at one end or both ends. The intention is to pass the gaseous mixture



Drigas manifold with vortex chamber

through the vortex chamber without materially increasing its temperature. The inner wall of the vortex chamber may be provided with low transverse ribs to increase the heating surface and break up the layer of unvaporized fuel. The outlet or outlets from the vortex chamber and the inlets to the branches of the manifold are restricted in area.

The invention also refers to means for introducing an inert gas, such as exhaust gas, into the fuel stream entering the manifold during a period of low power development, to increase economy.



One form of Brewer's 1914 manifold

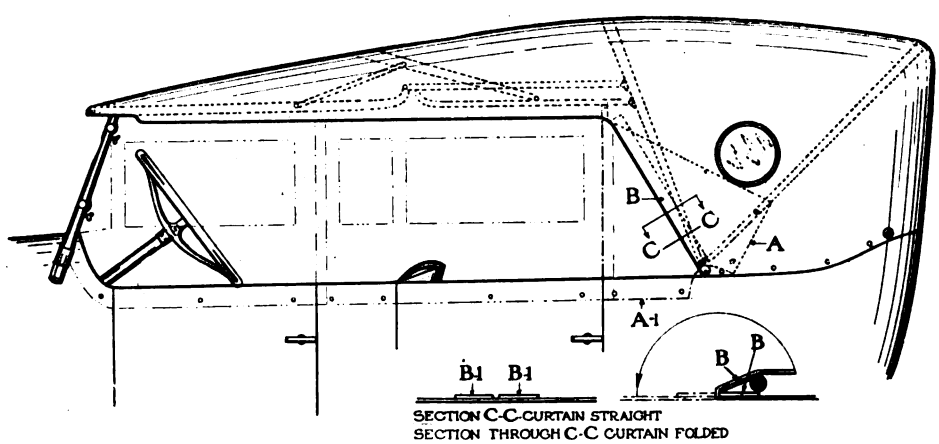
Design Problems in New Semi-Victoria Touring Top

There have been a number of cars recently equipped with a new type semi-victoria touring top, which presents some interesting problems of design. The following article discusses these problems and describes how they were solved by the writer in a particular case.

By George J. Mercer

SEVERAL car models seen for the first time this year are equipped with the new semi-victoria touring top, which presents for examination a number of interesting features. This type of top offers a completeness in appearance and a nicety of balance that is generally lacking where only the gypsy quarter is used. Some of the semi-victoria tops are equipped with detachable curtains so that the gypsy quarter can be used alone when desired.

The results of some recent experiments carried by the writer in connection with this top are shown in the accompanying diagram. The problem in this particular case was to provide some effective way of closing the triangular opening back of the rear door, without resorting to the use of a detachable curtain. The doors opened from the rear on this car and door curtain rods were used. A detailed discussion of the drawing will point out the way in which the problem was solved in this instance.



The semi-Victoria top with folding curtain described in the text

A and A-1 indicate the bottom edge of this curtain part as finally worked out in the two positions. The side is integral up the door line, where the door curtain laps over. The dot and dash line shows it assembled and the storm curtains in place, while the dotted lines show it folded back inside and fastened with a button to the rear bow. The round glass is set just above so that the fabric does not cross the line of vision.

B-1 and B-1 are reenforcements sewed inside the curtain with a space of about 3/32 inch between. This makes a natural hinge, so that the goods will fold with the minimum liability of cracking. Moreover, since no pressure is ever exerted at this point, such a curtain should last as long as the top.

The section through C-C shows some details of construction. The section at the right shows the flap turned back and fastened to the bow, while the section at the left shows how the folding operation is controlled. Through the method used a straight line is presented when the flap is back, thus giving to the top a pleasing and finished appearance.

There are several very definite advantages to be gained from folding the flap back in this particular manner. Among the chief of these are:

1. The flap is always in place for instant use.
2. There is one less curtain to attach than would be the case were a different method used.
3. A more finished appearance is presented on both sides, whether the flap is folded or open.
4. There is a saving in weight.
5. Less space is taken up in the storm curtain storage pocket.

Thoroughly satisfactory methods of storing curtains have not yet been evolved by manufacturers, even after many years of experience and experiment. One of the chief difficulties encountered has been the spoiling of celluloid when rolled or folded. For this reason, it has been necessary to discard curtains on rods and wires attached to the bows.

Some success has been attained by the use of a large flat pocket attached to the bows at one end. The difficulty with this arrangement, however, is that the curtains cannot be taken out or put away unless the passenger leaves the car.

Most of the new cars are using space at the rear of the front seats for this purpose. Considerable expense is attached to such a method, however, since the framing and the door cost more than does a roof pocket. Nevertheless, no means has been devised to equal it for practical service, so that its utility value well repays the added cost. The more general use of the five-passenger model, moreover, eliminating, as it does, the space necessary for folding seats, gives added room which may advantageously be devoted to curtain space.

The relative value of the service rendered to the cost of using a certain method will always constitute a nice problem, of course, which must be solved for each case.

Government Research in Road Construction

The road construction research work, being carried on by the U. S. Bureau of Public Roads, is discussed in detail by Mr. Heldt. The tests aim to enable engineers to predetermine the adequacy of roads. Impact and subsoil tests the subjects of exhaustive experiment.

By P. M. Heldt

ROAD building is one of the oldest engineering arts, dating back to the time of the Romans, and a large amount of technical data has accumulated on the subject. Unfortunately, however, little of it is directly applicable to modern road construction, for the reason that the character of road traffic has undergone fundamental changes during the past 20 years.

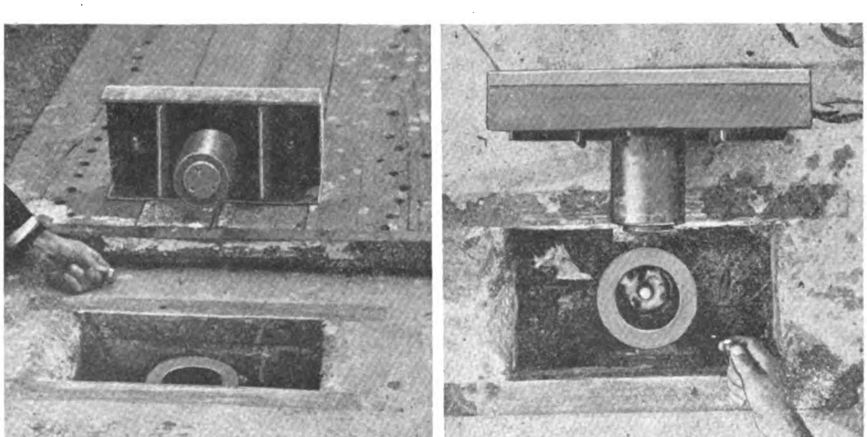
At the beginning of the present century the macadam road was considered a nearly perfect construction, and for light and moderately heavy horse traffic it served well indeed. Then came the high speed passenger automobile with its large size pneumatic tires and proved exceedingly destructive to these roads. The so-called suction of the tire as it left the road drew the binding material from between the stones, and the wind distributed it over the roadside and surrounding fields. After this had been going on for some time the road became rutty and defective and then quickly went to pieces. The solution of this problem was found in oiled roads and in tar macadam.

During the war period motor truck traffic over country roads first assumed considerable importance, and this led to another kind of road trouble. Most of the improved highways constructed in this country from 1900 on were built for light traffic, that of motor-propelled passenger vehicles being the class of traffic chiefly in view. These roads were not equal to the heavy concentrated pressure of the wheels of heavily loaded trucks, especially in spring time when the frost came out of the ground and the subgrade was unusually wet and soft. As a result they were rapidly ruined. Meanwhile large appropriations for road building were being made by many states, and it was realized that if these appropriations were to be spent to the best advantage it was absolutely necessary to make a careful study of the wearing or destructive effects of different kinds of road traffic, the wear and impact resisting qualities of different road surfacings, the bearing values of different subgrade materials, effectiveness of various drainage methods, etc. This research work was undertaken by the U. S. Bureau of Public Roads. Most of the experimental work is being carried out at Arlington, Va., a short distance from Washington, D. C. The work is in charge of A. T. Goldbeck, engineer of tests of the Bureau of Public Roads. Mr. Goldbeck has prepared a number of reports to the Department and papers for meetings of road engineers on the progress and results of the tests up to date, on which the following discussion is based.

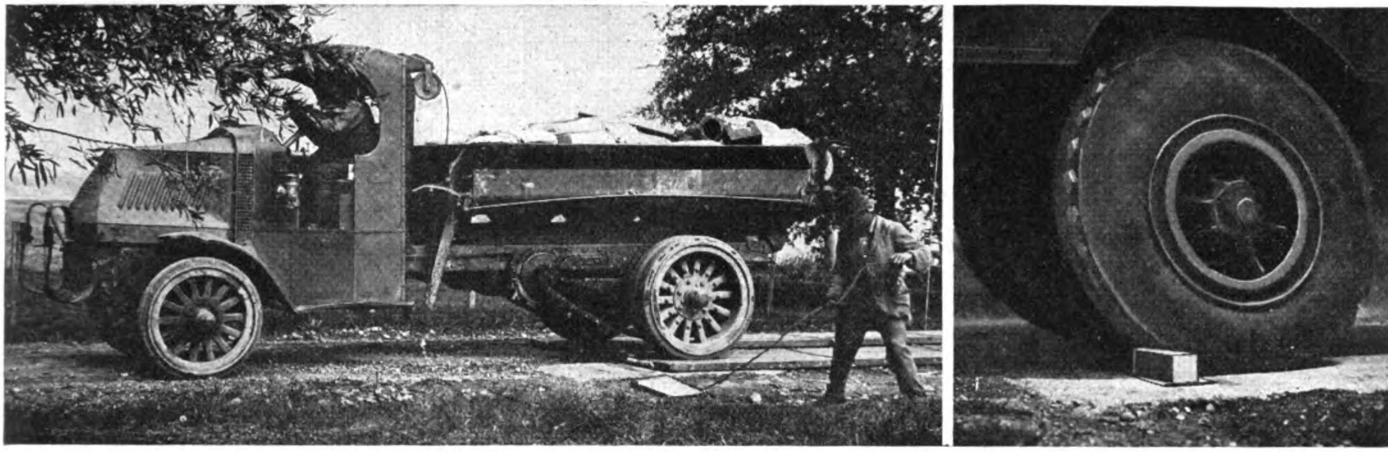
A Basis for Road Designs

It is the aim of these tests to establish the basis for a rational method of road design which would enable engineers to design roads with the same assurance regarding their adequacy for the traffic to be carried and their durability with which it is now possible to design bridges. The line of research work to be carried out was intended to bring to light all the basic facts bearing on road design. First it was to be determined how the impact varies with the speed, weight and tire equipment of a vehicle and with the relation between sprung and unsprung load. Another series of experiments was to determine the ability of road slabs of different materials and thickness to withstand such impacts, and finally the effect of the subgrade was to be investigated.

In the impact determination tests the rear wheel of a loaded truck is allowed to deliver its blow to the plunger of an hydraulic jack buried beneath the road. In some of the tests the truck wheel is allowed to drop off the end of a 2-in. plank directly onto the jack and in others it is driven over an obstruction in the form of a square sectional bar lying directly over the jack. The force of the blow is transmitted to a prepared copper cylinder, the deformation of which is a measure of the intensity of the blow. By subjecting the



Figs. 1 and 2—Two views of impact testing arrangement. Note copper cylinder in observer's hand



Figs. 3 and 4—The two methods of making impact tests (drop test and obstruction test)

copper cylinder to successively increasing pressures in a testing machine and taking note of corresponding pressures and deformations, it is possible to effect a calibration. It is realized that this method does not give the force of the blow in absolute terms but it serves well as a practical method of comparison. The harder the blow, the greater will be the deformation and it stands to reason that the blow causing the greatest deformation of the copper cylinder would also have the most destructive effect on a road slab. Figs. 1 and 2 herewith show the hydraulic jack as buried in the road, the plunger being carried by a section of channel steel flush with the road surface. The observer holds in his hand the small copper cylinder on which the force of the impact is spent.

Several thousand impact tests with this apparatus have been made to date. It is obvious that the impact must depend on the weight of the truck, but it also depends on a number of other factors, including the relation of sprung to unsprung weight, the tire equipment, the characteristics of the spring suspension, the unevenness of the road, etc. The method of conducting the tests is illustrated in Figs. 3 and 4, the truck wheels dropping off the end of a 2-in. plank onto the jack plunger in Fig. 3 and passing over an obstruction on the plunger in Fig. 4. In Fig. 3, in order to prevent the front wheel from delivering a blow and thus deforming the copper cylinder before the rear wheel blow takes effect, a bridge piece is placed over the jack, which is withdrawn by an assistant immediately the front wheel has passed. A similar plan is put into effect when making the obstruction tests illustrated in Fig. 4.

Results of Impact Tests

A summary of the results obtained in these impact tests is given by the four charts of Fig. 5. In each of these charts the speed at which the truck passed over the impact testing device is plotted along the horizontal scale and the force of the impact, in thousands of pounds, along the vertical scale. Chart A permits of a comparison of the impact caused by trucks of different load capacities. It will be noticed that at the same speed the impact increases with the load capacity, being greater for the 5-ton than for the 3-ton truck, greater for 3-ton than for the 2-ton and greater for the 2-ton than for the 1½-ton. But the smaller trucks are capable of considerably higher speed and the maximum impact seems to be substantially the same for all trucks. Mr. Goldbeck, however, cautioned his hearers that this must not be taken as conclusive evidence that large trucks are no more destructive to roads than small trucks.

The influence of tire equipment is brought out in Chart B. All experiments recorded in this chart were made with the same truck, the only thing that was changed being the tire equipment. As would be expected, the impact is greatest with solid tires, least with pneumatic tires and intermediate with cushion tires. With the solid and cushion tires the blow due to passing over an obstruction varies substantially in direct proportion to the speed. With the pneumatic there is very little increase of impact with the speed while passing over an obstruction. While dropping off the end of the plank the impact with all forms of tire equipment increases with the speed up to a certain point, in this case between 12 and 13 m.p.h., after which it remains substantially constant. This is the minimum speed under which the wheel can drop freely under the action of gravity and the spring action. The deflection given in the chart is the flattening of the tire under the dead load on its wheel, which in this case was 4500 lb. It will be noticed that the greater the deflection of the tire under load the smaller the impact, which is exactly what would be expected. No investigation has yet been made of the effect of springing characteristics of the suspension on the impact.

Effect of Unsprung Weight

Chart C is intended to bring out the effect of the relation between sprung and unsprung weight. In this test two trucks were used, one having an unsprung weight of 1950 lb. and the other of 1350 lb. and both were loaded to the same total weight on each rear wheel (10,100 lbs.). The wheels were allowed to drop 2 in. and ½ in. and in both cases the wheel carrying the greater unsprung weight gave the maximum impact. Mr. Goldbeck, however, expresses the view that within the limits of present truck design the influence of differences in the relation of sprung to unsprung weight is not sufficient to influence road design. But he urges truck designers to keep down the unsprung weight to a minimum, as this will reduce road wear. Fortunately, the truck designer has a reason of even more direct importance to him to keep down his unsprung weight because a high ratio of unsprung to sprung weight is also very destructive to tires.

A comparison of the blows struck a road slab by solid and pneumatic tires, respectively, mounted on trucks of 5 tons capacity, is made in Chart D. It will be noted that a solid tired wheel passing over a ½-in. obstruction delivers a heavier blow than a pneumatic tired wheel passing over a 4-in. obstruction. At moderate speeds with pneumatic tires the blow increases with the air pressure, but at rather high speeds the blow is greater with low than with high pressures of inflation. Here

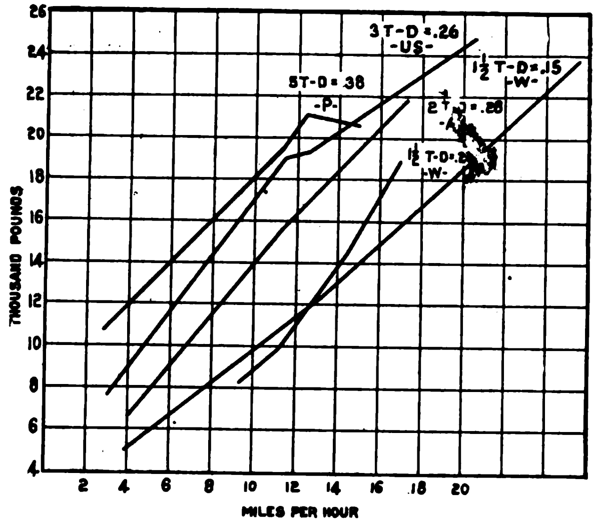


Chart A COMPARISON OF TRUCKS
TIRE DEFLECTIONS INDICATED
ALL 2" OBSTRUCTIONS

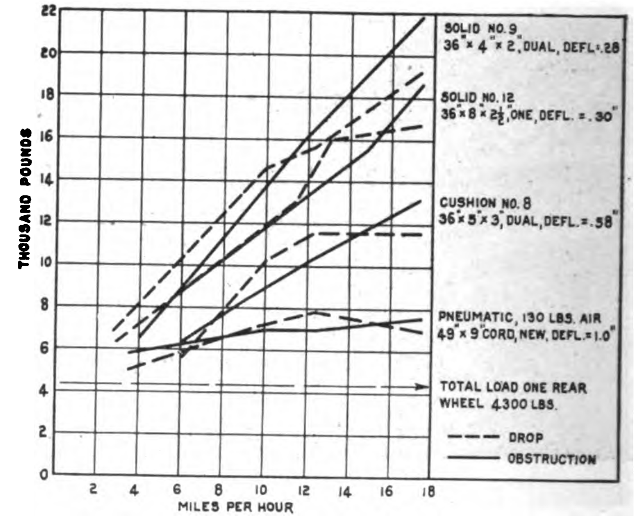


Chart B COMPARISON OF TIRES
2 TON TRUCK A
LOAD, 2 TONS U = 1000 LBS.

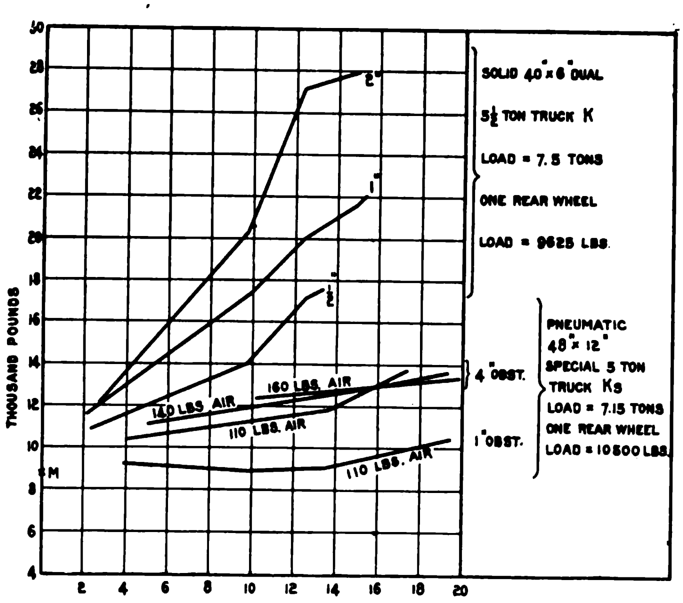


Chart D COMPARISON OF SOLID AND PNEUMATIC TIRES
TWO TRUCKS APPROXIMATELY THE SAME

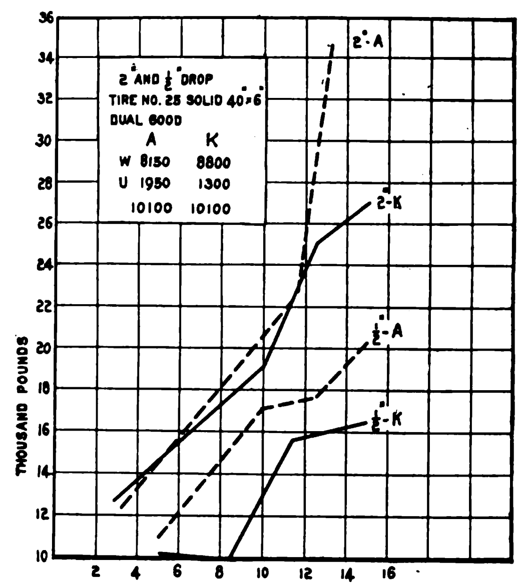


Chart C COMPARISON OF TRUCKS VS SPEED

Fig. 5—Charted results of impact tests conducted at Arlington, Va.

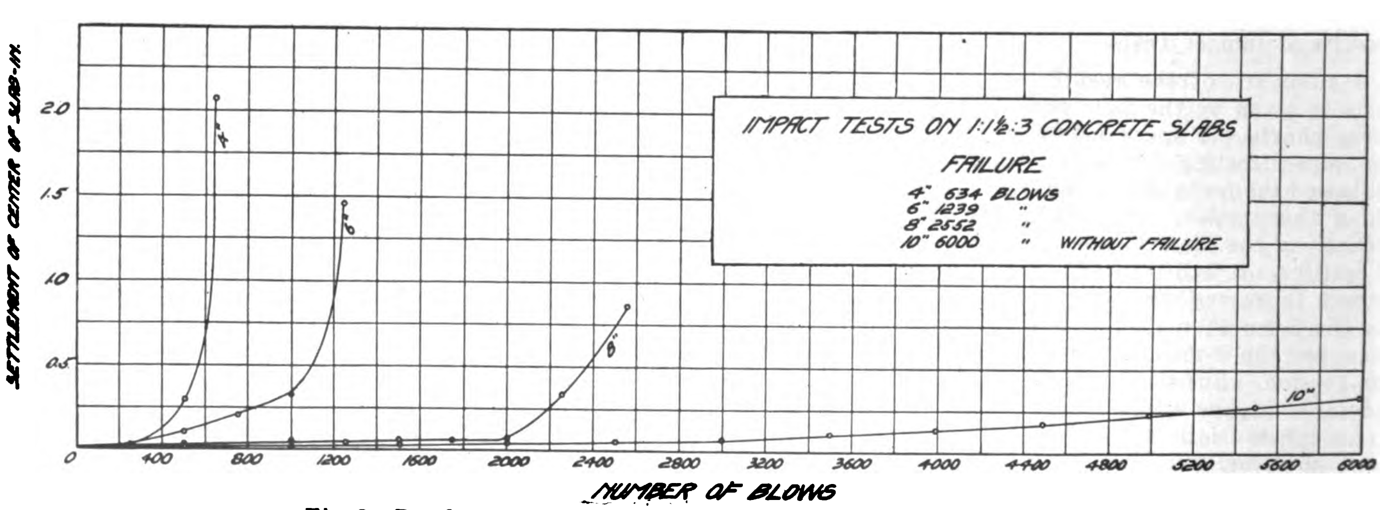


Fig. 8—Results of impact tests on concrete slabs of different thickness

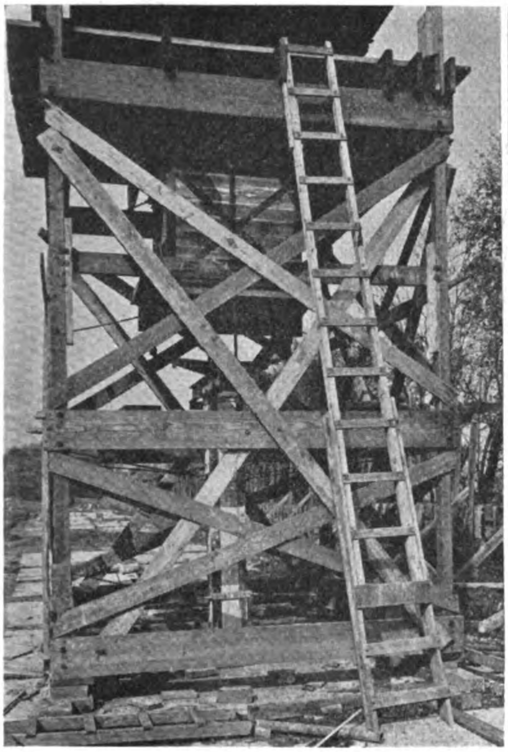


Fig. 6—Apparatus for determining the resistance of road slabs to impact

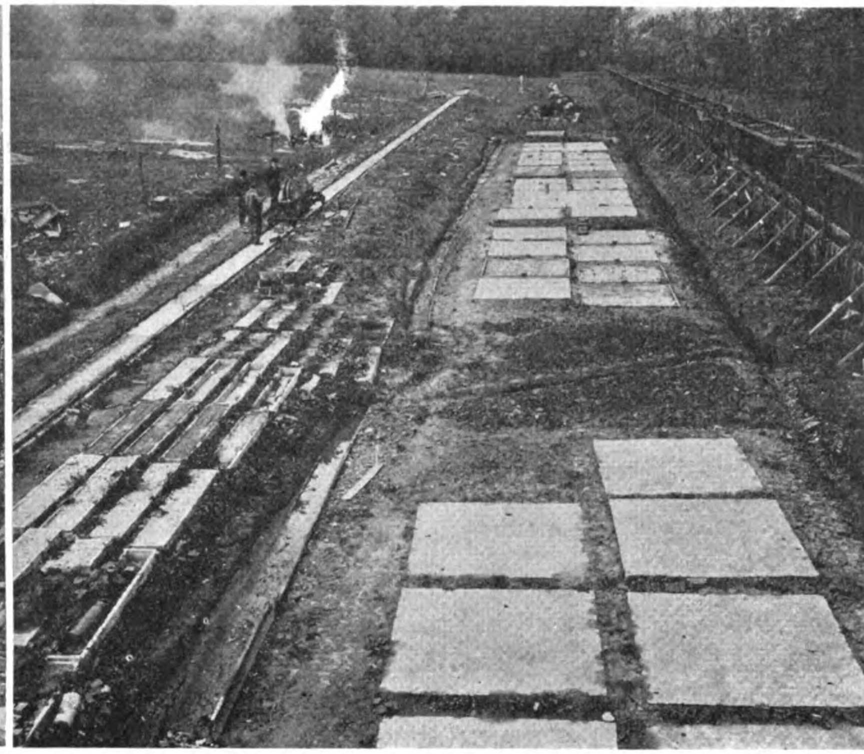
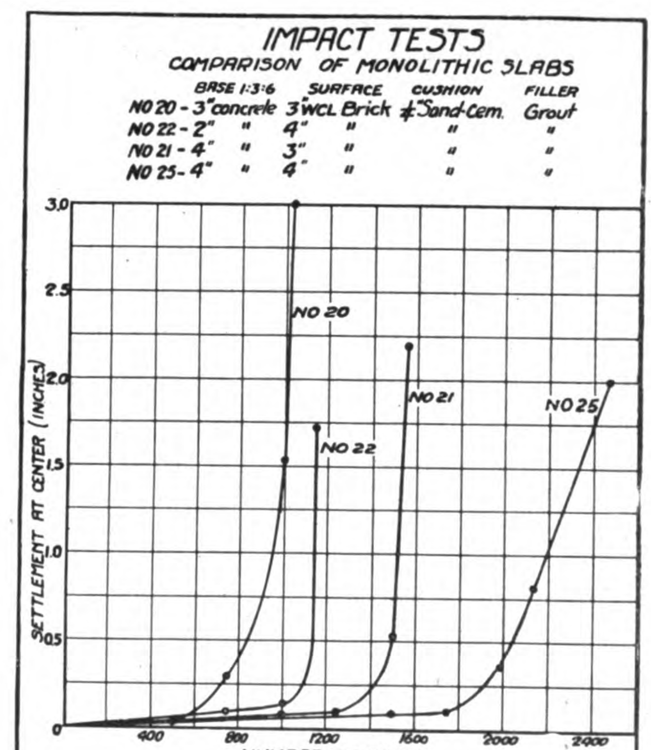


Fig. 7—General view of construction for impact tests (rapid wear test section to left) on concrete slabs

again the slight dependence of road impact on speed with pneumatic tires is shown.

Tests of Road Slabs

One of the important factors affecting the endurance of roads is the resistance of the road slab to impact. A series of tests were therefore made in which slabs measuring 7 ft. square were laid on subgrades in duplicate, one of the slabs being laid on subgrades purposely rendered wet, and the other on a subgrade which was carefully drained. In these tests the effect of impact by truck wheels was simulated as closely as possible by means of a specially constructed testing machine illustrated in Fig. 6. All specimen slabs were tested to destruction. The apparatus comprises a weight of 1800 lb., which is shod at the bottom with a section of 12-in. solid rubber tire, and carries at the top a 5-ton truck spring on which is supported a weight of 6000 lb. The entire weight is raised and allowed to fall repeatedly on the center of the slab, the height of fall being increased after every 500 blows. At first 500 blows are struck with a drop of ⅛ in., then with a drop of ½ in., then



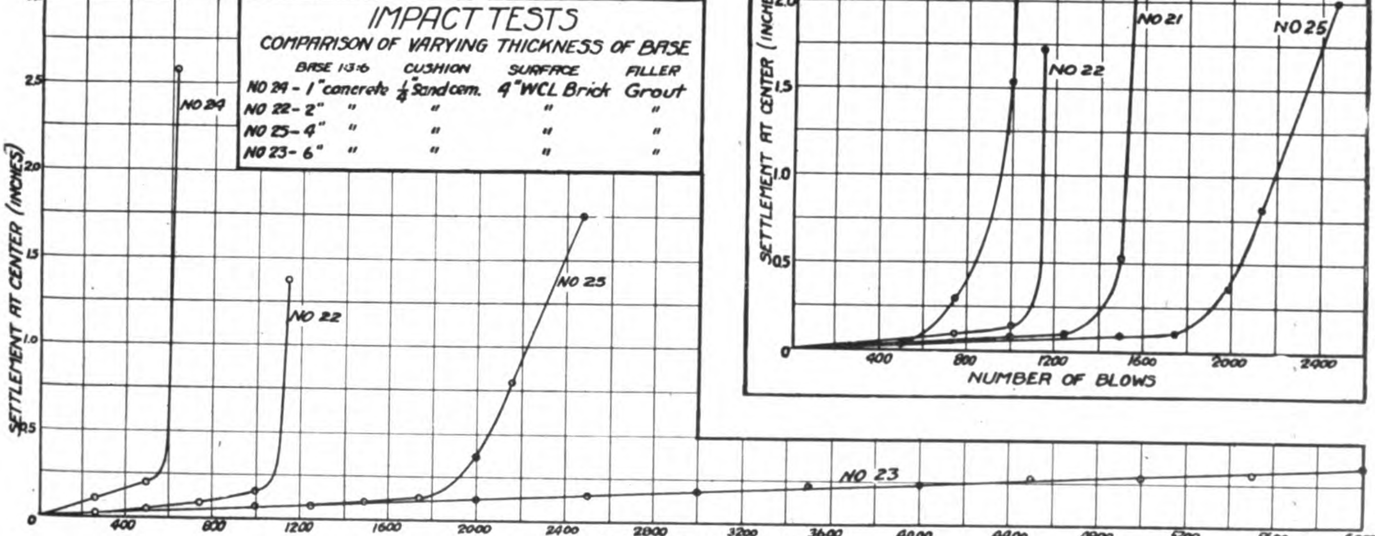


Fig. 9—Results of impact tests on monolithic brick slabs

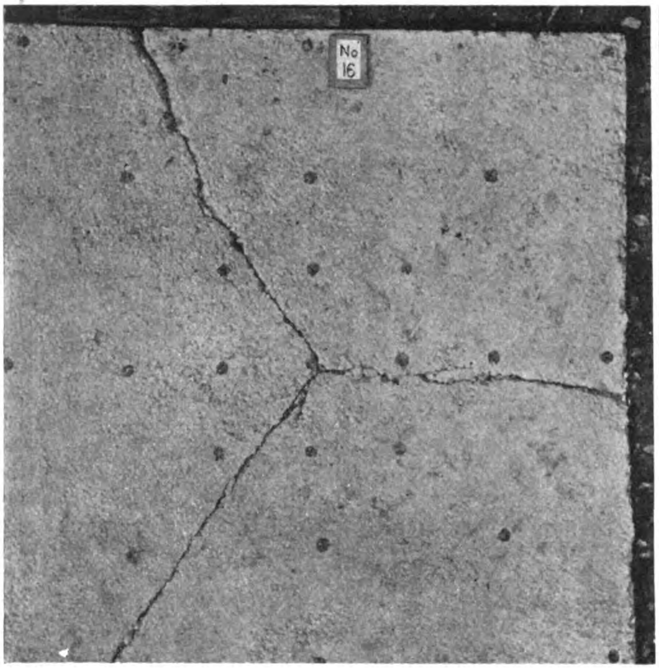


Fig. 10—*Section of concrete pavement broken during tests*

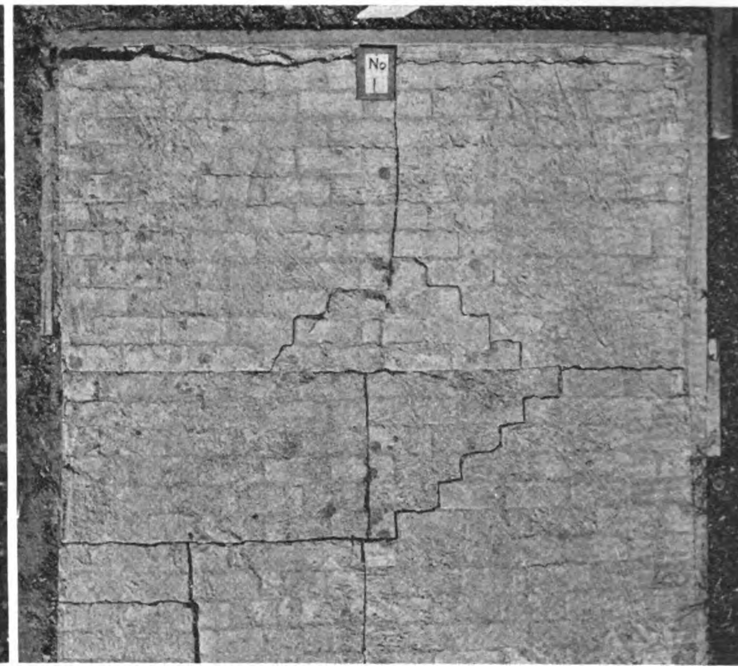


Fig. 11—*Brick section broken during test*

with 7/8 in. and so on until a height of drop of 2 in. is reached or the slab is destroyed. In this test the 1800-lb. weight represents the unsprung weight (the truck wheel and axle) and the 6000 lb. the sprung weight of the truck. The pressure exerted by the falling weight upon the slab depends, of course, upon the time in which the weight comes to rest. A general view of the slabs prepared for impact tests is shown in Fig. 7.

In making impact tests it is essential that the specimen be supported in the same way as the road surface is supported in regular service. Service conditions must also be duplicated in respect to weight of falling bodies and range of drop, as any departure from these conditions would give results which it would be difficult to interpret. Fig. 8 shows the influence of the thickness of concrete slabs on their life, as determined by this experimental apparatus. In the tests, all of the slabs were supported on a very poor subgrade. It will be seen that the resistance to impact varies nearly as the square of the depth. It was found that a 4-in. concrete slab has about the same resistance to impact as a 4-in. wire cut slug grouted brick pavement on a 1-in. concrete base. Also, that a 6-in. concrete slab has about the same resistance as a monolithic brick pavement on a 2-in. base. An 8-in. slab has about the same resistance as a 4-in. monolithic brick pavement on a 4-in. concrete base. The deflection curves for a 10-in. concrete slab and monolithic brick on a 6-in. base are quite similar.

Fig. 9 gives the results of comparative tests between monolithic brick pavements, using both 3-in. and 4-in. bricks. In the upper chart are plotted the results of tests with pavements alike in every respect except that the thickness of the concrete base was increased from 1 to 5 in. in three steps. In these charts the number of blows are plotted on the horizontal scale and the settlements at the center of the monolithic slab on the vertical scale. The lower chart represents a comparison of pavements of the same total depth but with varying depths of brick and concrete base respectively, and a comparison of roads with the same depth of concrete base with different thicknesses of brick.

Figs. 10 and 11 show a concrete slab and a monolithic brick slab tested to destruction in the impact test. Tests on tar-sand cushions show less deflection before failure than sections laid on sand. Sand cushion sections have the peculiarity of large settlements before failure. When a pavement is built with a sand cushion, there are two separate slabs, which can move independently one of the other. With a sand cushion the upper slab does not get as firm a support as a monolithic or semi-monolithic construction. A comparison of the sand cushion construction with monolithic and semi-monolithic types shows the monolithic to be stronger that the semi-monolithic and the latter to be stronger than the sand cushion road, the thickness of the base being the same throughout. A 6-in. concrete base proved stronger than a 4-in. base.

Whenever a slab is broken, complete data of the circumstances were noted down. Tests of the subgrade were made with a small impact machine, comprising a 10-lb. steel plunger, having a face area of 10 sq. in. A 10-lb. weight, guided by means of a rod, was allowed to fall on this plunger from a definite height, and the penetration of the plunger under a certain number of blows was noted. This furnishes an arbitrary but convenient method of determining the bearing power of the subgrade. Moisture samples of subgrade were also taken.

(To be continued)

English as She's Writ in Continental Europe

From a circular on a new mechanical direction indicator:

The taxi is drawing great drafts on the public's patience and commodity. No wonder that the taxies are being fitted with apparatus that can reduce the friction of the traffic, to common pleasure. The public, the society ought to demand it, and for the owner of the taxi it should be a dear duty. Ships have turning and speed signals, just as much required in darkness as by day. Autopil ought to be found on every motor-car or truck. The millions of mollifications of the nerves that are yearly quoted over the whole world will be reduced by Autopil. Quiet and flegmatically the public can at any time by only looking on Autopil assure it-self about the taxi's intentions and turning-direction.

The Aeronautic Research Laboratory at the Institute of St. Cyr

Facilities for aerodynamic investigations include two sizes of wind tunnels, a whirling arm, and two electrically operated trucks running on rails, all of which are equipped for determining the characteristics of airfoils. One truck is designed for testing propellers.

By John Jay Ide

THE Aerotechnical Institute of St. Cyr, near Versailles, was founded in 1911 by the late Henri Deutsch de la Meurthe, the eminent French patron of aeronautics. It originally formed part of the University of Paris. The first director was Prof. Maurain and his associate was M. Toussaint.

Between 1911 and 1914, in addition to wind-tunnel tests, experiments were made with complete aeroplanes and propellers by means of electric trucks running on a track about a mile long. During the first two years of the war the buildings of the Institute were used as a cantonment for 3000 soldiers of the balloon service. In 1916 the Institute was attached to the Technical Section of Aeronautics and in December, 1917, Major Caquot (then chief of the Technical Section) reorganized it and changed the motive power of the apparatus from steam to electricity. The Institute has now returned to the control of the University of Paris and is under the direction of M. Toussaint.

The equipment for aerodynamical research at the Institute comprises wind tunnels, electric trucks and a whirling arm.

With the three wind tunnels of different sections, complete models of aeroplanes or wings up to one meter span can be tested. The tunnels are also used to determine resistance of streamlined bodies, the working of air-speed indicators, anemometers, etc.

In principle, the object to be tested is subjected to an air stream of known speed and the action of the wind on it is determined by means of a special balance to which the object is attached. This action includes *drag* due to the relative wind acting on the object and, in the case of oblique surfaces, the vertical component or lift.

Description of Wind Tunnels

The large wind tunnel (Fig. 3) is 119.8 ft. in total length and 13.1 ft. in diameter at the propeller end. The range of speeds is between 16 and 147 ft. per second. The tunnel consists of:

1. An intake trumpet which collects in the entrance to the test chamber sufficient air for the air stream. At the time of my visit there was under construction a honeycomb of 8-inch squares to be fitted in the mouth of the trumpet to eliminate turbulence. This honeycomb was to replace the one at that time in use placed at the entrance to the test chamber, as is the customary practice.
2. The test chamber, 6.6 ft. in diameter and 19.7 ft. long.
3. The diffuser, a diverging cone prolonged by a wood lattice cylinder 31.2 ft. long.
4. The six-bladed screw. An electric motor of 120 hp. operates the screw which sucks the air from the room into the intake trumpet. The air stream reaches its maximum speed in the reduced section of the test chamber where the pressure is below that of the outside air. At the exit of the test chamber the air passes into the diffuser, which brings the pressure back to normal.

In the center of the test chamber is the movable arm (*B*) (see diagram) of the aerodynamic balance protected from the wind by a casing. The model to be tested is attached to the end of the beam in the center of the tunnel.

The balance is composed of two systems of joined parallelograms interconnected but independent as to the measurement of horizontal and vertical forces to which the model is subjected. The balance is carried by a truck with four rollers permitting easy displacement on two rails perpendicular to the axis of the tunnel and four jackscrews to raise the truck on the rails and to clamp it in desired position. This balance is shown in Figs. 1 and 5.

The vertical support carrying the bearing points of the mobile system is attached to the cars. This system is composed of a series of steel levers of cross-shaped tubular section. The joints of the different lever arms are provided with ball bearings.

The Aerodynamic Balance

The intermediate cross arms of aluminum form a rigid connection between the two systems of parallelograms. The carbon steel cross beam of T section is attached to the vertical rod, of which the thin arm carrying the model is a prolongation. The model is attached to the arm by adjustable rods.

The case (*A*), Fig. 5, inclosing the vertical rod is bolted to a plate arranged to close the tunnel completely between the two doors. Four vertical bars attach the head directly to the truck so that the balance, plate and case comprise an assembly that can be moved at will.

An arrangement with a mercury joint, while permitting freedom of movement, renders the passage of the bar through the plate airtight, while the depression inside the tunnel translated into a downward vertical force is neutralized. Finally there are provided gages registering simultaneously the forces of lift and drag.

Aerodynamic experiments with the wind tunnel are made in the following manner:

Once the model is adjusted to a predetermined angle to the horizontal and the needles of the lift and drag indicators (*K*) and (*K′*) set at zero, the air stream is given the desired speed which the observer reads on an alcohol manometer connected to the test chamber. Weights placed on the scale pans (*C*), (*D*) balance the lift and drag forces so that the measurements are made simultaneously.

The small wind tunnel is distinguished from the large

one by the various diameters 0.66, 0.98 and 1.31 ft. of the test chamber which can be obtained. An electric motor of 20 hp. operates the centrifugal suction pump, which gives to the air stream speeds varying from 65 to 278 ft. per second. This small tunnel is intended particularly for experiments on the resistance of bodies of small diameters in high-speed air currents. Coefficients of similitude have also been determined for different scales by testing various shapes of streamlined hulls in the small tunnel and comparing the results with those obtained by testing similar bodies in the large tunnel. The small tunnel is likewise used for calibrating speed indicators, Pitot tubes, anemometers and other aeroplane instruments.

The wind tunnel of Captain Lelarge originally at Chalais-Meudon and later removed to St. Cyr differ in principle from the tunnels described above. It is of the single duct continuous circuit type. It has an effective section of 4.9 x 8.2 ft. and the air stream varies in speed from 13 to 65 ft. per second.

There are two electric trucks designed to run at high speed along a track 0.9 mile long. One of them (Fig. 2), for testing full size wings and airplanes, is in reality an aerodynamic balance moving through still air; it measures forces comparable to those measured in a wind tunnel.

The truck has a 120 hp. electric motor mounted on a platform and carries a superstructure forming an aerodynamic balance to which is attached the aeroplane or wing section to be tested. The tubes carrying the test section compose the superstructure; these tubes are carried at the end of four vertical struts jointed with the superstructure at their upper ends. The struts, movable about an axis perpendicular to the direction of motion of the truck, form a jointed parallelogram deformable under the action of the forces of head resistance. On the other hand, a system of horizontal levers themselves jointed at the points of the fixed framework of the truck support the struts and permit them to be displaced parallel to themselves in the vertical direction under the action of the forces of lift.

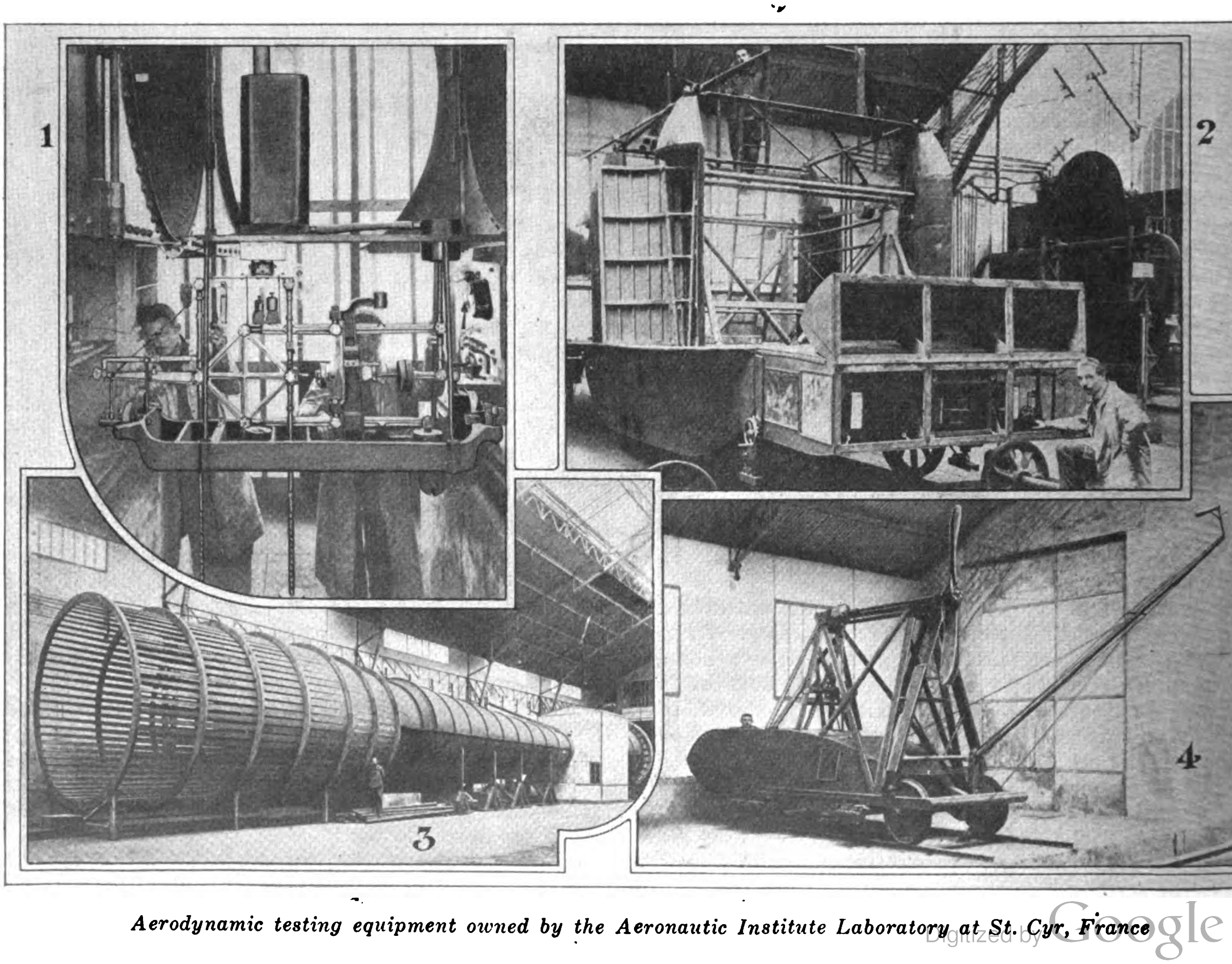
Counterweights balance the system as to inertia and force of gravity, while dynamometers measure the forces of drag and lift which the speed of the truck with reference to the air registers by means of an anemometer calibrated in calm weather.

For testing, the truck is sent over the track at speeds between 0 and 55 miles per hour. The recording instruments show the values of lift and drag on the surface as well as speeds relative to the ground or air. Care is taken to experiment in calm weather although a wind vane gives the component of the relative wind which is taken into account in the calculations.

An electric current scores a reference mark at the right moment on the record of each instrument and thus facilitates taking all the measurements simultaneously. Comparative wing tests between the truck and the large wind tunnel show that the two methods are in substantial agreement.

The truck for propeller testing (Fig. 4) differs from the truck just described in that it is driven by the propellor under test. An 80 h.p. motor drives the propeller through two bevel gears at speeds between 0 and 50 miles per hour.

The vertical shaft connected to the universal joint between the two transmission cases can be displaced parallel to its axis. The shaft is partially held in place forward by a ball thrust bearing at the top of the frame jointed at the base. The shaft is supported by a plain bearing.



Aerodynamic testing equipment owned by the Aeronautic Institute Laboratory at St. Cyr, France

Under the action of the pull of the propeller the horizontal shaft tends to move forward, taking with it the top of the frame. This movement is checked and recorded by dynamometers. The forward speed is measured by means of a tachometer giving the speed of rotation of the back axle and it is checked by an anemometer giving directly the speed of the truck with reference to the air. The speed of revolution of the propeller is read on a tachometer giving the revolutions per minute of the motor. Watt meters indicate the power delivered and absorbed by the screw.

From the information furnished by the various recording instruments which includes the traction of the propeller, revolutions per minute, absolute ground speed, relative speed with respect to the air, power delivered and absorbed, the efficiency curves of each type of propeller can be drawn.

With the whirling arm the same tests can be made as with the wind tunnels, the objects to be tested being moved through the air. Difficulties in connection with neutralizing centrifugal forces have resulted in discontinuing experiments with the whirling arm at the present time.

In addition to the apparatus described above the Institute possesses physical and chemical laboratories, a low pressure air chamber used for physiological tests and machine shops for metal and woodworking and for making models.

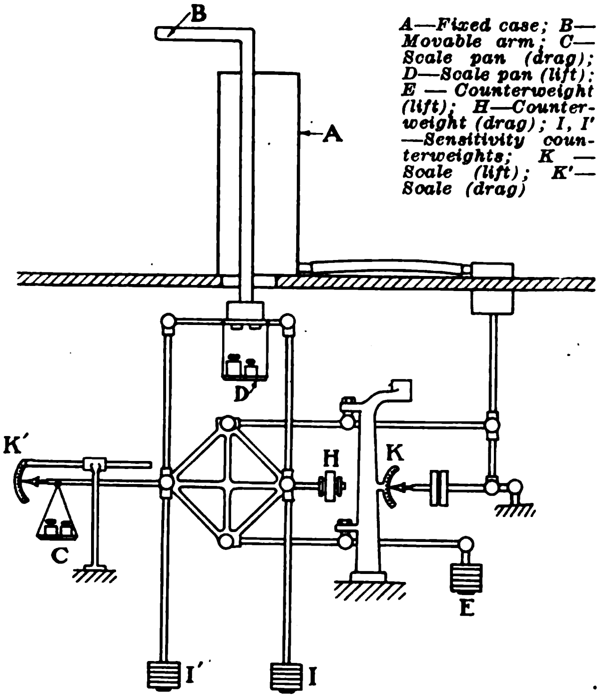
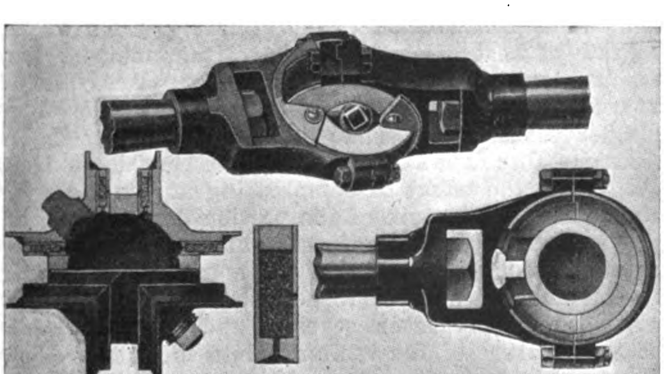


Fig. 5—Diagram of aerodynamic balance used at St. Cyr

A Self Lubricating Universal Joint

A METAL universal joint containing a large lubricant reservoir, having large bearing surfaces and permitting of great angularity between shafts, has been developed by the Noyes-Richards Engineering Co. As will be seen by the cut it is somewhat similar to the type of universal joint used on machine tools, as the central member connecting the two forks is of spherical form and is provided with two circumferential grooves at right angles to each other in which the forks of the joint engage. The two forks are arranged at right angles, as usual, and are secured to their shafts by a taper joint with key and nut. Each fork is provided with a cap which has a stepped joint with the fork and is held in place by two cap screws.

The central, spherical portion is a hollow bronze casting and has two holes closed with pipe plugs, through which the lubricant can be introduced. These plugs are located on opposite sides of the ball, and one or the other will always be in an accessible position. Adjacent to the grooves in the ball into which the fork rings fit there are lubricant cartridges. These cartridges are embedded in the flanges of the ball, which between them form the grooves for the fork rings. Each cartridge has a lubricant inlet opening to the lubricant chamber in the ball. The cartridge is bored out and is filled with compressed felt, which is saturated with lubricant. The felt is compressed by forcing a plug into the end of the cartridge. At the side of the cartridge there is an outlet through which the lubricant reaches the bearing surface.



A new all-metal universal joint with reservoir for lubricant

The fork ring is formed with an internal flange which fits into the groove on the bronze ball. The web or backbone of the fork ring fits into a widened portion of the groove on the bronze ball and its inner corners are chamfered so as to make room for triangular leather packings in the groove at both sides of the ring. Metal dust clips lined with leather washers can be secured to the bronze ball so as to exclude dust from the joint.

It is claimed for this joint that it has more bearing surface and more angularity and is much lighter than a pin joint built to transmit the same power. We understand that this joint has been thoroughly tested out and that its freedom from oil-throwing has been demonstrated.

Carbureter Tests for Fuel Economy

THE fuel economy of motor cars, which can be affected by adjustments of the carbureter, has recently been demonstrated by the Royal Automobile Club. Tests made at Brooklands on six different makes of car showed that by merely changing to smaller carbureter jets an average increase of mileage of 22 per cent. was obtained. The average loss in maximum speed was only two miles per hour, and the average extra time taken to climb the test hill was only 1 4-5 seconds. It is proposed to organize a competition on lines similar to those of the tests, for which some prizes are being offered by a motor car paper.

The Influence of Various Fuels on Engine Performance

Part II

In this instalment of the report upon the investigation of fuels, detonation and the effect thereon of combustion chamber design, turbulence, speed of rotation, temperature and pressure are discussed at length, and measurements of the value of a fuel in terms of its tendency to detonate are tabulated and plotted in their relation to other important factors.

By H. R. Ricardo*

PREVIOUS experience had indicated very clearly not only that the tendency of fuels to detonate was probably by far the most important of the factors controlling the power output and efficiency of an internal combustion engine of the explosion type, but also that the tendency to detonate varied widely as between different fuels, and was likely to prove much the most important factor in determining their suitability or otherwise for use in an internal combustion engine. This has proved to be the case. It was, of course, common knowledge that certain brands of gasoline detonated more readily than others, that commercial benzol would not detonate under any circumstances in an engine of normal design, and that the addition of benzol to gasoline always reduced its tendency to detonate. Beyond this little was definitely known. It was decided, therefore, to make as thorough an investigation as possible into the whole phenomenon of detonation.

Before dealing with the influence of the nature of the fuel upon detonation it will be well to consider first the influence of detonation itself upon the performance of an engine.

All engines using volatile liquid fuels operate on a cycle in which a combustible mixture of fuel and air is drawn into the cylinder, is compressed, ignited and then expanded until it occupies the same volume as before compression. From any given weight of mixture, the power output and efficiency obtainable depend upon the degree of expansion, and since, in this cycle, the ratio of compression and expansion are equal, it follows that both power and efficiency are dependent upon the ratio of compression. Setting aside for the time being such questions as dissociation at high temperatures, change of specific heat and loss of heat to the cylinder walls, all of which reduce the absolute efficiency obtainable, but which do not alter materially the relationship between compression ratio and efficiency, we find that the limiting theoretical efficiency is as given by the formula

$$E = 1 - \left(\frac{1}{r}\right)^{\gamma - 1}$$

where r = the compression ratio and γ the ratio between the specific heat of air at constant pressure and at constant volume.

*From a preliminary report on extensive research work conducted by the author and other prominent British investigators for the Asiatic Petroleum Co. and published in *The Automobile Engineer*.

Fig. 1 shows the relationship between efficiency and compression over the range from 3.5:1 up to 7.5:1 according to this formula, which is known as the air standard of efficiency, and is the accepted basis of comparison.

It will be observed that the air standard efficiency rises rapidly at first as the compression ratio is increased, but the gain in efficiency diminishes considerably with the higher compression ratios. It is doubtful whether, but for exceptional cases, any material advantage would be obtained from the use of a compression ratio higher than 7:1, on account of the relatively small gain in efficiency obtainable thereby, and the very high maximum pressures involved. To withstand these high pressures would necessitate a considerable increase in the cost and weight of the engine, and an increase also in the internal friction due to the heavier reciprocating and rotating parts.

The compression ratio which can actually be employed is governed in practice by the tendency of the working fluid to detonate under the high pressure and temperature of compression.

The phenomenon of detonation appears to be substantially as follows. When a mixture of hydrocarbon vapor and air is compressed to a high pressure and to a temperature approaching that of its self-ignition temperature and then ignited from any one point, the flame at first spreads by the normal process of combustion, compressing before it the unburnt portion of the charge. When the rise in temperature of the unburnt portion due to compression by the burning gases exceeds the rate of heat dissipation by a certain margin, spontaneous ignition of the former takes place, and an explosion wave is set up which strikes the walls of the cylinder with a hammerlike blow, thus causing the familiar metallic ring known as "pinking" or "detonation." It also has the effect of compressing and still further raising the temperature of the portion first ignited, and with it the temperature of the ignition plugs or other partially insulated objects in their immediate vicinity. If detonation be allowed to persist it will, unless it be very slight, increase in severity and ultimately raise the temperature of the igniter points to such a degree as to cause pre-ignition, or self-ignition of the charge, during compression and before the spark has passed; this is quite a distinct phenomenon and must not be confused with detonation.

It will be seen that detonation depends upon the normal rate of burning of the fuel, and occurs only when the rate of spread of flame is appreciably greater than the rate at which the unburnt portion can get rid of its heat. It is dependent also to a lesser degree upon a number of other factors which will be considered shortly.

Before proceeding further, it is well to point out that there are several stages of detonation, depending upon how far the normal spread of combustion has extended throughout the mass of the working fluid before spontaneous ignition occurs. Detonation, in its incipient stages, is sometimes very difficult to detect, because it is often unaccompanied by any audible noise, but rather by what may be termed harsh running.

The following very interesting and instructive experiment was frequently carried out:

A fuel was selected which, in the variable compression engine, was known to detonate with a compression ratio of say 5:1. The compression was set at, say, 4:1, and the engine run wide open at a constant speed. The compression was then gradually increased, and the general running and behavior of the engine carefully watched. As the compression rose gradually from 4 to about 4.7:1, the power output would rise also, approximately in proportion to the air-cycle efficiency, and the running of the engine generally would be smooth and silent, with very little vibration. Between 4.7 and 4.8:1 the running would become slightly harsher; from 4.8 to 4.9:1 there would be a very noticeable increase in harshness, accompanied by a considerably greater volume of noise and a marked increase in vibration, while at 5:1 the first audible signs of detonation would be detected, though they would be apparent only when ignition was fully advanced and the mixture strength also was adjusted to give maximum possible power.

With a compression ratio of 5:1 the engine would continue to run developing maximum power for an indefinite period, but pinking slightly all the time. If the compression ratio were further raised to about 5.1:1 and the ignition and mixture settings unaltered, detonation would increase in severity until, after about 5 or 10 minutes, pre-ignition would set in, and the power would fall off. If, however, the mixture strength were increased to give a slower burning mixture or the ignition timing retarded, the compression could be raised considerably higher, even to as high as 5.25:1 without any perceptible detonation. The same result could also be obtained by reducing the mixture strength, though freedom from detonation would become apparent only when the strength was so far reduced as to leave very little range. The total available range of mixture strength on the weak side is very narrow in the case of all volatile hydrocarbon fuels, so narrow indeed that to attempt to escape detonation by working entirely on the weak side would be completely out of the question in any practical multi-cylinder engine on account of irregularities in distribution. That it is possible to defer detonation by working between these very narrow limits is only what one would be led to expect from a consideration of the factors controlling detonation. This condition can readily be demonstrated as a laboratory experiment on a single-cylinder engine equipped with very delicate adjustments, and is interesting from a scientific point of view, but it can hardly be considered to be applicable in practice.

So far as practical considerations are concerned the rate of burning can be reduced, and at the same time stable conditions of running can be maintained, only by working on the rich side of the range. Under these conditions, however, the power output and economy cease to rise with increase of compression because the time of ignition or the mixture strength is no longer the most favorable. By further enriching the mixture and retarding the ignition, the compression can be increased to as high as 5.4:1, but, of course, only at great sacrifice of economy. The m.e.p. and thermal efficiency curves obtained from such a test are shown in Fig. 2.

It will be observed that, although the first indications of detonation occurred with a compression ratio of about 4.75:1, it is possible by suitable adjustments of the mixture strength and ignition timing to raise the compression to as high as 5.4:1 without allowing the detonation to become so severe as to set up preignition. **Although the precise compression at which detonation becomes serious varies with different mixture strengths or ignition timing, the compression at which it develops with the most efficient mixture strength and ignition timing is quite clearly defined, and that to within very narrow limits.** This point, namely, the compression at which detonation first becomes audible with certain definite temperature conditions and with both the ignition and mixture strength adjusted to give the highest efficiency, is taken hereafter as representing the highest useful compression ratio for any fuel. It is not the highest compression which can be employed, but the highest that it is worth while to employ.

It is necessary to emphasize this definition because it has a very important bearing upon what follows, and largely explains why certain fuels or mixtures of fuels appear to give more power and increased efficiency than others in the same engine.

The explanation of this is evident enough. Most engines have already too high a compression to enable them to run efficiently on many or even most of the brands of gasoline now on the market, with the result that they have to operate with the ignition too far retarded, and the mixture too rich. On changing over to another fuel having a higher detonation point, it at once becomes possible to advance the ignition timing and correct the mixture strength, with an immediate gain both in power and economy. Had the same two brands of gasoline

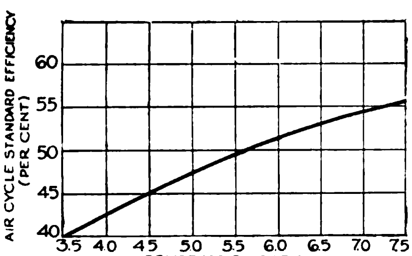


Fig. 1—Relation between the air cycle standard efficiency and compression ratio. (Total volume ÷ clearance volume)

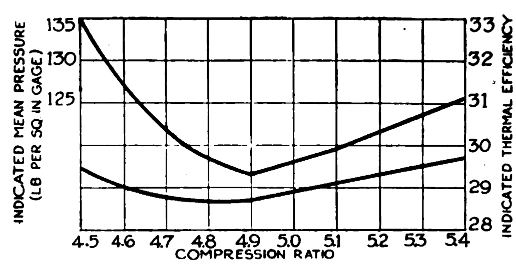


Fig. 2—Variation in mean effective pressure and thermal efficiency with different compression ratios for a fuel detonating normally at a compression of 5.0:1

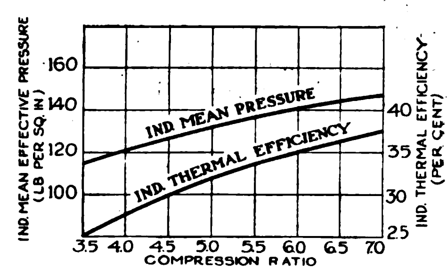


Fig. 3—Variation in indicated m.e.p. and indicated thermal efficiency with different compression ratios for a fuel not detonating below a ratio of 7:1 (say for toluene) in the variable compression engine

been tried in an engine with a lower compression ratio no perceptible difference in power or efficiency would have been observed. **It will be shown later that when various fuels are compared at a compression ratio low enough to permit of the most efficient mixture strength and ignition timing being used in each case, the efficiency is substantially the same on all fuels. Likewise it will be shown that so long as the liquid fuel is completely evaporated before its entry to the cylinder, the power output also is substantially the same for any fuel.**

Before dealing with the effect of the composition of the fuel upon its tendency to detonate it will be well to consider first certain other factors which influence detonation.

Factors Which Influence Detonation

(1) The design of the combustion chamber and the position of the ignition plug have a very important influence. **The more compact the combustion chamber, and the more central the position of the igniter, the less will be the tendency to detonate.** For it is clear that with a compact combustion chamber there is less danger of any unburnt portion of the gas becoming stagnant and therefore unable to give up its heat at a greater rate than it is generated by compression due to the burning portion of the working fluid. Again, it is clear that the ignition plug should be as nearly as possible in the center of the combustion space, in order to reduce as far as possible the distance the flame has to travel. With the exception of sleeve-valve engines, it is usually impracticable to place the ignition plug in the center of the combustion space, and the question therefore arises as to the best position for it. **Consideration will show that if the gases must be ignited from one side of the combustion chamber, the ignition plug should be placed on the hottest side, that is to say, on the side nearest the exhaust valve, so that the unburnt gases are compressed against the coolest surfaces, and can therefore get rid of their heat the more rapidly. When the ignition plug cannot be fitted centrally in the head it is clearly preferable to provide two plugs at opposite sides so that the spread of flame takes place from two opposite points and has only about half the distance to travel. The use of two plugs is, however, of little value unless the time of passage of the spark across both is perfectly synchronized.**

(2) **Turbulence.**—The greater the degree of turbulence within the combustion chamber the better, since turbulence tends to spread and distribute the flame uniformly throughout the working fluid and so reduces the danger of portions of it being entrapped and detonated. **From the point of view of detonation the worst possible condition is reached when the exhaust valve is fitted in a side pocket in which the mixture may become more or less stagnant, and the igniter fitted at the opposite side of the combustion chamber.** In such a design (and it is not an uncommon one) a portion of the working fluid will be entrapped in a position ideal for detonation where the bulk of the surface to which it can impart its heat is made up of a hot exhaust valve head and, generally, an uncooled plug for the removal of the valve. Under these conditions, detonation will occur very readily, but it may not so readily develop into pre-ignition, because the sparking plug may have very good facilities for getting rid of its heat, and the points are not so readily overheated by the return wave.

(3) **Speed of rotation.**—It is, of course, common knowledge that the tendency to detonate varies with the speed of rotation, and indeed this is only what might be expected, for the lower the speed, the lower the turbulence. As the speed is reduced not only is the velocity of entrance reduced in the same proportion, but the time during which turbulence may die down is correspondingly prolonged. Again, although the mean temperature of the working fluid at the end of the compression is, no doubt, somewhat lower at low speeds, yet the temperature of the surface of the combustion chamber necessarily varies considerably, and this, coupled with the lack of turbulence, results in the formation of local zones of gas, in the neighborhood of the exhaust valve for example, of much higher temperature than the average, and which may in fact attain a temperature approaching very nearly to the self-ignition temperature of the fuel. The existence of these hot zones coupled with a condition of general stagnation naturally predisposes the very conditions favorable to the development of detonation.

(4) **Effect of temperature** upon detonation. Since detonation is brought about by the compression of some portion of the working fluid to a temperature in excess of its self-ignition temperature, it follows that **for any given normal rate of burning, the higher the temperature of the working fluid the greater will be its tendency to detonate,** since the rise of temperature required to produce spontaneous combustion is correspondingly less.

(5) **Effect of pressure** upon detonation. Apart from the composition of the fuel, **the pressure of compression appears to be by far the most important factor controling detonation.** It appears that the normal rate of flame propagation prior to the formation of an explosion wave bears some direct relation to the pressure of the gases, the explanation presumably being that under high pressure the fuel and air are in more intimate contact, and therefore each particle of fuel can the more readily find the oxygen necessary for its combustion. It will be shown later that the pressure of compression was found to play relatively a considerably more important part than the temperature of the gases at the end of the compression.

Use of Supercharging Engine

For the investigations into the relationship between the composition of the fuel and the tendency to detonation both the research engines referred to previously were employed. In this connection the supercharging engine working with a stratified charge proved particularly valuable. This engine was, for the purpose of these tests, fitted with a piston giving a normal compression ratio of 5.18:1, corresponding to a compression pressure of 116 lb. per sq. in. gage. When desired, additional air, compressed below the piston, could be admitted to the cylinder after the completion of the suction stroke through ports cut near the bottom of the cylinder barrel, thus raising the compression pressure to approximately 155 lb. per sq. in. Before entering the cylinders, the air —compressed to a pressure of 9 lb. per sq. in.—is forced to pass through an intercooler by means of which it is cooled to a temperature approximating that of the cylinder contents. It will be seen, therefore, that when the supercharge is admitted by opening the ports in the cylinder wall, the pressure of compression is raised by approximately 35 per cent, but, since the ratio of compression is unaltered, the temperature is unchanged. By this means, therefore, it became possible to raise the compression pressure without raising appreciably its temperature.

By admitting the air supercharge through ports near the bottom of the cylinder and by suitable formation of the ports and the head of the piston, it was found possible so to separate the active working fluid and the air that they did not completely mix during the compression stroke, and by this means the presence of a considerable excess of air over that required for complete com-

bustion could always be assured, thus permitting what is not obtainable in an ordinary engine, namely, a very wide range of mixture strength over which combustion was complete. In the supercharging engine, therefore, two variables, always present in any normal type of engine, were almost eliminated, namely, the temperature of compression and the mixture strength. Thanks to the absence of these two variable factors it was found possible to arrive at the detonation point of any fuel not only very quickly but also with a very high degree of accuracy.

To attempt to analyze fully the process of combustion in such an engine is beyond the scope of this report, but it is sufficient to state that this method afforded a means of comparing the detonation points of various fuels under strictly comparable conditions, with great readiness and fair precision. It is, however, open to the obvious objection that it does not afford any means of expressing the detonation point in terms of compression ratio, which, of course, is the practical issue; this deficiency was, however, met by means of check tests in the variable compression engine.

Use of Variable Compression Engine

In the case of the variable compression engine, the actual compression ratio at which detonation first became apparent could be found by gradually raising the compression. Since, however, the tendency to detonate depends largely upon the mixture strength, it was always necessary to insure, by making fuel consumption tests, that the correct mixture had been found, and in view of the fact that for every fuel tested a different carbureter adjustment had to be found, it will readily be realized that the detonation point could not be determined so quickly or with quite such precision as in the supercharging engine. Also in the variable compression engine, probably owing to its more rigid construction, detonation was less easily detected.

The procedure adopted in nearly every case was first to test each fuel against the standard fuel in the supercharging engine, and so determine its detonation point in relation to that of the standard, the detonation point as found on this engine being expressed in terms of the indicated mean pressure at which detonation became apparent. The same samples were then tested in the variable compression engine and a definite relationship established between the mean pressure at which detonation occurred in the supercharging engine, and the corresponding compression ratio in the variable compression engine. With one or two notable exceptions the results tallied reasonably closely, so that once the relative detonation point of any fuel had been determined in the supercharging engine, the highest useful compression ratio for that fuel could be predicted fairly closely. There were, however, one or two exceptions to this rule, and in the case of these exceptions it must be assumed that the relative influence of temperature and pressure upon the tendency to detonate differed from that of the majority.

In view of the influence both of speed of rotation and of temperature upon the tendency to detonate, great care was taken to insure that the same temperature conditions prevailed in both engines and that the speed of rotation was always the same.

In all, many hundreds of tests of the nature described above were carried out. Not only were samples of practically all the brands of commercial gasoline and benzol tested, but also nearly pure samples of several members of each of the series comprised in gasoline, including various sulphur compounds, also alcohol, acetone, acetylene, ether, etc., were investigated.

Effect of Fuel on Detonation

In the case of ethyl-alcohol, acetone, toluene and xylene, it was found quite impossible to induce detonation under any circumstances in either engine. The relative detonation point, however, of these fuels could be determined by preparing mixtures of each of them with the standard aromatic free gasoline or with hexane. It was found that, in all cases, the detonation point of such mixtures followed a straight line law when the mixture was apportioned by weight and not by volume: that is to say, the addition of 40 per cent by weight of, say, toluene to hexane would raise the detonation point exactly four times as much as the addition of 10 per cent. One interesting point was repeatedly observed. When benzol and certain other fuels also were tested alone in the variable compression engine and attempts made to induce detonation by raising the compression, occasional pre-ignition would occur when the compression ratio exceeded 7:1 these pre-ignitions being denoted by a dull thud and an immediate drop in speed and power. It would appear, therefore, that such fuels when used pure, pre-ignite without preliminary detonation, but the addition of a comparatively small proportion of paraffins would induce preliminary detonation at high compression ratios. The same applies also to the naphthenes, methyl alcohol, methylated spirits and one or two others.

Table III gives the detonation point as found in both the variable compression and supercharging engines.

In Fig. 3 is shown the variation in mean pressure and efficiency with compression ratio as found by actual experiments on the variable compression engine. These curves represent the mean of a great number of tests carried out on a large number of different fuels, and

Table III—Effect of Compression on Detonation

	A	B	C	D
		In Variable Compression Engine. Compression at Which Detonation Occurred with Most Economical Mixture and Ignition Timing		In Supercharging Engine Ind. Mean Pressure at Which Detonation Occurred Lbs. per Sq. In. (Gage)
Fuel	Specific Gravity at 15° C. (59° F.)	Comp. Ratio	Comp. Pressure Lbs. per Sq. In. (Gage)	
Aromatic free gasoline.	0.718	4.85	105.5	120.0
"A" gasoline	0.782	6.0	148.5	144.0
"B" gasoline	0.723	5.7	133.5	133.0
"C" gasoline	0.727	5.25	118.0	129.0
"D" gasoline	0.760	5.35	121.5	129.5
"E" gasoline	0.719	4.7	100.5	117.0
"F" gasoline	0.704	5.05	111.5	125.0
"G" gasoline	0.750	4.55	96.0	115.0
"H" gasoline	0.767	5.9	140.5	137.0
Heavy aromatics	0.885	6.5	163.5	....
Kerosene	0.813	4.2	86.0	....
Paraffin Series				
Hexane, 80%	0.685	5.1	113.5	124.5
Heptane (pure)	0.691	3.75	72.0	....
Aromatic Series				
Benzol, 98%	0.884	6.9*	179.0*	ND
Toluene, 99%	0.870	>7.0	>183.0	ND
Xylene, 91%	0.862	>7.0	>183.0	ND
Naphthene Series				
Cyclohexane, 90%.....	0.786	5.9*	140.5*	148.0
Hexahydrotoluene, 78%	0.780	5.8	136.5	140.0
Hexahydroxylene, 60%	0.744	4.9	107.0	121.5
Olefine Series				
Cracked spirit, 53%...	0.757	5.55	128.0	....
Alcohol Group				
Ethyl alcohol, 98%...	0.798	>7.5	>204.0	ND
Methyl alcohol (purified wood naphtha)	0.829	5.2*	116.5*	....
Methylated spirits....	0.821	6.5*	163.5*	....
Acetone	0.798	>7.0	>183.0	ND
Ether	0.785	(2.95)	(47.5)	....
Miscellaneous				
Carbon disulph.	1.270	(5.4)	(123.0)	(134.0)

Notes.—* Denotes that the value given for compression could not be exceeded owing to preignition occurring before audible detonation.

( ) Where values are given in parentheses they are arrived at by extrapolation of the curves obtained from tests made with mixtures of these fuels with aromatic free gasoline.

ND Signifies that there was no detonation up to the limit of pressure obtainable in the supercharging engine.

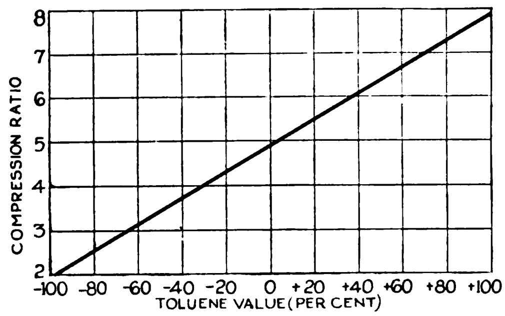


Fig. 4—Relation between toluene value and compression ratio in the variable compression engine

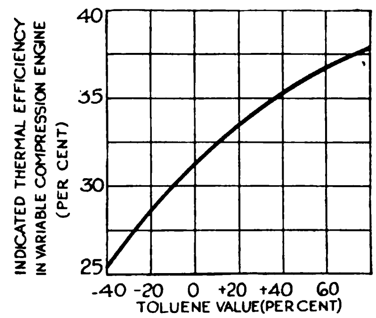


Fig. 5—Relation between toluene value and indicated thermal efficiency in variable compression engine

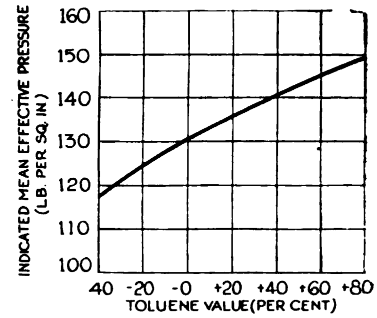


Fig. 6—Relation between toluene value and indicated mean effective pressure in variable compression engine

since in no case did the results vary by more than 1 per cent, the accuracy of the mean result may be accepted as being of a high order. It is very important to note that the relationship between power output (expressed in terms of indicated mean pressure), and of economy (expressed in terms of indicated thermal efficiency), and compression ratio was found to be the same for all fuels. Examination of these results will reveal that the inter-relationship between power output and thermal efficiency varies at different compressions. This can be partially, but not, in the writer's opinion, wholly, explained by certain investigations which will be dealt with later on.

In Table IV are given the efficiency and power output obtainable from many different relatively pure samples, and a number also of composite fuels, comprising representative samples of most of the brands of gasoline now on the market. As already explained, it is improbable if it will ever be worth while to employ a compression ratio in excess of 7:1, and the efficiency corresponding to this compression ratio has been taken as 100. It is well to bear in mind, however, that toluene, xylene, alcohol and one or two others will, in fact, withstand a considerably higher compression without detonation. **Prior to the investigations on ethyl alcohol, and the members of its group, the highest detonation point observed was that of toluene, and it was therefore decided, for the sake of conve-**

Table IV—Relative Merit of Various Fuels in Respect to Power and Thermal Efficiency

	A	B	C	D	E	F
Fuel	Specific Gravity at 15° C. (59° F.)	Highest Useful Compression Ratio. Total Volume / Clearance Volume	Ind. Thermal Efficiency at Highest Useful Compression. Per Cent	Relative Thermal Efficiency (Efficiency of 37.5% at Compression Ratio of 7:1 Is Taken as = 100). Per Cent	Ind. Mean Pressure at Highest Useful Compression with Heat Input to Carbureter of 65 B.t.u.'s per Min. Lbs. per Sq. In. Gage	Relative Ind. M.E.P. (the I.M.E.P. of 147 Lbs. per Sq. In. Obtained with Toluene at 7:1 Compression Is Taken as = 100). Per Cent
Aromatic free gasoline	0.718	4.85	31.4	83.7	130.0	88.4
"A" gasoline	0.782	6.0	34.9	93.0	140.1	95.3
"B" gasoline	0.723	5.7	34.1	91.0	137.5	93.5
"C" gasoline	0.727	5.25	32.5	86.7	133.9	91.0
"D" gasoline	0.760	5.35	33.1	88.3	134.9	91.7
"E" gasoline	0.719	4.7	30.7	81.8	128.6	87.5
"F" gasoline	0.704	5.05	32.1	85.6	132.7	90.2
"G" gasoline	0.750	4.55	30.2	80.5	127.4	86.6
"H" gasoline	0.767	5.9	34.6	92.2	139.5	94.8
Heavy aromatics	0.885	6.5	...	...	142.5	96.9
Kerosene	0.813	4.2	...	...	123.0	83.6
Paraffin Series						
Hexane, 80%	0.685	5.1	32.4	86.4	133.1	90.5
Heptane (pure)	0.691	3.75	26.7	71.2	119.0	81.0
Aromatics Series						
Benzol, 98%	0.884	6.9	37.2	99.2	146.5	99.6
Toluene, 99%	0.870	7.0	37.5	100.0	147.0	100.0
Xylene, 91%	0.862	7.0	37.3	99.5	146.8	99.9
Naphthene Series						
Cyclohexane	0.786	5.9	34.9	93.0	139.2	94.6
Hexahydrotoluene	0.780	5.8	34.3	91.5	137.9	93.7
Hexahydroxylene	0.744	4.9*	31.5	84.0	130.0	88.4
Olefine Series						
Cracked spirit, 53%	0.757	5.55	33.9	90.4	136.0	92.5
Alcohol Group						
Ethyl alcohol, 98%	0.798	7.5	40.4	107.9	156.5	106.4
Methyl alcohol (purified wood naphtha)	0.829	5.2	35.0 approx.	93.3	146.6	99.6
Methylated spirits	0.821	6.5	38.5 approx.	102.7	155.5	105.8
Ether	0.735	(2.95)	(19.5)	52.0	(116.5)	79.2

Notes.—* The sample of hexahydroxylene was very impure, namely, not more than 60 per cent.

( ) The values for ether are deduced from tests made with a mixture containing 50 per cent by volume of ether and 50 per cent of aromatic free gasoline, since the detonation point of ether alone was below and beyond the range of the apparatus.

Column C shows the indicated thermal efficiency actually observed when each of the fuels named was tested in the variable compression engine. The efficiencies given in this and other columns stating efficiencies are based on the assumption that the available energy of each fuel is equal to its lower calorific value plus its latent heat of evaporation. Justification for this assumption will be dealt with later. Calorific values and latent heats for the fuels named here are shown in Table II.

Column D shows the relation between the indicated thermal efficiency actually observed (as shown in column C) and that which was obtained in the same engine at a compression ratio of 7:1 when using toluene, *i.e.*, 37.5 per cent is taken as = 100.

Column F gives the ratio between the indicated mean effective pressure actually observed (as shown in column E) and that obtained with a compression ratio of 7:1 and using toluene as the fuel, *i.e.*, 147 is taken as = 100.

Columns D and *F* therefore give, respectively, relative figures of merit for thermal efficiency and power output obtainable for each of the samples named.

nience, to express the tendency of fuels to detonate in terms of their equivalent toluene content. This value will in future be termed the "toluene value" of the fuel.

With the exception of alcohol and the members of its group, the efficiency obtainable with all fuels appears to be the same at the same compression ratio to within less than ± 0.5 per cent. Since the toluene value defines the compression ratio which can be used, it forms a definite and precise measure of the efficiency obtainable from any fuel when used at its most efficient compression ratio. The curve, Fig. 4, shows the observed relationship between toluene value and compression ratio, and Fig. 5 the observed relationship between toluene value and efficiency, while Fig. 6 shows the relationship between toluene value and indicated mean effective pressure or power output. The curves shown in Figs. 4 and 5 are strictly applicable to all fuels outside the alcohol group, and with but very slight amendment to that group also. The relationship between toluene value and indicated mean pressure assumes that all fuels have the same total internal energy per unit volume of mixture, which is very nearly, but not strictly, true. This subject will, however, be dealt with when discussing the maximum power output obtainable from different fuels.

Table V gives the toluene value for a large number of different samples and composite fuels. Reference to this table will show that, **of the aromatic group, benzol is markedly inferior to toluene in checking detonation, while xylene occupies a position intermediate between the two. Ethyl alcohol is by far the most effective of all. With the exception of ether and acetylene, the members of the paraffin series are the worst, and, generally speaking, their tendency to detonate increases with increase of molecular weight.** In the estimates of toluene values, the standard aromatic free gasoline is taken as zero, and toluene as 100 per cent.

It would possibly have been better to have selected either a pure paraffin fraction or a range of pure paraffins as a zero standard, but neither of these was procurable either in sufficient quantity or of a sufficient degree of purity for the purpose. It must be borne in mind when making comparisons that, although the aromatic free gasoline contains less than 2 per cent of aromatics, it does, nevertheless, contain a substantial proportion—about 35 per cent—of naphthenes, and that these have a positive toluene value of about 25 per cent.

Table V—Toluene Value of Various Fuels**

	A	B	C	D	E	F	G	H	J
Fuel	Specific Gravity at 15° C. (59° F.)	Approximate Composition: Paraffins Per Cent by Wt.	Aromatics Per Cent by Wt.	Naphthenes Per Cent by Wt.	Highest Useful Compression in Variable Compression Engine: Ratio $\frac{\text{Total Vol.}}{\text{Clearance}}$	Pressure (Lbs. per Sq. In. Gage)	Toluene Value Per Cent	Mean Effective Pressure in Supercharging Engine at Detonation Point (Lbs. per Sq. In. Gage)	Toluene Value Per Cent
Aromatic free gasoline	0.718	63.0	1.7	35.0	4.85	105.5	0.0	120.0	0.0
"A" gasoline	0.782	26.0	39.0	35.0	6.0	148.5	38.0	144.0	33.0
"B" gasoline	0.723	62.0	14.9	23.0	5.7	133.5	28.0	133.0	18.0
"C" gasoline	0.727	61.0	8.5	30.5	5.25	118.0	13.5	129.0	13.0
"D" gasoline	0.760	38.0	14.6	47.0	5.35	121.5	16.5	129.5	14.0
"E" gasoline	0.719	68.0	11.3	20.0	4.7	100.5	— 5.0	117.0	— 4.5
"F" gasoline	0.704	80.0	4.3	15.2	5.05	111.5	6.5	125.0	7.5
"G" gasoline	0.750	...	7.5	...	4.55	96.0	—10.0	115.0	— 7.5
"H" gasoline	0.767	10.0	4.8	85.0	5.9	140.5	35.0	137.0	24.0
Heavy aromatics	0.885	...	71.5	...	6.5	163.5	55.0	....	...
Kerosene	0.813	...	...	...	4.2	86.0	—22.0	....	...
Paraffin Series									
Hexane (80%)	0.685	77.0	2.7	20.0 app.	5.1	113.5	8.0	124.5	7.0
Heptane (pure)	0.691	100.0	to within 0.2%	...	3.75	72.0	—37.0	....	...
Aromatic Series									
Benzol (98%)	0.884	negligible	98	negligible	6.9*	179.0	(67)	ND	(66)
Toluene (99%)	0.870	negligible	99	negligible	>7.0	>183.0	100.0	ND	100.0
Xylene (91%)	0.862	5	91	4	>7.0	>183.0	(85)	ND	(83)
Naphthenes Series									
Cyclohexane (93%)	0.786	...	4.6	93.0	5.9*	140.5	35.0	148.0SS	38.0SS
Hexahydrotoluene (78%)	0.780	...	10.0	78.0	5.8	136.5	31.5	140.0	28.0
Hexahydroxylene (60%)	0.744	...	...	60.0	4.9	107.0	1.5	121.5	2.5
Olefine Series		Olefines		Paraf. and Naphth.					
Cracked spirit	0.757	53.0	10.0	37.0	5.55	128.0	23.5	....	...
Alcohol Group		Water							
Ethyl alcohol	0.798	1.5	...	...	>7.5	>204.0	>88.0	ND	(130)
Methyl alcohol (purified wood naphtha)	0.829	(Not fully determined)			5.2*	116.5	...	....	...
Methylated spirits	0.821	6 approx.	...	...	6.5*	163.5	...	....	...
Acetone	0.798	0.5	...	...	>7.0	>183.0	>72.0	ND	(79)
Miscellaneous				Aromatic free by vol.					
Ether 50% with A.F. gasoline	0.727	2.5 approx.	...	50.0	3.9	77.0	—32.0	....	...
Ether	0.735	5.0 approx.	...	...	(2.95)	(47.5)	(—64)	....	...
Carbon disulph. 50% and A.F. gasoline	0.994	...	...	50.0	5.15*	115.0	...	....	...
Carbon disulph.	1.270	...	...	...	(5.4)	(123.0)	(18)	(134)	(20)

Notes.—** The toluene value of a fuel bears a definite straight line relation to the maximum compression ratio that can be used without detonation. The author establishes the scale of values (as will be seen by reference to Fig. 4) by arbitrarily assuming that the standard aromatic free gasoline used as the basis for comparison has zero toluene value and that toluene has 100 per cent toluene value. The standard gasoline can be used without detonation when a maximum compression ratio of 4.85 is employed while toluene can be used with a maximum ratio of 7.8. If these values be plotted on a chart using compression ratios as ordinates and toluene values per cent as abscissas, and the points be joined by a straight line continued to the left of the zero toluene ordinate, as is done in Fig. 4, the toluene value is easily read off when the maximum useful compression ratio is known. When the compression ratio is less than 4.85 the toluene value will be negative. Thus the toluene value can be considered as an index of susceptibility to detonation. The higher the toluene value, the higher the compression ratio that can be used without detonation and vice versa.—EDITOR.

*Where this mark appears it indicates that the value given could not be exceeded due to preignition intervening before audible detonation.

( ) Where toluene values and highest compressions are bracketed thus it indicates that the values could not be arrived at from direct results owing to the detonation point being beyond the range of the apparatus. In such cases the values given are derived from extrapolation of the curves (which are practically straight lines) obtained from mixtures with aromatic free gasoline.

ND Indicates that there was no detonation up to the limit of mean effective pressure obtainable with full supercharge.

SS Cyclohexane did not behave normally in the supercharging engine. In the case of the other samples of naphthenes the toluene values arrived at from the variable compression engine exceeded those from detonation tests made in the supercharger.

All the naphthenes, however, were alike in that there was a greater tendency to preignition than with the aromatics.

If a fuel consisting of a similar range of paraffins only had been selected as forming a datum line, then the aromatic free gasoline would have a positive toluene value of about 10 per cent. The standard aromatic free gasoline was selected because it was available in very large quantities, and, the whole bulk of it having been prepared at one operation, its consistency could be relied upon as being uniform—a very important factor in the case of a fuel used throughout as a standard basis for comparison.

Ether and acetylene and the heavier paraffins have, therefore, minus values, while hexane (a very light paraffin) has a very slightly positive value. In the case of the paraffin series it was found difficult to determine the detonation point of the heavier members of the group, partly because these could not be isolated in sufficient quantities or of a sufficient degree of purity for the purpose, and partly because a considerable amount of heat had to be added to sufficiently vaporize them.

There was, however, considerable evidence to show that the toluene value falls as the molecular weight increases. Small quantities of heptane of a very high degree of purity were eventually obtained, and it is hoped that sufficient supplies of both octane and nonane may soon be procured. The results obtained on heptane were as interesting as they were surprising, for, contrary to all expectations, not only did this fuel detonate far more readily than the aromatic free gasoline of which it forms one of the relatively lighter constituents, but when used pure it detonated with a compression ratio of only 3.75:1, and when mixed with hexane, even in quite small quantities, it increased the latter's tendency to detonate.

Experiments on the variable compression engine showed that heptane had a negative toluene value of minus 37 per cent. The particular sample of heptane with which the experiments were conducted was of a vegetable origin. Before any tests were run, it was very carefully analyzed, and, but for a small proportion, about 3 per cent, of terpenes was found to be remarkably pure. The results obtained were so unexpected that suspicions were aroused as to the possible influence of the presence of terpenes. Experiments with mixtures of gasoline and turpentine, however, showed that the addition of turpentine served to reduce the tendency to detonate. Finally, the remainder of the heptane was eventually almost completely freed from terpenes, and its purity raised to over 99.5 per cent; but, even so, its behavior was not influenced to any perceptible degree.

The quite remarkable difference observed between the behavior of hexane and heptane, two contiguous members of the same series, emphasizes very strongly the necessity for taking nothing for granted, and for investigating, individually, the behavior of each member of a series; moreover, there is reason to believe that certain other members of the paraffin series behave in the same erratic manner.

In this connection it may be of interest to note that a sample of commercial kerosene consisting mainly of heavy paraffin fractions detonated at a compression ratio of 4.2:1. This is equivalent to a toluene value of minus 22 per cent. Under the same conditions of heating the toluene value of hexane was found to be plus 8 per cent and of pure heptane to be minus 37 per cent. However, in spite of the above and possibly other notable exceptions **there is some evidence to show that as a general rule the heavier members of the paraffin series detonate more readily than the light ones.** Applied to this series, and to this series alone, the accepted specification, based on boiling points, affords a very approximate indication of the quality of the fuel; but that when only a small percentage of aromatics or even naphthenes are present, the position is entirely reversed, and the whole basis of the accepted specification at once falls to the ground.

(*To be continued.*)

Progress of American Engineering Standards Committee

THE American Engineering Standards Committee has approved "Tentative American Standard Specifications and Tests for Portland Cement," "Tentative American Standard Specifications for Fire Tests of Materials and Construction," and "American Standard Pipe Threads." Moreover there has been submitted for approval by the committee the "National Electrical Code" as an American Standard, and "Standard Test for Toughness of Rock," "Standard Method of Distillation of Bituminous Materials for Road Treatment" and "Standard Method of Sampling Coal" as Tentative American Standards, with the "Safety Code for Head and Eye Protection" submitted for approval as "Recommended American Practice."

The committee is composed of 47 members representing 17 bodies or groups of bodies, including 6 national engineering societies, 5 governmental departments and 13 national industrial associations. The Society of Automotive Engineers is a member body. Its function is merely to see that each body or group concerned in a standard shall have opportunity to participate in its formulation, which is in the hands of a working committee, technically called a "sectional committee." Each sectional committee is organized by one or more of the principal bodies interested, such bodies being known as "sponsors." Sponsorships have been arranged for the following projects which were under way at the beginning of this year:

Electrical Projects—"Rating of Electrical Machinery" and "Term Markings for Electrical Apparatus."

Mechanical Projects—"Ball Bearings," "Plain Limit Gages," "Gears," "Machine Tools," "Nut and Bolt Heads," "Pipe Flanges and Fittings," "Screw Threads," "Shafting."

General Projects—"Passenger and Freight Elevators," "Color Scheme for Pipe Lines," "Steel Shapes," "Zinc Ores and Zinc."

Safety Codes—"Aviation Safety Code," "Construction Work," "Electrical Fire Code," "Electrical Safety Code," "Floor Openings, Railings, Toe Boards," "Foundries," "Gas Safety Code," "Grinding Wheels," "Head and Eye Protection," "Ladder Code," "Lighting Code," "Lightning Protection," "Logging Operations and Sawmill Machinery," "Machine Tools," "Mechanical Transmission of Power," "Paper and Pulp Mills," "Electrical Power Control," "Power Presses," "Mechanical Refrigeration," "Industrial Sanitation," "Stairways, Fire Escapes and Other Exits," "Textiles," "Ventilation," and "Woodworking Machinery."

On Dec. 8, 1920, at a conference at which more than 100 organizations were represented, it was unanimously voted that a comprehensive program of safety codes should be undertaken. Active work is in progress on 24 such codes.

THE Engineering Subcommittee of the Empire Motor Fuels Committee, under the chairmanship of Dr. W. R. Ormandy, is conducting tests and experiments on the design and operation of internal combustion engines running on alcohol fuel and on alcohol-benzol-ether mixtures.

Analyzing of the Elements of Production Cost

The following paper discusses production costs from the angle of the industrial executive. It is a practical analysis of the kind for cost knowledge needed, viewed from that standpoint, and was read before a recent meeting of the Pittsburgh Section of the Industrial Cost Association.

By W. E. Hundley

WE are not here this evening to discuss elementary principles of cost accounting. I assume that everyone present is more or less familiar with the usual formula found in text-books and referred to in most publications regarding costs; namely, that direct material, plus direct labor, plus manufacturing expense, equals manufacturing cost.

No doubt the equation is fundamentally correct, but I am going to ask you to consider Cost of Production from a somewhat different angle; to forget the narrow accounting view of the problem and to look at it from the standpoint of the stockholder and the Industrial Executive. These men are vitally interested to-day in getting maximum production at minimum cost, and they must know *definitely* what constitutes that cost if any progress is to be made toward reducing it.

We are now confronted with a situation that demands an immediate and thorough analysis of the vital facts that are back of the figures we are using.

We must take time to analyze our cost problem; to consider each factor that enters into it, and to determine the most practical method of applying the indirect charges which cause most of our trouble in calculating Cost of Production. To do this effectively we must first visualize the problem as a whole. We must stand off and get a good general view of the big basic sources of cost.

When we approach the subject in this way we find that the manufacturing and marketing of an industrial product involves seven fundamental factors, each spelled with an "M," which might appropriately be called "The seven M's of industry":

First—Money.
Second—Millsite.
Third—Mill.
Fourth—Machinery.
Fifth—Material.
Sixth—Men.
Seventh—Management

Each of these factors is the primary cause of certain expenditures which begin as soon as an enterprise is launched and continue as long as it exists. It is no more difficult for a capable cost accountant to classify expenditures with respect to these causes than it is for the naturalist to tell from the characteristics of a leaf the kind of tree on which it grew. I will endeavor to show how the ordinary expenditures of an industrial enterprise are related to these prime sources of cost and how they may readily be classified into three main groups:

First: Administration.
Second: Production.
Third: Distribution.

The first factor, **Money,** is the motive-power of industry. It is obtained, primarily, by financing the enterprise and represents wealth accumulated by men who are willing to risk the loss of it by exchanging it for pieces of paper which entitle them to participate, under certain conditions, in the profits which they feel assured will be earned by the venture and which they believe will exceed the ordinary rate of interest afforded by other investments involving little or no risk.

This return, which they expect to receive on their investment, is a combination of interest for the use of their money and profit for conducting the enterprise, which should be in proportion to the risk involved and cannot reasonably be expected to approximate a fixed rate for all industries. This has been duly recognized in England, where the percentage of profit allowed on invested capital, for income tax purposes, varies with the class or nature of the business.

I mention this matter of interest and profit because it has a certain bearing upon the problem we are going to discuss and cannot be entirely ignored, as it is still the storm center among professional cost accountants and engineers, many of whom contend that interest on investment *must* be included in determining Cost of Production, reasoning that an enterprise must pay for the use of capital before it can show a profit.

We will have to put ourselves on record, sooner or later, on this point, but I think we need not include it in our discussion this evening.

This factor of Money involves the employment of treasurers, credit managers, comptrollers and auditors, with their retinue of clerks and accountants concerned primarily with the handling of receipts and disbursements, the recording of transactions with employees, customers and creditors and the keeping of accounts which reflect the financial condition of the business and guide the management in directing its activities and determining its policies.

All expenses in connection with the housing and maintenance of this organization, which are common to the business as a whole and cannot be apportioned on any equitable basis to productive departments or product and have no direct bearing upon "Distribution," are classified as "Administration."

Millsite, the second factor, although it plays a most important part in the economy of production and often limits the extent to which improvements may be made that would tend to reduce costs, is not, of itself, the source of much expense, and has very little effect upon Cost of Production.

Money spent for a millsite constitutes a permanent investment which can neither be depreciated nor appreciated and on which no direct profit can be realized except through rental or sale.

Taxes and maintenance are the usual items of expense, and these are apportioned to Production on the basis of space occupied by each department or building.

Mill, the third factor, constitutes an important element of investment which is slowly absorbed into Cost of Production through the medium of depreciation charges and also is the source of certain expenditures which may readily be classified as "Building Expense," and apportioned on the basis of available floor space or cubic contents. These expenses are of two classes:

First—A more or less fixed expense, independent of production, which includes such items as depreciation, taxes, insurance, fire protection and general maintenance.

Second—A variable expense, increasing with the use of buildings and the number of men employed, including light, heat, water, ventilation, elevator service, janitor service, etc.

Under normal conditions this distinction is not important, but when certain departments are idle or production is curtailed the difference in expense may be worth considering.

Machinery, the fourth factor, which embraces all mill equipment directly or indirectly connected with manufacturing, is the most important element of invested capital and the source of most trouble for the industrial executive, the cost accountant and the income tax examiner in determining Cost of Production.

It used to be very difficult to persuade manufacturers that depreciation of machinery and equipment constituted an important element of cost. Now they not only swallow depreciation but they hunger and thirst for amortization, obsolescence and inadequacy, and the cost accountant, who is trying to show actual Cost of Production, has a hard time keeping his feet on the straight and narrow path while trying to satisfy the demand for this home-brew concoction made in accordance with the formula handed out by the income tax department.

It is most important at this time to know the actual valuation of plant equipment; the value in use, and this, of course, cannot be satisfactorily determined without making some kind of an appraisal which entails adjustment of book values. Depreciation allowances charged into cost from year to year are merely estimates for accounting purposes and cannot be depended upon as an indication of actual depreciation. Unless the reserves set up have been properly handled, the balance when deducted from the book value of the assets may show a valuation that cannot be reconciled with the actual physical condition of the equipment. This is frequently found to be the case where large amounts have been charged for repairs and maintenance, which, in fact, have involved important renewals or replacements and, in some instances, complete rebuilding of machines, disguised under the familiar mask of "General Overhauling."

Assuming that we can establish a reasonably accurate cost for machinery and equipment, we have a basis for determining the charges to be made to Cost of Production for the gradual wear and tear which will eventually cause the scrapping or disposal of such property, regardless of how much may be spent for repairs and maintenance. But the extent to which the repairing of machinery tends to prolong its useful life is an important consideration.

Machinery is a constant source of expense, whether idle or operating, and we may, therefore, very properly assemble the items of this expense under these two headings:

1—Idle Machine Expense.
2—Operating Machine Expense.

Idle Machine Expense includes the items usually referred to as fixed charges, such as

Depreciation—Insurance—Taxes—Space Charges—Small Maintenance Charges.

Operating Machine Expense covers all of the above charges plus the following, which vary more or less with production:

Wages of Operator—Indirect Labor—Labor Expense—Power — Tools — Supplies — Maintenance and Repairs — Crane Service—Miscellaneous Works Expense.

In departments where the work is done chiefly by machines a cost per hour can be calculated for units, groups or classes of machines. Where the work is done chiefly by hand hourly rates can be developed for various classes of labor or occupations which will absorb all expense of maintaining the equipment used.

These plans constitute what are generally known as machine-rate and man-hour cost methods. Some accountants prefer to figure separate hourly rates for machines and operators but the combined rate works out very satisfactorily in practice if reasonable care is exercised in checking the rates from month to month.

Material, the fifth factor, is generally considered an easy matter to dispose of chiefly because the tendency is to ignore most of the expenses incurred in connection with it, absorbing them as part of the "General Manufacturing Expense." As in the case of labor we have both direct and indirect Material Costs.

Direct Material Cost should include all items which can be charged direct to a particular quantity, lot or class of material, such as—Amount of Invoice—Freight, Express or Drayage—Cost of Unloading—Labor Charges for Cutting, Grading, etc., and should be credited with such items as—Cost of Containers—Allowances and Adjustments, etc.

Some accountants argue that cash discounts should also be deducted from invoices.

Indirect Material Cost should cover all other expenses incurred in connection with material until it is delivered to the department that has requisitioned it. It would include—Purchasing—Tracing—Demurrage and Switching Charges—Inspecting and Testing—Storing—Handling—Breakage and Shortage—Repairing and Adjusting—Returned Goods Expense—Inventory Expense—etc.

Special expenses in connection with material bought for a particular job should be charged direct to the shop order covering it and in some cases charges for demurrage, inspection, testing, etc., might be charged direct to a department. Otherwise, Indirect Material Cost should be distributed on some equitable basis that would take account of weight, bulk, etc. This might necessitate classification of material into several groups, each group having a common unit of measure such as weight, pieces, feet, etc., but there would always be certain general expenses that would have to be distributed on some such basis as the number of requisitions handled, or the total direct cost of purchases.

Applying a percentage on cost of material disbursed is the favorite answer to this problem, but it is just as inaccurate and illogical as using a "General Factory Burden."

There are other phases of the Material Factor that will stand a good deal of discussion. I refer to the proper disposition of charges for defective and spoiled material; the use of average cost, lot cost or last cost; the proper allowance to be made for normal waste; and to what extent salvage value should be credited to direct material cost.

Men, the sixth factor mentioned, not only constitute the greatest problem in the industrial world, but are the direct source of so many expenses that cost accountants as

a rule, have used what they call, "Productive Wages" and "Productive Hours," as an arbitrary basis for distributing all "Manufacturing Expense."

I need hardly say that such items as power, tools, supplies, repairs, etc., cannot be thrown into a melting pot called "Burden" and distributed to production on a basis of wages or labor hours if we are to get anything approximating actual costs. But we can and should analyze wages and the expenses incurred in connection with the employment and handling of men and classify them into groups as, for instance:

1—Direct Labor. 2—Indirect Labor. 3—Departmental Labor Expense. 4—General Labor Expense.

Direct Labor would consist of all wages paid for time actually consumed by employees when engaged on operations or processes definitely identified with shop orders or with units, lots or classes of material for product (regardless of the purpose for which such material or product might be used).

Indirect Labor would include all wages paid to employees for work that could not be charged to productive operations, processes, etc., such as—

Supervision—Inspection—Testing—Checking—Helping—etc.

Departmental Labor Expenses would constitute direct charges to operating departments for lost time of employees and expenses resulting from Defective Work—Delayed Operations—Idle Time—Instruction—etc.

General Labor Expense would cover all expenditures for maintenance of the departments which deal directly with the men and the expense of which could readily be distributed on the basis of total man-hours, men employed, men handled, etc., such as

Employment Department—Time Keeping Department—Hospital—Safety-First Department—Police Department—Welfare Department—Educational Department—Cafeteria.

As to the method of charging labor to Cost of Production there is much to be said in favor of a system of average rates for classes of labor worked out by departments and occupations, and for the practice of establishing hourly rates combining labor and expense for departments where work is done mostly by hand. This plan has been satisfactorily carried out in foundry practice and on repair work for carpenters, painters, bricklayers, tinners, electricians, pipefitters, plumbers, riggers, etc.

Management, the seventh factor, affects Administration, Production and Distribution, but it does not present any particular difficulties except in connection with Production.

Under "Administration" we find the salaries of all executives who are not identified with Production and Distribution. Also such items as legal expenses, traveling, telephone and telegraph, association dues, donations, etc.

Under "Distribution" are the salaries and expenses of the Sales Manager and the sales force, branch office expenses, advertising department, etc. If the company distributes its product locally there may also be the expense of operating motor trucks.

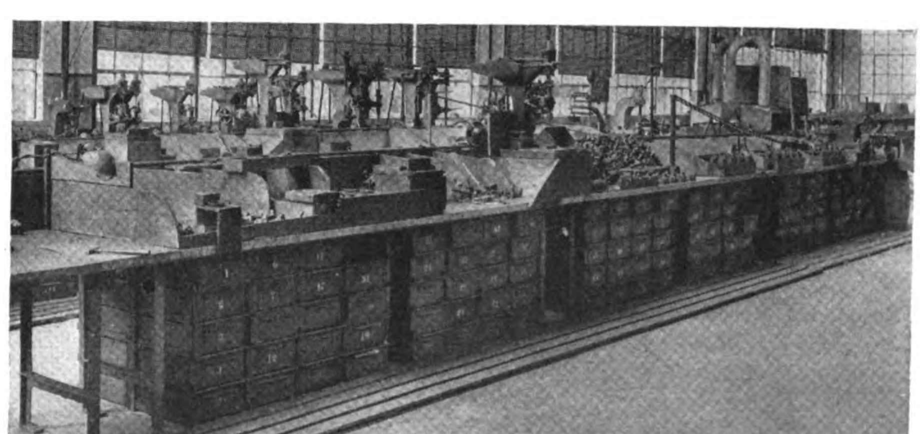
Management of Production involves a certain class of expenses which are variously referred to as "General Manufacturing Expense," "Plant Administration," etc. As a rule these expenses cannot be applied as direct charges to productive processes or operations but there is one element that is frequently separated and handled as a productive department. Engineering and Drafting can and should be handled on an hourly basis, each shop order, or department being charged with the direct time of engineers and draftsmen, as reported daily and a cost rate established to absorb all salaries and expenses.

The departmental activities generally identified with the Production Manager and which cannot be distributed on hours of direct labor are:—General Supervision—Planning and Dispatching—Timesetting—Inspection—Packing and Shipping—Works Accounting and Records—Costs and Statistics.

These general expenses of Production must be distributed on some equitable basis to departments, processes and operations but there is seldom a satisfactory basis available for this purpose. Theoretically each operating department should absorb an amount of this expense proportionate to its activity. Neither the hours nor wages of direct labor will adequately express the activity of all departments. Total hours or wages of direct and indirect labor would be a nearer approximation but even this would not be an adequate measure for departments consisting chiefly of machines. Inasmuch as the Production Manager is concerned with every feature of direct and indirect cost in each department, the total cost of operation is perhaps the best basis available. Pro-rating the expense on this basis would reach every department and keep every department manager on his toes to hold down his cost of production.

Tool Lockers Under Benches

ONE of the problems in any machine shop or manufacturing establishment is what to do with tools at night. The Holley Carburetor Co. has solved this problem in a very ingenious manner and in a way which has resulted in saving both time and space. In the system where the workman turns in all of his tools at the tool crib at night, a long line-up results with the consequent loss of time. In the morning he has to go with his tool checks again and another delay occurs. In the Holley system each man has a tool box of his own provided with a number and lock. This box is placed below the bench and contains just what the workman needs to go on with his work.



Tool boxes placed beneath work bench give a compact storage space and eliminate delay at the toolroom window

Striking Survey Shows Success of Farmer-Owner with Tractor

Results of a recent tractor survey by the Agricultural Experiment Station of the University of Idaho are presented. The facts are of special interest, as showing the success obtained by the farmer-owner as opposed to expert handling a new machine in national tractor demonstrations.

By John C. Wooley

THE national tractor demonstrations have shown that while new and in the hands of experts the tractor will do the work it is designed to do. These demonstrations have been very valuable aids in the development of the tractor as a form of power and of the business of making tractors. At the present time, however, we are most interested in knowing what success the farmer-owner is having with his machine. In order to secure information regarding the success of the tractor on the farm questionnaires were sent to 520 tractor owners. Two hundred twenty-six answers were received. One hundred twenty-seven of the questionnaires were filled out completely and it was from these that the conclusions were drawn.

Several studies were made of these data and some of the results are given below:

Study Number 1

PURPOSE.—To determine the success with which tractors have been operated in Idaho during the past ten years.

Date of Purchase	Has the Tractor Been a Paying Investment? Yes	No
1908	1	2
1909	0	2
1910	0	0
1911	2	0
1912	2	2
1913	1	0
1914	9	4
1915	15	7
1916	14	10
1917	42	14

Of the 127 reports, 86 indicated the tractor as a profitable and 41 as an unprofitable investment. In other words, 69.3 per cent of all the tractors that have been used in the state have been profitable. Considering alone the tractors purchased in 1917, we find that 75 per cent of them have been profitable to their owners. Some of the failures are due to poorly designed machines, but in many cases the trouble can be traced to a lack of knowledge regarding the care and proper method of operation of the machine, or to carelessness on the part of the operator.

The selection of the proper size and type of machine also has much to do with its success or failure.

Study Number 2

PURPOSE.—To find the relation of size of farm to the success of the tractor.

On less than 200 cultivated acres	70%	were successful
On 200 to 300 cultivated acres....	81.5%	were successful
On 300 to 400 cultivated acres....	50%	were successful
On 400 to 500 cultivated acres....	77%	were successful
On 500 to 600 cultivated acres....	75%	were successful
On 600 to 700 cultivated acres....	57%	were successful
On 700 to 800 cultivated acres....	63%	were successful
On over 1000 cultivated acres.....	78%	were successful

It is seen from this that the highest percentage of success was secured on the small farm and the next best results were secured on the farms with over 1000 acres in cultivation. On the smaller farm the owner was in all probability his own operator, which, no doubt, has something to do with this high percentage of success. On the larger ranch there is a tendency to overload the machine and this at once makes the tractor an unprofitable investment. On the largest ranches an expert operator is often hired and less loss of time and less expense is usually the result.

Study Number 3

PURPOSE.—To determine the relation of size of tractor to the profitableness of the investment.

Size	No. Reported Profitable	No. Reported Unprofitable
8-16 horsepower	10	5
10-20 horsepower	16	3
12-25 horsepower	18	8
15-30 horsepower	14	7
20-45 horsepower	13	6
30-60 horsepower	7	4
40-75 horsepower	5	1

The higher percentages here are found in the 10 to 12 draw bar horsepower class and in the 40-75 size. The smaller type has been, in most cases, used to supplement the horsepower on the farm, while in many cases, the larger type has been used for all the work on the wheat ranch. Both have been found profitable investments.

Study Number 4

PURPOSE.—To find the size of tractor favored by owners of different size farms.

Cultivated Areas	Favored Size
Less than 100 acres	8-16 horsepower
100-200 acres	12-25 horsepower
200-300 acres	10-20 horsepower
300-400 acres	20-40 horsepower
400-500 acres	12-25 horsepower
500-600 acres	15-30 horsepower
600-700 acres	25-50 horsepower
700 acres and over	40-75 horsepower

The size of tractor selected will depend upon other factors beside the size of farm. One of these factors is the requirement for belt power. Another is the type of soil and still another is the type of farming. On the specialized wheat ranch, where the plowing, disking, seeding and harvesting can be done with the tractor, one of the larger

sizes will be necessary for success. While on a ranch where diversified farming is followed, one or two smaller machines may be more successful.

Study Number 5

PURPOSE.—To determine the effect of dependability on success of the tractor.

Size of Tractor	Number Reporting	Profitable Days Out of Repair When Needed	Unprofitable Days Out of Repair When Needed
Less than 10 D. B. Hp.	26	8.3	60
10 to 16 D. B. Hp......	42	3.2	30
Over 16 D. B. Hp......	21	7.0	33
Average	..	6.1	41

Note.—D. B. Hp. is the abbreviation for Draw Bar Horsepower.

Dependability is one of the most important factors in the success or failure of the tractor as an investment. If the tractor can be depended on to work when the busy season comes, it proves to be, in most cases, a profitable investment. Where it fails in the busy season, it is certain to be a marked failure.

Study Number 6

PURPOSE.—To find the number of horses displaced by different size tractors and to determine the effect of this displacement on the success of the tractor.

Size of Tractor	—Horses Displaced— By Profitable Machines	By Unprofitable Machines
Tractors less than 10 D. B. Hp...	4	2
10 to 16 D. B. Hp...............	7	4
Over 16 D. B. Hp................	14	6

In every case the tractors reported as having been profitable investments have displaced a larger number of horses than those that have not been reported as profitable. A tractor can be made more easily a financial success if it displaces some horses, but quite a few owners feel that they have made money by supplementing the horse power with the tractor. They have taken some of the hardest work off the horses and have had an abundance of power for the rush seasons.

Study Number 7

PURPOSE.—To determine the effect of the tractor on the labor situation.

Size of Tractor	Percent of Owners Reporting a Decrease in Hired Help: Profitable Machines	Unprofitable
Less than 10 D. B. Hp.....	73%	12½%
10 to 16 D. B. Hp.........	83%	19%
Over 16 D. B. Hp.........	90%	55%

Eighty-two per cent of all tractor owners reported that the tractor enabled them to get along with less hired help. The men who have been able to displace some man labor with their machines are the ones who in a majority of cases have made the greatest financial success with these machines.

Study Number 8

PURPOSE.—To find the different farm operations in which the tractor is being used in Idaho.

Ninety-seven per cent of the owners make the greatest use of the tractor in plowing. A few operators use their machines in plowing as many as 120 days each season.

About one-third of the owners use their tractors in the preparation of the seed bed. A large number of the men who use their tractors in this work are among the successful operators. By use of the tractor this work can be done rapidly and without expensive equipment, and such use will help the tractor to pay its way.

Twenty per cent of the owners use their machines for harvesting and about 40 per cent of the machines are used in threshing. Clearing of land, pumping, silo filling, feed grinding, grading, and hauling are other lines of work in which the tractor is being used successfully.

Study Number 9

PURPOSE.—To learn the troubles that tractor owners encountered.

Quite a large number of men have reported trouble with ignition and in almost every case this has been due to dust that has found its way into the magneto. A dust-proof cover should be carefully kept in place and by this means much of this trouble will be avoided.

Lubrication was one of the difficulties encountered last season. Some of the most successful operators are the ones who take the greatest care with their lubricating oil. Lubricating oil is destroyed by being burned, by being cut with kerosene that works past the piston rings, and by being worn out in the bearings and cylinders. One successful operator drains his crank case at the end of each day's run. He allows the oil to stand until morning and then pours off any washy material and filters the remainder. At the end of one week he uses new oil in the crank case. Tests have indicated that the oil should be changed after thirty hours of work where the engine is being operated under maximum load. Trouble with bearings, with rings, and with loss of power are very often the result of poor lubrication.

Gears and chains come in for a large share of the trouble in this State, due to the large amount of dust that prevails. It is well to inspect the gears and chains often and thus anticipate the need for new parts.

Study Number 10

PURPOSE.—To determine the items in tractor cost to the owner.

One of the items that is quite important is that of deterioration. If a tractor gives service for only five years, then one-fifth of the original cost must be charged to deterioration each year, and at this rate this will be one of the big items. If the tractor will give service for ten to twelve years, as it should under proper usage, then this item will not be so great. Loss of time when power is most needed is an expensive item and must be avoided by care in operation and by effective service on the part of the dealer, in case of a breakdown during the busy season. Fuel and oil should probably be listed next, with repairs as one of the lesser items in cost. Fuel and oil costs for plowing should be kept below 50 cents per acre. The other items of cost are so variable that no accurate figures can be given.

Conclusions

1. The tractor, when carefully selected and intelligently operated, is a profitable investment.

2. The farmer must be able to make all minor repairs himself and to get repairs and expert help quickly for larger installations.

3. Dependability is probably the largest factor in the success of the tractor.

4. The three plow size is favored in this State.

5. Proper care of lubrication will prolong the life.

6. The best quality of oil is the cheapest.

7. The tractor motor is required to pull its rated load the greater portion of the time. The automobile motor is very rarely subjected to full load for a ten-hour day. Care for the tractor accordingly.

8. The tractor that displaces half its value in horses can easily be made to pay its way.

9. The man who makes up his mind to care for his machine and to be as independent as possible of outside help is the satisfied owner.

10. Taking off one plow may enable the tractor to operate at its rated speed and bring better results.

11. Overloading brings trouble and reduces results.

Foreign Import Duties on American Automotive Products

Argentina:
Cars and trucks..............32% A.V.
Motorcycles ....$36.80 each
Parts ....32% A.V.

Bolivia:
Cars .... 8% A.V.
Trucks .... 4% A.V.
Motorcycles ....15% A.V.

Brazil:
Cars and trucks....7% A.V. nominal duty: 25.71% A.V. actual duty. See note *.
Chassis mounted or not; front or back wheels complete; including motor and accessories rough, but not including body.20.57% A.V.
Bicycles, including solo motor cycles (engines are dutiable separately), per 100 lb.......$20.15
Motors and engines, including those for motorcycles........46.28% A.V.

Chile:
Trucks, not otherwise specified for the transportation of merchandise assembled or knocked down and separate parts of the same not subject to other duties, per 100 lb.......... $3.31
Automobile bodies imported separately, per 100 lb. gross.. 16.48
Cars and car parts, per 100 lb. 9.95
Up to 2204 lb.—$6.63 for each 100 lb. exceeding 2204 lb.
Motor and frames or chassis for automobiles, per 100 lb.. 1.66
Motorcycles, per 100 lb........ 24.86

Columbia:
Cars and trucks, per 100 lb... 0.4731
Motorcycles, per 100 lb......... 2.365

Ecuador:
Automobiles ....Free. 2% A.V. surtax
Motorcycles, per 100 lb. Surtax included $1.0153

Paraguay:
Cars and trucks..............63.5% A.V.
Motorcycles ....$65.52 each

Peru:
Trucks, per 100 lb............. 5.30
Cars and motorcycles per 100 lb. 15.92
See note **.

Uruguay:
Automobiles and taxis........29% A.V.
Motorcycles ....$82.72 each, plus 14% A.V. surtax

Venezuela:
Automobiles and trucks, per 100 lb. $0.6853
Motorcycles, per 100 lb........ 3.4330

Costa Rica:
Trucks for province of Limon, per 100 lb.................... 1.3314
Trucks for interior provinces, per 100 lb................... 1.2933
Cars and motorcycles for province of Limon, per 100 lb.... 4.4381
Cars and motorcycles for interior provinces, per 100 lb.. 4.3113

Cuba:
C. T. & M.....................25% A.V.

Dominican Republic:
Cars and passenger omnibuses. 5% A.V.
Trucks ....Free
Motorcycles ....10% A.V.

Haiti:
Cars, trucks, motorcycles.....24% A.V.

Guatemala:
Automobiles, trucks and motors (gross weight), per 100 lb.... $4.64
Motorcycles and parts (gross weight), per 100 lb.......... 6.95

Honduras:
Cars and trucks, per 100 lb.... 12.50
Motorcycles, per 100 lb........ 5.00
Note: Surtax of $0.14 per 100 lb. on imports into Amalpa.

Nicaragua:
Cars, trucks, motorcycles and parts .... 5% A.V.
Surtax ....12½% of duty

Panama:
Cars, trucks, motorcycles and parts ....15% A.V.

Salvador:
Cars, trucks, motorcycles and parts, per 100 lb............. $2.30

Mexico:
Trucks under 1100 lb, per 100 lb. 6.21
Trucks over 1100 lb. per 100 lb. 2.48
Cars not over 550 lb. (gross), per 100 lb..................... 18.66
Cars from 550 to 1650 lb. (gross) 14.93
Cars over 1650 lb. (gross), per 100 lb. 12.44
Motorcycles, per 100 lb........ 24.98

British Guiana:
C. Tr. M. parts, etc., General..22% A.V.
Preferential ....11% A.V.
Invoice surtax, 1½% A.V. and surtax of 10% of duty.

Dutch Guiana:
C. Tr. M. parts, etc...........10% A.V.

French Guiana:
Automobiles under 5500 lb....50% A.V.
Automobiles over 2500 lb., per 100 lb..$11.80, plus 5% A.V. Octroi duties
Motorcycles, per 100 lb., $28.05 plus 5% A.V.

Canada:
C. and Tr. of all kinds, including motorcycles, chassis, bodies and steel wheels.
General ....35% A.V.
Preferential 25%

New Foundland:
Cars, trucks and motorcycles..45% A.V.
Surtax 10% of duty.

British Honduras:
General ....15% A.V.
Preferential ....10% A.V.

Antigua:
General ....13.33% A.V.
Preferential .... 8.88% A.V.

Bahama Islands:
Cars and trucks. General.....20% A.V.
Preferential ....15% A.V.
Motorcycles. General ....50% A.V.
Preferential ....37.5% A.V.
Parts ....

Barbados:
C. trucks and motorcycles....10% A.V.

Bermuda:
Automobiles and motorcycles are prohibited.

Dominica:
General ....12.5% A.V.
Preferential .... 8.33% A.V.

Grenada:
General ....10% A.V.
Preferential .... 6.66% A.V

Jamaica:
Motor cars and accessories.
General ....20% A.V.
Preferential ....15% A.V.

Montserrat:
General ....13.33% A.V.
Preferential .... 8.88% A.V.

St. Christopher and Nevis:
General ....11% A.V.
Preferential .... 7.33% A.V.

St. Lucia:
General ....16.5% A.V.
Preferential ....11% A.V.

St. Vincent:
General ....12.5% A.V.
Preferential .... 8.33% A.V.

Hongkong: ....Free
Straits Settlements: ....Free
Gibraltar: ....Free
Hawaii:
Philippines: ....Free
Porto Rico: ....Free
Guam: ....Free
Virgin Islands, U. S. ....Free

Cypress:
Cars and trucks..............Free
Articles not specified. General 8% A.V.
Preferential .... 6.66% A.V.

Malta:
Cars, trucks and motorcycles.15% A.V.

China:
Cars, trucks and motorcycles.. 5% A.V.
Surtax 10% of duty.

Tutuila:
Cars, trucks and motorcycles..10% A.V.

Trinidad and Tobago:
Motorcycles and trucks.
General ....15% A.V.
Preferential ....10% A.V.
Cars. General ....30% A.V.
Preferential ....20% A.V.

Australia:
Cars: 1. Single seated bodies.
General ....$194.40 each
Preferential ....135.80 each
2. Double seated bodies.
General ....271.60 each
Preferential ....243.00 each
3. Bodies with fixed or movable canopy tops such as limousines, etc.
General ....364.50 each
Preferential ....315.90 each
4. Chassis: Unassembled.
General ....17% A.V.
Preferential .... 7.5% A.V.
Assembled:
General ....20% A.V.
Preferential ....10% A.V.

British India:
Cars and motorcycles..........20% A.V.
Trucks .... 7.5% A.V.

Ceylon:
Motor vehicles .... 7.5% A.V.

Federated Malay States:
Motor vehicles ....10% A.V.

North Borneo:
Vehicles ....10% A.V.

New Zealand:
Cars, trucks and motorcycles.
General ....20% A.V.
Preferential ....10% A.V.

Aden: ....Free

Japan and Chosen:
Cars and trucks. General.....50%
Conventional 35%
Motorcycles ....$46.61 each

Siam:
Cars, trucks and motorcycles.. 3% A.V.

French Indo-China:
Cars and trucks under 5500 lb..45% A.V.
Cars and trucks over 5500 lb, per 100 lb...................$11.80
Motorcycles, per 100 lb......... 28.05

Dutch East Indies:
Carriages, including automobiles ....10% A.V.
Not specified .... 6% A.V.

Persia:
Cars, trucks and motorcycles..15% A.V.

Syria:
Cars, trucks and motorcycles..11% A.V.

Abyssinia:
Cars, trucks and motorcycles..10% A.V.

Belgian Congo:
Cars, trucks and motorcycles..10% A.V.

Egypt:
Cars, trucks and motorcycles.. 8%
Local tax of ½% at Alexandria.

Algeria:
Cars and trucks under 5500 lb.45% A.V.
Cars and trucks over 5500 lb., per 100 lb...................$11.80
Motorcycles, per 100 lb......... 28.05

Nigeria:
Cars, trucks and motorcycles..Free

Mauritus:
Cars, trucks and motorcycles..12% A.V.

Zanzibar:
Cars, trucks and motorcycles.. 7.5% A.V.

Eritrea:
Cars, trucks and motorcycles.. 8% A.V.

Libya:
Cars, trucks and motorcycles..11% A.V.

Somaliland:
Cars, trucks and motorcycles..15% A.V.

Liberia:
Cars, trucks and motorcycles..12½% A.V.

Morocco:
Cars, trucks and motorcycles..12½% A.V.

Union of South Africa:
Cars and motorcycles. General.20% A.V.
Preferential ....17% A.V.
Trucks. General .... 3% A.V.
Preferential ....Free

Mozambique:
Cars and trucks...............10% A.V.
Motorcycles .... 5% A.V.

Czecho-Slovakia:
Cars or trucks over 5500 lb, per 100 lb. $4.54
Cars or trucks under 5500 lb...45% A.V.
Truck bodies over 5500 lb., per 100 lb. $0.90
Passenger car carriage work over 5500 lb., per 100 lb...... 6.91
Car or truck bodies under 5500 lb. ....45% A.V.

Austria:
Cars, trucks and motorcycles—
Up to 880 lb., per 100 lb......$13.63
Over 880 to 3960 lb., per 100 lb. 11.07
Over 3960 to 7040 lb., per 100 lb. 9.22
Over 7040 lb., per 100 lb..... 5.53
When above duties are paid in paper, figures should be multiplied by 80.

Belgium:
Motorcycles, per 100 lb........$31.54
Automobiles—Chassis with or without motor, with or without body, weighing less than 4400 lb., per 100 lb.......... 21.04

From 4400 lb. to 8800 lb., inclusive:
- Passenger cars, per 100 lb... 21.04
- Other, per 100 lb. ... 13.15

8800 lb. and more, per 100 lb.. 6.58

Bulgaria:
- Motorcycles, per 100 lb. General 26.63
  - Minimum ... 19.20
- Automobiles ... 33.03 each*

These duties are paid in paper and should be multiplied by 6.

Denmark:
- Motorcycles, per 100 lb. ... $7.30
- Automobile and chassis (including motorcycle side cars), per 100 lb. ... 3.04 Plus 5% A.V

Finland:
- Motorcycles ... $11.58 each
- Cars and trucks ... 10% A.V.

Above duties are to be increased 200%.

France:
- Motorcycles, per 100 lb. ... $28.05
- Cars and trucks under 5500 lb. 45% A.V.
- Cars and trucks over 5500 lb., per 100 lb. ... $11.80
- Chassis frames for automobiles weighing 5500 lb. or more, per 100 lb. ... 11.80
  - Less than 5500 lb. ... 45% A.V.
- Bodies of automobiles weighing 5500 lb. or more:
  - Trucks, per 100 lb. ... $3.68
  - Passenger cars, per 100 lb 23.19
- Bodies weighing less than 5500 lb. ... 45% A.V.

Faroe Islands:
- Cars, trucks and motorcycles.. Free

Iceland:
- Cars, trucks and motorcycles, per 100 lb. ... $0.22

Germany:
- Motorcycles:
  - 110 lb. or under, per 100 lb.. 16.22
  - Over 110 lb. to 220 lb., per 100 lb. ... 12.97
  - Over 220 lb. to 550 lb., per 100 lb. ... 9.72
- Automobiles:
  - Over 550 lb., but not over 1100 lb., per 100 lb. ... 6.48
  - Over 1100 lb., but not over 2200 lb., per 100 lb. ... 4.32
  - Over 2200 lb., per 100 lb. ... 2.16

When duties are paid in paper there is a surtax of 900%.

Greece:
- Motorcycles ... $11.58 each
- Motor vehicles: Trucks and omnibuses, per 100 lb. ... 2.31
- Passenger cars:
  - 1320 lb. or under, per 100 lb. 6.23
  - Over 1320 lb., per 100 lb. ... 7.91
- Chassis, with or without motors or motors separate, per 100 lb. ... 1.26
- Bodies for trucks, per 100 lb.. 11.07
- Bodies for omnibuses and passenger cars ... 154.40 each

Hungary:
- Automobiles, chassis and motorcycles:
  - 880 lb. and under, per 100 lb. 13.81
  - Over 880 lb. to 3960 lb., per 100 lb. ... 11.04
  - Over 3960 lb. to 7040 lb., per 100 lb. ... 9.22
  - Over 7040 lb., per 100 lb. ... 5.49

These duties are paid in paper and should be multiplied by 20.

Italy:
- Motorcycles ... 15.44 each
- Cars and trucks weighing:
  - Not more than 880 lb., per 100 lb. ... 10.53
  - Over 880 lb. up to 1980 lb., per 100 lb. ... 10.04
  - Over 1980 lb. up to 3520 lb., per 100 lb. ... 5.68
  - Over 3520 lb. up to 5500 lb., per 100 lb. ... 6.54
  - Over 5500 lb. up to 8800 lb., per 100 lb. ... 8.31
  - Over 8800 lb., per 100 lb. ... 5.22

Automobiles with or without bodies weighing not more than 5500 lb. will also pay a surtax of 35% A.V. Duties paid in paper are to be multiplied by 3.

Jugo Slavia:
- Cars, motorcycles and parts ... 30% A.V.
- Trucks ... 20% A.V.

There is a 10% surtax on luxuries.

Netherlands:
- Cars, trucks and motorcycles.. 5% A.V.

Norway:
- Motorcycles (motors are dutiable separately), per 100 lbs.. $487.22
- Automobiles of all kinds including motorcycle side cars ... 18% A.V.
- Motors, including motorcycle motors ... 15% A.V.

Portugal:
- Cars and trucks complete ... $129.60 each
- Cars and trucks incomplete, with motor ... 75.60 each
- Motorcycles ... 54.00 each
- Surtaxes:
  - Cars complete:
    - Up to 18 hp. ... 540.00 each
    - Over 18 hp. ... 1,080.00 each
  - Cars incomplete:
    - Up to 18 hp. ... 270.00 each
    - Over 18 hp. ... 756.00 each
  - Incomplete bodies ... 334.80 each
  - Trucks—Complete or not ... 129.60 each
  - Motorcycles ... 54.00 each

Import duties and surtaxes in Portugal are payable in English exchange, one-half being converted at normal rate and one-half at current exchange rate.

Roumania:
- Cars, trucks and motorcycles, weighing each:
  - Less than 220 lb., per 100 lb. 7.63
  - From 220 to 550 lb., per 100 lb. 6.36
  - From 550 to 1100 lb., per 100 lb. ... 5.08
  - From 1100 to 2200 lb., per 100 lb. ... 3.81
  - Over 2200 lb., per 100 lb. ... 2.54

These duties are to be increased five times.

Spain:
- Motorcycles and parts (including motors) per 100 lb. ... 78.62
- Chassis, with or without motor weighing, net:
  - Not over 2200 lb., per 100 lb. 26.31
  - More than 2200 lb., per 100 lb. 31.54
- Cars—with or without motors in addition to the duty on chassis:
  - Open ... $115.80 each
  - Closed ... 185.28 each
- Trucks, per 100 lb. ... $13.13

(A new tariff is to be issued at an early date.)

Sweden:
- Motorcycles (complete) ... $16.08 each
- Vehicles with or without motor, chassis wheels with rubber tires for such vehicles ... 15% A.V.

Switzerland:
- Motorcycles—not covered with leather or upholstered, per 100 lb. ... $4.36
- Motor vehicles, including chassis, bodies, axles with driving gears, and radiators, not covered with leather or upholstered, per 100 lb. ... $3.49
- Same, covered with leather or upholstered, per 100 lb. ... $6.98
- Motor vehicles, covered with leather or upholstered, per 100 lb. ... $5.22

Turkey:
- Cars, Trucks and Motorcycles. 11% A.V.

United Kingdom:
- Motor Cars and Motorcycles and Parts:
  - General tariff ... 33⅓% A.V.
  - Preferential ... ⅔ of full rate

(In calculating the value, the value of the tires is deducted from total value.)

NOTES

*The "actual duties" include 2% gold surtax and increase due to proportion of duty payable on a gold basis. The calculations are based on a value of 14 cents to the paper milries and are subject to change in accordance with variations in its value.

**Surtax included in each case where a surtax is imposed unless otherwise noted.

Gas and Electric Welding

THE welding of steel, cast iron, aluminum and other metals has become an important factor in industry during the past two decades. Both in the manufacture of machinery and in the repair of breaks much welding is done. There are two general processes of machine welding—the gas flame method and the electric method. Under each of these heads there are a number of distinct processes differing considerably in their details and adaptability. In industrial work where welding of this kind is to be used it is well to make a thorough study of the different methods available to see which one lends itself best to the work in hand. Such a study will be facilitated in the future by two books just issued by the McGraw-Hill Book Co. dealing with Gas Torch and Thermit Welding and Electric Welding respectively. The author is Ethan Viall, formerly editor of *American Machinist*.

Mr. Viall deals with the different gases used in gas welding, namely, acetylene, Blaugas, coal gas, Drigas, hydrogen and thermalene, giving their flame temperatures, ignition temperatures and other physical properties affecting their value as welding fuels. He outlines the field of gas torch welding and cutting, stating that the welding process is used in automobile and airplane construction, in lead burning and in sheet metal work, such as the manufacture of light air tanks, tubing and oil storage tanks. In aircraft manufacture gas welding is used for welding water jackets to the cylinder, valve cages to the cylinder, flanges to manifold connections, of manifolds, spark plug thimbles, tubular frame sections, splice plates, sockets to frame, aluminum crankcases and water tank. In automobile manufacture it is used for welding rear axle housings, defective gears and pinions, manifolds, shafts, steering posts, automobile bodies, tubing used in windshields, crankcases, transmission cases, wheels which are made of stamped-out parts, mufflers, valve stems to valves, rims, repairing crank shafts and frames and extending the frame to convert passenger cars into commercial vehicles.

In the book on gas welding are described the different methods of producing oxygen and the manner of its delivery to the trade, acetylene welding outfits and welding methods. The last part of this book deals with the Goldschmidt Thermit process of welding.

The book on Electric Welding deals in a similar manner with that subject. All methods are divided into two classes—arc welding and resistance welding.

What Do You Know About Your Factory Doctor?

The necessity for a careful selection of industrial physicians is emphasized by Major Magnuson of the Surgeon General's Office. Major Magnuson is associated with the Illinois Industrial Board and is thoroughly familiar with the various phases of medical work in industrial plants.

SEVERAL years ago there was a young man practicing dentistry in a Pennsylvania mining town. He had prepared at a second-rate dental school and had failed three times to pass the examinations necessary to obtain his State certificate. He had many friends in the town, however, and for several years was able to practice, in spite of his lack of license, and to elude the law through the support of his following and political friends.

This man, an incompetent dentist, obtained a position as assistant to the chief physician at one of the largest shipbuilding plants in America, held that position throughout the war and still holds it. He acted in the capacity of a medical man, not of a dentist. He started at $25 per week but has been greatly advanced.

The work of this pseudo-physician was unsatisfactory to the employees almost from the start, and later the suspicion got out that he was not a medical doctor at all but a dentist. Not only did the medical work suffer, but the reputation of the plant among outsiders was seriously affected by it. Had it not been for the excellent ability of the chief physician things might have been in bad shape.

This failure of employers to investigate carefully the qualifications of the men whom they employ as plant physicians is forcefully brought out by Major P. B. Magnuson, of the Surgeon General's Office of the War Department, in an address to the International Association of Industrial Accident Boards and Commissions.

"I don't know," Major Magnuson said in part, "how much the layman is expected to know about the different classifications of medical schools in this country. We have a number of classifications under the American Medical Association, the A-plus school—standing the highest—and the A, B-plus and the B, and these are rated according to their faculty, their equipment, their clinical facilities. Now, it makes a good deal of difference to a man in his education as to what sort of contact he has had during his student days—in the formative period. A man who has gone to one of the schools that we have in Chicago, which we call the "mill" and which the State Board of Licensors has been trying to put out of business for a good while, is not apt to have very high ideals when he comes out of school. He gets a job, usually, as a night surgeon at some large plant to help himself through school, and when he comes out, instead of taking an internship, he goes right into industrial work nine times out of ten.

"Why does he go into industrial work? Principally because, to the average corporation, the doctor is a doctor. The president of that corporation wouldn't take that man on as his own family physician, but it never occurs to him that a cheap doctor is an expensive proposition.

"I would like to tell something that happened to me when I first went into industrial work. I had been with Doctor Murphy of Chicago for several years as his assistant, and upon his advice went over to the stockyards —along Halstead Street—to get a little more experience. I went in to see the president of one of the large corporations and asked him if he didn't want a doctor.

"'No,' he said, 'We have one doctor; we don't need any more.'

"I said, 'How much do you pay him?'

"He said, 'I don't know, but I will find out;' so he called up the claim agent. They were paying the doctor $75 a month. They were being cheated, I think.

"He said, 'What do you want to do it for?'

"I said, 'I want to do it on a fee basis.'

"He said, 'How much will that cost?'

"I said, 'It will cost you $2 for the first office visit and $1 for every other one after that; $3 for the first call and $2 for every one after that.'

"He said, 'That will run over $75 a month.'

"I said, 'I hope so, or I don't want the job.'

"After thinking it over—I had quite a conversation with him—I asked him if he knew anything about his doctor. I said, 'Where did he graduate from?'

"He said, 'I don't know.'

"'What experience did he have before he came to you?'

"'I don't know.'

"I said, 'Do you know who he is?'

"'Well,' he said, 'I know his name is so and so.'

"'Well,' I said, 'Do you think it would save you any money if you had surgical treatment which was a little better than you are getting now?'

"He said, 'I don't know, but I am willing to gamble with you. I will pay you on a fee basis and I will let the other fellow stay here and pay him a salary, and the fellow that has the most business at the end of three months I will let have the job.' He added, 'You are starting out with a handicap, because the boys know this other fellow and they don't know you.'

"I said, 'Maybe that is no handicap; that may be an advantage.'

"So we went to it. At the end of three months I am glad to say I had about 80 per cent of the business. At the end of six months the bill for that one company, on a fee basis, totaled more than $600—the same work the other fellow was doing for $75.

"At the end of the year this was the record: We had had almost ten per cent more accidents than we had had the year before; we had had only one

lawsuit filed, as against thirty-one the year before. There was a total saving of $20,000 in the claim department, and the surgical department expense had been boosted almost $900.

"The training of a surgeon should be brought to the attention of an employer as much as the training of his general manager.

"He should look into the training of the surgeon he employs and the man's character as carefully as he does the general manager's, because it pays in dollars and cents, and, if we are going to talk to a corporation head, we have got to talk in dollars and cents and not in medical ethics, because he isn't interested in medical ethics; he is interested in dollars and cents saving at the end of the year.

"The weighing of medical testimony as it comes before the industrial board from the men who have examined a case and had it under observation is sometimes a rather difficult thing.

"We have tried, in Illinois, to put ourselves in a position so that the employers and employees would have enough confidence in the medical department and the industrial commission to eliminate all expert testimony; to send their case to the commission and to say, 'You tell us how much this thing is worth in dollars and cents.'

"We would like to be able to talk in dollars and cents to the employer and to show him the difference saved in compensation by the supplying of expert surgical treatment and poor surgical treatment; and, to that end, I have a rough surgical report to be filled in by the commission on every case, in order to trace our accident cases down and find out what the dollars and cents saving is per case in certain classes of injuries occurring in industry.

"If we get that information we can say to a company, 'Last year cases treated by men who rate as class A-1 men cost in compensation $350 for certain classes of injuries, on an average. Cases treated by class B men cost $850 per case. The medical treatment paid for class A men cost $75 more per case than the medical treatment paid class B men. Therefore, you have a saving of $400 or $500 per case.'"

S. A. E. Summer Meeting Program Nearing Completion

PLANS for the semi-annual meeting of the Society of Automotive Engineers to be held at West Baden, Ind., May 24 to 28, are nearing completion. Of the technical sessions at this meeting the Research and Fuel Sessions will undoubtedly rank first in point of general interest: Although the visit of Sir Dugald Clerk, the noted British scientist, has been canceled because of illness in his family, his paper will be read and discussed at the Research Session. In this session will also be included a paper by C. W. Stratford of the Associated Oil Company on automotive engine and vehicle lubrication as well as a description by Professor W. E. Lay of the new research laboratory at the University of Michigan to be used in connection with their newly established Bureau of Research Investigation. The paper by Dr. H. C. Dickinson at the Fuel Session will discuss fundamentals affecting passenger car economy. Fred C. Ziesenheim of the Carnegie Institute of Technology will present at this session a paper on the Development of a High-Compression Oil Engine for Automotive Purposes and a description of a new manifold for the Dorris car will be the subject of the paper by George P. Dorris.

Other technical sessions will be devoted to aeronautics, farm power, highway transport and engineering relation to sales. V. E. Clark's paper scheduled for the Aeronautic Session will discuss the economic reasons for the present unsatisfactory status of commercial aviation and contain suggestions of possible remedies. S. H. Philbin will emphasize the necessity of adequate Federal legislation to secure the support of the substantial business man for air transportation. G. J. Mead's paper will criticize the present practice of powerplant installation in aircraft and point the way to probable future development.

The tractor testing work and operation study at Purdue University will be the basis of a paper by Professor G. A. Young. The United States Department of Agriculture has recently spent several months making a survey of the farm tractor under varied conditions, and H. R. Tolley, who has been engaged in this work, will present data resulting from these investigations. It is planned to have the recent progress of the Government highway research work described at the Highway Session. The Economic Status of the Automotive Industry is the title of a timely paper to be read by F. R. Pleasonton at the Engineering Sales-Stimulus Session, stressing the importance of economy of operation in future car designs.

The sports program this year will be one of the most comprehensive ever conducted by the Society, including everything from a tug-of-war to croquet, with appropriate prizes. Golf, tennis and trapshooting tournaments are planned, as well as two baseball series. The ladies will find card parties, clock-golf, croquet and tennis tournaments arranged for them, not to mention the dancing contest that has proved so popular at past meetings.

The reduced-fare plan which has been arranged with the railroads differs from the one in effect at the annual meeting last January. A reduced-fare certificate will be mailed by the Society to its members about May 1. This must be presented when transportation to West Baden is purchased in order to secure a 25 per cent reduction. Round-trip tickets only may be purchased under this plan; no stop-overs are allowed and the same route must be used in both the trip to West Baden and return. A map, which will be mailed with the certificates, will show the area in which this reduced-fare plan applies.

While the meeting at West Baden will open with a session of the Standards Committee on Tuesday, May 24, it is planned to hold a joint session with the American Society of Mechanical Engineers at McCook Field, Dayton, Ohio, on the preceding Saturday, May 21, at which time the members of the two societies are to be the guests of the Air Service. Opportunity will be given for inspection of the Air Service laboratories and flying equipment at McCook Field, and special arrangements for exhibition flights are being made. The session at McCook Field will include a talk by Major Thurman H. Bane on the Future of the Air Service, to be accompanied by motion pictures of aircraft and aeronautic devices in operation.

On Saturday evening the Dayton Section of the S. A. E. will entertain members of the S. A. E. and A. S. M. E. at the Dayton Engineers' Club, the functions including a dinner at 6:30, to be followed by a ball to which members and their wives are invited. C. F. Kettering will make an address at the dinner.

"Bunk" or a Fair Deal? A Discussion of Mental Attitudes

Mr. Tipper discusses how honest attempts at fair dealing by the manufacturer may be regarded as "bunk" by the worker. The worker's point of view must be recognized when information is being presented to him. Ignorance may bring as bad results as deliberate deception.

By Harry Tipper

THE men were filing out of the plant after the day's work and receiving their pay at the pay office on their way out. As each man received his envelope, attached to it was a larger envelope evidently containing some kind of a notice from the concern.

A little group of men who had received their pay were engaged in counting it up and perhaps speculating upon the contents of the other envelope which no one had opened up to that time.

Another man came up to the group with his envelopes in his hand.

"Say, fellows," he said, "what's the dope?"

"Some more bunk from the old man; suppose we might just as well see what it is, any way."

After the man had left the group to go home the old man caught up with him.

"Look here, Bill; I heard you say you supposed this was more bunk. Is that what you really think about it?"

"Why, sure. When you've worked in as many places as I have you will find out that just so much of the stuff they hand you is bunk, pure bunk, that you don't pay any attention to anything they say."

"Well, now," returned the old man, "that's all right, Bill; but you have been here about four months and you have had time to find out what is happening in this shop. Have you found us giving you any bunk?"

The man thought a minute.

"No, now that I think about it, I guess I have not. Everything you handed me has meant something and you stood by it. I guess I got into the habit of thinking everything was bunk, and had not figured out the difference."

"That's fine, Bill," returned the old man, "I am glad to hear that; now if we have been on the square with you you should have been on the square with us. You have some influence with some of these other fellows, and it makes them suspicious when they hear you talking about the bunk we are handing out. Don't you think it would be only fair to let them know what you have found out?"

It was a custom of the old man to stick around the pay office once in a while after the shop was closed, and get next to the man who had a grievance or who indicated that he had a suspicion of the treatment he was getting. It had paid. The family spirit had continued in the organization even when it had grown large enough to employ two or three thousand men and conducted a business big enough to occupy the full time of any leader.

Bill's remark about the bunk illustrates a point of view which is quite prevalent among intelligent workers, and the man who is sincerely endeavoring to be square with his employees suffers from this condition. Even his own executives in their attempt to be fair and to give the worker a proper knowledge of the organization, are likely to address employees through factory house organs or bulletins or in other ways, in inspirational talks, things which look like preachments. They don't appeal to him, the worker, and are classified as mere bunk.

In many establishments the same care for the individual human relations is not evident, and in such establishments the methods employed to communicate from the management to the worker are irritating to him and the methods of expression destroy the interest that might be established or throw doubt on the sincerity of the information itself.

The men talk freely among themselves about these things. They are inclined to suspect the motives of the management and they get into the habit of regarding most of the material from the management as meaningless or as an attempt to put something over.

No man likes to feel that his point of view has been entirely neglected by the boss; every man has some sense of his own worth and some self respect. Every man expects an acknowledgment of his individuality and his individual interest.

A man must be a pretty close friend before we will permit him to preach to us about what we should do or advise us as to our mistakes without resenting it. That is particularly the case where business obliges us to work together and to conceal our resentment to some extent.

A good many of the attempts to establish understanding within the factories have developed into the definite development of propaganda to the men, instead of working out any discussions with them. Many factory house organs published by the management have turned out more copy about the company, its strength and its facilities, the high character of its organization and so forth, than they have about the practical difficulties of the shop and the practical necessities of the workers.

Some house organs in their editorial approach to the worker remind me very much of the politician to whom the colored voter had been listening for a considerable time as he expounded his platform. Afterward the colored man was asked what he thought of the candidate, to which he replied: "He certainly do recommend himself most highly."

A good deal of the material sent from the management to the workers, supposedly for the purpose of establish-

ing the co-operative or family spirit in the organization, is so definitely a high recommendation for the concern that it cannot fail to evoke a similar but stronger comment from the worker who reads it.

The unfortunate part of the matter is the influence exercised upon the attitude of the worker by these experiences. Labor turnover is considerable in most industries; even the skilled workers float from job to job. There is considerable free masonry among men of the same occupation, and the comments arising out of some of these experiences are carried far and wide beyond the area of the establishment in which they exist.

Very few men, even those who are writing to the factory workers through house organs or other contacts between the management and the workers, get out among the men so that they can study the attitude of the worker and his reactions to his own work. This cannot be done by simply going among the men in the shop; the freedom of their conversation is lost as soon as a stranger gets into it and the man who sees his workers only when he is in his official capacity will not get their full reaction unless he has been able to prove by patient acquaintanceship with them, that he respects their confidence and their individual point of view. It is very easy to lose the atmosphere in which influence is created and through which differences are erected when the circumstances of the work removes one from the continual pressure of that atmosphere.

Some years ago I had occasion to write some advertising relating particularly to conditions in the State of Texas. I spent a month in Texas at that time and had been in that State a number of times before. The first pieces of advertising were written while I was in Texas. After I had been back about three months in New York it was necessary to write more of the advertising to continue the campaign. I found it impossible to duplicate the work which had been done in Texas, even though conditions were fairly fresh in my memory, because the suggestion arising out of the pressure of the atmosphere was lost.

Unless we constantly refresh ourselves by contact with various kinds of people, we lose the understanding of their attitude and the reason for their influence. When we do that our attempts to interest them must appear absurd and of little value. A lot of the things which appeal to the worker as bunk are sincere efforts to improve his understanding of business, his capacity as a worker and the co-operative spirit of the plant.

They fail not from lack of sincerity but from ignorance of the man to whom they are addressed. Of course there are many plants where there is no attempt to understand the worker at all, and these plants are always sources of possible dissatisfaction and trouble. Ignorance is responsible for more misunderstanding than the deliberate attempt to deceive, but well-meaning ignorance will be just as certain in its results as the deception created by the deliberate desire.

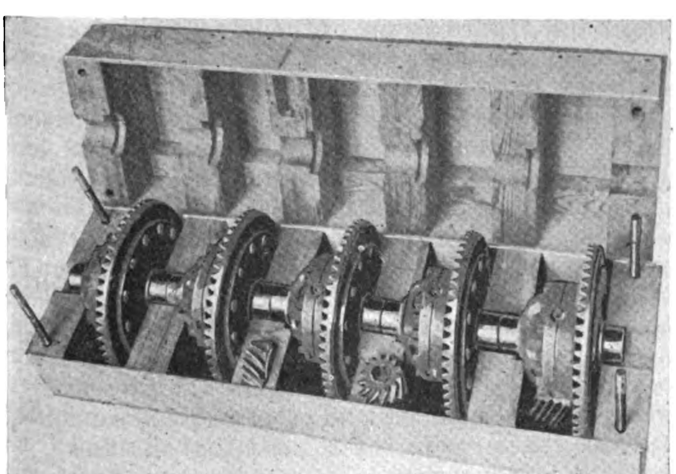
It is worth while that every approach to the factory worker should be carefully considered from his standpoint, so that the things which he should understand are understood in their proper relation.

New Type Returnable Container for Differentials

A NEW type of returnable container suitable for use in shipping five differentials has been developed by the Forest Products Laboratory of the U. S. Department of Agriculture. The new container was perfected after two experimental types had failed to withstand the severe test to which the boxes were subjected.

This new container is not only so constructed as to prevent damage or breakage of any kind, but also protects the differentials from dirt, dust and moisture. The construction of this crate was as follows.

Longitudinals—1¾ x 1¾ x 36 in., Southern yellow pine. Spacing blocks—2⅝ x 3⅝ x 10¾ in., Southern yellow pine. The longitudinals are nailed to spacers with 2-16d cc. box nails at each intersection. Bolts at the four corners are ½ x 11-in. machine bolts. A covering of 3/16-in. 3-ply birch is used.



Returnable shipping container for differentials

Three-ply material is used for covering because it is much more durable under rough handling than single-ply material. Practically any species can be used in this wood covering, but hardwoods, such as black ash, soft or silver maple, red gum, sycamore, white elm, hickory, beech, birch, oak, white ash, or rock elm, are preferable.

Four pieces of a 4½ x 36-in. size, and two pieces, size 9 x 32 in., are required to cover the crate.

The cover is nailed on with large headed nails. Sixpenny cement coated box nails are best to use with plywood of the hardwood groups, but special large head nails are advisable if any of the softer woods are used.

This crate was developed by the Forest Products Laboratory at the request of a large manufacturer of differentials, and can be built as described at a cost of about $3. A similar crate, built along slightly modified lines, can be made at a cost of about $1.75, although this latter type is possibly somewhat less efficient than crate described.

TESTS are being carried out by the Bureau of Standards on special blended fuels at the request of other government departments. Conferences have been held with members of the Fuel Research Committee of the S. A. E. and other organizations, including representatives of the government, looking toward the formation of a definite program for the investigation of various fuel problems of interest in connection with automotive engineering practice. During a recent visit of one of the members of the Bureau's staff to Europe a special study was made of fuel conditions abroad.

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The AUTOMOBILE
Reg. U. S. Pat. Off.

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Industrial Investigations

ANNOUNCEMENT is made from Washington that President Harding has asked that Congress initiate a movement to inquire into the methods of a number of industrial associations. The idea behind this movement appears to be that the Federal Trade Commission believes that a number of industrial associations are given to price fixing. It is not the idea that these associations actually fix prices for their members, but the members exchange such price information as leads to practically uniform prices on similar products. The rather informal method of reaching a uniformity of price is called the "open price system."

The idea developed by the Federal Trade Commission, and furthered by President Harding, is that these lines of business must be brought to a competitive basis. Most of the industries involved are basic from a cost of living standpoint. They include coal, sugar, lumber, petroleum and similar articles.

The industrial organizations of the automotive industry are not included in this list. It perhaps is somewhat unfortunate that our organizations are not to be investigated, considering what one hears in some quarters. There are persons who cannot see any use for an industrial organization unless it is to fix prices. We believe that the automotive organizations have a much worthier objective than this, and that it would be little trouble to prove this objective in any inquiry that Congress might authorize. While an inquiry of an organization or an industry is not desirable ordinarily, it is sometimes worth while as an opportunity to show clean hands.

The industrial organizations named as likely to be investigated are perhaps to be envied by some others against whom the tongue of scandal has been turned. An opportunity to answer a false charge should always be welcomed.

Better Papers Needed at S. A. E. Section Meetings

MANY of the papers presented at meetings of the Sections of the Society of Automotive Engineers are excellent engineering treatments of the subjects considered, but it happens quite frequently that Section meetings are given over to papers and discussion which center around some single commercial device which the author of the paper is desirous of exploiting in engineering circles. Such papers are no credit either to the Society, the Section or the author. They are, in fact, a liability, for they lay the Society and the Section open to the criticism of allowing itself to be used for commercial rather than strictly engineering purposes, and they leave a bad taste in the mouth of the engineer who attends the meeting in expectation of hearing a genuine engineering discussion and is disappointed when he hears a sales talk, of which he gets a plenty through legitimate channels.

Few things can do a professional society greater injury. It is a thing which every engineering society must continually watch. Engineering ethics condemn it, yet men who call themselves engineers not infrequently "put over" papers open to criticism in this regard. Fortunately, the S. A. E. (the parent Society) has for many years been at least as free from criticism in this regard as any of the large, well organized engineering societies, but the S. A. E. Sections still have much to do in this direction.

The same methods which are used by the parent Society to prevent abuse in this direction can and should be used by the Sections, and the Society should insist upon this being done. Section papers should be requested long in advance of the meeting at which they are presumably to be used, subject to reasonable rules in regard to their acceptance and use. They should then be passed upon by a papers committee, and if acceptable be printed, at least in abstract form, and circulated prior to the date set for presentation among Section members and other engineers qualified to discuss them, with the request that discussion be prepared in advance.

At the meeting the paper should preferably not be presented in full, if printed and distributed in ad-

vance. An outline should be given, and the paper then be thrown open to discussion. Engineers naturally hesitate to discuss a paper which they have not had an opportunity to digest but will gladly do so if given an opportunity to study it. The primary idea of an engineering meeting is to bring on an interchange of ideas, and a meeting in which the discussion is meager and ill considered fails in its main purpose.

Discussion can be controlled to a considerable degree by the chairman, especially if he knows the subject and is as familiar with the paper as he should be. Discussions should be held strictly to the subject and not revert, as it often does, to some more or less irrelevant topic raised by someone in the audience.

Importance of Foreign Trade

FOREIGN trade is to be an important topic at two national business organization meetings which will be held in the very near future. The first is the meeting of the Chamber of Commerce of the United States at Atlantic City next week and the next the Foreign Trade Convention at Cleveland, the week following. It is interesting to note that in both of these conventions the importance of foreign trade to the industrial welfare of this country is the big thought. Also it is interesting to note the attention given to the leaders in automotive export trade in the formation of these programs. Practically all industries in this country are recognizing the importance of the automotive industry as a leader in export affairs.

Recent announcements of the development of the program of the Chamber of Commerce of the United States call particular attention to the group meeting on taxation. One of the chief speakers at this group meeting will be C. C. Hanch, chairman of the Taxation Committee of the National Automobile Chamber of Commerce. Mr. Hanch will present the N. A. C. C. tax program which has been attracting so much attention.

Economics of Tractor Plowing

THE remark has often been made that a farmer purchasing a tractor does not do so, as a rule, because of an expected gain in economy, but because he wants to farm a greater acreage without any additional help or because he wants to be able to get his crops into the ground in time in spite of unfavorable weather. While this statement is undoubtedly true, yet it cannot be denied that many more farmers would buy tractors if they felt certain that by doing so they could reduce their operating costs. Farming in this respect is very similar to manufacturing. Operations on a larger scale permit of increased profits, but a reduction in operating costs allows of an increased profit on the same turnover.

The three largest items of cost in tractor operation are labor, depreciation and fuel. Repairs and interest on investment are smaller items, while the cost of lubricant is rather unsettled. All of these items of cost when reduced to a basis of acreage plowed depend upon various conditions. The labor charge comes especially high in the case of a small tractor. Theoretically it should cost twice as much for labor per acre if the work is done with a two-plow tractor as when it is done with a four-plow tractor. In practice the difference is not quite so great because the small tractors usually operate at somewhat higher speed. The way costs run at present, labor is easily the largest item in plowing cost with a two-plow tractor burning kerosene, whereas with a four-plow tractor fuel is the main item.

This would point to the desirability of increasing the capacity of tractors. However, farms are usually either one-man, two-men or three-men farms; that is, they are of such size that the number of men indicated can do all the necessary work. A larger tractor might save a few days' work in plowing, but would not permit of dispensing of the services of one man and hence would be of little added advantage to the farmer. The only way that the greater capacity of the larger tractor can be taken advantage of is to increase the acreage under cultivation, and this is what frequently happens when a farmer buys a tractor or substitutes a larger tractor for a smaller one. The fact is that the labor supply on the farm is not very flexible and in order to take advantage of labor-saving machinery the easiest way is to increase the scale of operation.

Interpreting Failure

THE proper handling of industrial relationships is a definite aid to reducing costs and increasing production, both as to quality and quantity. Only upon this basis should any labor policy or plan be based; and upon this basis it should be judged. When it is regarded in any other way, it will not be beneficial to either employer or employee, viewed over any considerable period of time.

Until such a conception becomes more widespread, there are likely to be additions to the already long list of ineffective labor policies. When an industrial relations plan is put in as a sop to the worker, lacking any more fundamental purpose, it will fail. But such failures do not indicate that an everlasting battle constitutes the only possible future. They do indicate that sufficient study of the problem has not yet been made to enable us to devise really effective plans.

Spread the Good News

PRESIDENT CLIFTON of the National Automobile Chamber of Commerce has suggested that every car and truck manufacturer shall print on his letterhead this quotation from the President's message:

> The motor car has become an indispensable instrument in our political, social and industrial life.—President Harding.

This is such an excellent suggestion that its promotion should not stop with the manufacturers but should extend to all persons whose chief business is with the automotive industry.

Collins to Head Durant Subsidiary

Cadillac President Soon to Quit Post

Will Resign from General Motors to Direct Durant Manufacturing in Michigan

NEW YORK, April 18—R. H. Collins will resign as president and general manager of the Cadillac Motor Car Co. to associate himself with W. C. Durant in the development of Durant Motors, Inc. He will head the Durant subsidiary company in Michigan which may be known as the Durant-Collins Co. In this capacity he will be in charge of the chief manufacturing activities of Durant Motors, which will be centralized in the Detroit district. The main factory will be located either in Detroit or Flint. Collins is said to be in favor of locating in the former city.

The addition of Collins to the Durant organization is regarded as a strong acquisition. He will have much to say regarding the development of the Durant line and it is thought probable that in addition to the Durant "four" there also will be a Collins car.

Collins has been intimately associated with Durant for years, having joined him in the old Durant-Dort Carriage Co. at Flint in 1907. After remaining there 3½ years he went to the Buick Motor Co. as sales manager. When Durant regained control of the General Motors Corp. after it was taken out of his hands by a bankers' committee, he brought Collins on to New York as his assistant.

Collins remained in this city until Henry M. Leland resigned as president of the Cadillac company in 1917. He then took charge of the Cadillac operations and has conducted them successfully ever since that time. He is credited with having had much to do with building up the reputation for sterling worth which the Cadillac line now enjoys. His most recent announcement in regard to that company was that there would be no change in prices for the remainder of this year at least.

The formal resignation of Collins has not been submitted to President duPont of General Motors but he will retire in a short time and take up active direction of the affairs of Durant Motors in Michigan. Formal denial of the resignation was made by General Motors and also by Collins.

QUASH TEMPLAR SUIT SUMMONS

COLUMBUS, April 16—Service of summons in the receivership suit filed by S. B. Clyburn against the Templar Motor Car Co. of Cleveland in the Columbus courts has been quashed upon orders of Judge Sowers. The suit was also filed against the Templar Fiscal Co. and W. O. Cooper. President Bramley of the company was served while in the State capitol and this was fought on the grounds of illegality. The court held that the service on the president, who is a co-defendant, is legal but that the corporation must be served in Cuyahoga county, which is now being done by the plaintiff. It is expected to have the case finally decided by a commissioner.

Milwaukee Parts Plants Speed to Meet Demand

MILWAUKEE, April 18—Further extension of operating schedules and the steady addition of men to working forces is a feature of the situation in the automotive parts and equipment industries of Milwaukee. The A. O. Smith Co., for instance, which was virtually down on Feb. 1, is now employing more than 1200 operatives, and re-employing more almost daily. This is due to the revival of demand for pressed steel frames, forgings and pressed steel parts for passenger cars as well as trucks.

Makers of ignition apparatus and similar specialties, likewise are enlarging the scope of operations as a reflection of brisk activity in the retail trade which gradually is crowding dealers and in turn the manufacturers. The scale of factory wages is now about 20 per cent lower, on a broad average, than on Jan. 1.

The revival of demand for passenger cars in the last two weeks has been astonishingly good, and while in ordinary years this was to be expected with the progress of spring, nevertheless the extent to which business has expanded is considerably greater than the most enthusiastic dealers had looked for earlier.

HARDING RENOMINATES BAIN

WASHINGTON, April 18—President Harding last Saturday sent to the Senate the name of H. Foster Bain for renomination as director of the Bureau of Mines. It is believed that the appointment will be confirmed. There had been reports current that the Secretary of the Interior might send in the name of another for the position, though recognizing the ability and services of Bain, who had taken the appointment under President Wilson as a duty rather than through any personal desire.

AIR MAIL HELPS COAST TRADE

ROCKFORD, ILL., April 18—The Fyrac Mfg. Co., makers of spark plugs, has brought its San Francisco office one day nearer the factory by making use of the air mail service.

Government Suggests New Tire Standards

Rubber Association Gets Copy of Tentative Specifications for Further Revision

WASHINGTON, April 19—Ways and means for revising government tire specifications with a view to adopting better standards were discussed at a meeting at the Bureau of Standards this week. Specifications for tires which the Bureau had prepared were submitted to the committee present, comprised of tire manufacturers and representatives of the Government and of the District of Columbia, and the various members suggested such changes as seemed desirable.

The committee decided to send a copy of the specifications together with these recommended changes to the Rubber Association of America for its consideration and possible further revision. The specifications and the resulting changes are then to be returned to the Bureau of Standards when a second meeting will be called for further consideration of the problem. When completed, these specifications for tires, the Bureau has announced, will be available to the various branches of the Government, to municipalities, and to private corporations who buy tires in quantity.

The Motor Transport Corps, as a large user of automobile tires, it was stated, is particularly interested in the question of tire specifications, and it assisted by sending announcements of the meeting to the various tire makers. Representatives of the different companies were especially requested to be present and in addition the Government was represented as follows: War, Navy, Treasury, Agriculture, Interior, Postoffice, and Commerce Departments, the Panama Canal, Shipping Board, Compensation Commission, and the Commissioners of the District of Columbia.

OHIO GETS ROAD ASSURANCES

CLEVELAND, April 18—Ohio hereafter is not going to build roads that start nowhere and get nowhere, Fred H. Caley, secretary of the Cleveland Automobile Club, declared at the annual meeting of the organization. "Our club officers have been assured that State and Federal funds are to be systematically expended in the construction of main highways and intercounty roads," he declared. He spoke of the increase in the rates of insurance on theft of cars that had been imposed in the last thirty days and scored leniency in dealing with automobile thieves.

Governor Raps Reserve Bank Action

Harding to Take Up Kansas City Policy

No Instructions Ever Issued to Ban Car Paper—Reserves Show Big Gains

WASHINGTON, April 18—A personal investigation into the relations between the Kansas City Federal Reserve Bank and the automobile industry will be made by Governor W. P. G. Harding of the Federal Reserve Board, as a result of a conference here to-day between the governor and C. A. Vane, general counsel of the National Automobile Dealers Association.

Governor Harding promised Vane that he would visit Kansas City, May 21, and at that time he would take up with the directors of the Kansas City bank the question of policies that have been pursued toward the automobile trade in that district and that he would additionally give a committee from the Kansas City Automobile Dealers Association, which is affiliated with the N. A. D. A., an opportunity of presenting their side of the case. Vane immediately wired E. E. Peake, secretary of the Kansas City association, to get his committee and his information together for the hearing.

At Vane's request, Governor Harding also agreed to address a gathering of representative Kansas City business men, bankers, merchants, automobile dealers and the like, and give a talk on business, economic and financial conditions in Kansas City, Saturday night, May 21. Peake will have complete charge of the arrangements for this meeting.

Decision Rests With Bank

Governor Harding displayed intense interest in the Kansas City district situation. As the result of information given him by Vane, the Governor said that he would tell the bankers of the State of Kansas in a speech he will make at Topeka, May 20, that if they refuse to extend credit to the automobile business or to any other business that they should admit that such refusal is a result of their own decision and not be so cowardly as to hide behind the declaration that they were acting upon instructions from the Federal Reserve Banks or the Federal Reserve Board.

"No such orders ever have been issued," the Governor said. "Commercial paper is either eligible for rediscount or it isn't eligible. We never have ruled against automobile dealer paper. Under no circumstances could we order a discrimination against paper which is legally eligible. Either the member bank will accept it or refuse it. It accepts or refuses on its own decision."

Governor Harding was asked if there had been an improvement in the general credit situation and if a further improvement could be expected. To both questions his reply was "yes." The following question was then put to him:

"If there is a general credit improvement do you know of any reason why the Federal Reserve banks should single out the automobile industry for restriction?"

(*Continued on page* 882)

Packard Bonds Sold Out Two Hours After Offered

DETROIT, April 15—President Alvan Macauley of the Packard Motor Car Co., in announcing that the issue of $10,000,000 bonds by the company had been subscribed in less than two hours after being offered, declared it was simply proof of public confidence in the automotive industry.

The money received from the note issue will be used as working capital, and will permit of increased production, Macauley said. Packard had planned an output of 1000 single Sixes for April and at the beginning of the month was employing 3000 men. With ample financial resources production schedules will be increased rapidly, and it is expected the May output will be double that of April.

While practically all efforts of the company are being directed at production of the single Six, twin Sixes are coming through every day in small numbers. Sales demand throughout the country except in three sections which have not yet recovered from the depression, Macauley said, assures a ready market.

COLLISION RATES INCREASE

NEW YORK, April 15—Following the failure of the automobile committee of the National Workmen's Compensation Service Bureau and the National Automobile Underwriters' Conference to abolish full collision insurance, rates on this cover have been increased 60 per cent. On the $50 deductible cover (where the assured undertakes to pay all losses less than $50) the rates have risen only 40 per cent and on the $100 deductible 33 1/3 per cent.

PIERCE-ARROW AT CAPACITY

BUFFALO, April 19—The Pierce-Arrow Motor Car Co. shipped 280 passenger cars in March, and April schedules call for 300. This is approximately capacity production for the passenger car plant. Sales of motor trucks are slow.

Better Relations, Hope of Dealers

Dealers Look to Detroit Conference to Correct Evils of Present Factory Relations

MILWAUKEE, April 20—President Jesse A. Smith of the National Automobile Dealers Association, at a meeting of the Milwaukee Automobile Dealers Association, said the conference between committees of his association and the National Automobile Chamber of Commerce at Detroit on May 9 will mark the opening of a new era of factory and dealer relations.

Appointed to serve on the N. A. D. A. committee are President Smith, Milwaukee, Hudson-Essex; H. B. Harper, Philadelphia, Overland; F. W. A. Vesper, St. Louis, Buick; A. J. Shorey, Boston, Velie; P. H. Greer, Los Angeles, Maxwell-Chalmers and Hupmobile, and N. H. Cartinhour, Indianapolis, Federal truck.

The dealers believe there are eight subjects which need discussion and that revision of some of the principles of operation is necessary before the selling of automobiles can be satisfactory. In the main these are the subjects discussed at the N. A. D. A. convention in Chicago in February, and they are:

1—Contract cancellation clause.
2—Discounts.
3—Exclusive representation.
4—Used car problems.
5—Parts, discounts and stocks.
6—Service policies.
7—Advertising.
8—Freight rates.

In the correction of evils affecting the dealer, which come under these general heads, the dealer association believes much of the friction resulting from present methods of intercourse will be abolished. Fundamental policies are changed too readily by certain factories, it is felt, and these changes, declare the dealers, do not tend to increase stability in the dealer organization.

AVIATION RISKS DECLINED

NEW YORK, April 16—The association of casualty insurance companies writing health and accident insurance, known as the Bureau of Personal Accident and Health, has adopted the following provision relative to the participation by the assured in aeronautics:

"Nor shall it cover any injury, fatal or unfatal, sustained by the insured in or on any vehicle or mechanical device for aerial navigation, or in falling therefrom or therewith, or while operating or handling any such vehicle or device."

Ford Does Not Need Aid of Banks

Gets Back on Feet and Pays Back Loans

Financial Recovery in Few Weeks Remarkable—Proves Strength of Industry

NEW YORK, April 15—One of the most remarkable financial comebacks in the history of the automotive industry has been staged by Henry Ford. Only a few weeks ago financial circles in this city were asserting positively that he would have to negotiate a large loan at the banks upon the bankers' own terms but no similar prediction ever was farther from the actual facts.

Ford not only has been able to avoid asking the banks for new financing but he has just paid $25,000,000 in notes a few days before their maturity. This wipes out the bank obligations. Besides paying the bank notes standing against him, Ford has discounted his April trade acceptances and last Thursday had $8,000,000 in cash.

It is confidently believed that Ford will have ample cash to meet his trade acceptances for May, but if he is unable to clean them all up on the due dates, Detroit banks have agreed to extend him all the accommodation necessary for a brief period. In addition to meeting his bank loans and merchandise obligations, Ford paid his quarterly income tax instalment before it was due.

The marvelously rapid turnover in cash in the Ford treasury for the past two months has been due in large measure to the fact that his traffic department has worked out a plan under which deliveries which formerly took eighteen days now are made in eight days. Increased labor efficiency has made it possible to operate the plant at approximately 80 per cent of capacity with 60 per cent of the normal labor quota. Overhead costs have been cut to the bone. This process has gone so far as to discontinue some of the telephone trunk lines which ran into his factories and surplus office equipment has been sold.

Lower Material Prices Help

The prices of all materials used in the manufacture of Ford cars have been substantially reduced and this has added a substantial sum in the aggregate to the profit on car sales. These manufacturing economies were what finally turned the scales and they will permit continued large scale operations without further financing except, perhaps, for temporary loans of comparatively small sums by Detroit banks.

The detailed story of Ford's negotiations with New York bankers was told in AUTOMOTIVE INDUSTRIES several weeks ago. The facts did not coincide in any way with the stories printed with so much gusto by the financial publications which seemed to take delight in picturing him as on the verge of ruin. The only negotiations which actually were instituted were on the most friendly basis and he could have had any sum he needed on reasonable interest terms without turning over the control of his factory to bank representatives. He pulled through, however, without any assistance.

Franklin April Output Sold Out on April 9

NEW YORK, April 18 — Franklin Automobile Co. reports that the entire production for this month, totaling 940 cars, had been sold on April 9 and that in addition there remain 420 orders for April delivery which could not be filled. In the first quarter of the year Franklin sold and shipped 2546 cars.

Inventories of the Franklin company were reduced more than $1,250,000 in the first three months of 1920. This is from the peak of $11,100,000 recorded early last fall and the total reduction since that period amounts to approximately $5,000,000. Current accounts and notes payable were reduced 40 per cent in the three months period ended March 31.

In order to increase its present supply of bodies, the Franklin company has reopened its body plant which occupies 65,000 ft. of floor space and has been closed since Dec. 1. Production of bodies is expected to reach 3 a day by June 1.

GEORGIA GETS FEDERAL AID

ATLANTA, April 16—The sum of $550,477.35 has been received by the State of Georgia from the Federal aid road fund during the months of February and March to reimburse the State and counties that are constructing modern roads as a part of the State highway system. There are numerous other projects in operation with county funds or State funds alone, representing several million dollars. Many of these projects will be completed this year, the State highway department announces, giving Georgia one of the best highway systems in the South.

MICHIGAN PASSES THEFT BILL

LANSING, April 16—The Condon bill which establishes a system of abstracts governing all transactions in automobiles which was passed by both houses of the legislature was approved yesterday by Governor A. J. Groesbeck. The measure is one which was offered by the Detroit Automobile Club and other automobile interests in the effort to put a check on thefts in Michigan.

Cleveland Factories Advertise for Help

Papers Carry Ads for First Time in Months — Production Gradually Grows

CLEVELAND, April 18—The Grant Motor Car Co. has given one of the most striking demonstrations in the local field of the progress made in the production end of the automobile industry since the first of the year. The March program provided for production of 350 cars, but a flood of orders came in from all over the country and there were 450 cars made and delivered from the factory.

The schedule for April calls for 450 cars, but the volume of orders the first week in April were in excess of the number received in the same period in March. Predictions are made that the company will be forced to exceed its April schedule by from 50 to 75 cars. The company has made a practice of exceeding its production schedule each month since the first of January.

For the first time in months, help wanted ads are appearing in local newspapers over the signature of automobile companies. Manufacturers are advising former employees to get in touch with them at once, as positions are open.

The Jordan Motor Car Co. has been advertising for the return of its men to their old positions. This company has gradually increased its production each month, and April will be no exception.

The Chandler Motor Car Co. reports better business in April so far than it had during March. The same is true of Peerless, Templar, White and Cleveland. The Merit car, which just recently has been produced in this city, has encountered a nice demand, the management reporting 500 orders received.

On an average, it is estimated that local automobile factories are working on about a 50 per cent of capacity basis, with prospects favorable to a considerable increase in production in the next two or three months.

MICHELIN ADDS TWO TIRES

MILLTOWN, N. J., April 18—The Michelin Tire Co. has added two new cord sizes, a 30 x 3½ soft bead clincher and a 32 x 4. The former size fits all 30 x 3½ clincher rims and is considerably oversize, being actually 31 x 4. The price is $30. The 32 x 4 regular size cord is $37 which is only $3.50 more than the fabric tire of the same make and size. A reduction in the price of the 32 x 3½ cord from $40.70 to $37.50 has also been made. This size fits the Dodge and other cars of similar type.

Ansted Takes Over Spring-Axle Plant

Connersville Factory of Standard Parts to Make Parts for Lexington Cars

CONNERSVILLE, IND., April 18—Ansted Spring & Axle Co. has been organized under the laws of Indiana with an authorized capital of $500,000 by Frank B. Ansted, president of the United States Automotive Corp. and the Lexington Motor Co., and has taken over the property in Connersville formerly owned by the Standard Parts Co. of Cleveland.

Under the plans of the management, all springs for Lexington cars will be made in this plant and, in addition, springs will be made for other car manufacturers. When running at capacity the plant employs between 300 and 400 men and is modernly equipped throughout.

The acquisition of the spring plant is regarded as another step in the expansion of the United States Automotive Corp. and will bring under unified control and central management the making of all major parts entering into the assembly of Lexington cars.

In calling the company the Ansted Spring & Axle Co., the plant is resuming an original title. When first organized by Edward W. Ansted, father of Frank B., Arthur A. and George W. Ansted, it was called by this name until merged with other plants under the name of the Western Spring & Axle Co. Edward W. Ansted was vice-president of this company until its sale to the Standard Parts Co., just before his death in 1916.

Ansted Finds Business Coming Back Sanely

INDIANAPOLIS, April 18—Frank B. Ansted, president of the Lexington Motor Co. at Connersville, Ind., declared that "business is coming back along sane paths and through legitimate channels," in speaking at a reception given in his honor at the Connersville Country Club. "We are recovering under a sound monetary system," he said, "and although the processes of recovery must be slow, they are being furthered on safe grounds."

The occasion for Ansted's address was upon his return from a two months' tour of the West which took him to all the principal cities of the Western states and Pacific Coast. His trip was made for the purpose of studying business conditions.

KING WOULD PROBE ROADS

WASHINGTON, April 18—Senator King of Utah has introduced a resolution authorizing the appointment of a special committee to investigate Federal aid expenditures in the construction and maintenance of highways throughout the country. The Senator reflected the opinion of President Harding as expressed in his address to Congress, that there had been wastefulness in the distribution of Federal monies. It is pointed out that sums aggregating more than $266,000,000 have been expended since July, 1916.

The Commission would be authorized to conduct hearings in all sections and in places where complaints have been made of political patronage on government money.

Indiana Plants Show Increased Activity

ANDERSON, IND., April 16—Automotive industries here have shown some slight improvement in the month. The Remy electric division, General Motors Corp., is now employing about 1300 men, according to information this week. This is about 33 per cent of the normal force. The plant has been working on about 10 per cent basis for a number of months.

Laurel Motors Co. is working about half a force. It is filling motor block orders for one or two standard cars. Officials of the company assert they have sufficient business in sight to make them certain of almost normal production after May 1.

The Bull Tractor Co. is in the hands of receivers and developments are uncertain at this time.

Colonial Tire & Rubber Co. and the Quality Tire & Rubber Co. are still shut down and none of the officials reached would commit themselves to statements. Both companies are said to be in fair condition that will permit them to resume operations if the tire consumption produces a market. Inventories were liquidated some time ago.

Government Undertakes Farm Equipment Survey

WASHINGTON, April 18—The division of rural engineering of the Department of Agriculture has begun a compilation of statistics of the production and sale of farm operating equipment, a subject on which there is comparatively little information of a reliable character. No such comprehensive efforts have been undertaken heretofore. A questionnaire will be sent to all manufacturers requesting information on the number of machines manufactured, their total value, the number sold in the United States and number exported. One division of the questionnaire includes tractors and traction engines. The survey is expected to give accurate information on the relative demands of domestic and export trade.

TO OPERATE MEXICAN PLANES

TAMPICO, MEXICO, April 15—The Eastern Mexican Aviation Co. has been formed in Tampico under the management of R. H. Maloney and will operate planes in and around this city and between Tampico and the City of Mexico, San Luis, Monterey, Vera Cruz, Tuxpam, Matamoras and other cities.

Hart-Parr Suspends Tractor Production

Finds Conditions Unfavorable for Manufacturing—Will Clear Off Unsold Stock

CHARLES CITY, April 18—The tractor plant of the Hart-Parr Co. has suspended operations for an indefinite period. Notices posted at the plant state that it seems unwise to continue manufacturing under existing conditions with a large number of tractors on hand. Business is sound, but it is quiet at this time and buying is extremely light. The company will retain many of its superintendents and foremen who will look after the plant while it is closed. Resumption of operations is expected within the next 30 or 60 days.

Checks for their share of the profits for 1920 were distributed by the Hart-Parr company on March 18 to employees eligible under the continuity of service participation plan. This plan was announced more than a year ago to apply to those supervisional employees who had been in continuous service for two years or more prior to Jan. 1 last. Checks ranging from $10 to more than $500 were distributed. This plan is said to have resulted in much closer co-operation with the company on the part of the workmen.

The balance sheet of the company for the year ended Dec. 31, showed assets of $3,102,519, including $215,000 in cash; $94,000 in certificates of indebtedness; $10,000 notes receivable; $14,000 in trade acceptances; $245,000 in customers accounts, and $1,144,000 in merchandise inventory. The current liabilities included only $226,000 in accounts payable and $60,000 in mortgage bonds payable.

TO BUILD NEW BYARS TRACTOR

WICHITA, KAN., April 15—A new farm tractor designed by Edgar Byars, one of the original designers of American tractors, will be manufactured in this city by a company which will be organized by the designer. The Byars is an all-purpose tractor; the width of tread is adjustable from 46 in. minimum to 90 in. maximum. A new method of attaching lugs is provided; a simple gearing provides a positive square turn either right or left, and the speed on turn is the same as at straight going.

INDIANA S. A. E. MEETING SET

INDIANAPOLIS, April 15—The Indiana Section of the Society of Automotive Engineers has arranged to hold its next meeting April 29, at the Independent Athletic Club, this city. A six o'clock business mens' dinner will be served, after which the regular meeting of the Section will be held. The subject for discussion will be a paper on "Chassis Design." There will also be a four reel film on "The Making of Petroleum" gotten out by the Bureau of Mines

March Makes Record in California Sales

Southern Part of State Reports Exceptional Selling with Demand Increasing

LOS ANGELES, April 18—Indications are that the month of March established a new record for motor car and truck sales in Southern California. A recapitulation of car and truck registrations issued to-day shows 6259 cars and 747 trucks were registered during the month. This applies to new vehicles only and does not include motorcycles and tractors. There is no reason to doubt the authenticity of the report, and if it is correct it means that more new cars and trucks were sold last month than ever known before.

Ford deliveries came through with a bang during March, and of the totals 2820 cars and 407 trucks were of this one make. There are ten counties in Southern California and there was a liberal increase in sales, in all counties, with the biggest addition in Los Angeles city and county. From this city alone 4010 new cars were registered. The next big sensation of the registrations is the number of Studebakers sold. The figures credit Studebaker with 345 registrations, and this car led everything in its price class. Next to the Ford the Chevrolet was the biggest seller.

Truck registrations were particularly heavy. The registrations show that next to the Ford and Dodge came the Mack, which distanced all of the exclusively heavy-duty trucks. The sales of Macks show truck business outside of Los Angeles was exceptionally brisk, as 28 of a total of 41 were registered from elsewhere than this city.

Dealers assign the increasing number of motor vehicle sales to a return of confidence upon the part of the public, heavy advertising and consistently hard work. There has come an awakening to the fact that business has to be dug up and those who are driving the hardest are the ones who are getting results. To date this month indications are that April will prove even better than March.

MAXWELL PLANT ORDERED SOLD

DETROIT, April 18—A final court decree directs the sale at public auction of the Oakland Avenue plant of the Maxwell Motor Co., Inc., on May 12. The minimum bid acceptable is $10,925,000 under the court order. The sale will be a part of the reorganization plan under which the Maxwell company will be merged with Chalmers.

TO BUILD KENTUCKY REFINERY

LOUISVILLE, April 18—Construction of a new oil refinery, with a daily capacity of 1500 bbl., will be begun within the next thirty days by the Dixie Belle Refining Co. The new refinery will cost about $500,000 and will be built to convert crude petroleum into kerosene, gasoline and lubricating oil. The Dixie Belle Refining Co. does not itself own the wells from which this crude petroleum will be drawn, but will purchase it.

Construction of the refinery is expected to require five or six months for its completion. After the refining of oil has been begun the company will sell its products through the Kentucky Consumers Oil Co.

Premier Reorganization Brings New Confidence

INDIANAPOLIS, April 15—Work of reorganizing the old Premier company into the new Premier Motor Car Corp. is progressing rapidly, according to B. H. Miller of this city, who represents the creditors of the organization, among which is the Fletcher American National Bank. The company has been incorporated under Indiana laws, the corporation having taken over the Delaware corporation. By this method it is possible to add about $500,000 of new money. Under the new organization J. A. Price has been named president; I. F. Schaeffer, treasurer, and M. A. Whipple, secretary. Schaeffer is the only director remaining from the old organization.

Men back of the organization, including Miller, are more optimistic than they have been for some weeks past concerning the future of the corporation. Miller says it begins to look as though the company would pull itself together and get back on its feet in good shape. A. E. Doty, the new sales manager, has begun work and according to Miller, results already are being shown. Fifty cars have been sold during the past two weeks and to-day orders were received for twelve cars and thirteen were shipped from storage.

Studebaker Increases Light Six Production

SOUTH BEND, IND., April 18—Production jumped to 125 cars a day on the Studebaker light six this week. This brings the new plant within sight of its designed capacity of 150 cars a day which it is expected to reach in the near future. Vice President and General Sales Manager Biggs of the corporation said that it has been impossible to meet delivery requests for some time, and that production is steadily being built up to capacity. He believes that the present increase in sales is based upon a sound foundation and that there is every indication that it is permanent.

IOWA ENGINEERS MEET

WATERLOO, IOWA, April 16—A meeting was held here yesterday with the object of standardizing certain parts of stationary and portable gasoline engines, and similar manufactured products, as has been done in the case of automobiles, and other automotive products. R. S. Burnett, manager of the Standards Committee of the Society of Automotive Engineers of New York, represented the Society at the meeting.

Kansas City Trade Reacts Temporarily

Slowness of Farm Products to Move Delays Steady Business Progress

KANSAS CITY, April 18—Nearly every line of merchandise suffered a reaction the second week of April. Manufacturing, wholesaling and retailing were all on a lower level than the week previously, and much lower than the average for March.

Automobile sales showed a like reaction. The trade during April has been spotty. Sales rise for a day or so, and then fall—apparently all dealers having the same experience day by day. Wholesale trade continues extremely slow. Retail trade has on the whole been good, with movement close to normal, until the past few days. Declines in farm product prices constitute one factor.

Truck sales have declined more radically than passenger car sales. The farm demand has not yet arisen to constitute a balance for offsetting any temporary reaction in demand from city sources.

"Normal movement will come when surpluses are disposed of," said a Kansas City business man. The farmer must move his stocks on hand, and forget the prices he gets for them; merchants must move their surpluses—and the consumer must use up his surplus, and get normally into the market again, before trade can go ahead steadily.

It is reported that cheaper cars have a far greater demand than more expensive ones. A low-priced car dealer in Kansas City has been buying cars by wire from country dealers to meet his local demand for immediate deliveries.

COURT CONTINUES RECEIVER

INDIANAPOLIS, April 18—The petition to have a new receiver appointed in the place of William R. Hirst for the VanBriggle Motor Device Company, manufacturers of shock absorbers and trailers, was refused by Judge A. B. Anderson in adhering to his rule that a creditor who has accepted the appointment of a receiver for an insolvent in a State Court cannot come into the Federal court and have another appointed.

Bids have been received by Hirst on the company's plant which will not be made public until some time next week.

TO REVIVE ITALIAN RACE

NEW YORK, April 15—The famous Grand Prix of Italy will be revived during 1921 under the auspices of the Automobile Club d'Italia. Details are being arranged by the Automobile Club de Milan and the race will take place this summer on the same lines as the Grand Prix de France. In connection with this important event the light-car Grand Prix will take place at Brescia at the same time.

Alabama Business Rallies in Cities

Dealers Heavily Stocked, However, Due to Drop in Country District Demand

BIRMINGHAM, ALA., April 18—Motor car sales in this iron and steel center of the South, with a population of 178,000, are from 50 per cent to 60 per cent of normal in standard makes, and have shown a very great improvement in the last two months. With the exception of Fords and one or two other makes there is a 30-day supply of new cars in the territory and at least a 90-day supply of used cars.

One reason why new car sales are so good is that 75 per cent of the dealers are trading too heavily and making foolishly large allowances on trades. Some of them have had to do this because the banks are insisting that they move stocks and reduce loans. A bank calls on the dealer to pay a certain amount on a certain date, and to raise the necessary cash the dealer makes too large an allowance on new car sales. This is one of the reasons why the city is overstocked with used cars.

The market for used vehicles is not as strong as usual because the steel mills are not running at more than 50 per cent of capacity, and as a consequence many of the workers who might otherwise buy are out of the market. This condition prevails to a greater extent among the miners, because the mines are working at only 20 per cent of capacity. The Buick dealer reports that whereas he formerly sold 50 per cent of his cars to steel workers this business has ceased and sales are being made to salaried men and others not connected with steel.

Wholesale Trade at Standstill

Birmingham distributors generally have all of Alabama as their wholesale territory, and in most of this territory business is at a standstill. They have had no wholesale trade since September. Many of the territory dealers are liquidating their business as rapidly as they can and a considerable number already have closed up their affairs. Liquidation in many instances has been because of the fact that dealers were loaded too heavily with cars. They were financed by local bankers up to 80 per cent of the value of the cars, and these loans have been called because the same bankers financed the farmer for his 1920 crop.

The farmer has not sold his cotton, and for this reason has been unable to meet his loans. Most bankers are endeavoring to finance the farmer for his 1921 crop, and they must have cash. Many of the country dealers would gladly lose the 20 per cent they paid to the distributor for the cars, but the banks will not take over the automobiles and the dealer is forced to continue in business until he can dispose of them.

The cotton farmer will be out of the buying market for at least a year, and perhaps longer. There is little probability that he will be able to buy in September or October when the new crop comes in as he still has his 1920 crop on which the bank financed him, and if he disposes of it at the present price of 11 cents he will not be able to pay the bank which loaned as high as 14 cents a pound. In addition to his bank obligations, the cotton farmer has yet to pay for provisions, clothing and other supplies purchased from the town merchant. Many farmers already have made loans on the 1921 crop. The merchant is still giving credit on provisions and clothing. It is estimated that the cotton acreage this year will not exceed 50 per cent of last year.

Look for Fall Business

The conservative motor car dealer does not expect much business this fall in the rural sections and does not look for normal conditions before July or August, 1922. There are several counties in the State where the bankers are telling the farmers they will make loans on the 1921 crop provided motor cars are placed in warehouses. The only apparent reason is that the banker desires to force economy in every way.

Another unhappy phase of the situation for the motor car dealer is that banks are being compelled to take over cars on which farmers cannot complete their payments and turn them back to the dealers. This condition does not prevail to so great an extent in Birmingham, Montgomery and Mobile.

Some of the distributors have dismissed their wholesale organization and are centering their efforts on business in the cities and larger towns of the State. They have found that many of their salesmen are helpless now that an era of competition has returned and real salesmanship is necessary. Conditions in Birmingham probably are better than in any other city in the State notwithstanding the slump in the iron and coal industries.

Bank deposits in the cities have held up well but have fallen heavily in the country sections. There is a feeling that a great deal of money has been drawn from the country banks by farmers and hoarded as the banks have been unable to trace investment of these funds. Savings deposits in Birmingham banks have increased, and while bank clearances have fallen off 20 per cent, this is explained by the shrinkage in the value of commodities.

Cotton Sections Worst Hit

The southern section of Alabama is dependent largely on cotton and is in worse condition than other parts of the State where crops are more diversified. Mobile is surrounded by large vegetable areas from which shipments are made to northern cities during April, May and June. This should be a good time to exert sales efforts in this district.

Montgomery is a cotton center and business there is very slow.

Texas Finds Sales Improved on Farms

Dealers See Million Dollar Field When Normal Conditions Are Restored

DALLAS, TEX., April 16—The motor vehicle business in Texas was slightly improved this week, though dealers complained that the business was not up to the standard and said it probably would not be for several months. There was an increase in tractor sales and there was also an improvement in the automobile lines. Some dealers were reporting increased business in cream separators to farmers and small dairymen, and others found a good field for washing machines.

Financial conditions appeared to be improving and the dealers assert when these are back to normal the business would grow by leaps and bounds. The dealers declared the people are awake to the need and necessity of motor vehicles and motor implements, but are not buying them so readily because they can do without them for a time. Some of the dealers who are conducting intensified sales operations, coupled with considerable terms, are disposing of their goods about as easily as they did four years ago.

Not a dealer in Texas but realizes that people are alive to the advantages of motor vehicles, want them and are going to have them sooner or later. They are selling about what the people are able to assimilate under present conditions, and are awaiting the time when business will hum. As they put it, Texas is a virgin field for the business and one which will mean the spending of millions for motor vehicles and machinery in the next few years.

OHIO CODIFICATION DEFEATED

COLUMBUS, April 18—The bill introduced in the Ohio Legislature providing for a codification of all automobile laws of the state, has been killed by the house committee to which it was referred. This bill sought to codify all of the laws and to make radical changes and was opposed by the Ohio Automobile Association, an owners association. On the other hand the Ohio Automobile Trade Association favored the bill but the opposition was too strong.

REORGANIZE WRENCH COMPANY

WORCESTER, April 18—Reorganization of Walden-Worcester, Inc., manufacturer of wrenches here, is in progress, and in the meantime the business is being successfully operated by three receivers, William Woodward, Frank Kilmer, and Representative Edwin G. Norman. The new plant is being operated at normal capacity, running about 50 hours a week with a working force of more than 100. Under the proposed reorganization, it is expected there will be a number of changes among the officials.

Harding to Take Up Kansas City Policy

Credit Scrutiny to Be Lessened This Year—New Crops to Cost Less

(*Continued from page* 877)

The Governor, after first declaring that there never had been any singling out by the Federal Reserve Board, said that so far as he knew there was no reason why the automobile business should feel any special restrictions not equally applicable to other lines of industry.

The Governor was then asked if the Federal Reserve banks and in turn the member banks were calling upon borrowers for new credit statements. To which the Governor replied:

"We call for credit statements annually. I think this can be said safely now:

"CREDIT STATEMENTS ARE NOT GOING TO BE SUBJECTED TO THE SAME DEGREE OF SCRUTINY THAT THEY WERE A YEAR AGO."

Asked as to whether there would be a lowering of the discount rates, the Governor said:

"The average reserves in all the banks of the country is around 53.7 per cent. On April 16 the reserve in the Boston bank had been built up to 71.3 per cent. This is the ratio of total reserves to deposit and Federal Reserve note liabilities combined. Now the rate in the Boston district has been lowered. I leave it to your own judgment as to what will happen in the other districts when this ratio has been built up. It is largely mechanical and governed automatically."

In his conversation with Vane, Governor Harding said, among other things, concerning the general business situation:

Shortage Changed to Surplus

"This is no time to conduct a 'wake.'

"We thought a year ago that there was an actual shortage. The cry was 'Increase Production.' Consumption, however, has been reduced so that whatever over-production there is, is relative, rather than absolute. About a year ago it began to be noticed that the insistent demand for various commodities was falling off. From that position we advanced a step to a point where we found that there was no shortage as we thought, and then it developed that we had a surplus. While last year was one of physical plenty and the crops were bounteous the consumers' demand fell off. That is due primarily to the lack of a potential buying power in other countries."

"The reserve position of the Federal Reserve banks is now 53.7 per cent, against 42 per cent a year ago. This means a great deal."

"New crops ought to be produced at much less cost than crops of a year ago."

"People must make up their minds (in some sections) that they must get some capital loans—they may even have to mortgage property in order to tide the situation over."

"The agricultural sections are much interested in peace. We need an official peace and we need a cessation of hostilities and general pacification all over the world."

"Those people who have solved all their problems are in the cemeteries."

"Some of us fancied we had prosperity 18 months ago. Didn't we know conditions then were too good to last?"

"In nature we have the storm and the sunshine. There are some regions of perennial sunshine—Death Valley and the Sahara Desert."

"Now, so far as credit is concerned. Times like these are not the times when banks make new losses. In a period such as this banks must realize that they have a loss on transactions previously made, but it is a time also to be constructive. *It is safer to lend money now on present valuations than it was a year ago, and I think banks generally realize that what we want to do is to hold our domestic situation in hand, avoid drastic action of any kind, formulate constructive plans to live and let live and go the limit in extending renewals to those whose character and business ability show that they are entitled to accommodation.*"

The Governor's parting message to Vane was that:

"It is time to end the buyers' strike."

Boston Federal Reserve Reduces Discount Rate

WASHINGTON, April 18.—The Federal Reserve Bank of Boston has reduced its discount rates from 7 per cent to 6 per cent. This does not mean of necessity that changes will be made in the rates of other Federal Reserve banks, nor is it indicative of any contemplated changes, according to Governor Harding. Authorization of the reduction was granted because of the lessened demand for credit in the Boston district and because of the strength of the bank's reserves which have been as high as 70 per cent in the last six weeks. As credit conditions improve in other districts, it is not improbable that similar action will be taken.

SHERIDAN SEDAN COMPLETED

MUNCIE, IND., April 19—The first sedan from the production chain of the Sheridan Motor Car Co. has been wheeled out of the plant. A few minor changes in appointments will be made, it was said, but the general design and equipment will be unaffected. Production has not reached capacity, but shipments are taking all that present operations can turn out. Sales Manager Wilmoth expressed the fear that they would be oversold in a very short time. Frank Sealand, Cleveland distributor, was at the factory attempting to arrange for a large shipment.

Harvester Prices Cut to Steel Basis

Ten Per Cent Reduction Follows U. S. Steel Action—1920 Biggest Year

CHICAGO, April 18—The International Harvester Co. has announced a straight 10 per cent reduction, effective at once, on products in which steel is the principal raw material. This action is based on the reduction in steel prices announced by the U. S. Steel Corp.

"The reduction of steel comes after our year's production had been provided for and will have no bearing on the manufacturing cost of machines we sell this year," said an announcement by the company. "It does establish a lower replacement cost, and serves as the basis of a price to which our customers are entitled and which we are willing to accept."

The reduction applies chiefly to harvester machines. Reductions of from 10 to 15 per cent on machines made principally of wood and iron were announced on March 7.

The annual report of the Harvester company shows that notwithstanding domestic depression in the latter part of the year and difficulties in the way of foreign trade, its business for the year ended Dec. 31 was larger both in the home and foreign market than any previous year in its history. Sales amounted to $225,000,000, compared to $212,000,000 in 1919 and $204,000,000 in 1918. Foreign sales last year aggregated $60,000,000.

The report shows net profits, after all charges, of $16,555,353, equivalent after preferred dividends to 13.86 per cent on the $90,000,000 common stock outstanding at the end of the year, compared with $12,608,726, or 10.51 per cent on the $80,000,000 common stock outstanding in 1919. In the latter year, however, $7,403,033 was written off to complete a writing off of all war losses. The surplus for 1920, after deducting $10,000,000 transferred for stock dividends last September, was $68,350,741, compared with $71,645,388 in 1919.

The balance sheet shows cash amounting to $12,291,000, net receivables of $56,969,000 and inventories of $131,134,000. The liabilities include $33,153,000 in accounts payable and $11,785,000 in bills payable.

Deere Reduces Prices

MOLINE, ILL., April 18—Deere & Co. have announced a reduction of 10 per cent upon its general line of farm implements, effective immediately. The statement says: "The company's raw materials have been purchased at the higher prices and in its 1921 production receives no benefit of the recent steel reductions. The steel reduction, however, does furnish a new basis of replacement cost and the company is willing to take a loss to benefit dealer and farmer."

Sterling to Start Production at Once

Company Is Chartered with $1,000,000 Capital to Build High Priced Car

CLEVELAND, April 20—The Sterling Knight Motor Co. has been chartered with a capital stock of $1,000,000 preferred and 20,000 shares of no par value common stock to manufacture an automobile using the Knight sleeve valve engine. The car will rank in the high priced class. The vice-president and general manager of the company will be J. G. Sterling, for years engineer of the F. B. Stearns Co., which also manufactures a car using the Knight engine.

Associated with Sterling will be P. H. Withington of Toledo as president and treasurer, and Alonzo M. Snyder of Cleveland as secretary. In addition to the officers, the directors will be Alva Bradley, W. D. Gongwer, J. V. Thomas, C. O. Mininger, R. D. Jacobs and R. H. York, all of Cleveland.

It is understood that $250,000 of the preferred stock already has been subscribed and that payment on it will be handled through the Union Trust Co.

The new company will take over the work carried on during the past year by the Sterling-Knight Syndicate, an organization of Cleveland interests which financed the experimental work on the new automobile. Three cars of six cylinders have been built and tested and were exhibited at the automobile shows in Cleveland and Chicago. The new company intends to begin production immediately.

New Company Formed to Take Over Biddle

NEW YORK, April 20—The plant, equipment and assets of the Biddle Motor Car Co. have been purchased from the receiver by Ralph R. Owen, F. L. Crane of Cleveland, R. W. Stanley and associates, who will continue operations under the name of the Biddle-Crane Motor Car Co. Crane will be president of the company, Stanley, vice-president, and Owen general manager. Stanley was associated with the old company.

Operations will be continued with practically the same models as those previously built by the Biddle company and it is the purpose of the new owners to turn out a small, high class job which will sell at around $3,400. No attempt will be made to reach quantity production and if 200 cars are built this year the new owners will be well satisfied.

The Biddle car enjoyed an excellent reputation and the failure of the company was considered unfortunate. The inventory which was on hand at the time the receiver was appointed was adequate to complete a considerable number of cars except for two or three essential parts. These are now available.

NEWS BULLETINS

MEXICO CITY, April 20—(Special) Because of transportation difficulties, the automobile exposition, which was to have opened today in the National theater, has been postponed for ten days.

SHARON, PA., April 21—The Sharon Pressed Steel Co., with plants at Ellwood City and Wheatland, Pa., has been taken over for refinancing and reorganization by Harry W. Torney, of Torney & Co., Inc., New York; Albert W. Morris, formerly of the Harley Co., Springfield, Mass.; Arthur E. Swain, formerly of the Crucible Steel Co., Harrison, N. J., and their associates.

NEW YORK, April 21—Directors of the B. F. Goodrich Co. decided here yesterday to pass the dividend of $1.50 a share on the common stock. A. A. Tilney, of the Bankers Trust Co., and Harold Stanley, of the Guarantee Trust Co., were elected directors to succeed A. H. Marks and A. B. Jones, resigned.

NEW YORK, April 21—The directors of the General Motors Corp. were reelected at the annual meeting of the stockholders yesterday.

At the organization meeting of the directors to-day all the old officers were re-elected. This list includes R. H. Collins as president of the Cadillac company.

NEW YORK, April 21—Creditors of the Bethlehem Motors Corp. probably will decide in the near future to wind up the affairs of the company, as proposals for a reorganization have met with little success. A meeting of creditors' committees is being held at Allentown to-day to consider the sale of certain assets, and the same subject will be taken up in Federal court at Philadelphia to-morrow.

Freight Reduction Asked on Trucks Shipped West

NEW YORK, April 18—A plea for revision of freight rates charged by Western railroads on motor trucks was made before the Consolidated Classification Committee here to-day by J. S. Marvin, general traffic manager of the National Automobile Chamber of Commerce. He urged that they be placed on a second-class basis subject to a minimum carload weight of 12,000 lb. This adjustment already has been granted by Eastern and Southern roads. The Western roads charge first class rates on both trucks and passenger cars.

Classification of several automobile and truck parts also was discussed at the hearing. The change in classification is of great importance to manufacturers because it would mean to them a difference of from $40 to $80 and more a carload on trucks shipped to points west of Chicago. The Consolidated Committee has entire control of freight classification under the reorganized system.

Control of Goodyear Passes to Syndicate

Bankers Will Direct Affairs of Company During Life of New Bonds

NEW YORK, April 21—Control of the Goodyear Tire & Rubber Co. has passed from F. A. Seiberling, now the president, to a syndicate headed by Dillon, Read & Co., New York bankers, which has underwritten $30,000,000 first mortgage 20 year 8 per cent sinking fund gold bonds due May 1, 1941.

During the life of the bonds the management of the company, with the right to elect a majority of the directors, will be vested in Clarence Dillon, John Sherwin, chairman of the board of directors of the Union Trust Co. of Cleveland, and Owen D. Young, vice president of the General Electric Co., or their successors, through management stock or a voting trust. Some changes in the present personnel are expected.

The syndicate which has underwritten the bonds, includes Goldman, Sachs & Co., which a few months ago made a temporary loan of $15,000,000; the National City Co., the Guaranty Co., Lee, Higginson & Co., the Chase Securities Co., and Blair & Co. The bonds are offered at 99, and the mortgage provides for the retirement of the entire issue at 120 and interest by drawing by lot $750,000 on each interest date beginning November 1, 1921.

The proceeds of the first mortgage bonds together with the proceeds of $27,500,000 10 year 8 per cent debentures, which will be offered to stockholders, will be used to pay the company's current obligations and to increase working capital. The mortgage provides that the company must maintain at all times net current assets equal to 125 per cent of the entire amount of bonds outstanding.

Approximately 70,000 stockholders and merchandise creditors assented to the plan for reorganization as presented by the bankers.

NEW YORK LICENSE BILL LOST

ALBANY, N. Y., April 19—The bill introduced by Senator Lusk, majority leader in the Senate, which would have increased the license fees for passenger automobiles and motor trucks, was lost in the shuffle in the closing hours of the legislature and did not pass.

The legislature adopted a resolution providing for a committee of senators and assemblymen to sit anywhere in the state and compel the attendance of witnesses preparatory to making a report at the next session recommending changes in the motor vehicle law and remedial legislation.

A bill also was passed transferring the automobile licensing bureau from the office of the secretary of State to the State tax department which will administer the motor vehicle law after July 1.

Willys and Chrysler Not at Odds

Working Together in Perfect Accord They Both Assert

Chrysler Has No Intention of Leaving—Companies Making Good Progress

NEW YORK, April 19—Walter P. Chrysler has not the most remote intention of severing his relations with John N. Willys. The executive vice-president of the great Willys enterprises has no differences with his chief and has had none. They are in thorough accord on all questions of policy. The main object in life for both of them is to bring the Willys-Overland Co. and the Willys Corp. back to their former impregnable positions, and in this endeavor they are making splendid progress.

Many unfounded, exaggerated and vicious reports regarding the relations of the two men and the two companies have been circulated for months, but each has deemed it wisest not to dignify them with denials. In the days when the Willys enterprises, like most of those in the automotive field, were at a standstill, they adopted as their own the old adage that "silence is golden."

Conditions now are rapidly changing. The industry has come to life and business is forging ahead. Willys-Overland is coming back and Willys is at the helm. He has taken the field for a long series of conferences with dealers, distributers and bankers, and the results have been amazing even to his own organization.

Willys has told his dealers the exact truth about the affairs of his company, and at last has come to the conclusion it is time to spike the insinuations that he had stepped into the background and that his relations with Chrysler have been strained to the breaking point.

Never Had Any Differences

His positive and emphatic statement that there never have been any differences between them was made in response to an inquiry from AUTOMOTIVE INDUSTRIES as to whether there was any truth in the report that Chrsyler soon was to join the General Motors Corp.

In this denial, Willys was joined with equal emphasis by Chrysler. They were together in the former's office when they declared without equivocation that there was no foundation whatever for reports of friction between them. Willys asserted there never had been any differences. They sometimes disagreed on questions of policy, Willys said, but he usually was convinced Chrysler was right, although the reverse frequently was true. He asserted he was thoroughly "sold" on Chrysler.

Chrysler declared he was "sold" on Willys and was proud to work for him. He told his chief he had no intention of going with General Motors.

"I know that," said Willys. "We have no secrets from each other."

Willys dismissed as unworthy of consideration the assertion that he had been criticized because he was paying so large a salary to Chrysler at a time when his companies are not in the best of financial position.

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White to Reduce Force Until Surplus Is Sold

CLEVELAND, April 18—It was learned here to-day that the White Motor Co., one of the largest truck manufacturing concerns in America will on May 1 reduce its working force from 5000 to 3000 employees. Orders are being received at the plant in excess of the production, but the curtailment in the working force is the result of the policy of the company in keeping up maximum production for months when other similar corporations were either closed or were operating on a greatly reduced schedule.

All last winter, the White company kept its full force of night and day workers going at maximum capacity. There was a slight reduction in hours worked each week after Jan. 1 and later the night staff was combined with the day. That was but a few weeks ago. As a result the company accumulated a large reserve stock of trucks. It is now drawing on these. Hence the curtailment in production.

MOTORCYCLE RATE ADVANCED

NEW YORK, April 16—The London Bureau of the Eastern Underwriter reports a radical revision of motorcycle insurance rates in Great Britain, after what one official calls "two years of appalling losses." The multiplying of accidents, the increased cost of repairs and the alarming number of thefts necessitate an entirely new scale of rates. In consideration of higher premiums, the insurance companies are assuming unlimited public liability risks.

P. O. EXTENDS TIRE SHIPMENTS

WASHINGTON, April 15—Under a new ruling of the Postal Department, automobile tires up to a weight limit of 35 lb. may be sent by parcel post to points in Mexico reached by the railroads from the United States. Tires, likewise, may be sent under the same conditions from Mexico to this country.

Mott Heads Staff to Advise G. M. C.

Will Take Over Work Formerly Devolving Upon A. P. Sloan —New Members Named

NEW YORK, April 18—The following statement was authorized to-day by the General Motors Corporation:

"C. S. Mott, who has been a vice-president and director of General Motors Corp. for some years, has been made chief of the advisory staff with headquarters in the General Motors Building, Detroit. Mott will take over all duties which heretofore devolved upon Alfred P. Sloan, Jr., New York, who found it impossible to devote the time necessary to the corporation's affairs in Detroit. The advisory staff being located in Detroit, it was necessary for the vice-president in charge of that staff to be similarly located in Detroit.

"The advisory staff consists of a board of experts in the various sections of the corporation's activities who can be called upon when desired by the various operating divisions for consultation and advice upon broad and fundamental matters which each division could not attempt to develop for itself. Mott will be responsible for this organization.

"The appointments on the advisory staff made up to this time consist of: A. B. C. Hardy, director purchasing section; H. L. Barton, director of manufacturing; Eric L. Bergland, director of power house and building construction and design; Norval A. Hawkins, as already announced, recently joined the advisory staff as director of advertising, sales and service; C. F. Kittering, who is also a vice-president of the corporation, is a member of the advisory staff in charge of the research engineering and design section, with headquarters at Dayton, Ohio."

MULLINS TO MOVE BODY PLANT

NEW YORK, April 19—Because of labor trouble in its plant in Salem, Ohio, the Mullins Body Corp. announces that it has taken an option on a fully equipped plant at Detroit and will be in a position to start operations there on a large scale in a short time. The labor difficulties developed at Salem a month ago after the corporation announced a nine hour day to which the men objected and were locked out. Subsequently every large plant in Salem adopted the same policy, and as a consequence the five largest factories of the town are closed. The Mullins corporation has a large number of orders on hand.

Industry to Oppose Road Tax Bill

Fears Perpetuation of Excise Burden

Struggle Expected Because of Senate Backing—Work on Tariff Measures

WASHINGTON, April 19—Introduction of the Stanfield bill providing for a Federal highway fund through the segregation of revenues derived from automobile taxes has brought new complications for the industry. It is understood that the National Automobile Chamber of Commerce is opposed to the principles contained in the Stanfield amendment because it believes it would practically perpetuate the war-time taxations which have of late proved extremely burdensome.

Indications are that the industry will have a fight on its hands in opposing this proposed fiscal legislation because it has the indorsement of leaders in the Senate Finance Committee.

This amendment transcends in importance other tax proposals, principally because it may eventually block efforts of the organized industry to have the excise tax repealed. It is stated that the taxation committee of the N. A. C. C. will adopt a practical program opposing this plan. It is evident, however, that it must proceed with caution if it is to adhere to the plan for a national highway system.

The Stanfield amendment reads as follows:

Stanfield Bill Feature

"That on and after July 1, 1921, the receipts from the taxes imposed by subdivisions (1), (2), and (3) of section 900 and subdivision (11) of section 1001 of the Revenue Act of 1918 shall constitute a separate fund in the Treasury, to be known as the "Federal Highway Fund," to be used only for the expenditures authorized by law incurred in building or aiding the several States and territories in building public highways. The Secretary of the Treasury may use such fund for other purposes, but such fund shall be reimbursed for any portion thereof so used.

"Section 2: That when used in this Act, the term 'building' includes the selection, designation, location, survey, planning, improvement, maintenance, and all other necessary expense incident thereto, as well as the construction of such roads, trails, or highways."

Senator Stanfield, in a statement to AUTOMOTIVE INDUSTRIES said:

"If this becomes a law it will provide a continuing fund limited only by the amount of revenue this source will produce annually. A tax of three per cent is now imposed upon motor trucks and five per cent on automobiles, motorcycles and tires. For the year ending June 30, 1920, the revenue collected from this source amounted to $145,963,039.62. It is stated there are 2,500,000 miles of public roads in the United States of which about two per cent are of national or interstate importance, ten per cent State and eighty-eight per cent county and district roads."

Would Segregate Taxes

In segregating this fund, it is intended to provide any additional amounts in provisos, if necessary, that the war tax is not to be included in the price bill. In other words, it is the intention of the Oregon Senator to make the manufacturer pay the excise tax directly and not pass it on to the owner. It is said that he has a measure pending in the drafting committee which would require the manufacturer to make tax returns separately and not include other Federal taxes. By this provision it is expected that simplification would result in accounting for the amounts due the Federal highway fund which would be created under the bill. The tax on company earnings, etc., would continue to be used in the general tax fund.

Senator Penrose announced to-day that tax hearings before the Senate Committee on Finance would start after the Senate had disposed of the emergency tariff and its companion measure, the anti-dumping bill. Hearings have been held here this week on the affiliated measures and a bitter fight is anticipated when the bill is reported out of the Finance Committee. Senator Penrose has announced that he will personally direct the campaign on the Senate floor. Hence, it will not be possible to hold hearings on Internal Revenue revision for several days.

Discussions to Open in May

If the well laid plans of Senate leaders are fulfilled, the tax discussion before the committee will begin about the first week in May. Senator Penrose, however, does not expect to have the tax measure written into the statute before September. Therefore, whatever measures are finally adopted by Congress must of necessity be largely retroactive, as the fiscal year will be well under way when the revenue bill is enacted.

The anti-dumping bill, which passed the House as part of the emergency tariff, has met considerable opposition in the Senate, particularly as to the exchange items. George Davis, chief special agent of the United States Customs Service, has suggested that the duty should be based on prices paid by American importers abroad, and the amount thus determined could be converted at current

(Continued on next page)

Buick Discontinues St. Louis Operations

All Machinery and Equipment Moved to Flint—G. M. C. to Retain Plant

ST. LOUIS, April 19—It was learned to-day that the Buick plant of the General Motors Corp. in this city is being moved to Flint, the home of the Buick company. The transfer of the equipment and much of the machinery has been going on for several days. All except office equipment has been moved, it was said at the plant to-day. The purpose of the move could not be learned from L. E. Kurtz, general manager. "We are not yet ready to make any announcements," he said.

J. S. Hunt, manager of the Chevrolet plant which occupies half of the $4,138,000 structure, said Buick cars will hereafter be manufactured exclusively in Flint, where General Motors already has its largest Buick plant. He was unable to say at this time what use will be made of the St. Louis plant. He denied that the building would be used by any other than the General Motors Corp.

Construction of the General Motors plant on Natural Bridge Road started in April, 1919, on 40 acres of a 105-acre tract. The plant had a large assembly capacity and employed 1200 men when running full force.

G. M. C. Confirms Discontinuance

NEW YORK, April 20—Confirming the discontinuance of operations at the Buick St. Louis branch, General Motors Corp. to-day issued the following statement:

"The Buick Motor Co. has removed all machinery and equipment from St. Louis and will for the present concentrate all manufacturing operations at Flint. Plans for the future utilization by General Motors Corp. of the plant at St. Louis have not been formulated."

Indianapolis-Chicago Air Service to Start

INDIANAPOLIS, April 15—Aerial transportation service between Indianapolis and Chicago starts April 15, according to announcements by Dr. John K. Kingsbury of the Indianapolis Aero Association, for which a charter was filed in the office of secretary of state yesterday. The company is capitalized at $100,000. John P. Koehler and Leslie Sanders are associated with Dr. Kingsbury. C. S. Crawford, formerly with Premier, has been elected a director.

Industry to Oppose Road Taxation Plan

Retroactive Features of Proposed Anti-Dumping Measures Not Favored by Officials

(*Continued from preceding page*)

exchange rates at the time of importation.

J. D. Nevins of the same Federal organization has asked that the equalization of exchange clause contained in the emergency anti-dumping bill should apply only to shipments after the passing of the emergency act, and not to be retroactive as proposed.

It is anticipated that the exchange provisions of the anti-dumping bill will do much to check the influx of surplus war materials, including motor trucks which have been sold in large quantities by foreigners at prices far below American production costs. It is believed that in making the exchange provisions retroactive the large profits derived from the sales of surplus trucks on American markets would, to a large extent, be wiped out.

Senator Smoot of Utah has declared that he will oppose a permanent anti-dumping measure which does not contain provisions applicable to reimportation of trucks. Automobile dealers of the West and Middle West have appealed to the Utah Senator to protect them against unfair foreign competition. They claim that the sales of American made trucks originally sold to the Army, and then resold as surplus to foreigners, are being offered on domestic markets here at prices which they cannot meet.

Coast Highway Bill Offered

WASHINGTON, April 19—Congressman Baker of California to-day introduced a bill in the House which would authorize the examination, survey and report by the War Department as a preliminary to the improvement, construction and maintenance of a system of motor truck highways to make the transport requirements of heavy commerce in time of peace and of heavy ordnance in time of war and to serve as post roads. with proper and sufficient laterals, in the States of California, Oregon and Washington.

Propose Highway Department

WASHINGTON, April 18—Congressman Osborne of California has introduced a bill to create a Department of Federal Highways, to establish a national highway system, to promote efficient and economical highway transportation, and to amend an Act to provide that the United States shall aid the State in the construction of rural post roads.

The bill is similar to that printed at the last Congress and discussed before the Senate and House Committees on Post Office and Post Roads. The principles enunciated in this measure have been indorsed by the National Automobile Chamber of Commerce, the American Automobile Association and other leading organizations who have advocated a system of interstate roads.

It is provided that bonds shall be issued on and after July 1, 1921, up to and cluding July, 1926, to be named as United States National Highway bonds, to an amount not exceeding in any fiscal year the amount of the appropriation in this act provided for the current fiscal year during which bonds may be issued.

President Gives Assent to Aviation Program

WASHINGTON, April 19—President Harding submitted to Congress to-day a special report of the National Advisory Committee for Aeronautics which made numerous suggestions for the development of air navigation. The President stated that the program of the committee met with his approval. From the viewpoint of commercial aviation, the most important suggestions are:

Establishment of a bureau of aeronautics at a cost of $200,000 a year under the Secretary of Commerce for the regulation of air navigation and the encouragement of civilian and commercial aviation.

Development of a system of national continental air routes to cover the United States and include a meteorological service.

Extension of the air mail service.

To enable the army to go forward with its air routes to cover the country an appropriation of $2,000,000 is recommended. Legislation also is requested definitely authorizing the Post Office Department to establish air mail routes between Chicago, Minneapolis and St. Paul, between Chicago and St. Louis and other routes advocated by the Postmaster General.

APEX MOTORS REORGANIZED

DETROIT, April 19—Apex Motor Corp. of Ypsilanti, manufacturer of the Ace car, has undergone a reorganization and H. T. Hanover is president and general manager, succeeding O. W. Heinz. The creditors' committee with representatives of the finance companies who are back of the Apex has agreed to a year's extension on outstanding accounts. This covers about 97 per cent of the creditors and puts the company in good condition.

ALL-AMERICAN MAKES PROGRESS

CHICAGO, April 20—The creditors' committee which has been conducting the affairs of the All-American Truck Co. since last November has sent a letter to holders of the serial notes of the corporation informing them that from the standpoint of creditors, conditions are as satisfactory as they could be under the circumstances and continuation of the business under the present plan will yield the greatest profits.

Willys and Chrysler Working in Harmony

Activity of President Among Dealers Restores Confidence—Reticent on Financial Plans

(*Continued from page 885*)

"He's the cheapest man on the pay roll," he declared, "and worth every cent he gets. When you have a $115,000,000 business you need men with brains, and Chrysler has them. That's what we're paying him for."

Willys returned late yesterday from a long series of conferences with Willys-Overland dealers and distributers, in which he filled them with enthusiasm over the future. He will start out again to-morrow, and the hours in between had been filled with conferences, but he was full of fight, aggressiveness and confidence.

"This trip of Mr. Willys' out among the dealers has been wonderful," said Chrysler. "The whole situation has been turned directly about. The dealers are full of confidence and enthusiasm. We're selling cars and we're building them, but we're not making any more than we're selling, and we're not going to. I made that statement months ago and it stands. It wouldn't be good business. But we're working 6000 men at Toledo and with Charles B. Wilson at the head there and the present fine organization, we're going to fill orders as fast as we get them."

Willys spoke delightedly of his conferences with dealers and distributers in Chicago, Omaha, Kansas City, Oklahoma City, Dallas, St. Louis, Minneapolis, Charlotte, N. C., and Atlanta. He starts out again to-morrow for similar conferences at Indianapolis and Toledo.

"I've shown the boys," Willys said, "that I'm not dead and that the company is not going broke. I've nailed a lot of misstatements that have been going around and have tried to clarify the situation. I've just given them facts and the response has been wonderful. After each of these conferences the distributers have been busy booking orders, although we didn't ask for any business. I've invited bankers to come to these meetings, and I feel certain they understand a lot of things that they didn't before."

Delay Opening New Plant

On the subject of the refinancing program for Willys-Overland and the Willys Corporation, the "chief" was somewhat reticent.

"If I talked about it," he said, "a wrong impression might get out. Everything is running along smoothly."

Chrysler was asked about the opening of the great new plant at Elizabeth.

"Mr. Willys can answer that better than I can," was his reply.

"That's in the future," remarked Willys, "and let the future take care of itself."

Cleveland Section Hears L. H. Pomeroy

Possibilities of Higher Efficiency by Increasing Compression Ratio Are Shown

CLEVELAND, April 16—At the meeting of the Cleveland section of the Society of Automotive Engineers held here last night, Lawrence H. Pomeroy delivered a talk on the fundamentals of engine design. Pomeroy emphasized the importance of lightweight construction in order to realize the greatest possible efficiency in engine design. He pointed out the possibilities of obtaining higher efficiency by increasing the compression ratio. He stated that compression ratios of 4½ to 1, which is about as high as it is well to go in the overhead type of engine, are suitable for obtaining good performance results.

The speaker, who has on previous occasions pointed out the advantages of lightweight pistons, connecting rods and other reciprocating units, also emphasized these points in his talk on engine design. The lecture and the discussion which followed brought out the fact that many engineers are committed to the school of design, which favors the lightest weight construction, not only in the reciprocating parts, but in the revolving engine parts such as the crankshaft and camshaft. The use of the drilled camshaft and crankshaft has resulted in a material reduction of weight in these parts without sacrificing rigidity.

Regarding the oiling systems, Pomeroy stated that normal oil pressure should range from 20 to 30 lb. per sq. in. The oil should be supplied not only at this high pressure, but in sufficient volume to permit the oil to act as a cooling medium as well as a lubricant. The use of high pressure oil, fed in large volume, fits in well with the hollow crankshaft and camshaft construction, permitting of leads through the center of these shafts, thus not only providing the natural lead for the oil, but also taking advantage of centrifugal force in the oil feed.

Dr. Pomeroy confined his talk to engine design and did not take up the question of fuel which he regards as an entirely separate problem. His stand for a 4½ to 1 compression ratio, however, indicates that with this type of engine design, the use of some means to prevent detonation would be necessary.

In addition to the talk by Pomeroy, some interesting entertainment features were included on the program and an informal banquet was held just before the meeting. The annual election of officers also took place.

SUBMIT HEADLIGHT PROPOSALS

NEW YORK, April 18—The Illuminating Engineering Society has submitted its "Automobile Headlighting Specifications" to the American Engineering Standards Committee for approval. The specifications are submitted in accordance with the special provision in the procedure of the committee, under which important standards in existence prior to 1920 may be approved without going through the regular process followed in new work.

The specifications have been adopted in their essential details by the states of Wisconsin, Connecticut and Maryland, and by the Province of Ontario, and have been endorsed by the Standards Committee of the Society of Automotive Engineers; by the International Traffic Officers' Association, and by the conference committee on Uniform Vehicle Laws, representing some 30 different organizations, under the auspices of the National Safety Council.

Restrict Patent Rights in Advance-Rumely Suit

MILWAUKEE, April 18—The Court of Appeals for the Seventh Circuit has sustained the findings of Judge Ferdinand A. Geiger of the United States District denying the claim of the Advance-Rumely Co. of Illinois, against the John Lauson Mfg. Co., New Holstein, Wis., alleging infringement of patents purporting to cover broadly the practical use of kerosene as a fuel for internal combustion engines. The case has been in the Federal courts for five years.

Judge Geiger of Milwaukee held that in view of prior usage and expired patents the patents of the Advance-Rumely Co. must be restricted to minor details of construction, and that these patents involved no broad novelty in the use of kerosene as a fuel and were not infringed.

The suit was of vital importance to engine builders using kerosene as a fuel, due to the fact that if the courts had placed an interpretation upon the Advance-Rumely patents, as put upon them by its attorneys, all manufacturers of engines using kerosene as fuel in the United States would have been compelled to pay tribute to the Advance-Rumely Co. The alleged invention was specifically directed to the well-known principle of hydrating kerosene to prevent pre-ignition.

BATTERY RECEIVER PETITIONED

BLOOMINGTON, ILL., April 18—Four creditors of the Illinois Storage Battery Mfg. Co., Hoopeston, Ill., filed a petition in involuntary bankruptcy in the United States District Court, asking that the concern be declared bankrupt and asserting that it is insolvent. An investigation is sought by the referee in bankruptcy. The battery company was organized nearly two years ago by Ray Murray. It was capitalized at $25,000, most of the stock being held by residents of Hoopeston. Following the organization the company appeared to flourish. Later disagreements arose in the ranks of the stockholders resulting in the departure of Murray, who sold out his stock. During the past few months business has slumped and the plant has been inactive. It is probable that a receiver will be appointed.

METAL MARKETS

MUCH mischief has been done by the exaggerated headlines under which the news of the recent change in the U. S. Steel Corporation's prices was published in many of the daily newspapers. An utterly false impression has gone forth that as the result of this price revision by the leading interest the steel market rules considerably lower than it did before this announcement was made. The fact is that, excepting in a few specialties, bargain offerings, which were plentiful a few weeks ago, have largely disappeared and the views of independent producers, as to prices for the time being at least, have become firmer. The Corporation, to all intents and purposes, had been "out of the market" when it revised its prices downward and the independents had what market there was to themselves. The quotations of the latter to-day are, barring a few exceptions such as steel pipe, at least as high and in some instances higher than before the Corporation's change in prices. Utterly absurd are statements like the following telegraphed to one of the New York dailies by its Pittsburgh correspondent: "With a stabilized steel market, builders and manufacturers are expected to go ahead with the knowledge that steel prices are virtually fixed for the next year or two." No one in the steel industry, either within or without the Corporation's breastworks, whose opinion is at all worth while, deludes himself into the belief that steel prices "have now been virtually fixed for the next year or two." Those with whom the wish for stability is father to the thought will go only so far as to say that from now on further cuts in prices must wait upon corresponding cuts in wages and freight rates. Inasmuch as the best economic thought is unanimous in the opinion that if general economic disaster is to be averted, both wages and freight rates must be brought down to saner levels without delay, the more conservative element in the steel industry is of the opinion that the prevailing quotations will continue as at least nominal prices until the advent of lower wages and freight rates. There are those, however, who fear that failure of present prices to bring out a sufficient quota of orders will lead to renewed price cutting in the near future. This element is of the opinion that the tonnages which the Corporation's price revision will add to its unfilled orders will be relatively light, and that before very long the independents will be setting the pace once more by cutting under the Corporation's new prices.

Pig Iron—Automotive foundries in Michigan and Ohio are releasing additional tonnages of foundry and malleable. The market is flat, with $25, Valley, for malleable and foundry No. 2 the maximum quotation.

Steel—Some independent producers appear willing to accept fresh orders for cold-rolled strip at around 5.75c., base, Pittsburgh, while others quote 6c. Automotive consumers have about finished quotas due them on old contracts, but are not placing fresh contracts. Hot-rolled has been reduced by a leading independent to 2.85c. Automotive spring steel is in better demand. The sheet market is a shade firmer, but this may be only the temporary result of advances by some of the independents in response to the Corporation's price changes. Youngstown district mills have booked some light business for full finished sheets at 5c.

Aluminum—Quiet with light routine demand from the automotive industry.

FINANCIAL NOTES

Marathon Rubber Products Co. of Wausau, Wis., has been incorporated with a capital stock of $300,000. The company will take over the plant and equipment of the defunct Burlock Rubber Clothing Co. of Wausau. The property was bid in at receiver's sale by J. H. Hieb of Merrill, Wis., for $61,000.

Stephenson Motor Truck Co., Milwaukee, which failed about nine years ago, has been brought into court for final adjudication by the adoption of the final report of the trustee and the declaration of a final dividend of 2 per cent, making a total distribution of 35 per cent of claims.

Doss Rubber & Tube Co., Atlanta, has been granted license to sell $100,000 of preferred stock, paying 8 per cent, by the Georgia Securities Commission. The Doss company manufactures tires and tubes, having a factory in Atlanta that has been in operation some years.

Brown Mfg. Co. has been organized at Brunswick, Ga., with a capital stock of $100,000, by Samuel E. Brown and others, for the manufacture of a quick change rim for automobile tires invented by Brown.

Templar Motors Co. has formed a subsidiary to be known as the Templar Motor Co. of New York, which will have an authorized capitalization of $1,500,000.

Fisher Body Corp. will pay a dividend of 1¾ per cent on May 2 to preferred stockholders, and a dividend of $2.50 a share on the no par value common stock.

Rolls-Royce of America, Inc., has placed, privately, $2,000,000 in 8 per cent notes due March 1, 1931, and there will be no public offering.

O. K. Giant Battery Corp. has been organized in Atlanta with a capital stock of $75,000, by F. K. Adams, F. L. Cook and J. C. Rucker.

INDUSTRIAL NOTES

Diamond-Holfast Rubber Co., Atlanta, manufacturers of automobile tire patches and other patented rubber products, has purchased an eleven acre site in suburban Atlanta for $20,000, and will build a modern factory, to include salesrooms and general offices.

Air Reduction Sales Co. has secured control of the National Carbide Corp. of Virginia, with a new plant at Ivanhoe, Va., and beginning May 1 will direct the policy and control the operation and sales of the Carbide corporation.

E & W Co., Milwaukee, manufacturer of commercial car attachments for passenger car chassis, trailers, trailer-trucks, etc., has accepted the proposition of business men of Cedarburg, Wis., to transfer the operation to that city.

General Device Corp., New Lisbon, Wis., will start work at once on the erection of a factory, 75 x 150 ft., one story, equipped with new machinery and tools for manufacturing a line of patented devices and appliances.

G. Elias & Bro., Inc., Buffalo, has acquired membership in the Manufacturers Aircraft Association, New York. This is the twenty-first airplane company to join the organization, sixteen of which are active still.

Allan-Diffenbaugh Wrench & Tool Co., Baraboo, Wis., has filled original orders calling for 80,000 wrenches, and is receiving forgings and other materials for a second complement of the same size.

Flood Tractor Co., Spokane, is to change its name after May 1 to the International Automotive Corp., and will be reorganized with increased capital to manufacture a new standard tractor.

Kelsey Wheel Co., Memphis, Tenn., is nearing completion of its new body plant, which is expected to have a production capacity of 500 bodies a day.

Badger Brass Co., Milwaukee, is contemplating the erection of an entirely new and much larger foundry and machine shop during the summer and fall.

Tubular Steel Automobile Wheel Mfg. Co., Spokane, has started the manufacture of patented wheels made of tubular steel with galvanized iron spokes.

Modern Tool Co. announces arrangements whereby the E. L. Essley Machinery Co., Chicago, becomes exclusive selling agents in Chicago territory.

Kenison Mfg. Co., Solomon, Kan., has adopted the Climax Model KU, 5 x 6½ kerosene engine, as regular power equipment for its 15-30 tractor.

Victor Tool Co. has opened a New York office at 131 West Thirty-ninth Street, with F. W. Curtis as manager and Warren J. Boe sales engineer.

Laminated Shim Co., manufacturers of laminum for shims, will remove on May 1 to a new plant and offices in Long Island City, N. Y.

Motor Wheel Corp., Lansing, has opened a New York office, which will be under the management of Thomas J. Wetzel.

Armstrong Rubber Co., Garfield, N. J., reports operating 24 hours daily and production of 100 per cent of capacity.

Antigo Tractor Corp., Antigo, Wis., has five machines in process and will place them in the hands of users by June 1.

Emerson-Brantingham Implement Co., Inc., will locate its New York export office at 50 Church Street after May 1.

Paragon Motor Car Co. will remove its plant and general offices from Connellsville, Pa., to Cumberland, Md.

Republic Rubber Corp. has adjourned its annual meeting, scheduled for April 14, for another thirty days.

Petroleum Motors Buys Rockford Factory Site

ROCKFORD, ILL., April 15—Petroleum Motors Corp., organized to manufacture a low grade fuel burning engine, has acquired a tract of ten acres in this city on the Chicago, Milwaukee & Gary railroad, a belt line put in by the city of Rockford for the benefit of its manufacturing interests, on which to erect its factory.

The product, designed for truck use, is a four-cylinder, four-cycle, opposed piston engine with cylinders cast in pairs and has been under experimental observation for two years. The company is incorporated under the laws of Delaware for $1,250,000 with Chester A. Harris, president; T. G. Jackson, vice-president, and Charles C. Grassell, secretary-treasurer. They with L. A. Peil and B. J. Knight constitute the board of directors. R. C. Dale is manager.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America*

NEW YORK, April 21—The most noteworthy feature in the money markets last week was the announcement by the Boston Federal Reserve Bank that its discount rate on commercial, industrial and other unsecured paper had been reduced from 7 per cent to 6 per cent. At the same time the discount rate on notes secured by certificates of indebtedness was raised from 5½ per cent to 6 per cent, making all the published discount rates of the Bank uniform.

The New York call money market last week was much firmer than a week ago, with rates at 6 per cent to 7 per cent, as against 5 per cent to 7 per cent the previous week. Renewals were consistently at 7 per cent. Time money was also a trifle firmer, with 6½ per cent quoted for all maturities from sixty days to six months, as against 6¼ per cent to 6½ per cent the week before.

The total foreign trade for March showed a decline of more than $700,000,000 from the figures for March, 1920. Exports for the month totaled only $384,000,000, as compared with $489,000,000 in February and $820,000,000 in the corresponding month a year ago. Imports at $252,000,000 were larger by $37,000,000 than the total for February, and compared with $524,000,000 in March, 1920. For the nine months ended March, 1921, exports totaled $5,509,000,000, as against $6,050,000,000 for the same period a year ago.

Imports for the nine months' period totaled $3,009,000,000, as against $3,759,000,000 for the nine months ended March, 1920. March exports were the smallest for any month since the beginning of the World War, while imports made the largest monthly total for any month in 1921. The excess of exports for March at $132,000,000 was the smallest since last August.

U. S. SURPLUS $10,000,000

NEW YORK, April 20—Stockholders of the United States Rubber Co. were informed by Samuel P. Colt, chairman of the board of directors, at their annual meeting yesterday that earnings for the year 1920 were about $10,000,000 over and above dividend requirements and that regular dividends at 8 per cent have been paid on both preferred and common stock.

All the directors of the company were re-elected and John W. Davis, former ambassador to Great Britain, was added to the board.

ADVANCE-RUMELY CUTS PRICE

LAPORTE, IND., April 20—The Advance-Rumely Co. announces a 10 per cent reduction in price on all its farm machinery in which steel is the chief raw material used. This follows the price reduction recently made by the United States Steel Corp.

MEN OF THE INDUSTRY

H. M. Salisbury has been appointed export manager of Maxwell-Chalmers. Salisbury is a veteran of the industry, having been connected with General Motors Export Corp.; F. B. Stearns Co., New York, and John N. Willys Export Corp. In joining Maxwell-Chalmers he succeeds H. W. J. Russell, who resigned because of ill health.

Charles S. Crawford, former chief engineer of Premier, has been elected a director and consulting engineer for the Kant Kut Ignition Tube Co., Indianapolis. He has also been elected a director of the Indianapolis Aerial Association, which will operate a passenger air service between Indianapolis and Chicago.

Henry G. McComb, who for several months past has been doing sales engineering survey work for the American-La France Fire Engine Co., Inc., Elmira, has definitely joined the forces of that concern in connection with its new motor truck development. McComb will be stationed at the sales office, New York.

P. A. Tanner, who for the past five years has been connected with the Splitdorf Electrical Co. of Newark, N. J., and its subsidiaries in various capacities, has resigned as advertising and service manager and will spend the summer touring and looking after personal interests in Iowa and Missouri.

E. S. Crocker, who used to serve in an engineering capacity at the Chalmers Motors Co. and who during the war was connected in the development of the four-wheel-drive artillery tractor, has become chief engineer for the Rainier Truck Corp. at Flushing, L. I.

Victor T. Goggin, late New England sales manager of Fred T. Ley & Co., Inc., of Springfield, Boston and New York, has severed his connection with that concern to associate himself as contracting engineer with Dwight P. Robinson & Co., Inc.

W. G. Clay has been appointed assistant sales manager of the truck and tractor division of the Traylor Engineering & Mfg. Co., Cornwells, Pa. C. H. Patten and J. L. Fulton were appointed chief engineer and production engineer, respectively.

H. G. Egbert, treasurer of the Master Tire & Rubber Co., Dayton, and H. J. Alperin, owner of a chain of tire stores in Cleveland, Chicago and New York, have become connected in executive capacities with the Chillicothe Tire & Rubber Co.

J. E. Tracy, for the past four years general sales manager of the Sterling Motor Truck Co., Milwaukee, has become actively connected with the Hicks-Parrett Tractor Co., of Chicago Heights, as vice-president and director of sales.

George Pearson, Jr., former district supervisor for Maxwell-Chalmers in San Francisco, has resigned to become sales manager of the Union Motors, Inc., a new Los Angeles concern handling Maxwell-Chalmers products.

Henry H. Knapp, formerly treasurer of U. S. Light & Heat Corp., Niagara Falls, N. Y., has been elected treasurer of the H. B. Shontz Co., New York distributors of USL batteries and also distributors of equipment.

S. N. Clemons, for the past seven years assistant purchasing agent for the Northway Motor & Mfg. Co., recently resigned to become identified with the Mid-Western Sales Corp., Detroit, as general sales manager.

E. F. Jones, who recently resigned as president of the Republic Rubber Co., has been appointed assistant to Jerome R. George, vice-president of the Morgan Construction Co., Worcester, Mass.

E. E. Eby has joined the Remy Electric Co. in the capacity of purchasing agent. Eby was formerly American director of Delco-Remy, Ltd., and Hyatt, Ltd., with offices in New York.

N. C. Beerend has been named sales and advertising manager for the Jorgensen Mfg. Co., Waupaca, Wis. Beerend was formerly connected with Walters, Gemco and Badger, all of Milwaukee.

Robert R. Keith, formerly of the Moline Plow Co. in charge of the Universal Tractor Works, has been made superintendent of tractor works of the International Harvester Co. at Chicago.

Russell B. Reid, for several years past with Edward R. Ladew Co. as assistant sales manager, has been made manager of sales for the Sharon Pressed Steel Co., of Sharon, Pa.

Harry Schleininger, for nine years general sales manager of the Motor Car Equipment Co., New York, has been appointed sales manager of the Kellogg Mfg. Co., Rochester, N. Y.

James A. Patten has been elected to the board of directors of the Advance-Rumely Co., to succeed F. N. B. Close, of New York, who resigned to take up business in France.

J. Emerson, who was the purchasing agent of the King Motor Car Co. before it went under new ownership, again is connected with the company in the same capacity.

H. A. Winterknight, Jr., sales manager of the Manley Mfg. Co., of York, Pa., has resigned and is now associated with the Finchbaugh Machine Co. of that city.

A. H. P. Leuf has succeeded Robert I. Erlichman as president of the General Utility Co., makers of automotive necessities, Philadelphia.

Ward H. Marsh has been appointed assistant sales and advertising manager of the Lincoln Motor Car Co.

F. H. Shaw has been elected a director of the Elgin Motor Car Co., succeeding J. M. Snitzler.

Edwin S. Beggs has been appointed sales manager of the Planet Mfg. Corp., Detroit.

Class Journal Editors Visit Standards Bureau

WASHINGTON, April 19—Direct personal contact between representatives of technical journals and of the Bureau of Standards made during visits to the bureau are of the greatest possible value, according to a statement issued by the bureau relating to a trip made by a number of business paper representatives. During recent years, the bureau announcement says, the co-operation between the bureau and the industries has been particularly close and this work has been greatly aided by the valuable publicity given the bureau's researches by the technical journals.

Those making the visit on the date named were from leading journals in the automotive field, the statement says, who made a general inspection of the bureau's laboratories and equipment. They were: Erik Oberg, editor of *Machinery;* David Beecroft, Ray W. Sherman and James C. Dalton, of the Class Journal Co.; Clyde Jennings of AUTOMOTIVE INDUSTRIES; Neal G. Adair, of the *Motor World*, and George E. Quisenberry, of *El Automovil Americano.*

Dodge Tells Dealers of N. A. D. A. Advantages

DETROIT, April 15—Recognition of the National Automobile Dealers Association as the big factor in development of the retail end of the industry, has been given by Dodge Brothers. Letters now are being prepared to be sent out to the 4000 Dodge dealers throughout the country advising them to affiliate closely with the national association and the local dealer organizations which are connected with the parent body.

C. W. Matheson, general sales manager of the Dodge Brothers, in conference with Harry G. Moock, general manager of the N. A. D. A., said that he was anxious to have all Dodge dealers participate in N. A. D. A. activities and expressed the opinion that the organization was a vital force in the industry.

In a statement to AUTOMOTIVE INDUSTRIES this week, Matheson said Dodge Brothers executives fully realized the important work that was being done by the association in behalf of the individual dealer and the entire industry, and declared it would be the effort of that organization to have a full representation of Dodge dealers on the local and national rosters.

Tarkington to Build Light Car in Fall

ROCKFORD, ILL., April 15—The Tarkington Motor Car Co., with a plant already completed in this city, plans to begin the production of a quality, light-weight, six-cylinder car next fall. It will have an overhead motor, carry seven passengers and offer many details in refinements designed to give the car a high saleability.

The company was incorporated about a year ago by P. A. Peterson, who is identified with 25 or 30 different enterprises in this city. The factory manager is J. A. Tarkington, who has been in the automobile business for 21 years, with Rutenber, Apperson, Stoddard-Dayton and Kissel as a production executive. He is a brother of Booth Tarkington, the writer.

The company will make practically all of its own chassis.

EDWIN HALL PARIS DIES

NEW YORK, April 18—Announcement has been received here of the death of Edwin Hall Paris, treasurer and general manager of the Schuman Carriage Co., Ltd., at Honolulu, March 25.

Calendar

SHOWS

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

FOREIGN SHOWS

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina. Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September — Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

May 6—Detroit, N.A.C.C. Advertising Managers Meeting, Detroit Athletic Club.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N. A. C. C.

May 23-26 — Chicago, A.S.M.E. Spring Meeting, Congress Hotel.

May 24-28 — West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

July 4-9 — Mackinac Island, Mich., Summer Meeting Automobile Equipment Association.

Oct. 12-14, 1921—Chicago Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

RACES

May 31 — Indianapolis, International Sweepstakes.

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Dayton section—May 3.

Indiana Section—May 5.

Washington Section — May 6, Shaped Piston Rings, Cosmos Club.

Midwest Section — May 13, Smoker, Dinner and Entertainment at Chicago Automobile Club.

Dayton Section—May 17, H. L. Horning.

Cleveland Section—May 20.

Chassagne and Wilcox to Drive Peugeots Here

PARIS, April 8 (*By Mail*)—Jean Chassagne has entered a Peugeot racing car for the forthcoming 500-mile grind on Indianapolis track, where he will make his fourth appearance. Officially the Peugeot company is out of all racing for this season, but owing to the intervention of Jules Goux, two of the cars which had been begun for the French Grand Prix have been completed, and one of these has been given to Chassagne and the other to Howard Wilcox. Owing to his business engagements, for Goux is Peugeot agent in Paris, it is impossible for the winner of the 1913 race to come to America this year.

Chassagne's Peugeot is a four-cylinder model of 80 by 148-mm. bore and stroke with cast cylinders and four valves per cylinder in the head, on the same general lines as the pre-war Peugeots. Last year's design, with three camshafts and five valves per cylinder has been abandoned. Weight has been kept down very low and will be only a little more than the minimum imposed by the racing rules. Road tests recently carried out show that the car has a sufficiently high turn of speed to be a possible winner in the Hoosier contest.

Zeppelin Engined Car Wins British Contest

LONDON, April 4 (*By Mail*)—Chief interest at the Brooklands racing season opening Easter Monday centered in the contest between Count Zborowski's six-cylinder Maybach Zeppelin-engined car rated at 600 hp. and the Sunbeam-Coatalen "six" rated at 450 hp. Though the Maybach engined car had 150 hp. more to its credit on rating, it was given four seconds start over a 5¾ miles distance, and for the first quarter of a mile its time was only 15 3/5 seconds.

Going round it increased speed, and starting the descent seemed to perform a little leap in the air and a swerve. The crowd caught its breath, but the driver (the owner himself) got straight in an instant, and on the bank on the far side of the course he "let her go" and flashed by all the other competitors, racing home an easy winner from the Sunbeam. The official speed was given as 100.78 m.p.h.

Advertising Managers to Map Out Campaigns

NEW YORK, April 18—Directors of the National Automobile Chamber of Commerce have authorized a meeting of all advertising managers at the Detroit Athletic Club, Friday, May 6. The purpose of the meeting is further co-operation between the educational department of the N. A. C. C. and the advertising men of the motor car companies together with one or two papers of a definite character. This program will be followed by a series of five minute talks on plans and methods to be pursued in motor car and motor truck advertising for 1921. The meeting is designed not only to consider the best advertising policies to follow to increase sales but to consider those things which must be done further to sell the public on the position of the American vehicle in American life.

Racers Assigned Places in French Grand Prix

PARIS, April 8 (*By Mail*)—Ralph de Palma, on an eight-cylinder Ballot, and René Thomas, on a Sunbeam with the same number of cylinders, will be the first pair to be sent away in the French Grand Prix race—the first of its kind since 1914—at 9 o'clock on the morning of July 25. The start of the race will be given in pairs at intervals of 30 seconds.

After having completed a set of four-cylinder racing cars the Fiat company has built a series of eight-cylinder engines which have just completed their bench tests and probably will be used in the Grand Prix.

Metropolitan Section Hears Carburetion Talk

NEW YORK, April 15—The Metropolitan Section of the Society of Automotive Engineers, at its regular monthly meeting, planned to discuss the subject, "Carburetion of Low Grade Fuel," but the papers of the evening dealt largely with the kerosene carbureter developed by the authors, H. R. Beach and A. J. Weiss, and failed to develop the subject broadly. In consequence, many of those who attended the meeting in the expectation of hearing an engineering discussion along basic lines were disappointed.

Results of the canvass of the mail ballots cast in the annual election of Section officers, announced at the meeting, showed substantially unanimous choice of the regular ticket. Harrold Slauson, the newly elected chairman, was also elected to serve as the Section's representative on the parent Society's nominating committee, which will meet at the S. A. E. summer meeting in West Baden, Ind.

C. F. Scott, chairman of the S. A. E. meetings committee, and President David Beecroft, briefly outlined the plans for the summer meeting.

Advance-Rumely Starts New Truck Division

BATTLE CREEK, MICH., April 15—The new farm truck division of the Advance-Rumely Co. is now in operation here. The department, formerly in Clearing, Mich., has been moved here to replace the threshing machine department. Besides the new truck the plant will also make the Oil-Pull tractor. Working forces will gradually be increased.

According to present plans the truck will be built without the engine because officials have not yet decided on the type and specifications wanted. Officials are optimistic over the future since they declare the farmer is turning fast to motor driven and improved farming machinery and should again be buying heavily soon.

AUTOMOTIVE INDUSTRIES
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Our Government and Business

High taxes and low business totals have combined to interest industrial leaders in government as never before, and coincidentally the government leaders are more inclined to unbend to business. Results should be beneficial to both interests.

By Clyde Jennings

BUSINESS men and business interests have accepted very generally the invitation of the Harding Administration that business take more interest in government for the dual purpose of assisting Government and of getting more benefit from Government. The idea is abroad that this is to be a business administration—for the benefit of both business and Government.

The present is opportune for such a blending of interests. Before the war Government cost so little that business did not pay much attention to it. It was too cheap. Anything cheap never commands much respect. The smokers, liquor drinkers and consumers of imported articles were paying the bills; the politicians were doing the planning and the fairly well paid employees in government bureaus were doing the work. It was all very satisfactory to the business man, so why worry.

Then came the war and Government called a lot of business men to Washington to help run things. These men were paid an average of $1 a year. Most of them went there thinking that they would settle the problems of Government and war in a few days and then go back home and get busy again with their own business. But a good many of them remained in Washington until the armistice was signed and had the busiest days of their lives in trying to attend to Government business. A whole lot of men found that Government business was real business, especially in war time.

Then these men got back home and the next interest in Government was caused by their tax bills. Excess profit taxes, income taxes, corporation taxes, luxury taxes on the most ordinary articles, a series of questionnaires and, likely, investigators in the plant were next in order. These incidents made business men think more and more of Government. A good many of them concluded that the Administration in power was not a good one or Government would not cost so much. So they sought a change.

Now we have the change. The new Administration has started working quite nicely with business. But Government is still quite costly, so costly that business wants to know what makes it cost so much. They are interested, and good many business men are going to Washington and are sending their agents there to reduce the price of Government.

They have been received with open arms. Government is openly courting help and advice, to a certain degree. When this advice conflicts with what is desired by the instrument of Government—for the politician is still on the job—it is not so welcome. Sales tax suggestions for instance.

Herbert Hoover, as Secretary of Commerce, is to all appearances the special liaison officer of the ad-

ministration with business. Secretary Hoover is studying all lines of business and his own department with a view of making each more valuable to the other. He is striving to learn from business what it wants to know from his Department—and from Government in general if you please.

Also, he is striving to learn what it is possible for his department—and for Government—to do for business. He has indicated that he thinks it entirely possible that he can obtain much information that is really vital to business but which the industrial organizations in many lines have been unable to obtain.

Secretary Hoover's general program in aid to business is quite well defined. Before he took the Cabinet job he was directing a survey to lessen industrial waste. It is no secret that he still holds that industrial waste is a considerable factor in high prices. The work he so well started through his engineering associates is continuing and he hopes to further this work as Secretary of Commerce.

Industrial waste, as Secretary Hoover sees it, is chiefly "blindfold production"—if we may coin a phrase. This means that many industries are going but they do not know where they are going. They are depending solely upon chance to find signposts at the cross roads.

Sometimes the signpost is lettered sufficiently plain that the manufacturer sees the direction and has time to change his course. But usually he is going at such speed, or he is talking so earnestly with his companions, that he does not see the sign in time to make a good turn. As a result he wastes a lot of time getting back on the right road. He wastes fuel by going full speed ahead after the demand has lessened; or perhaps, that he has not estimated his market and the warehouses are full; or perhaps public fancy has turned away from the particular style of article he makes; or—well all manufacturers know the dangers.

The result is that there is a waste of manufacturing labor; there is waste in carrying heavy inventories; there is a very heavy waste in the unstable character of employment in industries and establishments that follow only current market reports in their quantity and kind of output.

It is Secretary Hoover's idea that almost any manufacturing problem can be stabilized by a better examination into the probable consumption over an extended period by a study of consumption figures. This in turn will make the demand all through the industries, from raw material to labor in the final distributing stations, more equitable.

Here comes in one of Secretary Hoover's strong points in this program: That of stabilizing the demand for labor, so that there will be less unemployment and consequently less economic waste. It is decidedly a human factor and the beneficial effect it would have on wage controversies can be seen at a glance. All manufacturers know how much less troublesome is the labor problem in an industry that provides 50 weeks of employment a year than one which is entirely seasonable and whose factory staff will vary from a long shut down period to a crowded workroom, with two or three shifts at other seasons of the year. Enforced idleness is always an important factor in wage scales.

Secretary Hoover is quite willing to aid any and all industries in this stabilization work through his department. He discussed this problem with the business paper editors a few days ago and asked what figures were wanted. First, of course, export and import figures came up for discussion, chiefly because they are now being given out and it is a less problem to remedy defects in a present practice than it is to establish an entirely new activity. But the additional aids to business are on the books to be worked out.

The important question, however, is not what Secretary Hoover and the present administration plan to do, or what they want to do, but WHAT CAN BE DONE.

All business men know that investigation problems, research activities and in fact all activities of this sort require money.

Secretary Hoover is quite plain in his statements that what his department will do is not so much a problem of plans as of money. His greatest problem is to get money with which to pay clerks for making the computations that he knows are desired and for establishing new sections in his bureaus, under charge of competent men, for the initiation of new activities.

At this point the treatment of this subject appears to take a slightly different turn. We will admit for the present that:

The Administration is sold on aiding business.

Business is sold on the possibility of being aided by government.

Business wants the costs of government reduced. The Administration was to lower costs, if possible; obtain fair treatment for people who patronize business, and co-operate with business in every legitimate way.

But here comes a new angle. First of all, Government is political; an Administration depends entirely for its success and continuance upon popular opinion. This popular opinion may be wrong, but the Administration must meet it. Actual good that Administration may do for business is secondary to popular opinion.

Business men generally cannot blame the individual units of the Administration (and the Administration as a whole) for looking to the life line first. **There are few, if any, men in public life who put the cause before the man.**

The idea of public men, first of all, is self preservation, and you cannot blame them for that. Put yourself in the place of the politician and reason this way:

"I want to do the most good I can while in office. I want to help business and consequently help the country and the people, because business is the life blood of the nation. I can only do this by staying in office. If I am defeated at the next election, Jones will succeed me. He does not favor any of the plans that I favor. My plans are better than his. If I can get my plans started this term I must come back next term to carry them through. Consequently, while starting my plans for good, I must look out for votes at the next election."

Under the ideal of making the cause bigger than the man, this course of reasoning would be fallacious. **Under the expediency and ideals of politics it is not. Business to-day must take conditions as it finds them, until there is time and opportunity to educate the great mass of voters to mark their ballots with greater idealism.**

Our forefathers, especially those who lived in Hamlin Garland's great west, studied backfires with a great deal of care. So do the politicians of the present day. So should business men. The backfire is the greatest weapon in the electoral government.

The hope of business to-day is not so much to consult with the Administration as to have some in-

fluence with the voters at home, so that business can start backfires in the home district.

The power of Government lies in Congress. And it is well that it does. You may obtain the co-operation of the powers that be in Government or the Administration, but without Congress these powers are not of much use. Witness Secretary Hoover, anxious and willing to aid business, who cannot enlarge the activities of his department until he can obtain the money.

You all have heard of the man who was forced by necessities of domestic peace, to take his pay envelope home unopened. You have heard many tales of woe from your own employes on this very subject.

But to-day administration executives are bound by much closer purse ties than the hen-pecked man. The executives do not even get the pay envelope until Congress has closely inspected the contents. And Congress is quite proud of this power.

The power of business to-day lies with the home Congressmen. The business man who expects to take his own part in the effort to get Government to come to the aid of business needs have on his desk a list of the local Congressmen, Representatives and Senators, and the chairmen of the various committees. He must use this list very often. He should write to these men on subjects that he wants acted upon.

Also the business man must take his friends into his confidence. He must get them to write on the subjects that he is talking about.

Of course, the head of a big business organization has much power in the world and he often feels that he wields much influence, but he should remember that unless he exerts this influence **he is only one voter on election day.** Some business men are so regarded by their helpers in business and at home, so that every man and woman in their employ delights in learning **"how the boss is going to vote" so that they may kill his vote.** It is only on election day that the humble helper is fully equal to "the boss" in public affairs. And, believe me, this fact is well known to the servitor. Perhaps the servitor has the most power in the election, at that. Remember in "Peg o' My Heart" the lesson of the two dogs. Michael was forced to sleep in the stable, but when it came to grips on the lawn, Michael was much the better of the two dogs. Politics is a good deal of a rough and tumble fight, and Congressmen and other politicians are likely to know just how much influence a man wields on election day. Some politicians are shrewder than they look.

Business cannot get what it wants from politics—which unfortunately is to-day a practical synonym for Government—unless it plays with politics all of the time. Business must learn to discriminate in men and platforms; especially men, rather than in party names.

Business to-day has the greatest opportunity in the history of this Government. What business realizes from this opportunity is solely up to the men of business, for business collectively does not vote and it is votes that count in the last analysis.

THIS article is not in any sense a presentation of an ideal of government. It is an expression of opinion as to present expediency. It should be the ideal of every American citizen to raise the standard of government to a point where the present political methods will not be paramount; then the best interests of the people will be the aim of every member of the legislative, executive and administrative branches of government.

This desirable state of affairs will be reached only when voters are as careful in their selection of legislative candidates as they are of the men with whom they have personal dealings.

Business organizations have a great potential power. To-day every business or industrial organization should be judged solely as it co-operates with Government for the betterment of business and the intelligence with which it works to interest Government in business and the men of business in Government.

Association work is co-operation. An association is powerful only as its members work with each other for the same purpose. Then the association's power is for good or evil, as its purpose is a worthy or a selfish one. The fact that the Administration has advised an inquiry into the activities of certain business organizations should not be construed as an overt act against business. Perhaps these associations should be inquired into. We hope not, but associations are as likely to be selfish and unworthy as men, and a good many men should be inquired into.

This act on the part of the Administration should not be construed entirely as an unfriendly act. We do not believe that there is a business man to-day who is willing to risk his reputation in giving to all business organizations a "clean bill of activities."

The fact that the Administration is doing a little housecleaning only illustrates the more the fact that Government is politics—often mob rule. It cannot be denied that the people generally believe some business associations are instruments established solely for the purpose of robbing the consumer. **If that belief is true, then a housecleaning is needed. If it is not true, the business represented in the associations should welcome an opportunity to tell the truth.**

Some very strange things have been uncovered in association inquiries this year and perhaps more of them will be uncovered during the year. This should not discourage the effort for honest co-operation between the right kind of business men and Government.

Have you the names of all local legislators on your desk?

Taxes and Registrations in England

CONSIDERABLE interest attaches to the working out of the new motor vehicle registration law which went into effect in England this year. The London *Times* of March 11 reports that "the revenue from the new motor taxation . . . has been coming in remarkably well and from the licenses issued during January and February it is evident that the estimates of £8,000,000 as the yield of the tax will be reached, if not exceeded."

The final registration figures are not yet in, but should furnish later the first really close estimate of the number of cars in the United Kingdom. The only information available at present states that "while comparative figures are to some extent deceptive, for all motor vehicles must now be registered in the district in which they are normally kept, the increase in vehicles registered in some areas as compared with last year is already large."

Factors to Be Studied in Merchandising Analysis

The advantages to be gained from a systematic and scientific study of the merchandising problem are being recognized by many manufacturers. Work along the lines of territorial analysis and the establishment of quotas is being recognized as essential. One company's start described

THE marketing phases of industry have never received the careful and scientific treatment accorded the engineering and production phases in the past. Intensive merchandising has now become almost an essential to existence, however, and the scientific methods which have proved so valuable in the shop and the engineering department must be brought to bear upon the efforts of the sales department.

With this fact in mind, the charts recently prepared by the Commercial Research Department of the Franklin Automobile Co. are of special interest. These charts, which are presented herewith, were prepared for use in connection with sales analysis and production plans and are of value as being the result of an intelligent and practical guess as to what the future holds in store for the automobile industry.

The chief conclusion presented by the charts is that there will be nearly 31,000,000 cars and trucks registered and 5,300,000 produced in the United States in 1940, but the process by which this conclusion was determined and the production probabilities for the next twenty years also comprise an important part of the analysis.

The figures from which the various curves are drawn all go back to the data shown in Fig. 1.

The chief feature is that this forecast is based on a study of ratios of registration to population, whereas most similar forecasts are made by merely plotting past statistics and extending the curves on that basis. The forecast for 1940 is based on an assumption of ratio of registration to population for 1940, and is therefore of little interest as compared with the forecasts obtained thereby for the next few years. The theory is that if the assumption of ratio is made for a date far enough ahead, even a material error in that assumption will not throw off to any

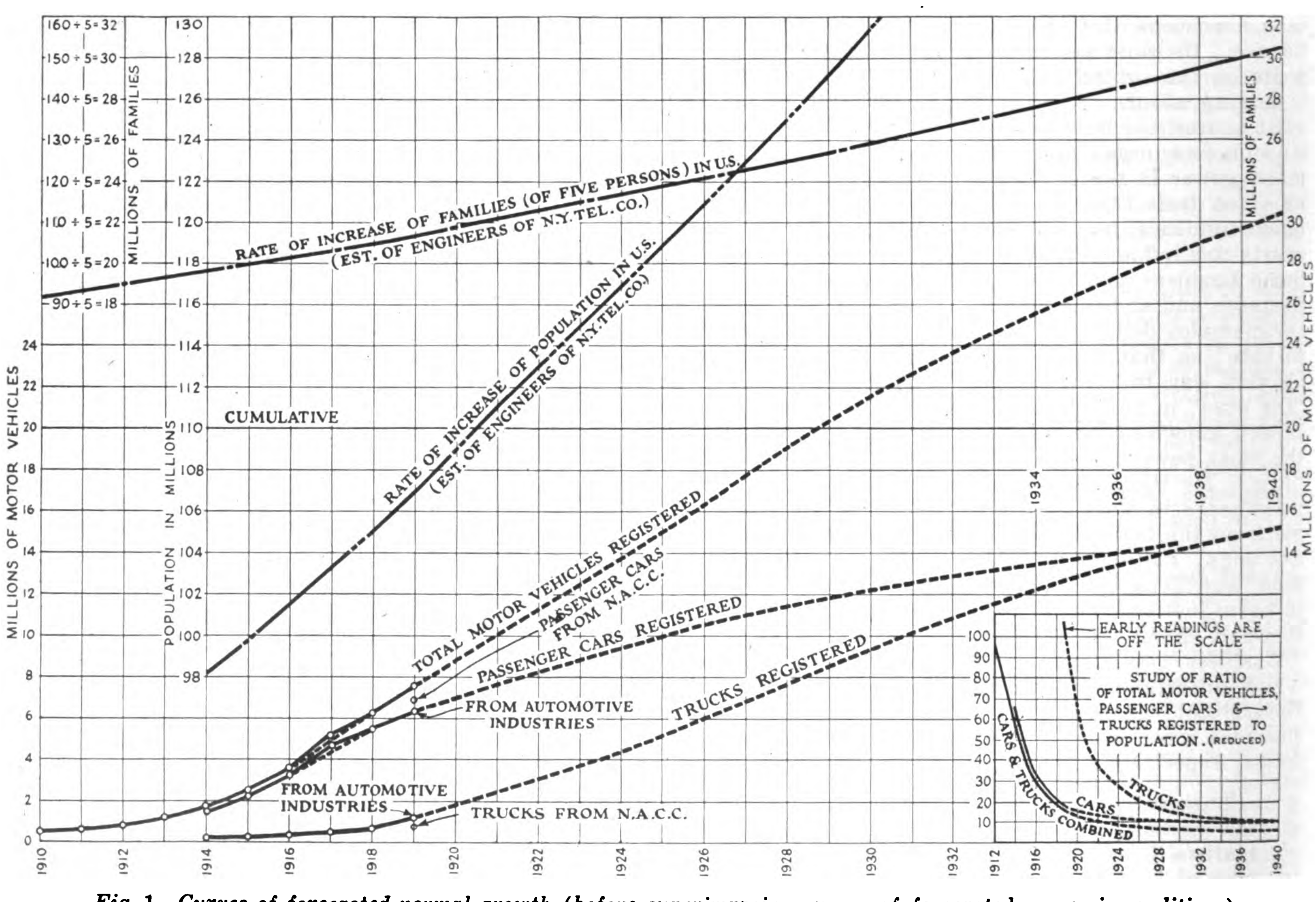


Fig. 1—Curves of forecasted normal growth (before superimposing curves of forecasted economic conditions)

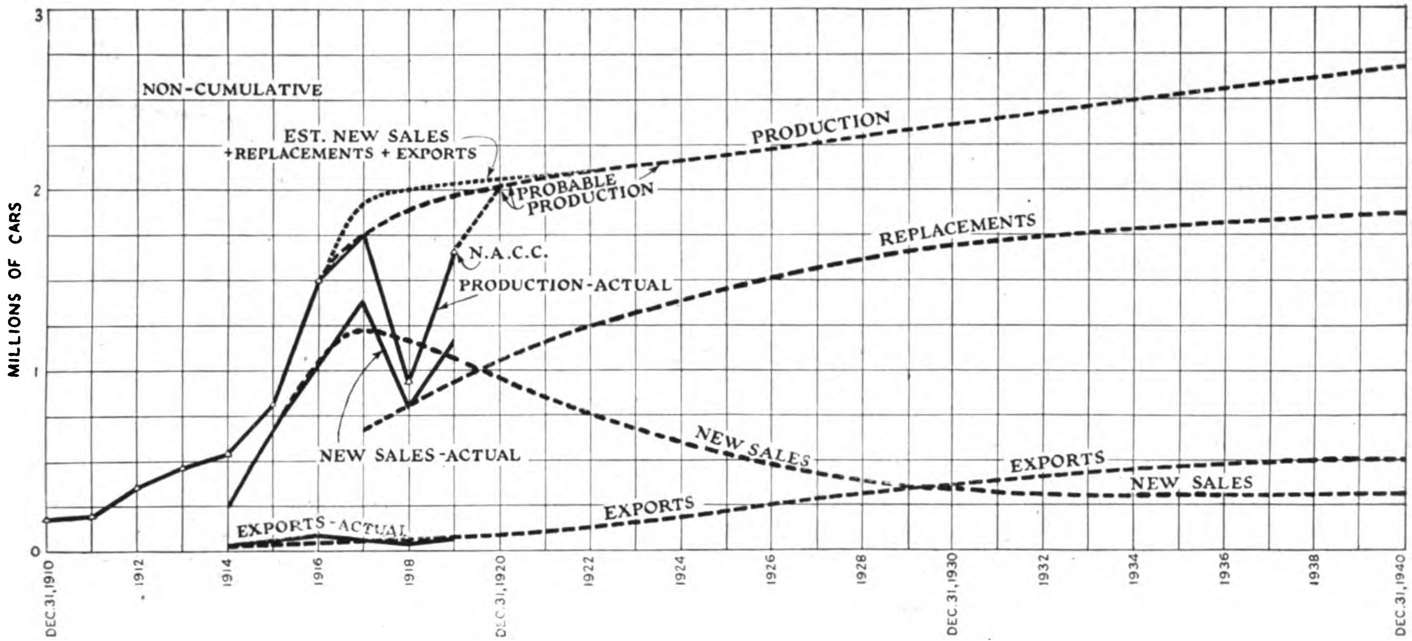


Fig. 2—Preliminary forecast of passenger car production (new sales + replacements + exports)

great extent the forecast for the next few years. This was tried out in this case and found to be true.

The curves were built up on that basis, in the following manner:

The highest ratios of motor vehicles to population in 1919 were:

California	1 car for every 6.07 persons
Iowa	1 car for every 6.12 persons
Nebraska	1 car for every 6.54 persons

The lowest ratio was in Mississippi, which had 1 car for every 45 persons, while the average for the country was 1 vehicle for every 14.14 persons—or 1 vehicle for every three families.

A superficial study of conditions then led to the assumption that in 1940 the average for the United States would be 1 vehicle for every 5 persons, so divided that there would be 1 passenger car and 1 truck for every 2 families.

Ratio Chart

The small chart in lower right-hand corner of Fig. 1 shows the ratio of the total registration, passenger car registration, and truck registration to population. The solid part of the lines represent actual figures to date, while the dotted parts of the lines are the predicted figures to 1940, based upon the assumption just discussed.

The readings thus obtained were then applied to the population curves furnished by the New York Telephone Co. Thus the curves for estimated vehicles registered were drawn.

It will be noted that the curves for passenger cars and trucks are constructed on the assumption that there will be an equal number of cars and trucks in the country in 1940; that is, one car and one truck for every two families.

For the purposes of this calculation, population rather than business houses, factories, etc., was used as a unit of measure for both cars and trucks, because it is, in the final analysis, the determining factor regarding future needs of the country.

On the basis of these curves shown in Fig. 1, the curves shown in Figs. 2 and 3 were constructed. It should be noted, however, that there has been no attempt to take into account such events as the present industrial depression or other economic circumstances which would disturb the natural progress of business. This attitude is warranted, since such depressions have only a temporary effect upon marketing problems.

The forecast of passenger car production is shown in Fig. 2. Again the solid lines show past figures, while the broken lines are the predicted trends. The war caused the radical dip in the production curve for 1918, but the dotted line above shows what the normal production would probably have been, based upon the theoretical standards upon which the future predictions are made.

Bases of Curves

Certain other factors should be explained in connection with Figs. 2 and 3. The average life of a car at present is figured as being between five and six years. But as automobile manufacture improves each year, the average life of a car will probably increase. It is assumed for the purposes of this calculation that the average life of a car in 1940 will be ten years and the replacement curve is drawn on this basis.

In drawing the export curve, it was assumed that the export market has a limited capacity in that manufacturing and assembly plants will be established in a foreign country after a certain point has been reached.

According to the prediction of this chart it will be noted that passenger car production in 1940 will reach about 2,680,000, while truck production at that time will have passed the 3,000,000 mark.

It is interesting to note on the passenger car chart that the replacement business has already become greater than the new sales, and that exports are expected to pass new sales about 1929.

In the truck field, however, it is predicted that new sales will be greater than replacements until 1925, while exports will not equal new sales until 1938.

Large Replacement

According to this forecast there will be more than a million and a half passenger cars needed for replacement alone after 1926, while the estimate gives necessary replacements for 1921 at about 1,300,000 passenger cars and about 300,000 trucks. This would indicate a thriving business for the automobile industry without taking into account the new sales which undoubtedly can be made.

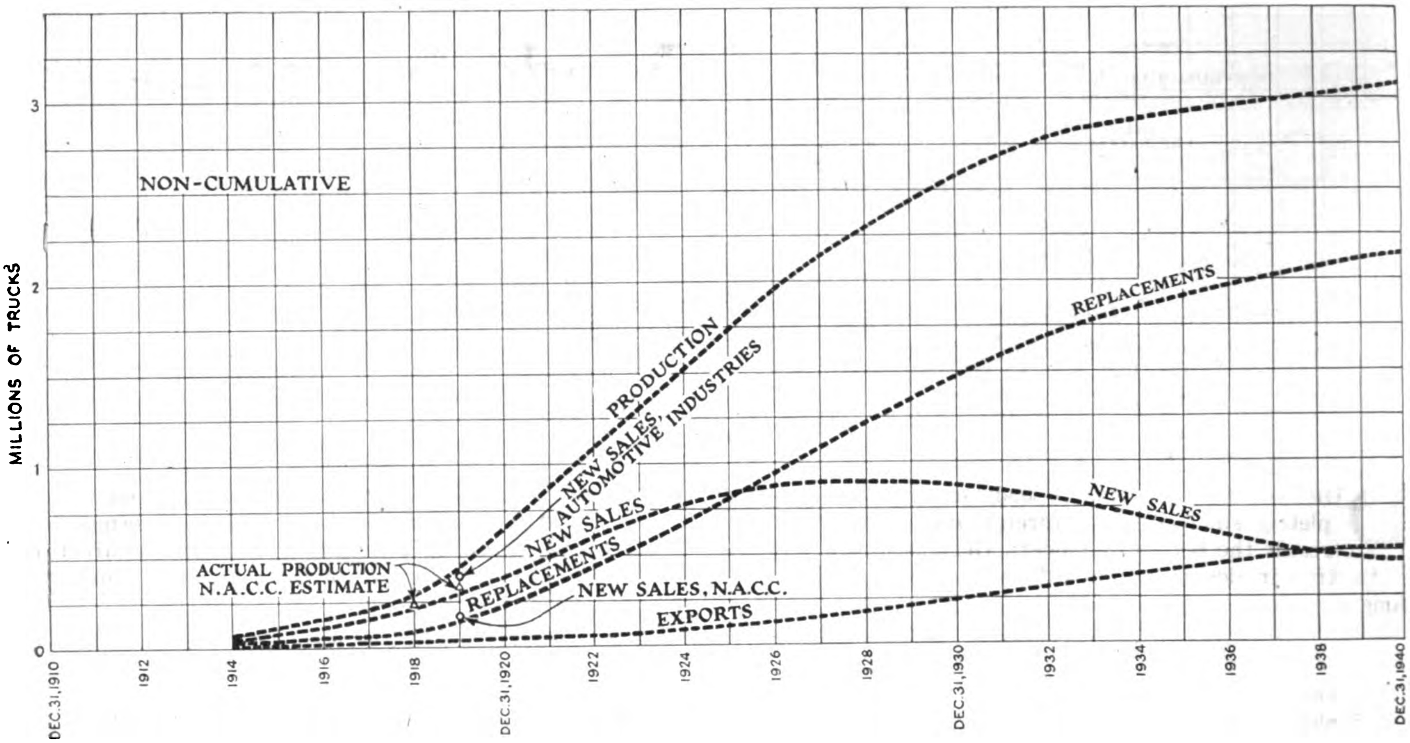


Fig. 3—Preliminary forecast of truck production (new sales + replacements + exports)

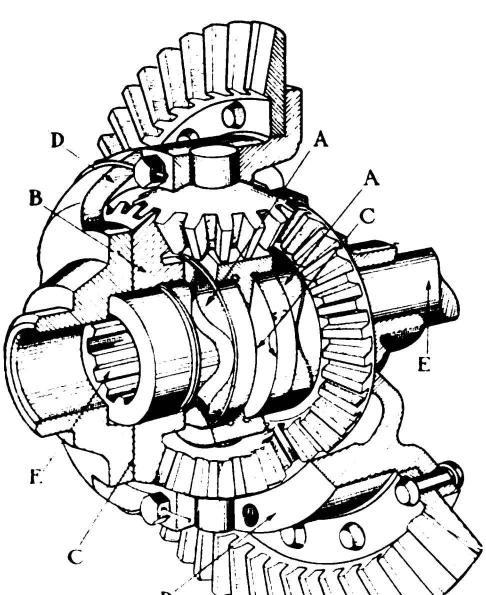
While such estimates as this cannot, of course, be expected to predict the future with strict accuracy, they are very much worth while as a general basis upon which to speculate as to the best plans to make. The charts are presented here as an example of the way in which one automobile manufacturer is going about a study of the problem and as a preliminary report on the results which have been attained.

A Sinusoidal Type Differential

A POSITIVE-DRIVE differential of the sinusoidal type designed by A. T. Nogrady has been the subject of investigation by the General Motors Co. and other concerns in the industry. The differential is fitted with the bevel pinion and side gears in the usual manner. However, the bevel gears are fitted with either helical splines or sinusoidal cams that engage with external and internal members, the latter a portion of a member fitted to, or integral with, the main axle shaft.

When the traction in either of the rear wheels varies, the cam shown in the drawing at *A* tends to thrust the differential bevel gear, or side gear *B*, against clutch faces *C*, thereby setting up a frictional load which is transmitted to the cage *D* as a torsional load, and thus to the main axle shafts *E*.

When operating under ordinary conditions, the effect due to the cam is to thrust the side gears inward and away from the provision for friction, and since the clutching faces are brought to bear one against the other, the thrust is equalized between the inner and outer clutching faces.



Nogrady differential. A, cam; B, differential bevel gear; C, clutch faces; D, cage; E, axle shafts

Automobile Industry in Canada

THE following brief statistics are of interest as showing the present size and development of the automobile industry in Canada, compiled by the Dominion Bureau of Statistics:

Canadian companies manufacturing cars...	10
Cars manufactured since 1916............	351,000
Annual necessary replacement............	80,000
Value of 1920 production of passenger cars.	$84,500,000
Dealers in Canada 1920..................	5,500
Persons employed in automobile and allied industries	80,000
Persons involved, including families of workmen	400,000
Capital investment in dealers' companies...	$43,000,000
Capital investment in manufacturing companies	$110,000,000

Some Examples of Modern Passenger Car Bodies Designed in Germany

Result of isolation during the war seen in distinctive designs with embodying V-type radiator and windshield, concealed top and divided rear seat. Some touring bodies have light detachable limousine top.

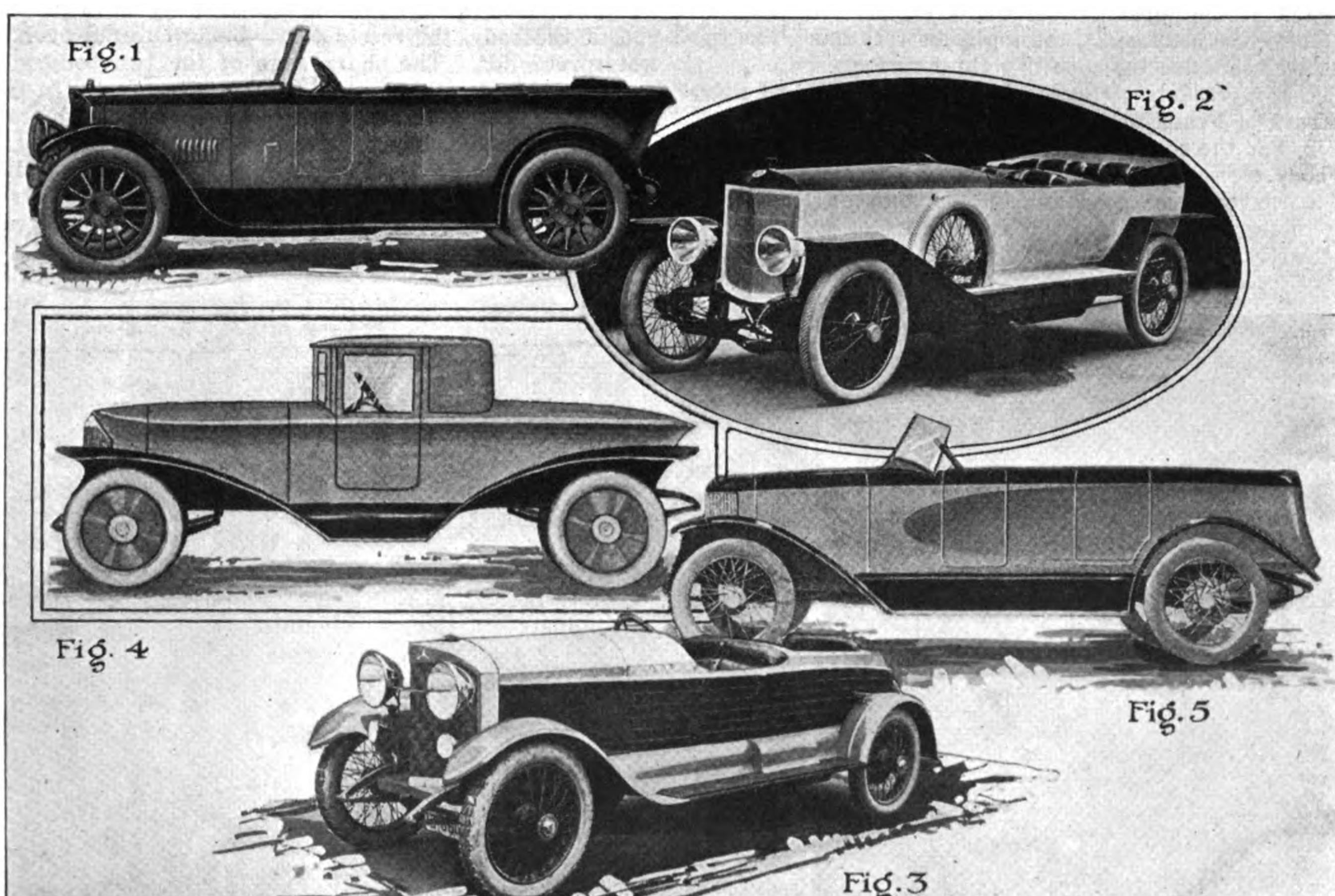
By Benno R. Dierfeld

DURING the war German body designers were completely shut off from foreign influences, and as a result the bodies of modern German cars are quite distinctive in design. The differences as compared with American and other foreign bodies are particularly accentuated in open bodies, but can also be found in closed cars. They are:

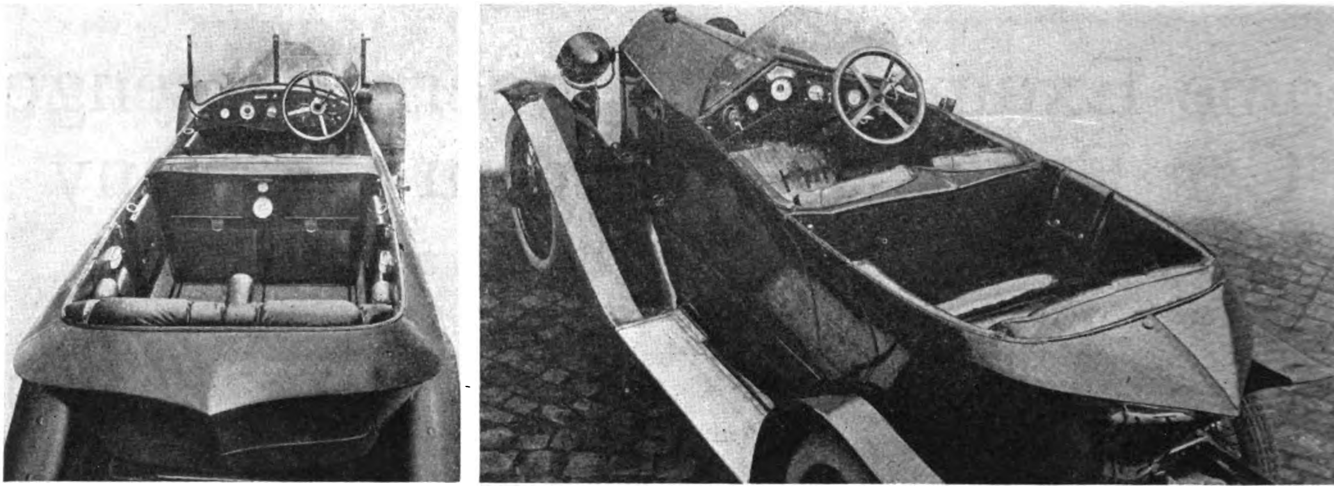
1. V-shaped radiator.
2. V-shaped windshield.
3. Sharp horizontal top line, running from the upper part of the engine bonnet to the rear end of the body.
4. Two-color finish with the horizontal top line mentioned above as line of demarcation.
5. Top concealed in the rear part of the body.
6. Rear seats generally divided by an arm rest and only wide enough for two passengers.

Of course all these features are not always combined in one body, but they are found in most of the German open cars. In the following a number of bodies manufactured by German automobile factories and body works are briefly described.

Fig. 1 shows a typical open body built by Benz. The car seats six passengers and the two rear seats are separated by a central arm rest. The radiator is V shaped, as in all German cars. This construction, while expensive and more difficult to repair than the ordinary flat radiator, gives the car a speedy, rakish appearance. For the same reason the windshield is V-shaped, a design that also reduces the wind resistance, and the top is concealed in a recess, between the rear seat back and the extreme end of the body, which is normally closed by a lid. The radiator is narrow, but very high, so that a horizontal line can be



A variety of German automobile bodies, mainly of the sporting type



Figs. 6 and 7—Interiors of two German open bodies

run along the top edge of the body from the radiator to the rear end, forming a sharp edge and separating the two colors. The body part lying above this line or edge is painted in black or a dark color, the same as the fenders, while the sides of the body are painted a light color.

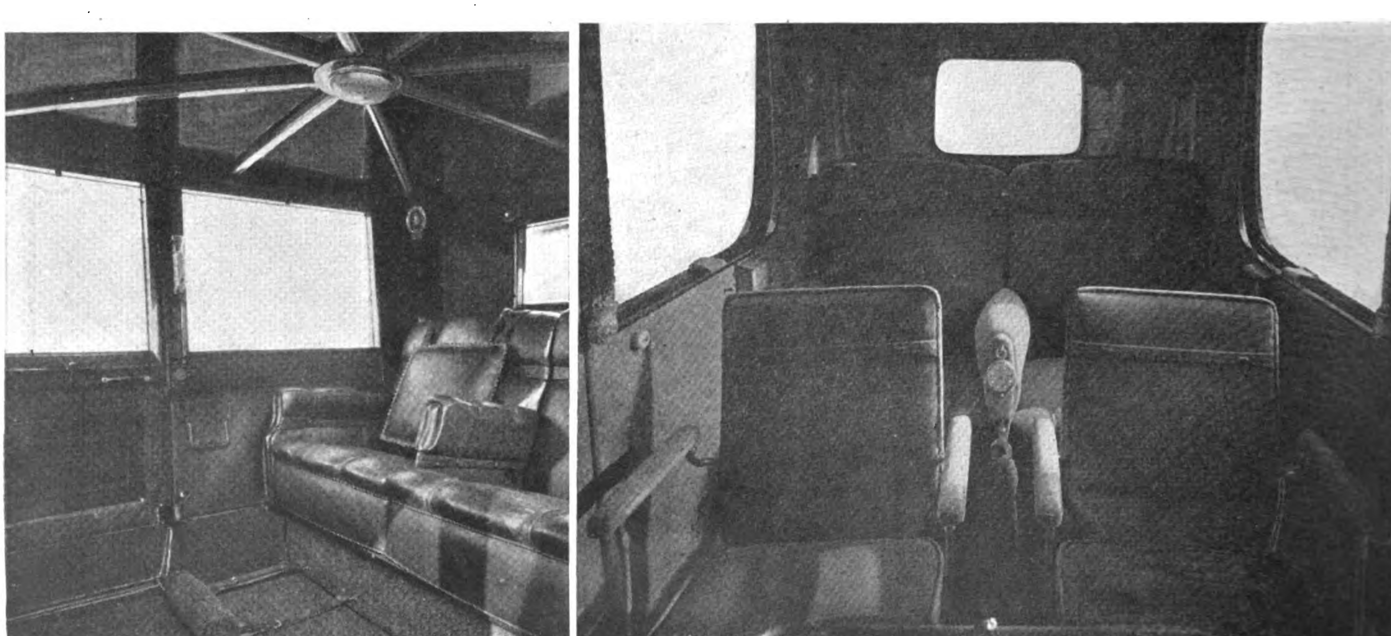
Sporting bodies also have been influenced to a certain extent by the new development in German body design. In Fig. 2 is shown a smart sporting four-seater built by Neuss of Berlin. The V-shaped windshield is here omitted; the fenders have straight lines and below the running board there is a long shallow box for carrying tools, spares, etc. The top does not disappear in the body, but rests upon the rear end of the body and is covered by a buttoned leather envelope. As this envelope is black, the same as the upper part of the body, and does not project above the body walls, the top looks very much like the so-called concealed top, but is lighter and cheaper.

Fig. 3 represents a torpedo body built of natural wood by Kruck of Frankfort. It shows lines similar to those of Fig. 2, but the top is really concealed in the rear part of the body.

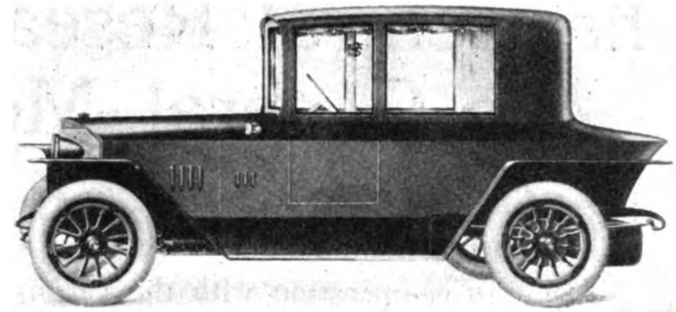
The conventional roadster and runabout are scarcely seen in Germany; indeed the appearance of most of the two-seaters does not differ materially from that of four seaters, and only with the top up can the two types be clearly distinguished. Fig. 4 shows a fine example of a German two-seater, built by Szabo & Wechselmann; it embodies all the characteristics of the four seaters—V-shaped radiator and windshield, horizontal sharp edge, concealed top, etc., the fenders have graceful lines, while in the rear deck there is a dinky seat and storage space for baggage, spare tires, tools, etc.

Fig. 5 shows another touring body, built by Szabo & Wechselmann, that combines all the distinctive German features, but also embodies unusual lines, the body side walls being concaved, producing an unusual, but attractive appearance.

An open six-seater by Voll & Huhrbeck of Charlottenburg, is shown in Fig. 6. The top is concealed in the rear end of the body, the recess for it being covered by large waterproof lids. The sharp edge of the two body sides end in a point at the rear, a feature often found in German cars. The rear seats are real club chairs with arm rests, etc.; the seats proper can be pulled out at will, so that during long runs the passengers can change their position. The two folding seats are of the usual construction, but the V-type windshield is built in three parts with metal frame.



Figs. 8 and 9—Interiors of two closed bodies



Figs. 10 *and* 11—*Conservative and radical types of German closed bodies*

Fig. 7 shows a three-quarter rear view of a four-seater which in outside appearance resembles the body of Fig. 6. The hood can be concealed in the rear pointed part, if so ordered by the customer, or is carried in the form of a small parcel and put up in case of bad weather. The V-shaped windshield is one bent piece of glass without metal frame, very light and rakish looking; the fenders also are of V-section, to harmonize with the radiator, windshield, etc. All tops have detachable side curtains with celluloid windows.

The transition from open to closed bodies is formed by bodies with detachable limousine top. Fig. 8 shows an interior view of such a Kruck body with limousine top in place for winter use. The limousine top is very light and can be put on or taken off within a few minutes by two men. When this top is removed it is replaced by a box containing a complete summer top, and then the open car cannot be distinguished from an ordinary touring car.

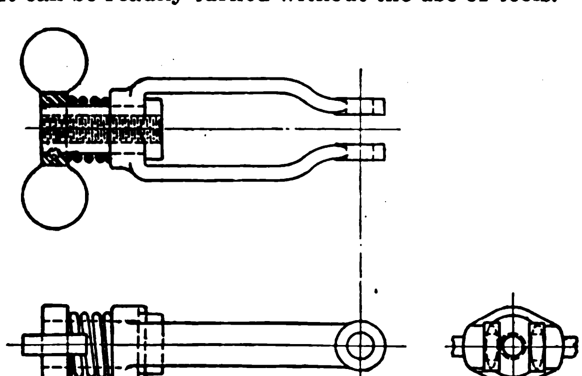
The view of the interior shows the characteristic German design, i. e., divided rear seats with central arm rest and foot rests. The detachable top is built entirely of natural-finished wood in order to prevent damage by moths. Of course it must be very carefully constructed, otherwise it would warp during the summer and not fit in winter. Landaulets are built in the conventional manner but are seldom used. Closed bodies are always built with inside drive; Fig. 10 shows a six seater limousine built by Neuss; the V-shaped radiator harmonizes with the V-shaped windshield and the top is finished in black and contrasts with a dark green body. At the driver's side the windshield is divided and can be opened at will; the front windows can be let down. An interior view of this limousine is seen in Fig. 9. The rear seats, as well as the auxiliary seats have arm rests at both sides. All limousines have doors on both sides at the rear seats and a door at the left side of the driver's seat.

Town cars or coupés are built with or without inside drive; Fig. 11 shows a coupé with inside drive built by Daimler. A dark horizontal stripe runs along the side at the height of the arm rest. The body has a compartment for spare tires, tools, etc. under the rear deck. There is only one door, at the left side. The large windows and the graceful arrangements of the side curtains gives the vehicle an attractive appearance.

An Improved Yoke End

WITH the ordinary yoked rod ends used in brake connections it is not as easy a matter to make an adjustment of the brakes as may seem to be the case. First the cotter pin has to be removed from the pin of the yoke end, then the yoke pin itself must be removed, the yoke end rotated one or more half turns on the end of the rod, the yoke pin replaced and the cotter pin reinserted. With a view to facilitating this operation the Gemmer yoke end, illustrated herewith, has been brought out by the M. J. Ford Mfg. Co. An intermediate piece between the yoke end proper and the rod is provided with ears or finger pieces so that it can be readily turned without the use of tools. This intermediate piece is in the form of a threaded collar which turns comparatively freely in the hub of the yoke proper, but the tendency of vibration to work it out of adjustment is prevented by providing one head with a V-shaped projection which engages with a corresponding notch in the hub of the yoke under the pressure of a coiled spring.

This adjustable yoke end takes the place of the adjustable yoke and turnbuckle. It is claimed to be easier to assemble, to adjust either by hand or wrench and to be less expensive than a separate yoke end and turnbuckle.



The Gemmer yoke end

THE Merchant Venturers' Technical College, which provides the Faculty of Engineering of the University of Bristol, and maintains a separate Department of Automobile Engineering, is just completing the re-equipment of the automobile laboratory. Several firms, recognizing the value of such a department devoted to the study of the problems of the industry and to the training of automobile engineers, have presented valuable specimens of engines and equipment to the college from time to time. The latest gift, presented by Douglas Motors, Ltd., is a standard 2¾ twin air-cooled engine. The same company has also promised one of its new O. H. V. engines immediately they are in production. The engine will be used both for demonstration and research work, with results, it is hoped, beneficial to the makers, students and the motor trade generally.

The Central Research Laboratory of the General Motors Company

Occupies a building 1000 ft. long by 270 ft. wide in Moraine City, a suburb of Dayton, and is operated as an independent unit of the G. M. C. but in co-operation with the various automobile and parts plants of the company, under the direction of C. F. Kettering and a staff of specialists.

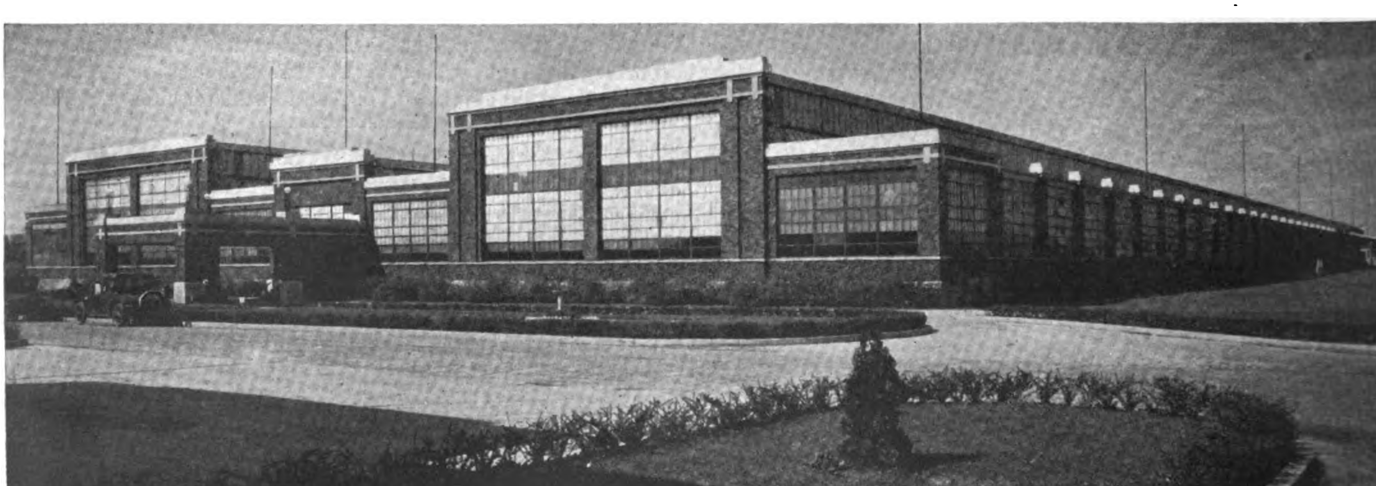
By J. Edward Schipper

REALIZING the advantages of bringing under one roof a number of branches of research activity, the General Motors Company is concentrating a great proportion of its activities along this line at the laboratory at Moraine City, Ohio. The research unit is a separate corporation known as the General Motors Research Corp., having its own officers and directorate, and operates as an independent unit, although co-operating with the different automobile and parts manufacturers in the General Motors group.

The organization occupies a building 1000 ft. long by 270 ft. wide. It has been possible to divide this structure into a number of laboratories, each equipped with all of the necessary devices for carrying on research work in the different departments into which this activity is being extended. At the same time, these small laboratories, which are 20 by 30 ft. in dimension, are elastic enough in their arrangements so that as soon as a research job is completed another one of entirely different characteristics can be started. The laboratories are all equipped with compressed air lines, vacuum lines, necessary electrical equipment and are provided with electric current of different characteristics, and are, furthermore, excellently lighted. Some of the research rooms are equipped with devices which render them permanently adapted to specific lines of research work. The majority of laboratory rooms, however, can be adapted to any of the general classes of research work which may be undertaken.

This centralization of the laboratory idea into one building has naturally led to a gathering together of specialists and experts in the various lines, giving an opportunity of so co-ordinating the work of these various lines that the work of the different divisions of the laboratory can be made to dovetail into a general scheme of research which renders it of highly practical value. In fact, a strict point of practicability is made in all of the laboratory work which is being undertaken. All of the development and research points to some commercial end, which, although it may be in the remote future, is, nevertheless, some day going to find its way on the market as a practical product. In addition to these activities which have to do with future products, there is also a great amount of routine work at the laboratory having to do with current problems in the General Motors plant.

The research corporation is fortunate in having at its head C. F. Kettering, whose personal research work has made him sufficiently acquainted with the different lines of activities going on at the laboratory to have an intimate and detailed knowledge of practically all the work under way. In order to allow the division heads who are in the actual research work to be absolutely free to devote all of their energies to the research part of the business, the control division is entirely separate and handles the business, accounting and personnel of the laboratory. In the direct research department there are eleven principal divisions: these include mechanical engineering, fuel, chemical and metallurgical control,



Exterior of the laboratory building of the General Motors Research Corporation at Moraine City, Ohio, which is just outside of Dayton

which has to do with current manufacturing processes, and chemical and metallurgical research, which has to do with future methods. There are also included divisions for electrical engineering, dynamics, refrigeration, farm engineering, experimental production, which has to do with reducing design to production, by means of model-building, etc.; semi-works engineering, which has to do with the development of manufacturing methods, such as special machines and tools, and instrumentation, which includes experimental and development work on matters requiring accurate dimensions, such as speedometer designs, etc.

These activities are carried on in forty-four laboratory rooms, and in addition there are machine shops in some of the laboratory departments where they are necessary to carry on the work. The laboratory is equipped with its own heat-treating plant, foundry and pattern shop, and carries on hand a stock of the different necessary steels for this work. With this equipment, and by the selection of men who are all highly practical in their line and who are willing to get right into the work themselves, some very noteworthy results should be accomplished. In order that the work is continually being co-ordinated and checked up at all times, frequent conferences are held. As a matter of routine, there is a conference every Saturday afternoon presided over by C. F. Kettering. At these Saturday afternoon conferences reports are made by the different divisions as to the status of the work under way. Problems are assigned to the divisions, and by a system of progress reports the advancement of the work is kept in view. With the wide range of activity carried on by the eleven principal divisions, which have their sub-divisions, two or three hundred problems may be receiving attention from the laboratory at a time.

The laboratory staff and equipment are at the disposal of all of the General Motors plants, and there is a growing tendency for the chief engineers and their assistants from all of the General Motors plants to get together at the laboratory every few months for discussion. A library is provided with an up-to-date supply of technical literature and it is large enough to act as a very advantageous lecture room. In addition, there is an exhibit room into which may be brought various products of the laboratory for display at the conferences.

The laboratory is not as yet a year old, the research corporation having been started in July, 1920. Consequently, the activities of the laboratory are not as yet by any means up to their full development. There has, however, been sufficient work going through to indicate that this plan is going to work out in a highly successful manner, and a great many advantages are going to result from the ability of the various plants in the General Motors group to place in the hands of a highly selected staff of experts, not only their current problems, but also those of future marketable devices.

The matter of fuel alone is sufficient to occupy a considerable share of attention. The fuel division at the laboratory is equipped with complete distillation apparatus for producing any of the possible fuels which may come into future use. The development of fuel "dope," which promises to be one of the matters of prime importance to the automotive industry in future years, is before this division at the present time.

With a mechanical engineering division under the same roof as the fuel division, after a fuel has been developed the engine design necessary for the utilization of the fuel can be handled, perhaps jointly by the mechanical division and the fuel division. By allowing the various divisions to co-operate, even though their activities demand widely divergent classes of knowledge, the solution of a problem involving ramifications which lead it into many special fields is far more feasible than it would be with a single-purpose laboratory.

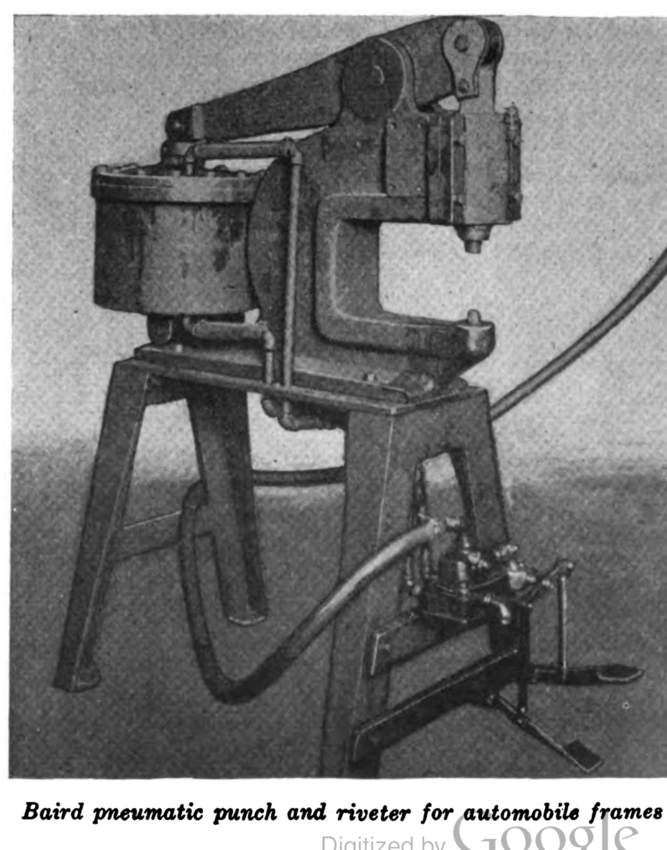
Production Short Cut in Frame Fabrication

A PUNCH and riveter for the fabrication of automobile frames is manufactured by the Baird Pneumatic Tool Co. It is operated by compressed air and does its work best with an air pressure of 100 lb.

With this tool the services of two men are required for maximum production, one to set up the frame and the other to guide it and operate the pedal of the riveter. The work is brought to the machine, which is stationary.

We are informed that during a test in an automobile assembly plant two men with the Baird riveter did in the same time the same amount of work previously done by four men. Two men with the Baird tool riveted 150 automobile frames in an eight-hour day, while previously four men with pneumatic hand hammers could rivet only 75 frames in the same length of time. Without special effort, eight rivets were set in thirty seconds.

By the use of this machine the rivet is headed with a single stroke or thrust, and there is said to be no vibration attending to loosen joints already made. Each rivet is uniformly headed and completely fills the rivet hole. A pressure of approximately 70,000 lb. is exerted on the rivet dies.



Baird pneumatic punch and riveter for automobile frames

COMMENTING on Sir Henry Fowler's presidential address before the Institution of Automobile Engineers, *The Engineer* says "he was in high gear all the way through it and took the hills and a few distinctly sharp corners at the same amazing velocity. If after dinner speeches were taxed on their horse power, we stand aghast at Sir Henry's R. A. C. rating."

Government Research in Road Construction

Part II

A continuation of the article dealing with the extensive investigation being conducted by the U. S. Bureau of Public Roads of factors entering into the strength and durability of different types of roads.

By P. M. Heldt

A SPECIAL investigation was conducted to determine how heavy wheel loads are transmitted to the subgrade. Several years ago a small pressure cell was developed by the Bureau of Public Roads. This was first used on the Camp Humphrey's concrete road to determine the maximum soil pressure under the rear wheels of a Class B army truck, which carry a weight of 8500 lb. each. Recently similar tests were made with a 5-ton, 6-wheel truck, in which the load of the truck is distributed over four instead of two wheels. Sectional and plan views of the diaphragm cell for determining soil pressure are shown in Fig. 12. The cell consists of three cast iron disks A, B, C, and a malleable iron ring D, A and B and D and C being secured together respectively by means of machine screws. The top is covered with a brass diaphragm 0.002 in. thick, pressed over the sides and cemented, to the sides only, with asphaltic cement. The brass top is protected by a covering of cheese cloth cemented to the top and sides with a blown oil asphalt. A brass diaphragm 0.002 in. thick is clamped between A and B and between C and D. The clamped joints, which must withstand air pressure, are treated with a special compound of rubber, vaseline and beeswax. The block E is of steel and is insulated from C, on which it is supported by a layer of Bakelite cement No. 5. From the block E extends a No. 16 copper wire with triple braid weather-proof insulation, through a ⅛-in. galvanized iron pipe. Evidently when Block E is in metallic contact with disk B an electric circuit is closed through the ground. The soil pressure tends to close this circuit, and by admitting compressed air through the iron pipe until the circuit is broken and then measuring the air pressure, the soil pressure per square inch is directly determined.

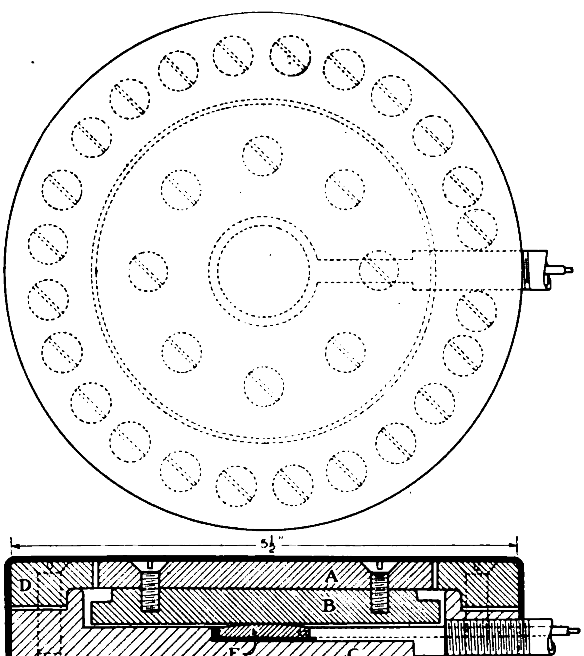


Fig. 12—Diaphragm cell for determining soil pressure

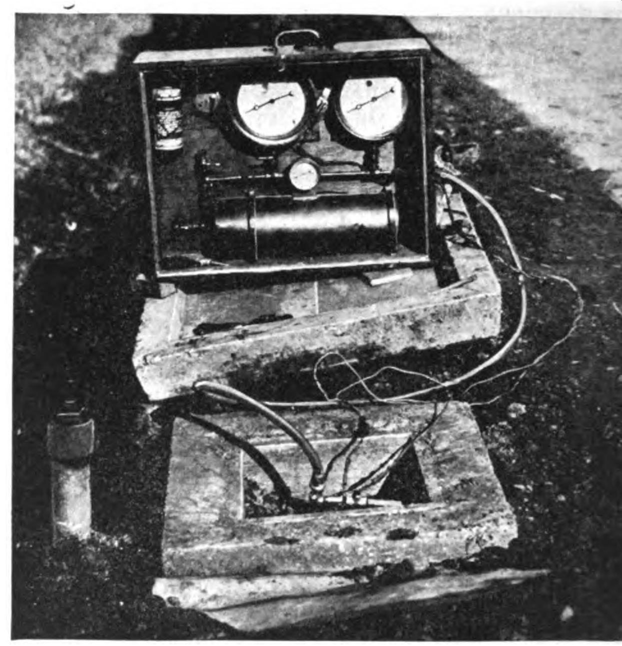


Fig. 13—Apparatus for reading pressure on soil pressure cells

Distribution of Subgrade Pressure

Fig. 13 shows the measuring box and connection for reading the soil pressure cell. In Fig. 14 a cross section of the Camp Humphrey's Road is shown, the location of the four cells used in making this test being indicated. This road had an 8-in. concrete slab of great strength, which naturally has the effect of distributing the concentrated wheel load over an extended area of subgrade. In spite of this fact, the maximum subgrade pressure under the wheel was greater than certain kinds of subgrades will support when water soaked. It is perfectly

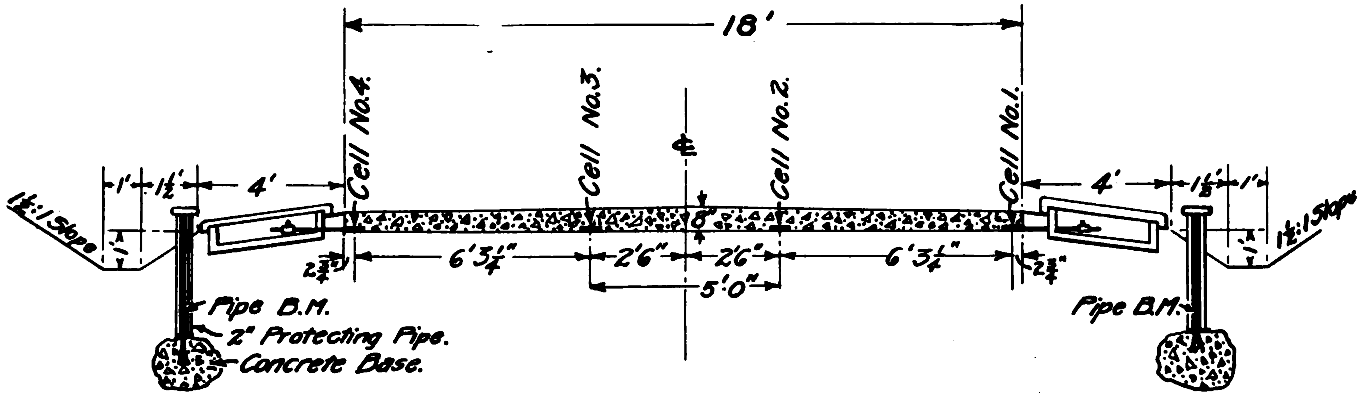


Fig 14—Section of Camp Humphreys road showing location of cells

obvious that roads, if they are to stand up, must be so designed that the maximum subgrade pressure will not exceed the minimum subgrade bearing capacity. Once the subgrade bearing capacity under all conditions is known, it is then a comparatively simple matter to determine the proper type and thickness of road surface which will support the traffic to be expected. A complete series of tests on subgrade bearing pressures with rigid and non-rigid road slabs is now being conducted.

In Fig. 15 are plotted the pressures obtained from the different cells when at different distances in the line of travel from the center point of contact of the wheel on the ground. The upper curves show the distribution of pressure when the truck travels in the center of the road and the lower curves when it travels to one side. These tests were made with a Class B army truck carrying 8500 lb. on one rear wheel and 2500 lb. on one front wheel. Comparative tests were made with the Goodyear six-wheeled truck, in which 9480 lb. were carried on two rear wheels, and it will be noticed that the maximum subgrade pressure is only about one-third as great, although the load carried is greater. This shows the advantage of distributing the load, or in other words, of not carrying too much load on one wheel.

A series of tests to determine the causes of subgrade failure is now being carried through. In certain parts of the country where there is heavy traffic, road failures have been directly traced to poor subgrades. It has been found that similar road surfaces under similar traffic conditions will stand up in some parts of the country but not in others, and the reason must be looked for in differences of subgrade. The exact qualities of soil which make for good subgrades are not definitely known at the present, and research work on the subject has been started. Almost 100 samples of subgrade soil have been selected from different parts of the country, for tests at the laboratories of the Bureau of Public Highways. Some of these samples are from parts where failure took place, and others from parts of the same roads that withstood the traffic.

Investigation of Subgrade Soils

Soil samples of a volume of 1 cu. ft. were sent to the laboratory and tests were made to determine the percentages of clay and silt, the colloidal properties, mechanical analysis, slaking value, cementing value, bearing value, specific gravity, capillary properties, moisture equivalent and miscellaneous properties such as volume changes with moisture, volume changes with freezing, and compressive strength. At the same time that the samples were taken, notes were made on the drainage system and the topography of the vicinity, and borings were made to a depth of 5 ft. to investigate the subsoil for the presence of seepage layers on impervious strata. These borings often throw light on the reason for excessive water content. Notes were also taken on construction features of the road and on the character of the traffic over it.

Results so far obtained have made it quite clear why roads stand up on some kinds of soil and fail on others. It has become quite apparent that the bearing value test is the most important of all those enumerated above. Roads must support their traffic under a wide variety of conditions. Sometimes the subsoil is completely saturated with moisture, while at other times it is perfectly dry. Frost occasionally will expand the subsoil when it is thoroughly saturated, and again the subsoil may be thoroughly compacted. In the test it is attempted to simulate all road conditions. The method of making this test is as follows:

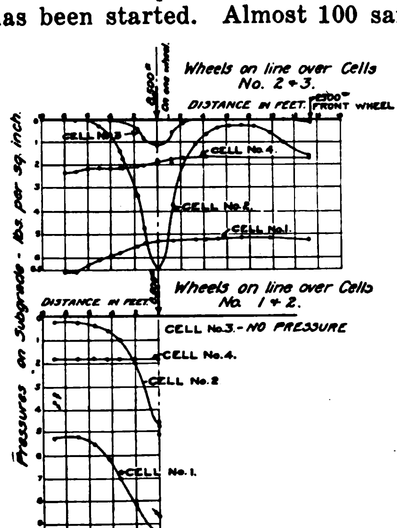


Fig. 15—Distribution of subgrade pressure under wheels of Class B Army truck

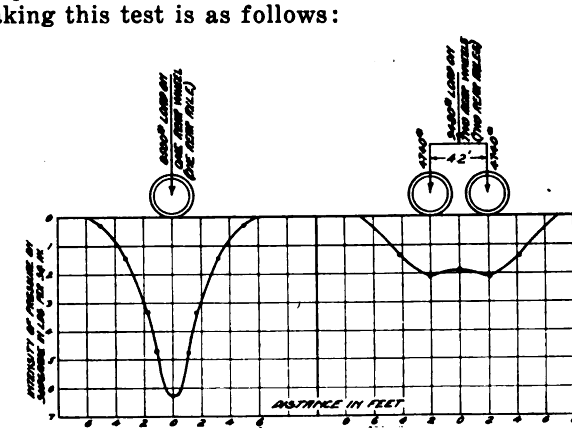


Fig. 16—Distribution of pressure in subgrade under 8-in. concrete slab with two and four rear truck wheels respectively

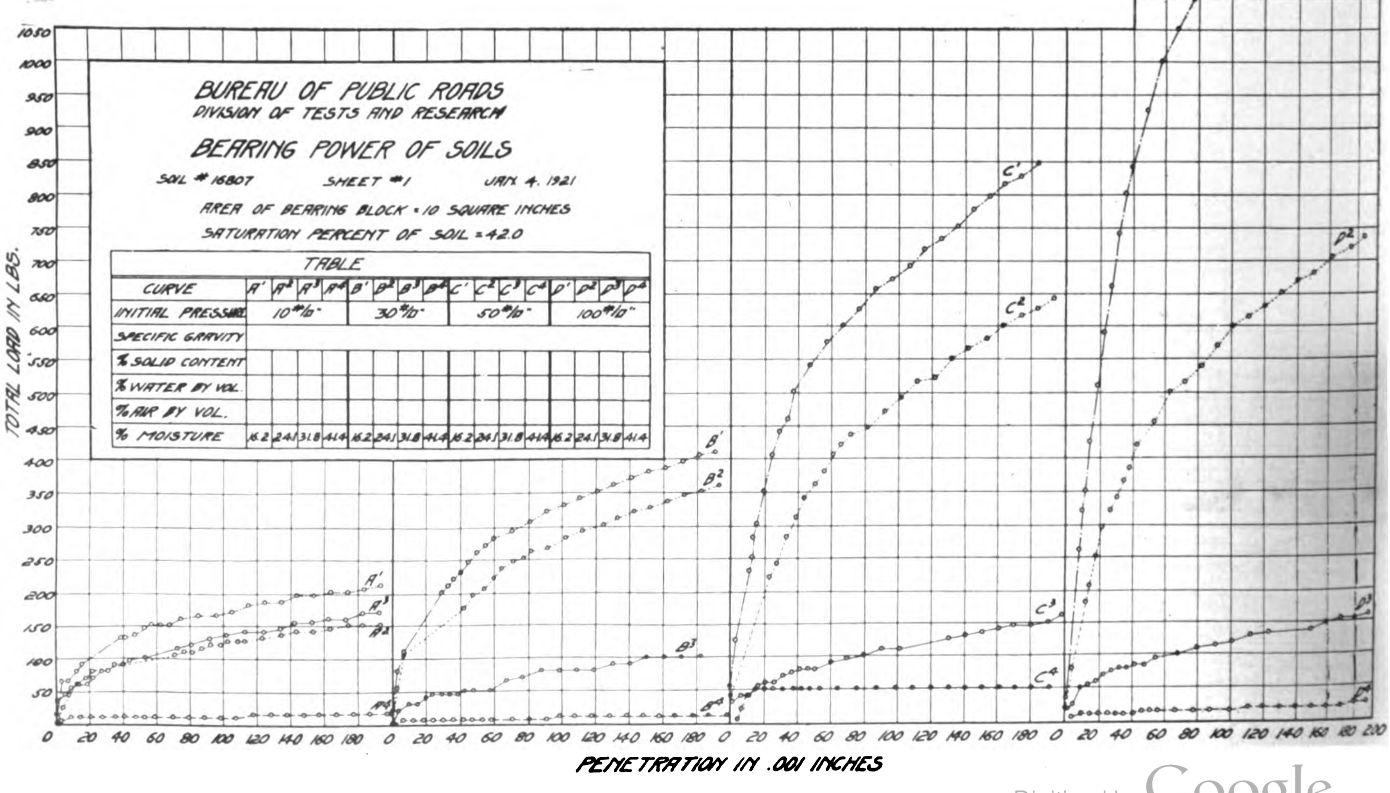
The soil is broken up in a mortar with a rubber-covered pestle and then is passed through a ¼-in. mesh screen. The material passing through this screen is pulverized by rubber rollers, without grinding it, however. The pulverized soil and the coarser material sifted out are then combined again and thoroughly mixed. Bearing value tests are made on the soil with four degrees of moisture content. One set of tests are made on soil containing only just enough moisture to enable it to be thoroughly mixed and placed in a small mold; another set of tests are made on the saturated soil and two other sets on soil with intermediate moisture contents. The saturation point is that percentage of moisture which the soil will take up by capillarity when loosely compacted. The bearing capacity of a subgrade also depends on the initial pressure. In the tests, initial pressures of 10, 30, 50 and 100 lb. per sq. inch are used. Each sample is therefore tested with four different moisture contents and under four different initial pressures.

After the sample is prepared as described, it is mixed with a small amount of water, kneaded with the hands protected with rubber gloves, and placed in a vertical cast iron cylinder of 6 in. diameter and 6 in. height. A plunger is then placed in the cylinder on top of the soil and the soil is compressed in a testing machine under a definite pressure for a period of 5 min. Then the plunger is removed and a circular bearing block is placed on top of the soil and pressure applied at the lowest speed of the testing machine. Readings are taken simultaneously of the pressure applied and of the penetration of the plunger, the latter being read off on an Ames dial gage, which reads to 1/1000 of an in. Between tests at different initial compressions the soil is removed from the cylinder and replaced, and when the tests at all four compressions have been completed, water is added and the tests with a new increased water content are begun. This artificial preparation of the soil is very similar in its effects to natural changes in soil conditions. Fig. 17 shows the results of the test on one type of soil. The enormous difference between the bearing value of a saturated and practically dry soil, when under 100 lb. per sq. in. initial pressure, is brought out very strikingly. In the saturated condition this soil has a bearing value of only about 2 lb. per sq. in, whereas in the dry condition the bearing value exceeds 150 lb. per sq. in. The soil to which these tests refer is an adobe soil, which absorbs 42 per cent of moisture and shows about the lowest bearing value in the saturated condition of any soil tested. The road from which this soil was taken failed badly.

A sand clay mixture made up of 75 per cent of coarse sand and 25 per cent of clay absorbed only 18 per cent of water by weight of the dry sample and showed considerably higher bearing value. Soils of this character, having a large percentage of coarse material, show higher bearing values when highly compacted than when loosely compacted even when the soil is saturated.

In the tests of the Class B truck on the Camp Humphrey's Road above referred to, it was found that the soil pressure under the 8-in. concrete road slab figured out to 6.5 lb. per sq. in. By comparing this value with the 2 lb. per sq. in. minimum bearing value of the adobe soil in the saturated condition, it will be seen that difficulties must be encountered in building roads for heavy motor traffic in some sections of the country. But even adobe soil will support heavy pressure when reasonably dry, which emphasizes the importance of proper drainage. This is further confirmed by the fact that city pavements of small depth stand up so well under the heaviest kind of traffic, the only explanation being that the subsoil here is well drained and never becomes saturated. Fine grained and very plastic soils when saturated are apt to give considerable trouble, while coarse

Fig. 17—Bearing values of adobe soil with different moisture contents and different initial pressures



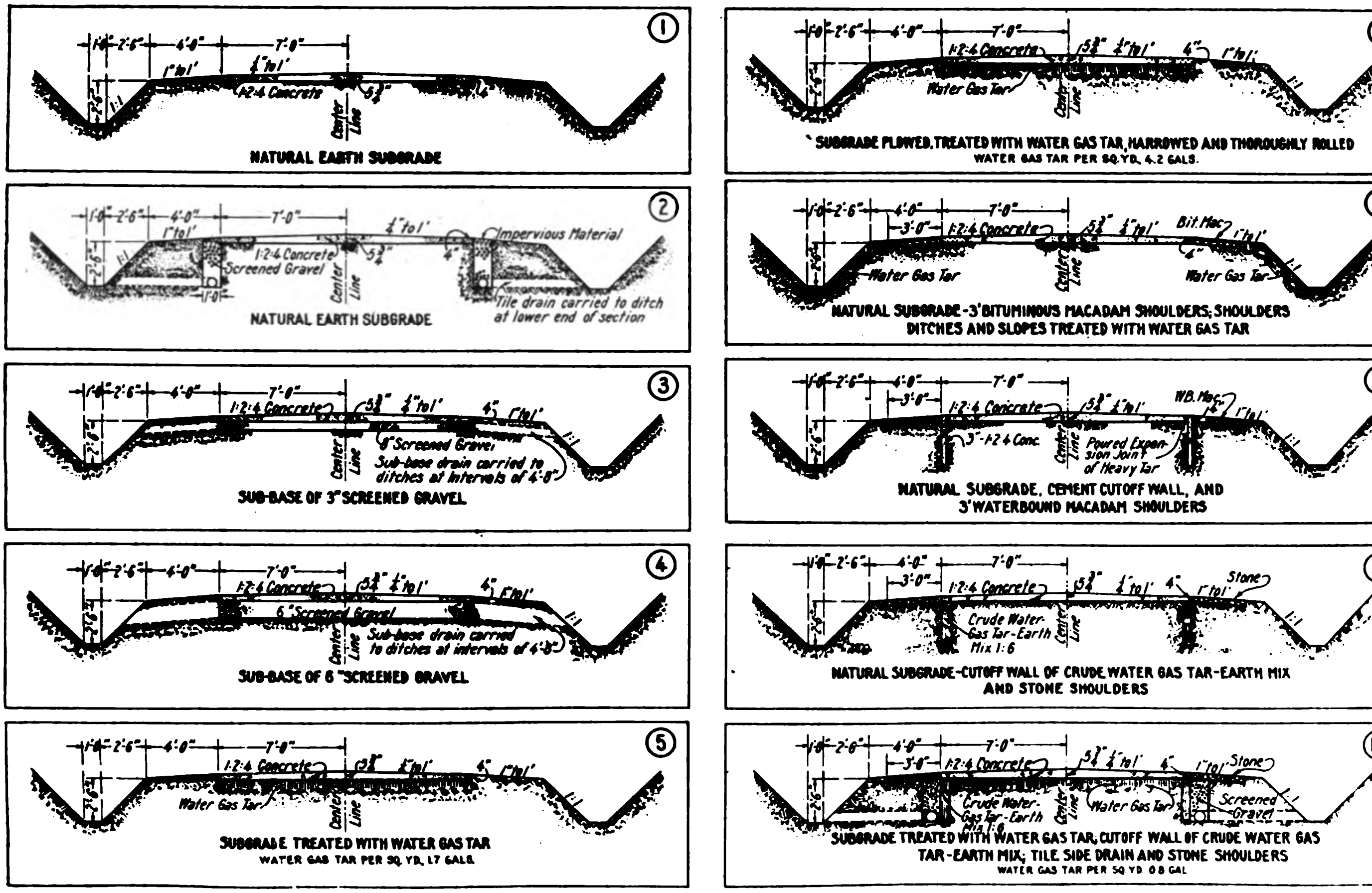


Fig. 18—Road sections showing different drainage schemes

grained and more porous soils are free from such trouble.

An attempt will be made by the Bureau of Public Roads to grade all soils with respect to their bearing value. Subgrade failures have occurred in many parts of the country where drainage was employed, but in view of the fact that in the cities very heavy traffic is successfully supported on light section pavements, the conclusion is arrived at that the drainage of our roads in many cases is not very effective during the wet season.

The next step in the Bureau of Public Roads investigation therefore was a series of tests on road drainage which was carried out at Arlington Farms, Va. The ideas underlying these tests are illustrated in Fig. 18.

Subgrade Drainage

The idea occurred to the officials in charge of the tests to try whether it was not possible to exclude water from the subgrade by the use of water proofing materials. This, of course, involves principles diametrically opposite to those on which the present drainage system is based, which only serves to carry away the water after it has saturated the subgrade and rendered it extremely soft. At 1 (Fig. 18) is shown an ordinary concrete pavement on natural earth subgrade with drainage ditches 2½ ft. deep on both sides. At 2 this construction is varied by providing at both edges of the concrete pavement screened gravel walls with a covering of impervious material, the walls forming a sort of blind ditches of the same depth as the drainage ditches with which they communicate through tiles. At 3 the concrete slab is laid on a 3 in. screened gravel subbase from which tiles extend to the ditches every 4 ft. 8 in. At 4 the thickness of the subbase is increased to 6 in. At 5 the subgrade of natural earth is treated with water gas tar, 1.7 gal. to the square yard. At 6 more of this water gas tar is used, 4.2 gal. to the sq. yd. The subgrade is plowed, treated with the water gas tar, harrowed and thoroughly rolled. At 7 the subgrade is of natural earth but on each side of the concrete there is a 3 ft. bituminous macadam shoulder, and shoulders, ditches and slopes are treated with water gas tar. At 8 there

Fig. 19—General view of construction for road drainage tests

are 3 ft. water bound macadam shoulders and cement cut-off walls 2½ ft. deep. At 9 there are crude water gas tar cut-off walls, earth mix and stone shoulders, and at 10 this construction is combined with screened gravel drains outside the cut-off walls with tile connection to the ditches. The results of these drainage experiments were to be observed this spring, and if they proved successful it was the intention to repeat them on a larger scale with the aid of the state highway departments.

According to the latest information available, the section with the gravel sublayer promised the most success. It is concluded that such a layer not only serves to keep the subgrade dry by aeration but also helps to distribute the wheel pressure over the soft subsoil. Fig. 19 is a general view of the subgrade drainage experiments.

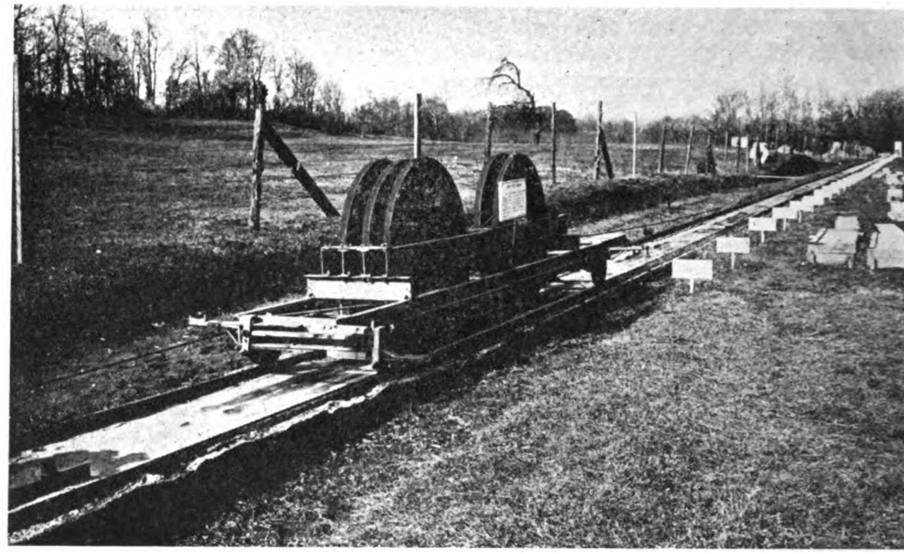


Fig. 20—General view of construction for accelerated wear tests

To quickly determine the wear-resisting qualities of different kinds of road pavement, an experimental road section was built, 400 ft. long and 2 ft. wide, made up of sections of different types of pavement. Concrete side walls were constructed on both sides of the experimental sections the whole length. The pavements were laid on a sub-foundation of compacted cinders 18 in. deep and the subgrade below this was tile-drained throughout its whole length. All wearing sections except those of concrete were laid on a 2-in. concrete base of 1:3:6 mixture. The concrete wearing sections were made 6 in. deep. The wearing machine (Fig. 20) consists of 5 cast iron wheels weighing 1000 lb. each and having a face width of 2 in. Three of these wheels are arranged side by side, spaced 3 in. apart, and the other two are to

(*Continued on page* 921)

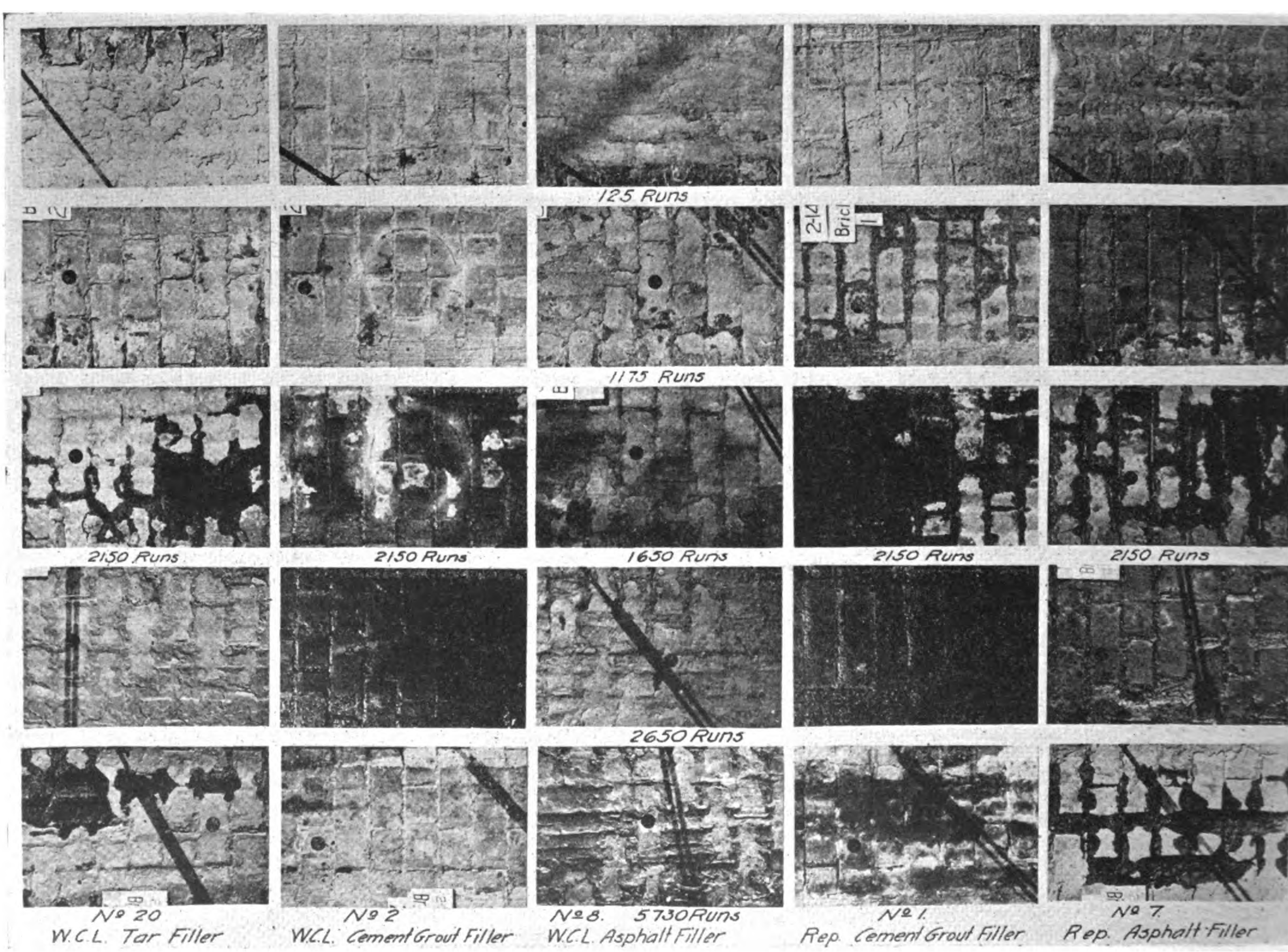


Fig. 21—Photographs of sections in different stages of wear

The FORUM

Hub, Wheel and Tire Standardization

Editor AUTOMOTIVE INDUSTRIES:

(1) The very interesting letter of John Younger in the March 10 issue of AUTOMOTIVE INDUSTRIES brings out many points in connection with hub standardization and standardization generally and shows the weakness and fallacy of the S. A. E. in entering into the design in detail rather than laying out the broad basic points to be covered in axle standardization.

(2) In the third paragraph he seems to have struck the key to the whole thing where he says: "There is a lurking suspicion in the back of my mind that such a standardization may eventually lead to loss of individuality." If the detail of design is furnished, the axle makers and designers, as intimated, become in fact mere rubber stamps, and all produce unified axles, all having the same merits or demerits, and all presumably producing at the same price, or under an association of prices, absolutely against the laws of the country, they become in effect *one* axle manufacturing corporation.

(3) All progress and improvements cease, and all individual incentive is lost. However advantageous a unified design of construction may be temporarily, as in the case of war, to bring this about as a permanency, is quite another matter, especially in an industry as large and varied as the automobile and truck business, and would in effect result in a complete centralization and monopolization.

(4) It is not the function of the S. A. E. to go into the detail design or the manufacturing business, and especially to present a design of proposed axle standardization for one type of bearing.

(5) The merits and advantages of the ball bearing are well recognized the world over, and especially it must not be overlooked that the ball bearing is the recognized standard, and practically the only completely standardized bearing, in every civilized country of the world outside the U. S. A.

(6) Therefore the car or truck maker seeking a worldwide market must determine for himself the advantages or desirability of adopting one or the other types of bearings. The ball bearings are universally standardized as regards interchangeability of size the world over, and it would therefore seem to be up to the roller bearing makers and all makers of other types of bearings to provide for an interchangeability of their bearings.

(7) In my view the S. A. E. should never recommend any individual maker's details of construction and dimensions. Instead it should collect and distribute data in regard to various recognized constructions to enable the car and truck maker and assemblers to have in a convenient form complete information for reference. The suggestion of Mr. Younger to gather the engineering practices as Professor Unwin did in his text book is an excellent one. The S.A.E. should co-operate with the makers in bringing this about and bring all this information into their data sheets. Undoubtedly the makers would appreciate this and would willingly co-operate and even reimburse the S. A. E. for the actual printing and distribution of such data sheets as a part of their publicity. This has been done in the past by the makers, but quite independently of the S. A. E. in regard to the arrangement. Of course the expense of any general data sheets should be continued and borne by the Society.

(8) Mr. Younger's contention is quite correct that any step tending toward a leveling of the design is to be deplored and lack of individuality is the result, as instanced in the experience of his English friend that to him all American cars look alike. This criticism is true, for the methods of assembling American cars all tend this way, as in reality many of the elements are alike, and, as Mr. Younger puts it, all the front axles are alike, and when in addition all radiators and front ends are also made alike (for apparently many so-called designers are only copyists), the reason for the criticism becomes apparent.

(9) The final result, therefore, of such a standardization would be the concentration and the manufacture of all passenger cars in one large corporation, for at the most it is only possible to make four different sizes of passenger cars to cover the entire field, and this might easily be undertaken by one such corporation, or the field extended to cover all trucks as well, as this would only take ten sizes, and by this means we get *absolute standardization* and *absolute monopolization.*

(10) Unless we have arrived at perfection to standardize all details at the present time would mean to standardize *all defects.* Would you suggest standardizing the front axle construction embodying the unmechanical and unscientific and heavy offset steering knuckle, which is perhaps the cause of more serious accidents than any one element of automobile or truck? The logical steering knuckle is the central or castor steering knuckle, having the steering pin in the center of the plane of rotation of the wheel, and this knuckle properly designed can be made much lighter and stronger and cheaper than the present "offset" steering knuckles and have only *half the number of parts.* It reduces to a minimum all strains, is much easier steering, especially in the larger sizes, and having a true "castor" effect, all machines *tend to run straight without steering,* and only need to be pulled out of the straight line and when left alone automatically revert again to the same position. This results in a simpler and cheaper steering post mechanism and absolute irreversibility becomes of secondary importance, as the steering wheel is not knocked out of the hand by every slight road obstruction. By this means also the front wheels can be made vertical instead of inclined, bringing the wear central upon the tire, the same as for the rear wheels. This inclination of the front wheel is the cause of many accidents resulting in crushed wheels in turning corners and oftentimes causing the complete machine to "turn turtle."

(11) Similarly to standardize the rear axle construction as at present made would be to standardize similar *defects.* As regards the three present types of rear axles, full floating, three-quarter floating and semi-floating, it would be a needless complication to attempt to standardize all three, as there is so little gained or saved in the manufacture of one over the other, and the best only should be recommended and standardized. It has never yet been demonstrated that an overhanging bearing is superior to a cen-

trally supported bearing, and until this has been done or demonstrated there does not seem to be much doubt as to where the superiority is. In fact, it seems to be the same condition as is met with in the front axle and referred to above as to the relative merits of the central steering knuckle or the offset steering knuckle, or in this case the overhung wheel and the centrally supported wheel.

(12) Therefore, as stated above, if it is desired to completely kill all progress, standardize present defects, or if the automobile has reached perfection, *complete standardization* cannot be brought about too soon. At the present time one maker of a so-called standardized car produces half of all the passenger cars made in the U. S. A., and a second maker has only to standardize two or three larger sizes to make the rest. That is assuming that No. 1 and Nos. 2, 3 and 4 standardized cars stay standardized and then all axle makers and special parts makers go out of business.

(13) Now the fact is that there are many parts of the car that can be legitimately standardized, and if the S. A. E. would devote themselves to this field they will be fully occupied and will be of great help to the industry. This is said not as a criticism, for having been one of the original subscribers or founders of the S. A. E. 'way back in 1904, I know something of the history of the Society and appreciate what has been done, and also what there is to do in the future if the S. A. E. is to continue to maintain its position.

(14) The first thing to be done before any axle standardization can be considered is the *standardization of pneumatic tires*, as everything depends upon the size of tire. There has been talk for two or more years of basing these tire diameters (wheel or rolling diameters) on a 24-in. tire seat diameter so as to get interchangeability of rim and also to reduce the number of sizes of tires. If this is what is wanted why not adopt it and then all designers know what the fundamental condition is to be and can proceed. A ballot could be sent out to every member and the result known in thirty days, and the Council of the S. A. E. could, if so decided, make this effective at once. This would in no way affect the present making of other sizes of tires, and it would be years before these old sizes would become completely obsolete.

(15) **Pneumatic Tire Specifications.**—A general form of specification to cover pneumatic tires is necessary covering sizes, diameters and general dimensions, and it is suggested that these be on the following lines:

The sizes of all *round pneumatic tires* shall be based upon a 24-in. diameter of rim seat, and the diameter of the tire proper shall be based on its outer diameter at its center cross section, and these standardized sizes shall be 3 in., 3½ in., 4 in., 4½ in., 5 in., 6 in., 7 in., 8 in., 9 in., 10 in., 12 in. and 14 in. diameter, and no other sizes shall be recommended or recognized, and all tire details shall be expressed in functions or percentages of the tire diameter and shall be as follows:

Width of tire rim seat	.75	of tire diameter
Width flat tread of tire	.75	of tire diameter
Center of tire	.50	of tire diameter from rim seat
Allowable deflection assumed	.10	of tire diameter
Added depth of tread assumed	.10	of tire diameter
Thickness of tire wall assumed	.10	of tire diameter
Thickness of tube wall assumed	.025	of tire diameter
Producing a cross-section of suspending air column of	.75	of tire diameter
Radius of curve at base of rim seat	.075	of tire diameter or nearest 1/16 in.
Radius of curve at edge of flat tread	.075	of tire diameter or nearest 1/16 in.
Molded outside diameter of tire	2.20	of tire diameter plus 24 in.

In order to make the point of ground contact of the tire "square" with the accepted nomenclature, it is necessary for the depth of added tread and the amount of deflection to be the same. In order to determine the width of the rim seat, which should be the same as the suspending air column, it is similarly necessary to assume a thickness of tire and tube wall.

(16) The making of any special sizes of tires, as say a special 5-in. tire, should be discouraged, and also the adoption of "over size" tires on a smaller rim is similarly discouraged. With a fixed tire seat diameter it should always be possible to interchange two sizes of regular tires on any given size of demountable rim properly standardized or to interchange two sizes of detachable wheels.

(17) **Solid Tires.**—To complete the axle standardization requires also the standardization of solid tires and raises at once the question whether these wheel sizes should not be so standardized as regards diameter to have as nearly as possible the same wheel diameter as the pneumatic, size for size, and it is suggested that these be as follows:

32 x 3	Based on 26-in. rim seat	36 x 7	Based on 30-in. rim seat
32 x 3½	Based on 26-in. rim seat	36 x 8	Based on 30-in. rim seat
32 x 4	Based on 26-in. rim seat	40 x 9	Based on 34-in. rim seat
32 x 4½	Based on 26-in. rim seat	40 x 10	Based on 34-in. rim seat
36 x 5	Based on 30-in. rim seat	40 x 12	Based on 34-in. rim seat
36 x 6	Based on 30-in. rim seat	40 x 14	Based on 34-in. rim seat

(18) As regards the carrying capacities of all solid tires, these are very much overloaded and should be *re-rated*, and they will be legislated off the roads unless some steps are taken in this matter. Already several states have taken steps to limit their capacity, and the S. A. E. rated loads of 1000 lb. per inch of width of tread are absurd. If size for size they were rated the same as pneumatic tires, the loads would be more reasonable, and even this would mean from 400 lb. for the smaller tires to 800 lb. for the larger tires *per inch of width of actual tread*. No state can afford to build roads, to stand such heavy concentrated loads, and no matter how heavily the trucks are taxed, these taxes will be quite inadequate for the damage and to maintain the upkeep of the roads. Unless it is desired to kill the solid tire truck completely this re-rating cannot be done too soon. Perhaps, though, it would not be such a bad idea to advocate all pneumatic tire trucks, before the people demand a heavy truck be taken off the roads on account of their damage, and also as interfering with and crowding off passenger car traffic from the roads and insisting that this heavy traffic revert to the railroads.

(19) In this connection the carrying capacity of dual tires should also be considered, and the fact that two 5-in. tires do not have the capacity of a single 10-in. tire, as the road contact of the two 5-in. tires is 6 in., and the one 10-in. tire 8 in., giving the latter 33 per cent more carrying surface. Further, the width of the two tire base bands is 11¾ in. (assuming they are placed side by side and close up), while the single 10-in. base is only 10⅞ in. Further, on crowned roads practically all the load is carried on the inner tires.

(20) When the standardization of the tire diameter, size of tires and load carrying capacity of each has been determined, the axle designer is then in a position to produce his standardized axle, embodying in it the best or the cheapest design as he may see fit.

(21) **Rims for Pneumatic Tires.**—In order to perfect the standardization it is necessary also that the rims be further standardized, as those now adopted are based haphazardly and are really "unstandardized standards," as is evidenced by an examination of the data sheets of the S. A. E. As these rims always are, at least always should be, only used with one given size of tire, the general dimensions should be based upon the functions or percentage of the tire diameter itself, at least everything except the tire seat diameter, which is a specified constant of, say, 24 in.

(22) The next important or leading dimension is the width of the tire rim seat, and this must be such as to give the tire the necessary lateral stability and should not

be less than the cross section of the suspending air column, and which could be easily determined if the thickness of the tire wall and of the tube wall were also a specified percentage of the tire diameter. An examination of the S. A. E. data sheets show that these *widths of tire seats* vary considerably in some of the smaller sizes, but in the newer and larger sizes are very uniformly taken at 0.75 of the tire diameter, and if this is right for these sizes should also be right for all the sizes. The load carrying capacity and the ease, or rather hardness of riding of the smaller sizes of tires, is undoubtedly greatly due to this narrow width of tire seat, and to bring these tires into conformity with the other sizes they should be brought to the same basis for the width of the tire rim seat.

(23) The sizes of rims and the width of rim seats as given by the S. A. E. data and the proposed standardized widths are as follows:

Size of Rim	Width of Rim, Inches	Percentage Tire Diam.	Proposed Width of Rim, Inches	Proposed % Tire Diameter
3½-in. Clincher	2.05	58.5	2.625	75
3½-in. S. S.	2.312	66.0	2.625	75
4-in. S. S.	2.688	66.6	3.000	75
4½-in. S. S.	3.12	70.0	3.375	75
5-in. S. S.	3.75	75.0	3.75	75
6-in. S. S.	4.33	72.0	4.5	75
7-in. S. S.	5.00	75.0	5.0	75
8-in. S. S.	6.00	75.0	6.0	75
9-in. S. S.	6.00	66.0	6.75	75
10-in. S. S.	7.33	73.3	7.5	75
12-in. S. S.	9.00	75.0	9.0	75

(24) **Side Flanges.**—The side flanges also are unnecessarily high, as with the present form of solid or inextensible bead they should be made as low as possible, so that the partially or completely deflated tire should ride as softly as possible upon the side flange. Further, this flange should drop away as fast as possible from the side of the tire. The only function of the side flange should be to hold the tire laterally, and as at present made the straight part of this flange is only ⅛ in. and upward, but it does not drop away quickly enough. Therefore it is suggested that the standardized rim be constructed as follows:

Width of tire rim seat................	.75	Tire diameter
Width of rim overall................	1.00	Tire diameter
Side flange overhang each............	.125	Tire diameter
Height of side flange total............	.125	Tire diameter
Height of side flange straight.........	.05	Tire diameter
Height of side flange curved..........	.075	Tire diameter
Radius of side flange curve...........	.075	Tire diameter
Inside radius at base of side flange....	.02	Tire diameter or nearest 1/16 in.
Thickness of rim	.04	Tire diameter or nearest selected gage

The saving in the weight in standardization of the rims as suggested would amount to 10 or 12 per cent and would be quite an item.

(25) The standardization of the rim, whether all the above suggestions are carried into effect or not, is absolutely essential, before fixing the wheel and demountable rim dimensions and the detachable wheel dimensions, as all of these are embodied in the proposed axle standardization.

(26) When demountable rims are used, the size and the number of the bolt should be specified for each size of tire, and the location of the center of these bolts from the center of the wheel should also be specified and should be the same for all sizes of tires using one-piece rims transversely cut. And it is suggested that this bolt center be stated as 23¼ in. for the 3 in., 3½ in., 4 in., 4½ in. and 5 in. rims, assuming eventually a 5-in. single piece rim may be made. For demountable rims using 2 or 3 piece rims it is suggested that this bolt center be 22¾ in. up to and including the 5-in. rim. Above this size the bolt diameters or centers for the 6-in. and 7-in. rims shall be — in.; for the 8-in. and 9-in. rims — in.; for the 10-in. and 12-in. rims — in. All demountable rims should be so designed that at least two sizes of rim can be used on each wheel, and it is suggested that this interchangeability shall apply as regards the 3½-in. and 4-in. rims, the 4½-in. and 5-in. rims, the 6-in. and 7-in. rims, the 8-in. and 9-in. rims, and the 10-in. and 12-in. rims.

(27) **Number and Size of Clamping Bolts.**—The number and size of clamping bolts used on demountable rims shall be as follows:

3-in. tires	5 bolts	7/16-in. diameter
3½-in. tires	6 bolts	7/16-in. diameter
4-in. tires	6 bolts	7/16-in. diameter
4½-in. tires	8 bolts	7/16-in. diameter
5-in. tires	8 bolts	7/16-in. diameter
6-in. tires	8 bolts	7/16-in. diameter
7-in. tires	8 bolts	7/16-in. diameter
8-in. tires	10 bolts	½-in. diameter
9-in. tires	10 bolts	½-in. diameter
10-in. tires	12 bolts	½-in. diameter
12-in. tires	12 bolts	½-in. diameter

(28) **Felloes.**—The width of all felloes should also be based on the tire diameter and should be 0.50 of tire diameter. The depth of the felloe (including the steel felloe band when used) should be definitely stated for each size.

(29) **Felloe Bands.**—Metal felloe bands when used in connection with demountable rims should also be specified as regards thickness and should be the same as the rim thickness.

(30) **Width of Wheel Tread.**—The width of tread for all sizes must be standardized and stated for both front and rear axles, and especially in the larger sizes involving the use of different size tires on the rear wheels from those used on the front wheels. It is all right to assume a basis of 56-in. tread for the smaller size of tires, but as a matter of fact this should be increased to 60-in. tread for the larger size of passenger cars in order to carry three passengers comfortably on the back seat, the width of the body would be such that it will extend to or beyond the center of the 56-in. tread wheel, making a very bad and clumsy looking body. In fact all rear mud guards should be attached to the chassis and not the body, the same as the front mud guards are, so that the touring body can be either removed or changed to a closed body, or vice versa, without having to disturb the mud guard.

(31) **Front Axles.**—The standardization of the front axle requires the location of the *center of the spring pad* as follows:

(a) Distance from the center of axle to the center of spring pad.

(b) Vertical distance from the center of the wheel to the top of the axle spring seat pad.

(c) Distance to the bottom of the axle seat pad when spring is placed under the axle. Axle to be designed for taking spring either above or below.

(d) Width of spring recommended for each size of axle (each size of tire) and also the size and diameter of the spring clips and bolts and the distances to the center of the bolt holes.

(e) Width of tread at center of hub and angle of wheel, if any.

(32) **Rear Axles.**—Same dimensions as above required and also:

(f) Type of axle either full floating, three-quarter floating or semi-floating.

(g) Brake drum — in. in diameter and fitted with two internal expanding brakes — in. wide as the minimum.

(h) The size and dimensions of the saddle for the differential must also be fixed for each size and probably many other dimensions may be essential.

(33) **Complete Standardized Axle and Wheel Units.**—In order to effectively standardize the axle it should also include the standardization by the axle maker of both the demountable rim wheel and the detachable type of wheel having the wire wheel form of hub detachability and an improved hub locking device. Even with the wood spoke type of wheel, the entire wheel construction bar only the wood

spider itself (which is a very small percentage of the entire wheel and can be obtained from any wood wheel maker) is entirely a metal and mechanical job as regards manufacture and assembling and should be provided and furnished by the axle maker. In connection with the detachable wheel the same applies whether the detachable wheel is wood spoke, metal spoke, wire, double disc suspension, single disc compression or any other type of wheel. Both the demountable rim wheel and the detachable wheel must be standardized and so designed as to interchange upon the same axles, and no one can do this effectively except the axle maker and the designer. In any case the axle maker must supply all the hubs, hub fixtures, rims, etc., even if he should sub-contract for the wood spider or the wire spokes, to be provided for his own hub and fixtures. In the case of the all metal wheel, its production *naturally* goes with the axle production, as the axle makers have the presses and all other facilities for making it. The result of attempting to produce metal wheels by an outsider or interloper is well illustrated by the condition of the present wire wheel makers (8 or 10 in number), all having *different standards* involving ten different sets of patterns and a tenfold expense for jigs, templates, tooling up, etc., which has now completely swamped them, and with the result that several of them are now in the hands of receivers. There is no logical reason why a car maker should buy his axles in *one place* and his wheels in *six places*. The axle maker who is in a position to supply his client with the *standardized axles* and *standardized wheels* of any type indifferently would pretty nearly control his trade and get the pick of the business, and by no other method can a practical standardization be brought about. Another important point is that the wheel repairs and replacements would be handled through the service stations of the car makers, which would be quite to their advantage.

(34) **Complete Chassis Unit.**—As several of the axle makers are also frame makers and spring makers, it is only one more step to provide the frame and springs and have a *complete chassis unit.*

(35) It will be seen, therefore, that in the hub and axle standardization there are enough basic points to be covered to give the S. A. E. sufficient to do without encroaching on the field of the designer.

W. J. P. MOORE.

Editor, AUTOMOTIVE INDUSTRIES:

I have your letter of April 20, asking whether I care to comment on Mr. Younger's letter on Hub Standardization, published in your March 10 issue, and on Mr. Moore's letter on the same subject which you propose to publish on April 28.

I have been quoted on this subject a number of times in your valued columns, and think my viewpoint has been pretty well set forth. I have purposely refrained from commenting on Mr. Younger's letter because the manner in which he has mistaken the issue is quite surprising in view of the fact that he has been conversant with the program of the Hub Standardization work since last June, and in view of his written and verbal approval of the work up to the time it was ready for submission to the S. A. E. Standards Committee.

It seems to me that the question is not one of "engineering individuality," but one of "economics." When an engineer or group of engineers produce a design that embodies the whole experience of an industry, is it not time to stop making inconsequential modifications and give the trade and the public the benefit of cost reduction and better service? Why not let the engineer turn his attention to other problems (which he will find no trouble finding), and let the manufacturing department have at least a Chinaman's chance at a good long production run? That the matter is one of economics is well borne out by the letter written to me on the subject by Mr. George E. Roberts, vice-president of the National City Bank. This letter was quoted, I think, in the March 17 issue of AUTOMOTIVE INDUSTRIES.

The Scotch have a gloomy way of regarding the efficacy of remedies that are not mixed in their own pharmacy, but I believe that a working acquaintance with the work that has been accomplished will relieve skeptics of their fears. Hub and axle design will not by any means become so petrified as one might think—in fact, the proposed recommended practice only defines the connecting assembly dimensions between definite sets of ball or roller bearings and the hubs and spindles which are to take them; it also gives similar dimensions between the hubs and the wheels that are to be mounted on these hubs. It has been done by the S. A. E. on so many other features that it is not only precedent but actually long-established custom. Moreover, nobody is obliged to follow the recommended practice if, in the course of time, he can design something economically better.

Mr. Moore seems to have used Mr. Younger's letter as an excuse for presenting another matter entirely. He devotes twice as much space to advocating standardization for tires and rims that he devotes to condemning the same thing for hubs and wheels. Before discussing his tire and rim suggestions it will be in order to hear what the members of the Tire and Rim Division of the Standards Committee have to say on the subject. As to the first twelve paragraphs of his letter: it seems to me that almost every one contains a statement that is in error, either due to his lack of information on what has been done by those working on the subject of recommended practice for hubs, or due to the inclusion of a half truth, or due to a too general and inclusive scope in expressing his views.

It should be borne in mind that the Truck Division of the Standards Committee proposes to submit through the Standards Committee to the main body of the S. A. E. the following (to apply to front hubs for motor trucks):

1. A series of inch-dimension roller bearings corresponding to the best practice of 95 per cent of the truck production to-day.
2. A series of ball bearings which was advocated by all the prominent manufacturers of ball bearings, and which has the approval of the only large truck manufacturer using ball bearings.
3. A series of millimeter-dimension roller bearings that will interchange in the same hubs as the ball bearings.
4. Definite spacing between the inner and outer bearings.
5. Definite machine dimensions on the spindles and in the hubs for the fits of the bearings.
6. Definite location and size of hub flanges.
7. Definite location and size of hub bolts.
8. Definite outside diameter of hub to fit wheel bore.
9. Definite thickness and number of wood wheel spokes.
10. Definite relation between center line of tire, spoke and shoulder for the inner bearing.

"If this be treason (or suppression of initiative) make the most of it."

The program and its details have been approved by

1. All prominent makers of roller bearings.
2. All prominent makers of ball bearings.
3. All prominent makers of wood wheels.
4. All prominent makers of steel wheels.
5. Clark, Russell, Sheldon, Timken, Torbensen and Vulcan axle companies.

6. G. M. C., Mack, Packard, Pierce, White and a large number of builders of assembled trucks.

7. The Truck Division of the S. A. E. Standards Committee.

I have lived with this proposition for thirteen solid months and have yet to hear one valid argument against it. The advantages of the work are so manifest that the tendency on the part of those favoring it is to assume that there will be little or no opposition—hence the small vote at the January meeting of the S. A. E. Standards Committee. If all those who are in favor of it turn out and vote for it at the West Baden meeting on May 24 the majority will be quite impressive.

C. T. MYERS.

Bignan Cars Entered in Corsican Race

THE special four-passenger Bignan sport cars to be driven by Albert Guyot and M. Nougué in the 3-liter race around the mountainous island of Corsica have shown a road speed of 90 miles an hour. This race is limited to 183 cu. in. sporting type cars carrying windshield, fenders, four seats of stipulated minimum dimensions and having a certain minimum distance between the steering wheel and the tangent of the rear wheels. Under such rules the competitors naturally employed a purely racing type engine and as it was not possible to diminish body width, total height was kept as low as possible.

The Bignan-Sports have four 3.42 x 4.85 in. cylinders in a single casting. A three-bearing crankshaft is employed, with only a very light external flywheel, sufficient for the cone clutch. There are circular discs on the shaft of 1.18 and 0.87 in. face width. Four valves per cylinder are employed, the weight of these being 0.28 lb. for the exhaust and 0.247 lb. for the intake. A single camshaft operates the 16 valves, and is driven by an inclosed vertical shaft and bevel gearing. Lubrication is forced, with a dry pump. Delco dual ignition is employed, the plugs being mounted horizontally on opposite sides of the cylinder. The output of the engine is 90 hp. at 3,200 r.p.m. and 95 hp. at 3,400 r.p.m. The car has been built to the designs of M. Causan, an expert in high-efficiency engines.

Standard Bignan practice has been followed in the gearbox and rear axle. Owing to the mountainous and varied nature of the course, however, direct drive is on third, and the fourth is geared up, so as to get a high rate of travel on a 20-mile level straightaway by the side of the sea. The rear axle construction is a combination of steel tubes around which an aluminum housing is cast, with the whole of the brake mechanism inside the axle housing. The front axle and brake mechanism is a copy of Delage practice. Front and rear brakes are not linked up, but have separate controls in order to give the driver an opportunity of skidding the rear end of the car on the turns. The front springs are shackled at the front end and have a fixed attachment at the rear.

The four-cylinder 3.42 x 4.85-in. Bignan sport model entered in Corsican three-liter race

The wheelbase is 114 in., the track 49 in., the body width 39 in. and the fender width 8 in. With a road clearance of 7.8 in. it has been possible to keep the maximum height of the car as low as 40 in.—less than the overall width. The seats are arranged so that the shoulders of the driver and mechanic are flush with the top of the body. The gas supply is carried in the cowl, with a reserve supply back of the driver's seat, this being adopted in order to get a good weight distribution. No passengers are carried in the race, their equivalent weight being made up, however, by ballast. This makes it possible to carry the spare wheels inside the body and thus reduce head resistance. With an all-aluminum body construction and the use of light materials throughout, it has been possible to get weight down to 1750 lb., with full road equipment.

THE Society of Motor Manufacturers and Traders (Great Britain) has voted a substantial sum for a period of years to the Institution of Automobile Engineers, subject to a stipulation as to representation that is likely to be accorded, so that it is anticipated the arrangement will very shortly become definite. The Institution some time since placed before the Society a proposed extended programme of work, together with particulars of the financial position, and the matter has received careful consideration at a number of meetings. The Council of the Society agreed that the proposed work in question would be of value to the industry generally, and that the institution should be assisted accordingly.

AN ignition system capable of higher current economy than the ordinary closed-circuit battery ignition system, has been recently invented. The feature of the system is a control cam which determines the length of time during which the primary circuit remains closed.

In the ordinary closed-circuit battery system the breaker cam must be designed to keep the circuit closed at high speed a sufficient length of time to permit of the proper loading up of the coil, and at low engine speed the primary then remains closed for a much longer time than necessary which results in waste of electrical energy. In the new system the regular breaker cam and the control cam are located side by side on the breaker shaft. The angular position of the breaker cam relative to the shaft is controlled by a centrifugal governor for the purpose of automatic spark timing. In the same way the angular position of the control cam is controlled by the governor. The two cams are both under the breaker lever, and the effect of the angular displacement of the control cam is to widen the nose of the compound cam at low speed and thus keep the circuit open for a longer time than it would otherwise remain open. The system is designed by Ralph B. Macnish.

Maintaining Continuity Throughout Roller Bearing Manufacture

The methods used to produce roller bearings in a large plant are described in this article. The company discussed operates its own steel plant and conducts the manufacturing process from the raw material to finished product. Interesting taper gaging machine used.

By J. Edward Schipper

QUANTITY production of a precision product always awakens speculation concerning the methods employed to maintain accuracy and at the same time secure large output. Exactness of dimension and quality of material are necessary to the highest degree in tapered roller bearings. The performance of the part mounted on these bearings depends directly on the accuracy and quality of the bearing and, consequently, the requirements of the purchasers of bearings are of the strictest character. At the plant of The Timken Roller Bearing Co., in Canton, Ohio, the care exercised in the production of a quality product starts with the manufacture of the steel which is used as material in making these bearings.

The Timken company operates its own steel plant, which is a part of a chain of operations which go to make up the manufacture of a tapered roller bearing. In this plant 125 tons of steel are produced each day exclusively for bearing manufacture. A large percentage of the steel manufactured is .15 to .20 carbon. This steel is manufactured from selected scrap in a battery of four Heroult electric furnaces. The total capacity of the four furnaces is slightly more than 150 tons per day. The steel produced is straight carbon, as indicated, while some chrome alloy electric steel is also made.

The molten steel from the electric furnaces is poured into ingot moulds and after having cooled into ingot form is transported to a manipulator. This is a combined hydraulic press and electric manipulator where the ingots are pressed into bloom under a pressure of approximately 5 tons per sq. in. The hydraulic press exerts the pressure on the ingot, while the electric manipulator twists and turns the ingots about in exactly the same way as human hands would do in order to bring the pressure of the hydraulic press to the proper point in transforming the ingot into a bloom.

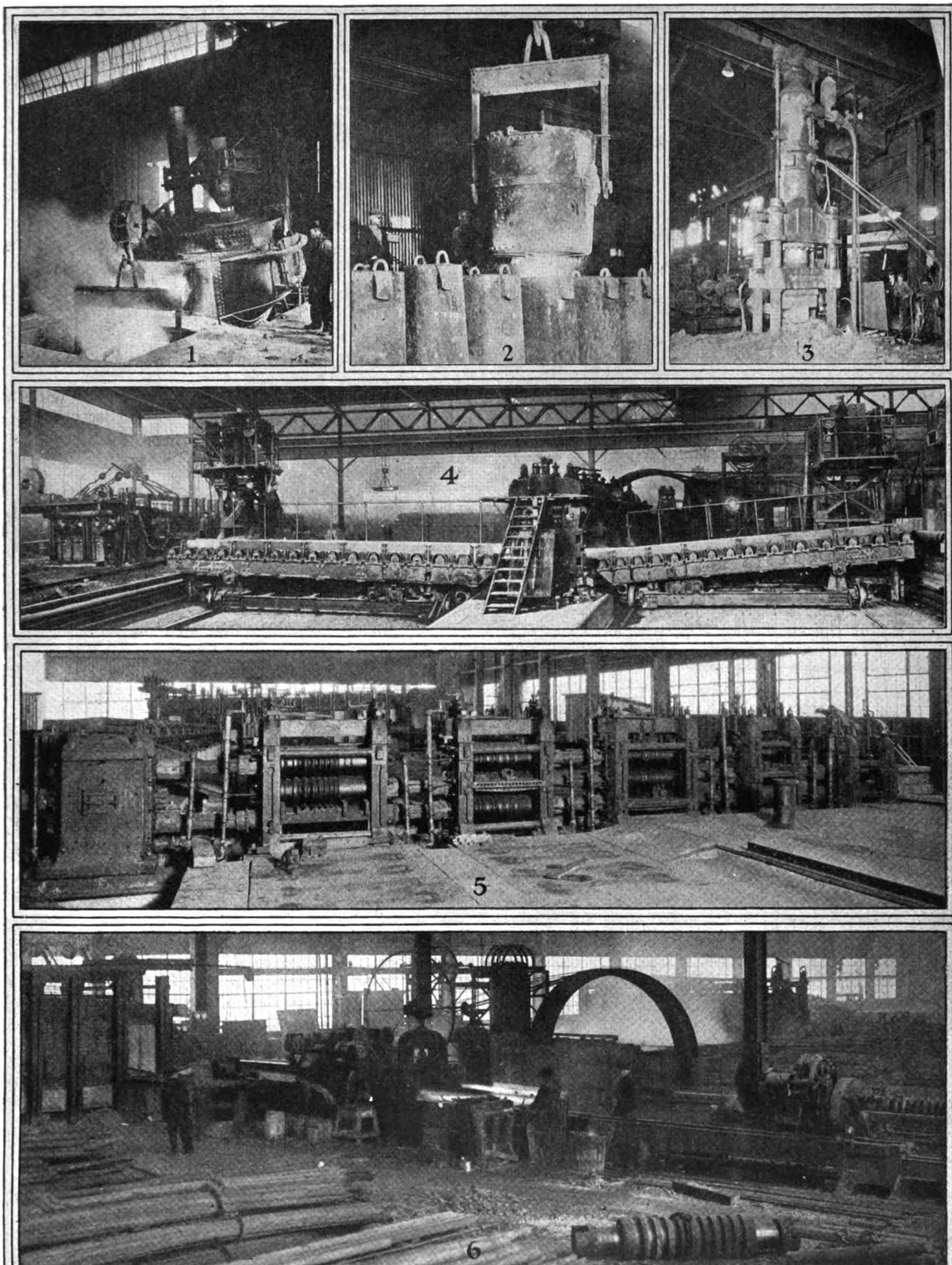
After the bloom has been formed it is transported to the rolling mills where a 22-in. three-stand rolling mill and tilting tables convert it into rounds and squares with a size range of from 2 in. to 6½ in. These are the raw stock from which the bearings are manufactured and are the forms which would be purchased if the Timken company did not make its own steel.

The first step in the actual manufacture of the bearings is to transform some of the bars into seamless steel tubes of a wide range of sizes to furnish raw stock for the cup and cone members of the bearing assembly. To do this the seamless steel tube is placed in the piercing mill, which takes the bar heated to a plastic condition and rolls it into tubular form on a specially formed device which converts the bar into a rough, unfinished piece of tubing. Another machine transforms this rough tubing into tubing of accurate size. The particular machine for the sizing of the tube is known as a reducing mill and after the tubing leaves this machine, it has been rolled accurately to size and shape externally as well as internally. The tubes are then cold drawn. As a final step in the manufacture of the seamless tubing, a straightening machine is employed. This takes out any bends or kinks which may exist in the tube. The tubes are then ready to pass on to the actual manufacturing operations as finished raw stock. They are handled in the automatic machinery from which the bearing parts are made.

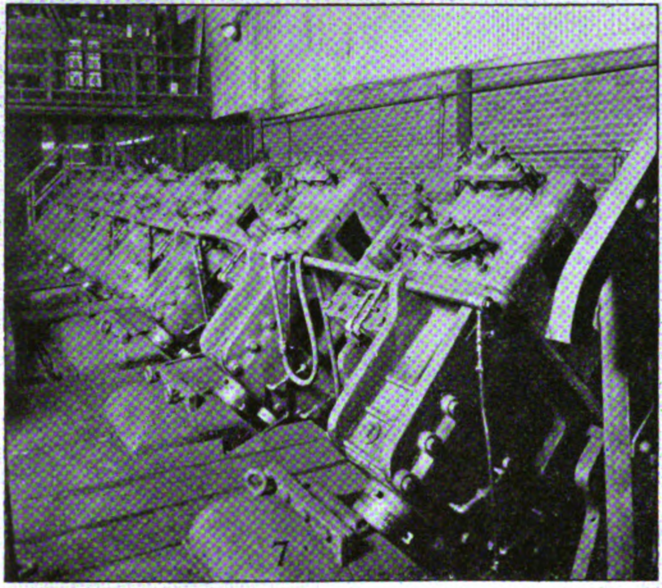
The Timken Tapered Roller Bearing consists of four principal parts. These are the cup or outer race, the cone or inner race, the rolls and the cage which acts as a roll retainer. For making the cup and cone, seamless tubing, manufactured as described, is used for the raw stock. For the manufacture of the rolls, bar stock is employed, made in the company's own steel mills by the methods described, except that instead of being rolled and pierced into tubing, the steel is rolled down to round bar form. For the manufacture of roll, retainer or cage, strip steel is used. This is bought outside.

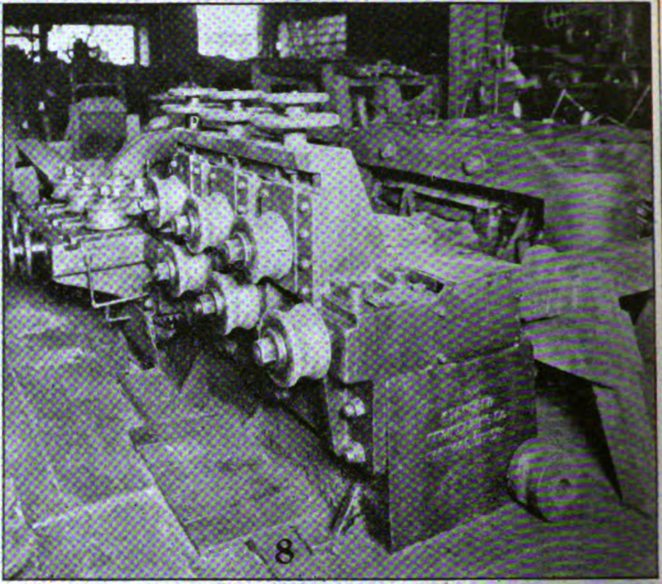
The finished steel tubes are now ready to go to the automatic screw machine department to be transformed into cups and cones. The tubes are fed into the automatic in the usual way and the operation of forming the cups and cones is completed on a single machine. This same process is true of the roll manufacture, except that in place of seamless steel tubing being used for the raw stock, the rods are employed in their place. The rods are fed into the machine through the magazine end in the usual way and the rollers, which are finish-machined, are dropped into the pan of the automatic completely fabricated except for grinding. These Gridley and National Acme automatic machines comprise the bulk of the machining department at the Timken factory. In the automatic screw machine processes where the rods are fabricated into a variety of sizes of rolls, the machining tolerances are not in excess of .003 of an inch. The tolerances on the cups and cones are .004 of an inch.

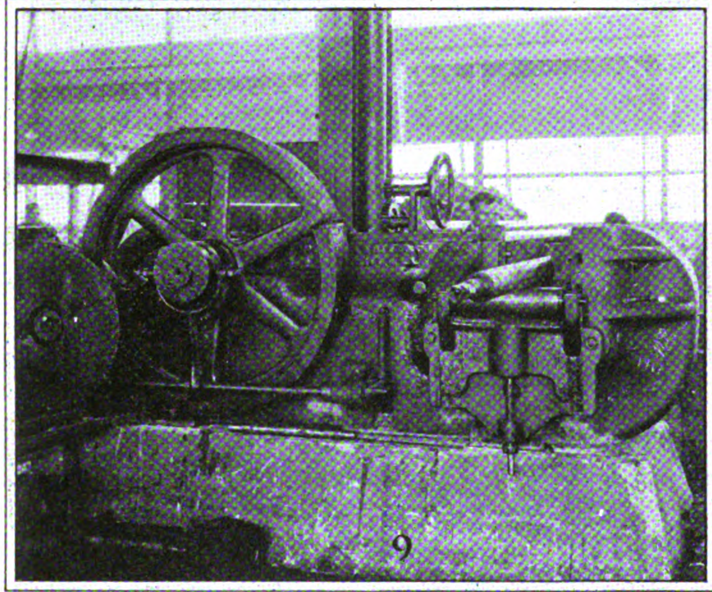
After the machining processes are complete and the parts have been gauged to size to find that they are within the limitations of the tolerances given, the products are placed in carburizing furnaces where the rolls, cups and cones remain from 16 to 48 hours, the time varying in accordance with the size of the part. Here the carbon content of the surface of the steel is increased by the aid of bone meal. The small parts are placed in rotary retort hardening furnaces where they are hardened after carburization.

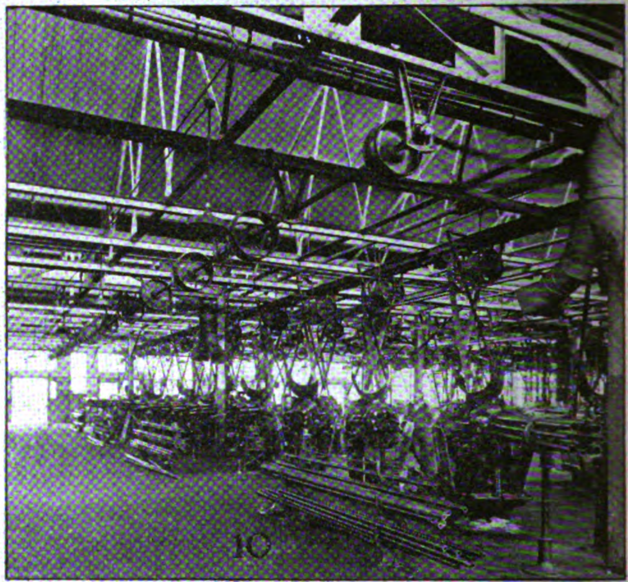


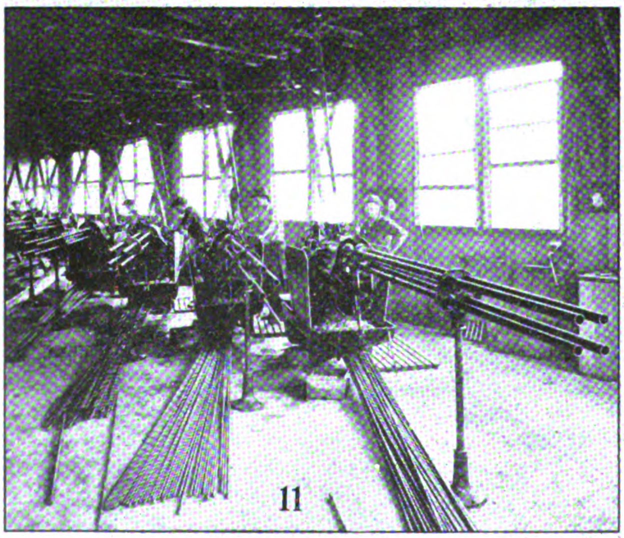
(1) *One of a battery of four modern electric furnaces with a daily capacity of slightly more than* 150 *tons.* (2) *Pouring electric steel into ingot moulds in the Timken steel mill.* (3) *Hydraulic press and electric manipulator where ingots are pressed into blooms.* (4) *Twenty-two inch, three stand rolling mill and tilting tables where blooms are converted into rounds and squares with a size range of from 2 in. to 6½ in.* (5) *Twelve inch, three-stand rolling mill where bars for rolls are converted into coils and small rods.* (6) *Piercing mill where bars are converted into seamless tubes.*

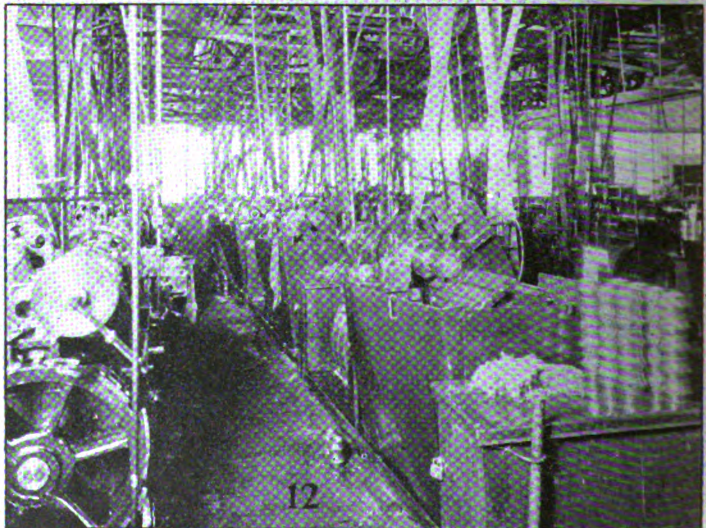




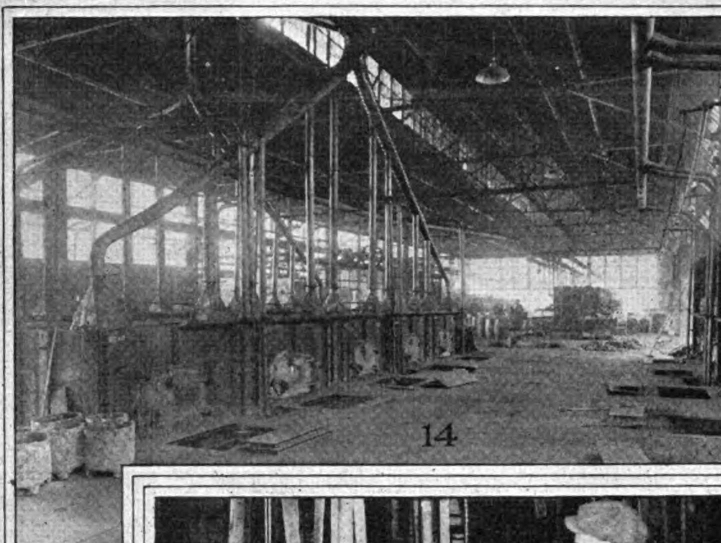


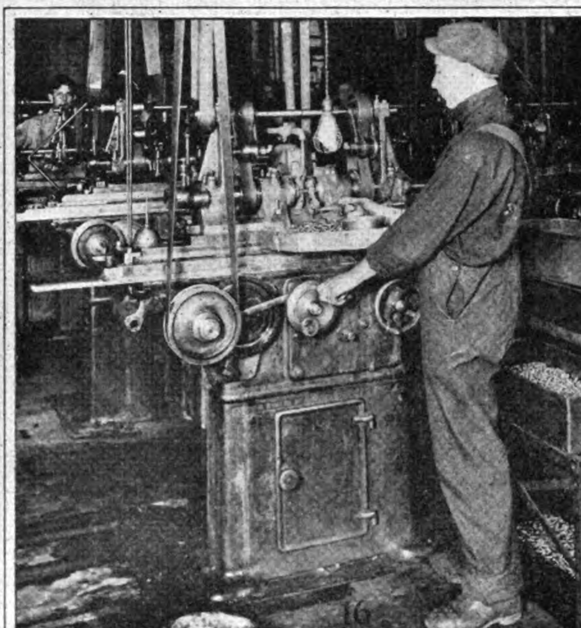


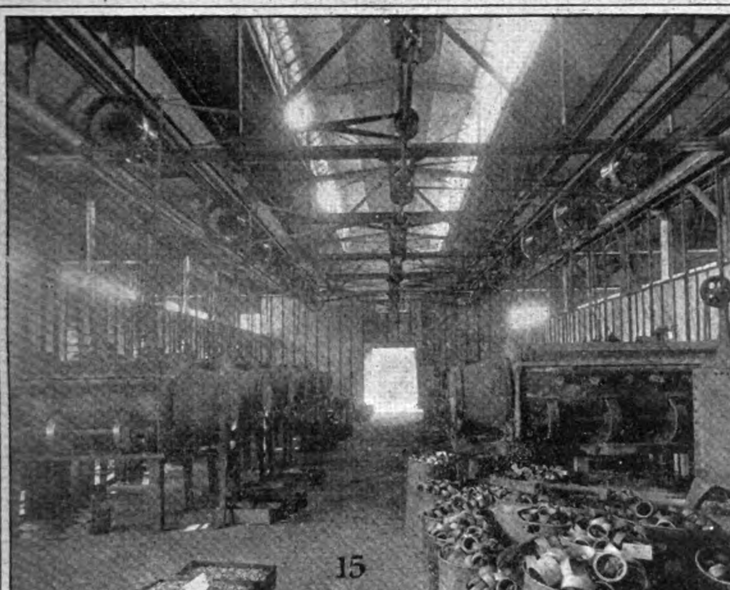


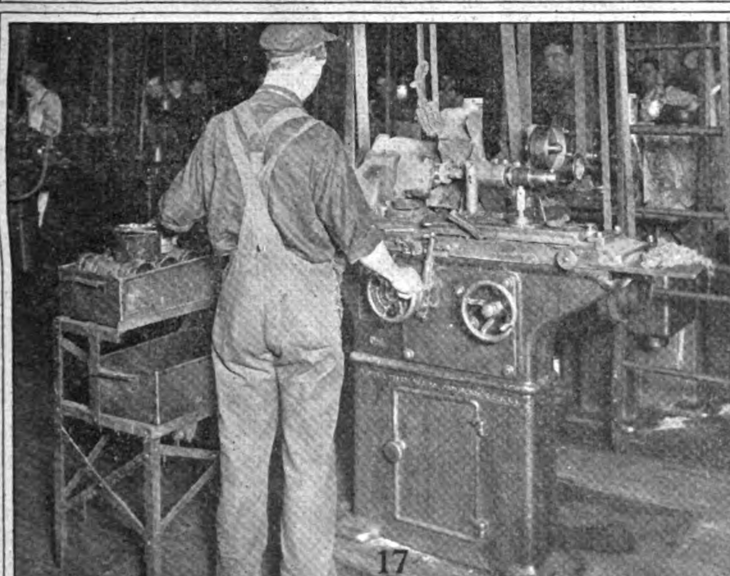


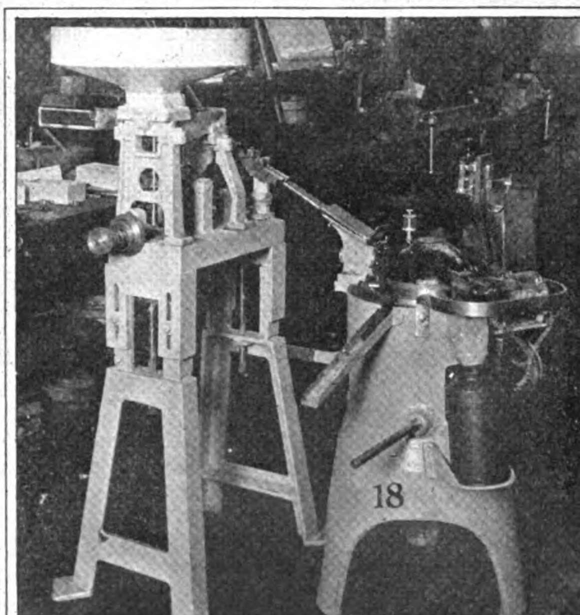
(7) *Reducing mill where pierced seamless tubes are automatically finished.* (8) *Straightening machine where finished seamless tubes are straightened.* (9) *Bulldozer for fabrication of formed seamless tubes.* (10) *Part of the screw machine department where tubes are fabricated on automatic screw machines into "green" cups and cones.* (11) *Four spindle roller fabricating machines where rods are fabricated at high speed into a variety of sizes of rolls held to machining tolerances not in excess of .003 of an inch.* (12) *Another view of the screw machine department where large cups and cones made from forgings are machined on automatic screw machines.*



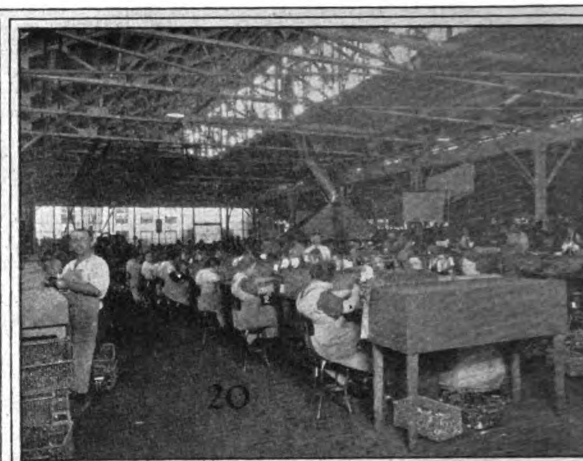


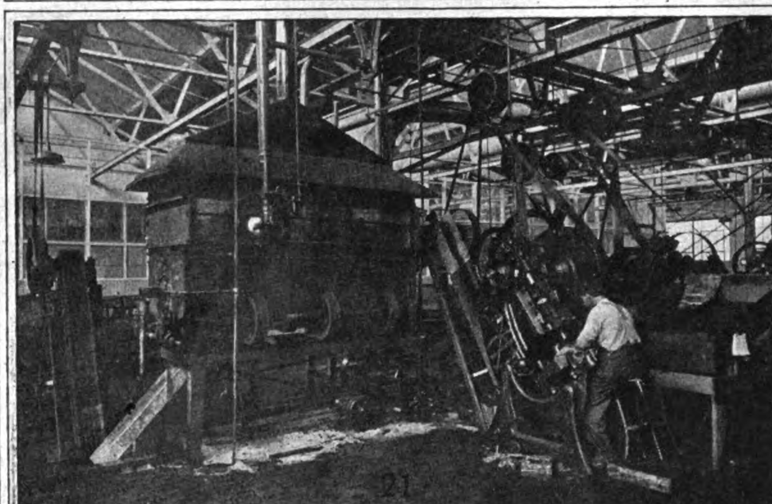


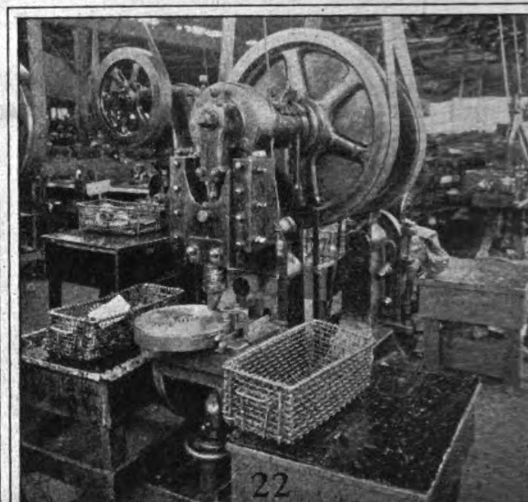




(13) *Gaging in the "green." Size gaging machine where cups and cones in the "green" are held to tolerances not to exceed .004 of an inch.* (14) *Battery of carburizing furnaces.* (15) *Rotary retort hardening furnace where small pieces are hardened after carburization.* (16) *Automatically fed roll grinders where rolls are ground to tolerances of .0005 of an inch.* (17) *Internal cup grinder where cups are ground to tolerances not exceeding .001 of an inch.* (18) *Taper gaging machines where rolls are gaged electrically. All rolls not of exact taper are automatically rejected.*







(19) *Part of the finished cup inspection department where cups are micrometrically gaged to a tolerance of .001 of an inch.* (20) *Part of the assembling department where parts which have passed the series of rigid inspections are finally assembled into complete bearings.* (21) *One of the stamping operations in the construction of the one-piece annealed cage or roll retainer.* (22) *Closing-in machine where the roll retainer or the cage of Timken bearings is formed to keep the roll in direct alignment.*

After the case hardening process is finished, the parts are ground to finished size. The cups are ground on internal cup grinders and the rolls on the same make of grinder supplied with automatic feed. The tolerances on the grinding operations are .001 of an inch on the cups and .0005 of an inch on the rolls.

One of the most interesting machines in the entire process of manufacture is the automatic taper gauging machine where the rolls are gauged electrically. All of the rolls not of the *exact* taper are automatically rejected by this machine and scrapped. The machine operates in such a way that unless the proper taper exists on the roll, the machine opens a by-pass which permits the roller to escape into a rejection chute, which drops the rejected rollers into a pan. The cups are inspected by hand, being gauged with micrometers to a tolerance of .001 of an inch after they are ground.

The manufacture of the cage or roller retainer consists of a number of press operations. The strip is first blanked to a modified cup shape. The next press has a die which sizes the interior surface of the cup and completes the forming. The next machine trims the outside of the cup, after which it is annealed and the flange left on the outer rim of the cup is drawn in. The bottom is then punched out of the cup, after which it is again annealed. The cup is then tapered and on the following machine perforated, and then winged. The winging operation consists of turning in the edges left on perforating to form the roll retainers. The cage is then spread and is ready for assembly.

The assembly of the roller bearings is a very simple proposition, the rollers being slipped into the cage or roller retainer and assembled in the cup and cone by hand. This work is largely taken care of by girls at this Canton factory. After the bearings are assembled they are inspected to see that all rolls revolve freely and that they function in the proper manner.

This routine method of manufacture is followed for practically all of the products of the company. A few of the very large size bearings have cups and cones made from forgings, and in the case of the very large bearings, the bigger cups and cones are formed hot in a special upsetting machine. Outside of this, the small and large bearings follow along about the same routine process of manufacture, the making of the bearings being distinguished by the comparatively small number of operations necessary for manufacture.

In the assembly work the rolls used on each bearing are selected by size so that even though they are held to close limits, the variation in the size of the rolls is not as great as the diametric tolerance limit. This is done by graduating the rolls with an electrical selecting machine which permits of selection by grading the rolls in very minute steps or stages. The rolls are carried around on a machine which, by a set of electrical contacts ingeniously devised, is so arranged that each roll

drops into a bin with its fellows of corresponding size. Thus, when a bearing is made up, rolls which have dropped into the same bin are selected, giving no chance for variation in the uniformity of bearing surface around the periphery of the bearing.

The interesting feature in the manufacture of this product is that in spite of the accuracy which must be maintained and the necessity for absolute uniformity and interchangeability, the machinery used is of the highest possible production capacity. The three most important parts of the bearing, the cup, the cone and the roll, are manufactured almost entirely on automatic machinery and finished by grinding.

The grinding operations have been worked out on a production basis so that the time required for chucking the pieces is reduced to a minimum. The Timken plants in America and Europe produce 100,000 bearings per day when running at normal capacity. When it is considered that this number of bearings is produced uniformly with a smooth flow from raw material through the process of steel manufacture, then the manufacture of seamless tubing, and finally to the manufacture of the finished bearing, it can be seen that an efficient production layout is required.

The reason, of course, is automatic machinery. As a matter of fact, the space required for the actual manufacture of the bearing is small compared to that required for the manufacture of steel and for the assembly and testing work. The actual fabricating operations are so concentrated by the use of the automatics that outside of a bolt and nut factory it would be practically impossible to picture any producing organization which is so highly concentrated as that of this bearing manufacture.

By manufacturing its own steel, this company is enabled to keep its product uniform, which would be difficult were the steel purchased outside, where the run of material for the Timken company would only be one of many other runs. It would necessitate a contact with the source of supply which would be inconvenient to maintain and probably unsatisfactory. On the other hand, the steels utilized in the manufacture of the bearings are of standard specifications, so that if labor trouble or any other disturbing cause arose in the steel plant of the Timken company, it would be possible to purchase the standard steel elsewhere.

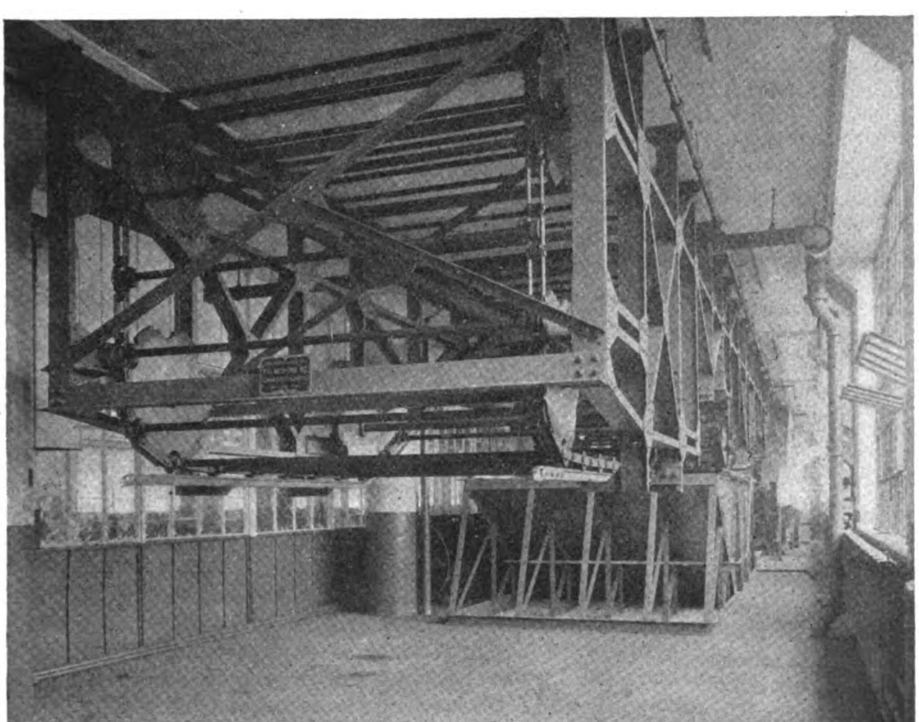
In very few industries is it possible to go back so far to the elementary material. Manufacture of the bearing really starts at the pile of steel scrap in the Timken yard. This steel scrap is stored outdoors and indoors for summer and winter consumption It is properly blended with the necessary fluxes and ferroalloys in the company's own plant, thereby putting the quality of the bearing directly under supervision at the inception of manufacture.

Continuous Motion Enameling Equipment

THREE installations have recently been completed for the baking of enamel on automobile fenders, hoods, etc., at the Cadillac Motor Car Co., Detroit; the Packard Motor Car Co., Detroit, and the Buick Motor Car Co., St. Louis.

The ovens at the Cadillac and Buick plants are of the continuous conveyor type, the work being hung on an overhead moving conveyor which automatically carries the parts down into the dip tank of enamel, up the drain board, into and through three ovens, progressively for three coat baking, without removing the work from the conveyor. Electric heaters of 2000 kw. capacity are installed in the Cadillac ovens and of 1680 kw. in the Buick ovens. These ovens are maintained at 450 deg. Fahr. by means of automatic temperature control equipment.

The Packard Motor Car Co. placed one of the largest orders during the year for heating equipment. This is in connection with the new six cylinder car, and consisted of 22 semi-continuous conveyor oven equipments, having a capacity of 3120 kw. The temperature of each oven is automatically controlled. The Packard Co. previously had some 12 or 15 electrically heated ovens in operation. Electrical equipment was manufactured by Westinghouse Electric & Mfg. Co.



General view of continuous conveyor for enameling ovens at Cadillac Motor Car Co. plant. Note the dip tank in the foreground

Heat Treatment of Valve Steel

THE proper heat-treatment for the valves of internal-combustion engines is given in an English house organ as follows: 3½ per cent nickel steel should be normalized at 830/850 deg. Cent. No further treatment is necessary. 25 per cent nickel steel should be normalized at 880/900 deg. Cent. No further treatment is necessary. 13/18 per cent tungsten valves should be heated to 950 deg. Cent. and cooled in still air, then reheated to 800 deg. Cent. and cooled in still air before machining. 13 per cent chromium valves should be heated to 900 deg. Cent. and cooled in oil, then reheated to 700 deg. Cent. and cooled in still air before machining.

Tide in Export Trade Is Turning

Stocks of automobiles in foreign trade centers are being liquidated and by the time the buying season south of equator opens there should be a steady flow of orders. Time element very different from that in domestic field and positive business should come shortly.

By George E. Quisenberry*

INDICATIONS accumulate that the export market for automotive equipment is again on the upgrade and that, despite the gravity of conditions affecting many other commercial lines, the liquidation of the surplus stocks of passenger cars, trucks and tractors in some of the larger foreign centers is progressing favorably. Manufacturers and foreign dealers are working more closely together than ever before in an effort to clear the market of these holdover goods and, as one export manager recently said, makers and sellers are beginning to get really acquainted with each other. The ultimate benefits to be derived from this can easily be imagined, and it is to be hoped that the exporters of this country will do everything possible to hold the business friendships they have made during the last few years.

The export market has not picked up to the same extent that has the domestic retail trade. It was to be expected that it would be several months behind the home market, but there is everywhere apparent the feeling that the tide has turned and that coming months will see a gradual but certain revival in the foreign sales of practically all automotive lines. One large New York exporter, naming the numerous countries in which his lines are being pushed, reported that the low points of retail sales had been January in certain districts, February in others and March in the remaining divisions. In each there has been a gradual quickening in retail sales of the foreign dealers since the low point, and, while few shipments of new stocks have yet gone forward to any of these sections, inquiries were being received and other evidences pointed the necessity of additional shipments shortly.

A second manufacturer, whose line has been very thoroughly and carefully handled in the foreign market, declared that his overseas shipments in March were 25 per cent of normal and that he expected them to be 50 per cent within 60 days of that time. Another exporter summed up the same condition by reporting a "much more favorable tone"; this is borne out by reports received from several foreign centers which spoke of a trade revival that seemed certain in the middle months of this year.

Far-Flung Field

The foreign manager has his field so far removed and covering such great stretches of territory that it is difficult for him to keep in close and immediate touch with his overseas connections. He does not, like his sales brother in the domestic field, have the unlimited services of night messages and special delivery letters, with voluminous reports from business publications and official or semi-official organizations to keep him constantly informed on the course of business in the districts where he disposes of his wares.

The export manager, taking full advantage of every available agency, must develop a sense of feeling or ability to interpret conditions in countries many days or weeks distant by steamer and mail. This ability to sense the markets is one of the chief qualifications of the good export manager and, without it, he is liable to find himself lost.

In New York, at least, it may be said that the exporters are "sensing an increased business." Certain countries, they know, have not yet passed through the business valley from which North America seems now to be ascending. But other countries have done so and are definitely on the upward trail again. Here and there may be found cities and even countries which have scarcely felt the depression, and these places, with those countries which have gotten past the bottom, are being "sensed" as offering positive business within the next few months.

The writer has recently talked with an American exporter who has just returned from a two-year trip in the foreign field. Thoroughly familiar with the district in which he traveled, this man was quite positive that extensive buying should be expected within the next two or three months. The reason for his expectation was that this particular territory is south of the equator and, consequently, enters its sales season in September and October. Last year and the year before the market was not well supplied at that time, orders had not been placed early enough, production and shipments were delayed and many dealers had scant stocks at the time when the real buying season got under way.

Time to Get Busy

This condition should not be repeated another year, the exporter declared. Manufacturers should begin now to go after this business, remembering that foreign transactions cannot be carried out in the few days that might suffice at home. If you would have good business in September and October, he said, prepare for it in March, April and May and be ready to make shipments in July and August, if not in June.

As a concrete example of this assertion the National Cattle Show of the Sociedad Rural Argentina will be held in Buenos Aires the first two weeks of September. It is to be presumed that every American exporter who sells to the River Platte territory will endeavor this year to exhibit his goods at that show. Undoubtedly it is the most important showing in all of South America, drawing hundreds of thousands of visitors from Argentina, Uruguay, Chile and other nearby countries, transcending in importance, from an automotive standpoint, even the annual motor car show of the Automovil Club Argentino, which is held a few weeks later. And, be-

*Managing Editor *El Automovil Americano.*

cause of the general conditions of business and trade, as well as the lessons learned domestically from the shows held at home this spring, there is every reason to believe that few exporters will pass up the Argentine cattle show this year. It must be used in an attempt to restore retail buying to a satisfactory level.

So, the manufacturer or exporter has learned of this show in late April or early May. He wishes to find out about space, about the arrangements for the exhibit, and he must take up these points with his distributor or other connections in Buenos Aires. He writes to Argentina the first week in May and the letter reaches its destination three weeks later, about the first of June. Let us suppose that the letter is answered immediately, although it would be rather doubtful if such quick service could be accorded. The reply requires three weeks more, and the month of June has practically passed away before it is received in the exporter's office here in the United States.

Consider the Time

Possessed with the detailed information required and having come to an agreement with his Buenos Aires connection, the exporter then must prepare for the exhibition, which starts two months later. Perhaps a new model or a special design must be shipped, as undoubtedly will be the case with many makers this year. The factory is asked to rush the order through, and the car is crated, shipped and arrives at New York in the latter part of July. Then it is rushed to a boat and sent on its way by August 1, reaching Buenos Aires just in time to get through the customs house, be uncrated and set up before the exhibition opens. Four months have passed, and it is doubtful if all the arrangements could have been handled satisfactorily in a shorter space of time, not forgetting that the exporter can take advantage of the cables to hasten his attempts to obtain information.

Previously it has been said in AUTOMOTIVE INDUSTRIES that foreign trading is not an impulse undertaking, that results cannot be expected over night from the first attempts to work up an export trade. This is even more true to-day than it was six months ago, and the statement is amply proven by the mistakes made by some companies which have attempted ill-advisedly to get into this lucrative business. But it does not mean that American manufacturers should not redouble their efforts in the foreign fields; the automotive development of the four corners of the world has no more than started.

We shipped heavily to all countries during 1919 and 1920 and, on the face of immediate business in sight or in prospect for the next two or three months, it may seem that the trade of those two years was excessive and abnormal. Perhaps it was, but the men most closely connected with the overseas markets believe that the start only has been made. The great developing countries, such as Latin America, Australia, South Africa and the Far East, have no more than begun the motorization that must come about during the next few years. Those countries to-day stand generally where the United States stood ten years ago or even longer. Then we were just beginning to use the automobile, the motor truck and the farm tractor. Our great development has come since that time. We were then beginning to talk of better roads, and the motor car was just pushing its way into the great farm areas.

Only the Beginning

That is the condition to-day throughout many countries of the foreign field. The belief that the automobile is a luxury for use only in the cities is just being overcome. Our pioneer companies—and any exporter can count them on the fingers of his hands—have done their work well and have started what ultimately will mean a much wider and more universal use of the essential motor car. Road improvement is just getting under way in many localities, and the development of the next few years in this regard doubtless will dwarf anything of the past.

The present months are no more than a breathing spell and already there are numerous indications that the immediate situation is about to mend. The stocks of cars that have been held up in ports and warehouses are being liquidated, just as they were liquidated in the domestic market. That movement is progressing slowly but certainly. In certain cases manufacturers have made concessions or affected compromises with their foreign dealers in an endeavor to wipe out the holdover stocks. Some companies, their sales policy not so well defined, are still faced with large supplies in their overseas markets and they will, of course, bear the burden for some months to come. But those which have not shipped so extensively and which have reached close cooperation with their distributers are getting to their feet again, their comparatively small stocks dwindling as retail trade has revived. These companies have nothing to fear in the future and can look forward to a continued increasing trade. Those which have erred will bear the consequences.

Thus we have a situation promising for those companies which have not compromised themselves during the last few months. Likewise, we have every reason to feel confident that the foreign trade of the automotive industry of North America will continue unabated. There will be competition that was lacking during the wild-cat days following the armistice, but that will not hurt the markets for our products.

The exporter has for his field of endeavor the entire world. As he views it to-day there are many spots and many localities under the shadow. Many others are just beginning to get into the sunlight again and to feel the beneficent results of the trade revival. The shadows will not entirely disappear for many years, but the whole world will not remain much longer under the cloud.

Service with the Car

SERVICE—the large initial belongs there—is the keynote of foreign sales, according to E. G. Poxson, export sales manager for the Dort Motor Car Co., who is, likely, more familiar with his foreign field and sales facilities than any other automotive export sales manager in this country. Poxson has lived and worked with his foreign representatives. He does not set any of these representatives up in business until he understands their motives and until they understand his methods.

He has spent much of his time abroad since he took this job, and he has seen hundreds and scores of American machines laid up indefinitely because there were no service parts in the country where the machine was sold. He is quite happy to say that this is not the case with the Dort cars. Service parts and an understanding of the mechanism of the car are quite necessary to the sale of Dorts in any part of the world.

Poxson is quite optimistic over the prospects. He says that the tide turned with him in several countries early in the year, and he anticipates a very good demand before the year ends. Even at the period when the demand for American cars was at the lowest, orders for Dorts were coming across the water because of the service idea.

Association for Purposes of Constructive Co-operation

The automotive industry seems to have been a target for legislative bodies recently. A new branch of automotive manufacturers has found the possible benefits of association. The Motor Vehicle Signal Manufacturers Association was formed to oppose something, but its future holds possibilities for constructive action.

THE prevalence of manufacturers' associations composed of companies engaged in a similar line of business indicates a growing realization of the interdependence of the units of modern industrial organization. Such associations, when they comprise the strongest elements in a particular trade, hold tremendous potential power for accomplishing constructive purposes. They hold similar power, of course, for accomplishing selfish ends, but the ultimate business futility as well as the moral injustice of combining for such entirely selfish purposes is being understood more fully every year. The current efforts of the Federal Trade Commission will probably tend to widen that understanding still further.

Clyde Jennings has pointed out in recent articles, however, the necessity for constant and intelligent watchfulness on the part of manufacturers as regards ill-conceived and unhealthy legislation, both national and local, tending to work injustice to both automotive manufacturers and consumers of automotive products. This does not mean lobbying for selfish legislation, but making certain that the laws which get on the statute books are intelligently framed so as to allow a healthy and permanent growth for all parts of the industry; a growth which will result in the ultimate benefit of the consumer as well as of the manufacturer.

The manufacturers of another branch of the automotive industry banded together last Monday for such constructive purposes and will add their efforts to those already being exerted to push constructive legislation and prevent narrow laws being passed. This new association is to be composed of the manufacturers of rear-end signals for cars and trucks, and its name will be the Motor Vehicle Signal Manufacturers' Association. The association was formed directly as the result of an unfortunate ordinance which was almost passed by the City of New York, and indirectly as the result of the realization by a large number of the manufacturers of the potential benefits of co-operative effort.

The ordinance in question is an interesting example of what may be done by legislative bodies as much through ignorance as through malice. The story of its origin and change is of interest because the same sort of thing is likely to occur in connection with other branches of the industry.

The ordinance as introduced read in this way:

> " . . . In order to avoid rear end collisions every motor vehicle, except motorcycles, shall, in addition to the red light, visible in the reverse direction, herein provided for, be equipped with a rear end traffic signal which shall indicate both by day and night that the said motor vehicle is about to slow down. The said light or signal shall be so operated from the foot brake or clutch that the operation of the foot brake or clutch shall result in the light or signal clearly showing that the vehicle is about to slow down.
>
> "No lamp, device or signal shall be used unless the same shall have the written approval of the commissioner of licenses, but no type of lamp, device or signal shall be approved by the commissioner which shall cost more than $10 complete."

When it is recognized that a large percentage of the signals manufactured operate electrically, that many of them contain the words "stop," "right turn," "left turn," etc., instead of "slow down," and that only one signal on the market comes within the terms of the ordinance as to both price and construction with the terms of the ordinance, the unfairness of the situation becomes obvious.

The danger of the ordinance being passed came to the attention of one New York signal manufacturer, who immediately took the matter up with the alderman responsible for the ordinance. As soon as the matter was explained to the alderman he admitted the injustice of the ordinance, said that he didn't know anything about signals, but had seen one like that described in the ordinance and had thought it was a good one. He offered to present an amendment at the hearing.

The signal manufacturer who had visited the alderman got in touch with a number of fellow manufacturers before the hearing. When the hearing was held a group of signal manufacturers attended and presented their case, and the ordinance was amended in such a way as to strike out the limiting provision and allow the use of practically any signal now manufactured.

Thus the necessity for such efforts as are so ably being put forth by the association was brought forcefully to the attention of the signal manufacturers. The result was the initial meeting for the formation of an association, which was held on April 25. At this meeting there was a good attendance from manufacturers within striking distance of New York, while letters were read from a number of more distant manufacturers expressing their approval of the association plan and stating their desire to co-operate in every way.

At this preliminary meeting the first steps for forming the association were taken. The name, Motor Vehicles Signal Manufacturers' Association, was approved and a committee was appointed to draw up by-laws and to make definite suggestions for future procedure.

It was the idea of those present to include in the membership of the association all the signal manufacturers in the country, and to ask those associated with the International Signal Manufacturers' Association, a

Pacific Coast organization, to associate themselves with this new body, whose activities may be expected to assume a broad and constructive scope.

The desire was also expressed to bring this new association into active touch with the work of the Motor Vehicle Conference Committee, so that the new organization's efforts might assist and work in harmony with those of the other organizations affiliated with the Conference Committee.

E. J. Livingston, 160 Fifth Ave., New York City, was appointed temporary chairman of the organization and his office designated as the temporary headquarters.

Another meeting of the association will be announced in the near future. To this meeting all signal manufacturers will be invited to send representatives, that the organization at its very beginning may comprise the best ideas of the entire industry. The representative nature of the attendance at the organization meeting and the constructive ideas voiced by those present indicate that the new organization will be able not only to further its own plans ably but also to effectively assist the other members of the Motor Vehicle Conference Committee.

A Non-Metallic Gear Material

UP to a few years ago practically all noiseless gears were made from rawhide or hard fiber. Both of these materials are unsuitable for timing gears, because they swell and distort when immersed in oil. Recently a number of non-metallic materials have been developed which have sufficiently high mechanical properties to permit of their use in toothed gearing and are non-sonorous and impervious to oil and alkalis. One of these materials, known as Condensite Celoron, contains two basic elements, Condensite (a phenol-formaldehyde condensation product) and fabric. The following particulars regarding the material and its use for camshaft gears have been furnished us by the manufacturers:

The material is as strong as cast iron, is not affected by moisture or oil, possesses a high dielectric strength, is chemically inert, insoluble, infusible and resistant to most acids. It can be kept in storage indefinitely without deterioration and is not attacked by rodents. When properly applied and lubricated it will often outlast cast iron and brass.

One of its distinctive features is its greater resiliency, or, rather, its greater resistance to shock, as compared with cast iron. Condensite Celoron is self-supporting and generally neither bushings nor flanges are required. If strain is severe the use of end plates is advisable, but teeth need not be shrouded. Pinions made from Condensite Celoron run successfully against gears of cast iron, steel, brass or bronze. The face of the pinion should always be equal to or less than that of the mating gear. Condensite Celoron pinions should never be run with gears having cast or badly worn teeth. In the case of timing gear trains with three gears, it is customary to make the center one from the fabric material, but oftentimes if this gear requires a great deal of machining or has an offset hub, it is better from an economic standpoint to have the two outside gears non-metallic.

Condensite Celoron has a tensile strength parallel to the laminations of 12,000 lb. per sq. in. and perpendicular to the laminations of 8000 lb. per sq. in. The compressive strength parallel to the laminations is 17,000 lb. per sq. in. and perpendicular to the laminations, 35,000 lb. The transverse strength is 17,000 lb. per sq. in. Other physical properties are: Brinell hardness, 30 to 40; specific gravity, 1.4; weight, 0.05 lb. per cu. in.; water absorption, ½ to 3 per cent in 24 hours. Up to a temperature of 300 deg. F. this material shows no material change in physical properties.

Condensite Celoron may be machined the same as metal. It cannot be molded, but when in the uncured state may be formed into special shapes. It will take a high polish. In turning, the piece should be turned to size whenever possible with one cut, but when two cuts are found to be desirable, the finishing cut should remove at least ⅛ in., as it is not always possible to turn a piece with a uniform diameter where a lighter cut is taken. The material should be turned at a peripheral speed 25 per cent faster than cast iron. A coarse feed and a wide-nosed tool should be used. The tool should not be raked but plenty of clearance should be allowed. No lubricant is necessary. The turning tool is dulled very quickly and should be frequently sharpened.

Drills should be run at high speeds, sizes ¼ in. and under, from 2500 r.p.m. to 10,000 r.p.m., and larger sizes in proportion. A drill in Condensite Celoron cuts smaller than itself and if the drill is properly ground, the hole will be clean and true, but about 0.003 in. undersize. If it is necessary to have the hole of the same size as or a little larger than the drill, the drill should be ground slightly off center.

Condensite Celoron may be sawed with either a band or circular saw. In milling it with standard milling cutters, high speeds and coarse feeds should be used. Whenever possible, all material should be removed in one cut. The use of a reamer is not recommended. Where accurate work is necessary, the holes should be drilled and then bored. The material is manufactured by the Diamond State Fibre Co.

Government Research in Road Construction

(*Continued from page* 906)

the rear of the three and are so located between the tracks of the forward wheels. Each wheel is independent of the others, and its whole weight rests on the road.

This wearing machine is constantly hauled back and forth over the experimental road section by means of a stationary engine and a steel cable. There is some lateral play to the wheels and the wearing surface is practically 12 in. wide. These tests are intended mainly to determine the wear-resisting qualities of different paving materials used in the cities where there is still a great deal of heavy horse traffic on steel tires. The experimental road comprises 48 different sections, including 21 of brick, 19 of granite and 8 of concrete. Photographs of the sections are taken at intervals and photos of the same section are mounted side by side, to permit ready comparison of wear. Fig. 21 shows five of the sections in four different stages of wear.

WITH the increase in the use of farm tractors the market for large stationary farm engines—engines of 10, 15 and 20 hp.—has declined materially. Formerly silo-filling, for instance, required an engine of this size, but now the tractor engine usually serves the purpose. The market for small farm engines, on the other hand, is not appreciably affected, as the farmer cannot afford to run the tractor half a mile or more every time he wants to do some corn-shelling or run the lighting plant.

View the Labor Problem in Perspective

Temporary conditions may delude the manufacturer into thinking the labor problem solved. It is not. In this article, Mr. Tipper tells what some workmen are thinking on the subject. Their views indicate future actions and conditions. The problem must be tackled. Now is the time.

By Harry Tipper

A GROUP of manufacturers were discussing business conditions and grumbling at the difficulty of getting enough business to make ends meet.

During the conversation, which ranged all the way from the hopes centering in the new government to the cancellation of contracts, some one introduced the question of labor.

"How do you find the labor situation?"

"That's all right, there is no trouble about labor, except that we haven't enough work for the men we have. Everything else is fine. These fellows are sticking on the job now. They don't want to lose the work they have with all this unemployment. They're getting down to business and cutting out all the foolishness we had last year.

"No, I guess our troubles in that direction are passed, we don't expect to get into the same jam we had last year. Any way, business does not look like a rush for a long time; meantime these fellows are learning that a good job is worth sticking to."

"Did you go on with the conference system your industrial relations man started last year?"

"No! We cut all that stuff out. Most of it was a waste of time, any way. Talking about a lot of things that ought to be decided in a few minutes. Going over a lot of trifles. Why those fellows spent all kinds of time mulling over why this man was fired, what should be done about light and ventilation in the dark part of the machine shop. I got pretty sick of it; believe I would have stopped it, any way. When the plant closed down I just took advantage of the situation to cut it out. I fired all the industrial relations department except Jones, he was a good man, so I put him under the production manager—he's working shop discipline and method."

"Well! I guess you're right. The old-fashioned way of handling a shop was best. You just told the men what to do and they did it.

"All this talk about the worker's point of view is new stuff, mostly started by the armchair theorists who never ran a shop in their lives. Probably wouldn't know what one looked like. What do you expect on raw material prices next month?"

So the matter was dismissed, the advantage obviously with the manufacturer and the half-hearted attempts at new human organization all disbanded when the employer's dominance has been regained.

This conversation occurred as I was on my way to some of the industrial cities in the Middle West. I thought I would check up and find out what the worker had to say about it. So I talked with some of the mechanics I noticed outside the employment offices, some of those I found on the cars coming home from work, and some of those who did not appear to be working, nor looking for work at the moment.

To these workers the labor problem was not solved at all; it is never solved. It is the big problem of their lives. When they have work the families eat and enjoy comforts, when work is scarce they lose first the comforts and then part of their food ration. They did not know why work was plentiful last year and scarce this year. They did not know how long the present job would last, or if they would get a job.

Some of them were so foolish as to believe that the manufacturer was responsible, in a way, for the scarcity and many of them were frankly suspicious of the Capitalist class, figuring that they got all the best of it all the time.

The more belligerent men were thinking of the time when they could seize the advantage once more, the less belligerent were afraid and deeply afraid of the immediate future in the matter of eating and sleeping. One or two believed thoroughly that the manufacturer was playing to put them deliberately in a starving position.

Many of these opinions were without any evidence or foundation, they were undoubtedly incorrect—but their inaccuracy does not affect their existence and the fact that there is a labor problem.

Unemployment is one of the phases of the labor problem. Lack of work when a man is healthy and ready to work is a disturbing factor of great moment and lays the foundation for much future trouble.

Ignorance as to the reasons for unemployment is another item in the labor problem, one which leads to many beliefs and opinions that will affect the future action of these men on their jobs and in their political opinions.

Organization is a growth; once begun it will continue to grow unless it is replaced by better types. The organization of trade unions was begun a hundred years ago, out of the fear of starvation, the suspicion of the employer and the demand of the worker for protection. Those same conditions to-day will form organizations of workers just as effectively as they did years ago. Unless these matters are dealt with, the labor problem still exists, although the pain and trouble is not visible for the moment.

Any manufacturer who is neglecting the human side of industry because he can control his workers for the moment, is as shortsighted as the man who determines his policy by the last six months and the next six months.

When the machinery is idle and there is no problem of

getting the work out, an opportunity exists to put the plant in shape for real work on a better basis. When jobs are scarce and the employer is not forced to listen to his workers, by the conditions, there is an opportunity to study the human necessities and lay the ground work for a better co-operation and a larger measure of human efficiency in future work of the establishment.

It will not be done by arbitrary methods of procedure. The old-fashioned way has no more to recommend it than the old-fashioned machine. It is just as clumsy, slow and inefficient in its results.

It is absurd for a manufacturer who prides himself on his up-to-date and efficient methods of manufacture, to deal with human beings as the employer of forty or fifty years ago. The production problem includes the labor problem. The increased production efficiency, the lowering of production costs depends largely upon the improvement of the incentive, skill and stability of the worker, who controls this production operation.

Study of mechanics will not overcome the inefficiencies of the human being. Arbitrary prejudice, opinion and decision will not solve the labor troubles. The sore spots still exist and the active agitators are still rubbing salt in these wounds. When men are idle they have a lot of time to listen. Are they listening to the employer or the agitator? Is the employer unconsciously handing the salt to the agitator by his method of handling the question? In a great many cases he is. It is the action of the manufacturer, which appears to be arbitrary and unfair that forms the text of most of the oratory of the agitator. To the man who does not know why he is out of a job, the whisper that the employer is still making money is enough to arouse his suspicion. To the man whose wages are cut, the statement that the concern has a big cash surplus they made last year is rubbing salt in his wound.

The salt is formed by the ignorance of the man plus the secrecy of the manufacturer, and it is a salt that will keep any wound open for years. There is a labor problem and there is a large opportunity how to study it while the trouble and interruption are not so visible or important. There is more available time for study and more available opportunity for experiment. The fact that there is no trouble does not justify the statement that there is no problem.

The problem must be tackled now or later, and what is done now will have a great influence on the character of the later developments.

Walter Raleigh says of language that "out of one hundred ways of saying a thing ninety-nine are wrong."

Out of a hundred ways of doing a thing, humanly speaking, ninety-nine are wrong and lead to misunderstanding, suspicion and fighting.

Six-Wheel Bus Now Used in Paris

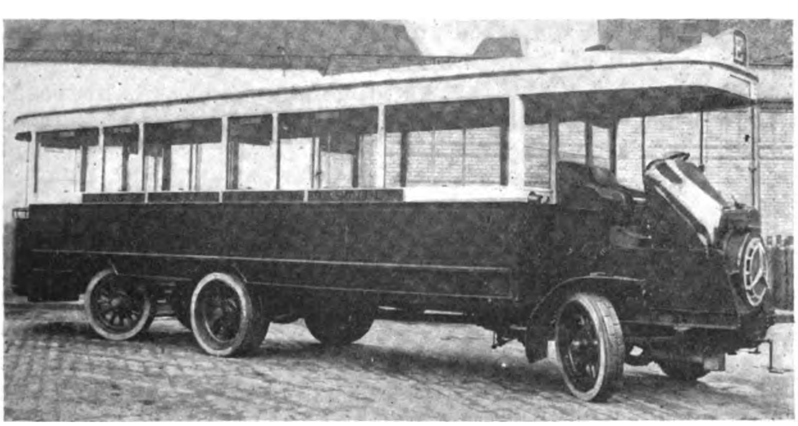
EXPERIMENTS are now being carried out in Paris with a six-wheel single deck omnibus steering through the front and the rear pair of wheels, and driving through the center pair. The advantage of the new type is that an increased wheel base and additional carrying capacity are obtained with the same turning radius as for the normal two axle machine. The experimental buses are being run on the Madeleine-Bastille route, which comprises the most crowded boulevards of the city.

No changes have been made in the engine, which is a four cylinder type placed under the driver's feet; the live axle is also practically the same, and the third axle is a duplicate of the front axle. Suspension is by means of three pairs of semi-elliptic springs.

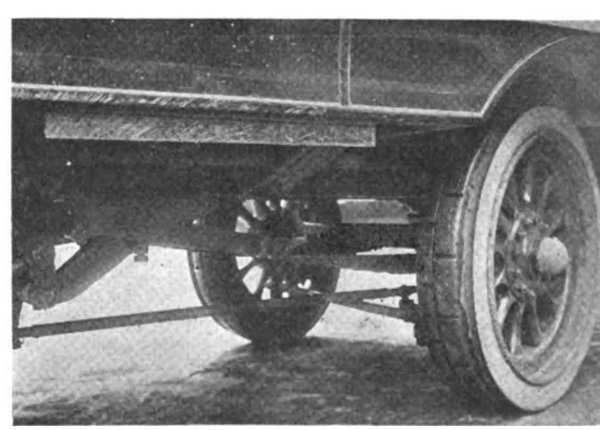
This type of bus is not entirely new, although this is the first time it has been used in Paris for passenger work. Before the war the French engineer Gros designed a similar type of six wheel bus, which was built by the De Dion Bouton Company and experimented with on the streets of Paris. Since the armistice the bus company has been making use of a three-axle chassis for tankers bringing gasoline and benzole from the refineries to the bus depots.

All Paris surface lines, comprising trolley cars and buses, went under the direct control of the municipal authorities on January 1st. The municipality is not running these lines itself, but is farming them out to an operating company, which is interested, to a certain extent, in the financial success of the concern. There will be no competition between electric trolley and gasoline omnibus lines, but cooperation between the two, each type being extended according to the requirements of traffic.

AMONG publications recently issued by the Director of the Air Service, Washington, are the following: Instructions for Installing 85-A Mixture Control in Zenith US-52 Carbureters, Performance Test of U.S.X. B.I.A. with 300 HP. Hispano-Suiza Engine and Performance Test of U.S.X.B.I.A. with 300 HP. Hispano-Suiza Engine Showing Improvement in Performance with Propeller X-19677.



Six-wheel motor bus now being experimented with in Paris. Front and rear steering give short turning radius



Rear axle on Paris bus is duplicate of front axle. Only the center axle has driving wheels

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Systems and Individual Development

AT a time when great emphasis is being given to systems and organization routines, it is well to recognize the fact that the multiplication of routine forms and systems inevitably results in a proportionate increase in overhead costs. There has been a tendency during recent years to reduce as far as possible the necessity for personal judgment and mental activity on the part of office workers; to establish rules and forms of procedure to so large an extent that the necessity for the exercise of intelligence on the part of the clerical worker is reduced to a minimum. This has been done on the principle that by such means the possibility of error is correspondingly reduced.

Looking at the matter from the opposite angle, however, it becomes evident that as the necessity for the exercise of intelligence on the part of the individual worker decreases, the necessity for supervision, both of the worker and the system increases. Or to state the same proposition in other words, as the intelligence of the individual worker is increased, the necessity for supervision is decreased.

In a recent editorial, the British journal, *Engineering Production*, says that "as a general proposition it may be stated that the Cinderella of commercial occupations is the clerical department. . . . The temptation to employers has been to replace efficiency with mere numbers—clerical labor being cheap—with the result that clerical staffs are frequently too large and unwieldy." This tendency is natural when overemphasis is placed upon systems, since more persons are always needed to operate the systems. The possibility of great gains accruing to the management through an attempt to increase personal development and to encourage the assuming of responsibility by individuals is worth serious thought.

It may take a little more time and effort to properly train and develop the individual in any given case so that he is capable of assuming a larger degree of responsibility for his personal efforts. But once accomplished the result is beneficial and permanent. Efforts to make system replace personal responsibility to a maximum degree result in trouble the moment the administration of the system lags. And even systems must be operated by human beings.

Physical Properties of Rubber

MANY people have wondered why the shock absorbers fitted to airplane landing gears should be made of rubber cord instead of steel. The great strength and elasticity of steel are well known, and it seems at first sight impossible that a material of comparatively low elastic limit like rubber could store a greater amount of energy in elastic deformation than the much stronger steel. Such, however, is the case, and the use of rubber for airplane shock absorbers is based on a sound principle. The amount of energy which a certain amount of a given material can store by elastic deformation depends upon both its elastic limit in tension and its elongation when the elastic limit in tension is reached, and this latter factor is, of course, much greater for rubber than for steel. The matter of the energy storing capacity by elastic deformation has been the subject of experimental investigation and it has been found that whereas tempered spring steel will store 95.3 ft. lb. per cu. in., vulcanized rubber will store 14,600 ft. lb. In view of this fact and the many endeavors in recent years to improve the riding qualities of automobiles it is a wonder that rubber has not been used for suspension purposes except in an indirect way.

Another peculiarity of rubber about which little is known is that it contracts when heated and expands when cooled, in which respect it differs from almost all other substances. In stretching rubber and allowing it to contract there is, moreover, a hysteresis effect. That is, the rubber does not exert the same tension during contraction as during extension while deformed the same amount. By plotting the curve of extensions and tensions for a complete cycle, a hysteresis loop is obtained, the area of which is a meas-

ure of the energy loss due to hysteresis. This hysteresis is one of the causes of heating in rubber tires and undoubtedly the chief cause in the case of solid tires. In pneumatics of the fabric type the heating is very largely due to the friction of one layer of fabric over another. Anything which decreases the hysteresis of rubber will improve the efficiency of tires from an energy conservation standpoint. It has been found that a slight overcuring has a beneficial effect in this respect, but, unfortunately, such overcuring is not good for the endurance of the rubber. It is readily conceivable that the fillers with which rubber is compounded have an influence on the hysteresis effect and thus influence the energy loss due to the tires.

Is Volumetric Efficiency of Prime Importance?

WHEN gasoline was cheap and the automobile was still regarded as a sporting vehicle or rich man's toy rather than the utility as we know it to-day, there were insistent demands for more power, with relatively little consideration for economy. Taxation, based largely upon engine size, and other factors then led, especially in Europe, to an effort to get the utmost power possible out of an engine of small bore. This, in turn, brought about many improvements in design intended to secure the maximum volumetric efficiency, and gave us in fact the modern high-speed passenger car engine.

To-day we still think in terms of maximum power, though economy in fuel is of quite as much, if not of greater, importance. It is generally conceded, in fact, that the average passenger car engine operates from 80 to 90 per cent of the time it is in use under loads of one-fifth to one-half maximum. In other words, we design for and talk about getting maximum volumetric efficiency and then proceed to use the engine thus designed under throttled conditions where, of course, the volumetric efficiency is purposely limited.

Every engine builder and car manufacturer can furnish from his files data on the full-load performance of his product, but few, indeed, appear to appreciate what a small fraction of the time the engine they build operates under full-load conditions, and fewer still have investigated the characteristics of the engine under light loads or appreciate how inefficient it then becomes, especially from a thermal standpoint.

As a matter of fact, there seems to be but slight appreciation of the truth that the engine which accelerates well and handles smoothly is not necessarily the more powerful; though the layman, if not the engineer, will often refer to such a car as being more powerful than one with a larger engine which in reality develops a greater maximum power when operated under the rare conditions which enable the potential power to be realized.

Much depends, of course, upon the manner in which the fuel is prepared prior to ignition in the engine. Of two engines identical, let us say, except in carbureter equipment and manifolding, including provision for heating the charge or the fuel, the one with the dryest or most readily combustible charge will give more satisfactory operation from the standpoint of acceleration and general handling and appear to be the more powerful, though it actually gives less maximum power when once it is wide open and the manifold cleared of fuel deposited on the walls. The first-mentioned engine will give far greater satisfaction in the hands of the user, and with rare exceptions will do all that the second engine will do under service conditions. Beside this, it will remain freer from carbon, will suffer less from fuel dilution of the lubricant, and probably travel much further per gallon of fuel consumed than the engine in which these desirable characteristics are sacrificed simply to secure a slightly greater maximum power.

In other words, the day when the utmost possible in volumetric efficiency was desirable regardless of other characteristics is past—perhaps it might better have never come. Some engineers still refuse to consider any vaporizing system which thoroughly heats the charge and thus decreases to some extent volumetric efficiency. With present-day fuels, at least, we feel that this is a serious mistake. Better by far sacrifice whatever relatively small amount of power is lost by heating the charge a sufficient amount and gain the benefits mentioned than sacrifice these for a slight gain in maximum power. It may even pay to use exhaust gas or some other diluent to prevent detonation with the hotter charge than to sacrifice the advantages gained. However this may be, let's forget the maximum power bugaboo, and aim, rather, to promote fuel economy and better performance under the average conditions of operation.

Ignorance Hurts as Much as Malice

LEGISLATION adverse to the interest of the automotive industry is not always designed with malice aforethought. It is often the result of ignorance of the true facts of the case on the part of legislators. This is illustrated by the New York City alderman who introduced an ordinance to compel all motor vehicles in that city to carry a rear-end signal device and so worded the ordinance as to exclude all except one signal on the market.

When other signal manufacturers protested, this alderman readily proposed an amendment so that other signals would be included. He said he really didn't know there were many different signals, and, having bought one of this particular kind and found it satisfactory, had molded the ordinance in accordance with its working.

This sort of thing provides ample justification for the efforts of automotive manufacturers to have the industry intelligently treated by legislative bodies, and emphasizes need for constant watchfulness.

It is undoubtedly true that ignorance of the real facts on the part of legislators can harm the industry fully as much as a conscious attempt to load it with burdens not properly its share. An honest attempt to get justice by the presentation of such facts has no relation to the pernicious lobby.

Credit Situation Improving Rapidly

Collections Easier, Parts Makers Find

Volume of Business Continues to Grow—Many New Orders Booked for Delivery

NEW YORK, April 26—Business in the automotive industry which began to forge ahead in January will show an improvement this month over last. The increase over March will not be so great, however, as it was in March compared with February. May remains something of a problem. Orders already on hand make it certain trade next month will approximate that for April, but whether it will continue to increase remains in doubt. There is a pronounced feeling that progress from now on will be slower than for the past quarter.

Conditions in the industry were discussed at a group credit meeting of the Motor and Accessory Manufacturers Association here to-day, and the experiences of the members showed a remarkable similarity.

The outstanding fact expressed is that collections are better than they have been since late last summer. Notes given last August are being paid and notes made more recently are being met, in most instances, upon the due dates. Cash has again made its appearance. Credit conditions are much easier than they have been in months. Collections showed considerable improvement last month, but the gain in April has been much more pronounced.

Old Orders Released

In general there has been a decided improvement among the parts manufacturers in the amount of new business, the number of releases on old orders, and in collections. Individual experiences differed somewhat, but the trend was all in the same direction. Additional passenger car companies are constantly coming into the market for supplies. The pulse of the truck end of the industry has begun to stir.

Parts and accessory manufacturers who depend on jobbers and retailers for a substantial share of their business reported that this trade is remarkably good and that it is now on virtually a normal basis.. Orders are substantial and payments prompt. Jobbers and dealers seem to be doing a greater volume of business in proportion to the capital invested than the manufacturers of complete vehicles.

April has brought a very large number of releases on old orders and they have come from virtually all the passenger car companies, small as well as large. This indicates that the business recovery has filtered through the entire industry. Some of the companies mentioned were Haynes, Jordan, Grant, Hupp, Briscoe, Peerless, Stutz, Lincoln, Rolls-Royce, Cadillac, Kissel, Dodge, Oakland, Barley, Maibohm, and Studebaker.

Ford and Franklin seem to be leading in the list of companies offering new business. Others mentioned in this class included Chevrolet, Oakland, Wills-Lee, Lincoln, Chandler, Mercer, Hudson, Dodge and Hare's Motors.

Truck companies which have come into the market include International, Ruggles, Brockway and Acme.

Orders Held to Minimum

Complaint was general that passenger car companies are ordering on a strictly hand-to-mouth basis and that they expect deliveries before it is humanly possible to make them. Stock chasers have again taken the field. Parts makers have little idea of the future requirements of their customers and it is difficult for them to keep stocks of materials on hand to this reason.

One particularly gratifying statement in regard to collections was that they have shown marked improvement in the South, where they have been almost hopeless for months.

HAYNES PRODUCTION HIGHEST IN HISTORY

KOKOMO, IND., April 25—A. G. Seiberling, general manager of the Haynes Automobile Co., has issued a statement in which he says the company is producing 33 1/3 per cent more cars than ever before in its history and employing approximately 16 per cent more men than ever before. In many departments day and night shifts are being operated.

Auto-Lite Prepares for Rush

TOLEDO, April 25—The Electric Auto-Lite Co. announces that business prospects for May are 20 per cent better than for April. As a consequence the company is gradually taking on additional employees and now has approximately 750 on the payroll.

H. C. S. on Normal Basis

INDIANAPOLIS, April 25—The factory of the H. C. S. Motor Car Co., of which Harry C. Stutz is president, reports that production now is on a normal basis and that at no time has it gone below 60 per cent of normal.

France Sells Parts; Plan Dumping Here

Private Company Takes Over Camp from Government—Stocks Run to Millions

(By Cable to AUTOMOTIVE INDUSTRIES.)

PARIS, April 25—The first American reconstruction camp at Verneuil, the largest motor transport organization in France, has been sold for 55,000,000 francs ($11,000,000 normal exchange rates) to a private company with a government interest in the profits.

The camp contains few automobiles, but an immense stock of parts, including 9000 boxes of Ford parts and 45,000 solid tires.

It is intended to sell the parts on commercial lines and a large part of them will be reimported into the United States.

So far as is known, this is the first sale in France of American automobile parts which are likely to come into competition with home industries. A large number of motor trucks and passenger cars have been sold and reimportation of them has been begun. An American company also has bought up all the American army automobile tires left in France and tire dealers in New York and other places are suffering severely because of the competition from these tires.

It is such competition as this which could be made much less harmful if a clause were inserted in the anti-dumping bill which will be passed at the present session of Congress compelling payment of duty on the difference between the price at which these goods were purchased and the price in the open market here. Under the present law such goods are being reimported free of duty.

C. of C. HONORS INDUSTRY

INDIANAPOLIS, April 22—The automotive industries were given considerable recognition as a factor in the industrial life of this city when the committee appointments of the Indianapolis Chamber of Commerce were made public. Harry C. Stutz, head of the H. C. S. Co., and D. McCall White of the Lafayette Motors Corp. were named on the manufacturers' committee. John B. Orman, secretary of the Indianapolis Automobile Trade Association, was placed on the membership committee, while Walter C. Marmon was named on the reception and appreciation committee.

Willys Extends Factory Schedule

Outlines 450 a Day for May Production

Will Increase Working Force 30 Per Cent—Chrysler Reiterates Belief in Company

TOLEDO, April 23 — Following the greatest drive-away of motor cars in the history of the Willys-Overland Co., and a meeting of 600 dealers and bankers in five neighboring States with factory officials, John N. Willys announced that the company was planning to increase its working force by 30 per cent in May and its production by 50 per cent.

There are now approximately 6500 men at work at the Toledo plant turning out about 300 cars a day. This force will be increased to nearly 9000 next month.

In the great selling exhibition staged at the factory yesterday 525 cars were driven away.

Willys is brimful of optimism following his recent trips into the South and Western States. He is planning to visit New England, the Denver district and the Pacific Coast territory on his next sales trips.

The dealers were assured of the financial position of the company at the present time by the officials and received the word that no new models or change in the executive staff would be made.

Sales Manager A. C. Barber was in charge of the dinner meeting at the Willys-Overland administration building dining room. At the meeting there were addresses by President Willys, Executive Vice-President Walter P. Chrysler and Vice-President Charles B. Wilson.

Will Stand for Quality

Wilson declared that Overland was to stand for quality from now on and that a great effort was being put forth to build up pride of workmanship in the factory. He said every employee had signed the petitions headed:

"We are doing our best every day to make the Overland car a good investment."

"Our first problem following the after-the-war depression was to examine the cost of our car. If we are wasteful in the building of a car," declared Vice-President Wilson, "you can bet it is tacked onto the selling price. We want to deliver a car that is equal in quality to any in America. We have passed the old extravagant period of the war and are back to a real competitive basis now."

Chrysler said the executives had been troubled by the deflation of business and financial conditions but said they had them whipped now.

"I believe the Willys-Overland has arrived again," he declared. "And don't any of you salesmen tolerate the statement that the automobile business is depleting itself. To-day it's the barometer of the business world. A few years ago steel measured business, but to-day the automobile and its accessories is the dominating feature of business. It has staged the comeback first and is now employing great forces of money, resources, and men.

"Our new President has placed the automobile into his first message to Congress because he realizes that transportation is the heart of business.

"I want to disperse these rumors, too. The very closest relation that can exist between two men characterizes the relation between John N. Willys and myself. And it's going to exist. I am here to make a success of this business.

Out For Clean Business

"We are out for clean business, a better product, and plain common sense."

Willys told the dealers that financially the company was gaining every day. He said economy had been built into the new organization, that he wasn't broke and confirmed what others had said about no change in personnel of executives.

"The last six months have been very troublesome," he declared. "We have learned many lessons. One which I have

(*Continued on page* 934)

Financial Worries Over, Willys Declares; Has $7,000,000 Cash and Surplus Sold

TOLEDO, April 22—President John N. Willys said today that great accomplishments had been made financially by the Willys-Overland Co. in the last few months.

He said the Executive Vice President Walter P. Chrysler had managed to cut overhead expenses so as to save $4,000,000 annually to the company.

"Our assets at the present time are $135,000,000," he reported. "A year ago we owed to bankers approximately $46,000,000 and they thought we were in good shape. Last fall we were owing more than half that and they thought we were broke. But now we have reduced to $21,000,000. They have said they will carry us until Nov. 1.

"We have liquidated our stocks. We have $7,000,000 in cash on hand now.

"Our floating loans and accounts payable during 1920 have been cut $13,000,000.

"We can face the future with optimism without departing from conservatism.

"Our business for many weeks has shown a steady, and now shows a rapid, improvement.

"Distributors' and dealers' inventories—nearly 6,000 in number—are in better condition than they have been for years."

Walter P. Chrysler reported that commitments for materials totalling $105,000,000 at the beginning of the depression had been reduced to $15,000,000 during the strenuous period of falling prices.

A. C. Barber, sales manager, reported that the sales incident to the drive-away yesterday in which 525 cars went out had brought in $545,180 in cash to the treasurer's office this week.

Car Tariffs Yield $786,628.75 in 1920

WASHINGTON, April 25—Duties on imported automotive products during the calendar year of 1920 amounted to $786,628.75 according to the statistical report completed this week by the Bureau of Foreign and Domestic Commerce. It is particularly important at this time because of the pending fight on tariff matters. The report shows that 30 per cent tax levied on 811 automobiles valued at less than $2000 each amounted to $197,992.50. Forty-five per cent assessed on 93 cars valued at $2000 or over brought $133,842.60 into the Federal Treasury. The same rate applying on 380 imported bodies amounted to $36,628 in duties. With the 30 per cent rate of duty applying on 240 chassis, $256,546.80 was yielded, and on other finished parts, not including tires, $71,499.30.

The reciprocity agreement with Cuba brought only $108 into the Federal Treasury on these items.

Few Motorcycles Imported

With the 25 per cent rate applying on motorcycles, the Government obtained $1992.75 in duties and $1875.25 on other unfinished parts of motorcycles, not including tires.

Levying 20 per cent on 78 airplanes imported into this country brought $35,-605.60. The same rate applying on metal parts of airplanes yielded $29,250.

Tariff Main Topic at U. S. C. C. Meeting

Industry Represented by Eight Organizations at Convention—Outline Business Plans

ATLANTIC CITY, April 26—The automotive industry is well represented at the annual meeting of the Chamber of Commerce of the United States which opens here to-night. The following organizations are entitled to delegates at the convention:

National Association of Automotive Mutual Insurance Companies, New York.
National Automobile Chamber of Commerce, New York.
National Automobile Dealers Association, St. Louis.
National Automobile Underwriters, New York.
National Association of Collapsible Tube Manufacturers, Chester, Pa.
Automotive Equipment Association, Chicago.
Motor and Accessory Manufacturers Association, New York.
Automotive Wood Wheel Manufacturers Association, Chicago.

In addition to the official delegates many leaders in the industry have come here to listen to the discussions. The general theme of the convention will be, "More business methods in government; less government management of business." The most important questions to be discussed are tariff, taxation and foreign trade.

In the discussion of the tariff, four questions will be considered. They are:

1—Should the tariff not be framed with due regard to export trade sales or for the protection of manufacturing in the United States?

2—Should the fact that the United States now is a creditor nation alter the American tariff policy with respect to protection?

3—Should the United States tariff offer trading or bargaining possibilities for international commercial treaties to encourage export trade?

4—Should the United States tariff be liberal in its provisions in view of the American desire for liberality of tariff on the part of other countries?

Other subjects of interest to the automotive industry will be:

Adjustment of laws relating to foreign trade so as to give merchants and firms a competitive opportunity with the nationals of other countries.

Discuss Highway Commission

Creation of a Federal highway commission to lay out and direct construction and maintenance of an interstate system of highways.

Modification, amendment or repeal of all legislation that restricts the operation of natural economic laws.

Reduction of freight rates if it can be done without impairing railroad credit or efficiency.

Readjustment of wages, valuation, cost of production and the cost of living.

Preparation of legislation calling for an aeronautical code and the necessary machinery for its enforcement.

C. C. Hanch, chairman of the tax committee of the National Automobile Chamber of Commerce, will present the tax program of that organization upon which virtually the entire industry is standing. The delegates to the convention will be asked to vote on whether there should be an increase in the income tax, a sales tax or a resort to loans.

J. Walter Drake, chairman of the foreign trade committee of the N. A. C. C., will present a resolution calling for retaliatory action of the United States against countries which impose discriminatory tariffs.

Highway Plans to Get Attention of Congress

WASHINGTON, April 25—"Concentration of Federal aid money upon the most important State roads which have an interstate character is the next logical step in co-operation with the several States in highways improvement," is the assertion of Senator Charles E. Townsend, chairman of the Senate Committee on Post Offices and Post Roads.

"That Congress undoubtedly will give comprehensive attention to the good roads subject in the present session is predicted by the quite exact reference set forth in President Harding's message. That the Federal agency of administration should be elevated to the importance and vested with authority comparable to the work before it is a proposition which is certain to meet with general approval from those who have truly at heart consistent good roads progress.

"Highways now concern five branches of our government, and there should be a distinct authority which can deal with all departments and possess an independence of procedure. No longer can this work be accomplished effectively through the bureau of a single department. Transportation is the life of the nation, and travelable highways facilitate the daily activities of millions of American families."

PROPOSE NEW AIR LINE

INDIANAPOLIS, April 22—The city council has promised J. C. Wright of Pittsburgh to co-operate in a plan for "the establishment of an aerial mail route from Washington to Chicago. Cities proposed for the route are Cumberland, Md.; Pittsburgh, Columbus, Dayton, Indianapolis and Chicago. The plan is proposed to have one mail plane start from each end of the route at 7 a.m. daily, and said to be possible to reduce by 14 hours the present mail time between cities on the route.

CLIFTON DINES DIRECTORS

NEW YORK, April 22—Col. Charles E. Clifton, president of the National Automobile Chamber of Commerce, gave his annual dinner to the directors of that organization at the Biltmore last night. The affair was very informal and there was a general discussion of the problems confronting the industry.

Industry to Push Foreign Trade Plans

N. A. C. C. Committee Will Be Named This Week to Co-operate with Hoover

NEW YORK, April 23—The special committee of the National Automobile Chamber of Commerce, which will co-operate with the Department of Commerce in devising plans for effective promotion of foreign trade in American-made motor vehicles, probably will be appointed this week. The co-operation will result in two kinds of foreign-trade service—promotive and intelligence.

Before starting promotive work for the sale of motor vehicles, the committee will confer with experts of the Bureau of Foreign and Domestic Commerce familiar with the countries in which the campaign is to be launched. Through these conferences the promotive work could be made to conform with the actual requirements of the various countries.

The intelligence service is to consist of world-wide inquiry to ascertain foreign demand and the collation of specific trade information. This service would enable the manufacturer to decide on a broad foreign-trade policy. The N. A. C. C. committee will decide what specific information is essential to the American manufacturers, and when this information is obtained it will be distributed among American motor vehicle manufacturers.

J. Walter Drake, chairman of the foreign-trade committee of the N. A. C. C., believes that this co-operative arrangement will be advantageous not only to the automotive industry but also in the solution of general problems of the United States export trade.

Secretary of Commerce Hoover has requested an additional appropriation of $250,000 "for promoting commerce." He would establish twelve new divisions to cover various commodities. One of the twelve would be automobiles and accessories.

The plan of Hoover is to have two experts on each industry, who will alternate in the field and serve in the bureau at Washington. These industrial divisions would pass on commercial problems of the trade connected with foreign commerce, utilizing the mass of foreign-trade information now available for the industry, and keeping up to date the market investigations undertaken during the last five years.

TO BUILD $1,200 SPORT PLANE

SEYMOUR, IND., April 22—Assembly of aircraft and the training of pilots will be started here by the Western Airline Syndicate, which has leased a three-floor building and 25 acres of ground. The company is capitalized for a quarter of a million dollars. The big production will be devoted to a light sport plane selling for $1,200.

Bethlehem Receiver to Sell Off Trucks

Sale of Pottstown Plant Held Up for Time—336 Vehicles to Go

PHILADELPHIA, April 22—On petition of Clinton E. Woods, receiver for the Bethlehem Motors Corp., asking instructions from the court, Judge Thompson, in United States District Court of the eastern district of Pennsylvania, this afternoon issued a decree granting the receiver authority to sell the completed trucks on hand and in the field, amounting to some three hundred and thirty-six vehicles at the Allentown, Pa., plant of the company and elsewhere, at private sale at prices he deems desirable, and also to sell under similar circumstances such excess inventory at the Allentown and the Pottstown plants not necessary for the maintenance of the service station.

This application of Receiver Woods to the court was in the receivership in equity case of William G. Keck, trading as Keck Bros. & Co., complainant, vs. the Bethlehem Motors Corporation and followed a meeting of a majority of the creditors and their counsel yesterday at the Allentown factory of the company. At this meeting resolutions were passed that Receiver Woods apply for the authority from the court not only to sell the trucks and the excess inventory, but also to sell the Pottstown plant, devoted to the manufacture of the engines, including the real estate, machinery and equipment.

The creditors' committees at this meeting represented both the banker creditors and the merchandise creditors. Creditors' counsel at to-day's session in court showed for one group, however, that it would not be advisable at this time to sell the Pottstown plant, and no decree was granted in this respect. The bankers' committee of creditors represents the larger claims, aggregating about $1,700,000.

It was shown at the creditors' meeting on Thursday that should the Pottstown plant be sold the Allentown factory, where the frames, springs, chassis and bodies are produced, could be operated by the receiver at approximately $6,000 to $7,000 a month, instead of from $12,000 to $13,000 as at present. It is regarded by some of the creditors as probable that application will be made later for a decree to sell the Pottstown plant. The Allentown factory will continue to operate for the present.

MADISON FAILS OF SALE

ANDERSON, April 22—Auctioning of the effects of the Madison Motors Corp. produced little interest. One bid of $34,000 was received for the factory. It was not accepted. The building and eight acres of land are appraised by the receiver at $70,000. Automobiles and automobile parts and supplies sold out readily enough at prices fixed on condition and age.

The Madison Motors Corp. quit business several years ago. It was organized by Cecil Gibson, organizer of the Gibson company, state distributer for the Overland line. Gibson no longer is connected with the company. Fred C. Dickson, receiver for the Madison Motors Corp., is in Wisconsin, and at his office no announcement was obtainable as to winding up affairs following this sale.

Passenger Cars Share Truck Fee Increases

HARRISBURG, PA., April 21—Objections made by motor truck interests in the State and such organizations as the Philadelphia Chamber of Commerce, apparently have caused the State Highway Department to agree to several important changes in the Buckman bill seeking to regulate motor traffic and which the department hitherto has been supporting.

Reducing the proposed increases with respect to trucks and raising the fee for passenger cars from forty to fifty cents per horsepower is suggested. It is understood that present truck fees will, however, be raised by about one-half their present rate. The original increase contemplated was all the way from 80 per cent to 200 per cent. Paul C. Wolff, Pittsburgh, representing, as secretary, the Pennsylvania Motor Federation, opposed the change in lighting regulations embodied in the bill.

The new light standards had been suggested by the Illumination Engineers' Society of the United States. The department plans to establish light testing stations throughout the State. It is reported that comparatively few of the present lights meet the legal standard.

Texas Tractor Sales Placed at $6,000,000

DALLAS, TEXAS, April 23—More than 3000 power tractors for farm and road use are being distributed to users in Texas by the twenty implement dealers in Dallas, according to estimates of men who keep closely in touch with the tractor trade here. The average value of those tractors is $2000 one of the implement men said, which makes a total of $6,000,000 for the tractor business in the State for the year.

LUBRICATING OILS REDUCED

NEW YORK, April 23—The Vacuum Oil Co. has announced a substantial reduction in the prices of its lubricating oils of all grades and in all size packages. The reductions range from $5 to $10 a barrel and from 10 to 30 cents a gal. in cans. The company reduced its prices as of April 20 to give its dealers who had price guarantees to May 1 on carload or other large quantities, protection against loss covering the unsold portion of such shipments remaining on hand. A refund will be made to all such customers of the net difference between the prices.

Mississippi Growth to Come with Trucks

Valley Association Gives Highway Transportation Important Part in Convention

NEW ORLEANS, April 25—The big outstanding feature of all the six great public conferences which will make up the annual convention of the Mississippi Valley Association at New Orleans, May 2, 3 and 4 this year, will be transportation, and the leading subject of discussion will be motor truck transportation in the Mississippi Valley, and how it can be made to coordinate and cooperate with water transportation, and, through the inland waterways, with deep-sea transportation out of the ports of the valley.

The first and largest of these conferences will be on highway-water-rail transportation; the second will be on agricultural transportation, highway building for motor trucks, thereby to give the farmer closer connection with his home market, and, through long-distance transportation, with foreign markets; the third will be on reclamation and conservation, with a large part of it devoted to highways and to motor truck lines and the parts they play in the reclamation of lands and the conservation of resources; the fourth will deal with the development of new trade routes, primarily at sea, but secondarily, in their connection with trade routes by highway, water and rail in the Mississippi Valley.

The employment of labor by the state in building highways and in keeping in repair those already constructed, will occupy a large part of the interest in the fifth public conference, and the sixth will deal with foreign trade, especially in connection with the exports of articles manufactured in the Mississippi Valley.

Probably never in the history of a convention of this kind has the automotive vehicle figured so largely. Delegates from 30 states of the Union and from 27 foreign countries, largely Latin-American, have made reservations for the convention, the call for which was sent to more than 10,000 firms, corporations, companies and individuals in the United States alone.

Export Financing Important

The question of the financing of exports from gulf ports, to which inland waterway transportation is now fairly well organized, will be taken up. This has been the great obstacle to the export of automobiles, trucks and tractors, manufactured in the Mississippi Valley, through the gulf ports, and the results of the conference should be of vital interest to every automobile manufacturer and distributor in the upper Valley, since water transportation from those manufacturing centers to the gulf ports is now lower than rail transportation to these or to any other ports in this country.

President an Ally; Will Keep Him So

Graham Tells Philadelphia Truck Association of Harding's Interest in Welfare

PHILADELPHIA, April 22—Members of the Motor Truck Association of Philadelphia listened to messages of unusual importance from men high in the industry when they gathered at the Hotel Adelphia for the April meeting. They heard George M. Graham, vice-president of the Pierce Arrow Motor Car Co., tell how, in an interview, President Harding had expressed deep interest in the problems of the overtaxed industry and showed that he is an ally of the business and will be kept so. They listened to R. E. Chamberlain, assistant general manager of the Packard Motor Car Co., discuss "What An Ideal Dealer Should Be," and they were entertained and interested by the address of J. D. Eggleston, motor transportation engineer of the Paige Motor Car Co., on "Analyzing Motor Transportation."

In his topic, "Making the 1921 Grade," Graham said in part:

"The speed already developed in the motor car business, especially considering past conditions, entitles the industry to be optimistic for the future. As to present business conditions, I blame the manufacturer for the slump we experienced on account of his over-optimism; for too great and rapid expansion and for not protecting his own credit and that of his dealer. But his revenue went to his partner, good old Uncle Sam, by way of the revenue bill, which took away most of his profits.

"Nevertheless, he has gone along pretty well. Throughout the war conditions were pretty difficult—what with restrictive legislation and being eliminated from foreign business.

"But conditions are changing. . . . I was one of a committee to see President Harding recently. He was interested in our problems and what we want and can do. We called his attention to the need of regulation of license fees of all States, to keep roads in repair, but not to build new roads.

Industry Needs Credit

"We told him our industry needs credit and we pointed out our export conditions. I pointed out that two-thirds of the motor vehicles, or in excess of 6,000,000 cars, are owned in homes where the yearly income is $4000 or less. Yet this is the most over-taxed industry existing and is one of the few with a sales tax. No such tax is imposed on steamships or locomotives. Mr. Harding used the phrase that the motor car is a 'purveyor of transportation.' We found him an ally and will keep him so."

In outlining the qualities of an ideal dealer, Chamberlain asserted that everyone in the automobile business was at fault for his own difficulties, adding that salesmen have not kept up to the mark and will have to correct this attitude. Retail establishments, he continued, for the most part are not as strong financially as they should be, but are stronger than they were a year ago.

After reviewing causes and conditions of the business hesitancy, Chamberlain said that the truck industry had been hit harder than the passenger car business, but that he considered both fundamentally sound. He added that the average truck dealer is not as good a business man as the average merchant.

He told of methods used by the Packard company which gave the factory an index of where distributors were lax.

Bonus Leading Factor in Deciding Taxation

WASHINGTON, April 26—Because Senator Penrose, chairman of Senate Finance Committee in conference with the Taxation Committee of the National Automobile Chamber of Commerce stressed the fact that the bonus legislation held the key to the tax problem of the automotive industry, it is significant to note that the National Industrial Council has opposed the proposed plans for monetary rewards to soldiers. The Council has distributed an analysis of the schemes and pointed out their effect on the nation's tax bill. Senator Penrose directed attention of the automotive industry to the need of retaining various methods of imposts if the bonus bill was enacted.

Two proposals are now before the Congress, known as the Fordney and McCumber bills. It is proposed to defer the execution of the plan until Jan. 1, 1923, but it will be necessary to make arrangements for a levy immediately. The McCumber bill offers five separate plans of which No. 1 and No. 2 are more or less acceptable to Senate leaders. The cash payments under the first plan are to be spread in quarterly installments over a period of two years or, in Plan No. 2, over twenty years in loans less repayments, or on account of deaths, or the maturity of what is for all practical purposes an endowment insurance.

If every veteran accepts the cash plan, it will cost the taxpayers $1,547,904,395. Should every veteran accept the certificate plan, with no borrowings, and making allowance for annual payment on account of debts, the total amounts in 1943 would aggregate $5,251,364,907. The other three plans range in total payments from three to four billion dollars.

RACING ASSOCIATION FORMED

PHILADELPHIA, April 22—The National Motor Racing Association, an enlargement of the Philadelphia Motor Racing Association, has been incorporated under the laws of Delaware and will stage races throughout the Middle Atlantic States during the season of 1921. The association now has approximately 70 members, including automobile, motorcycle, airplane drivers and motor boat pilots.

Good Quotes "Luxury" in Reply to Dealers

Says Cars Not Necessity in Dictionary Sense—Dealers Quote Harding's Message

CEDAR RAPIDS, Iowa, April 22—Despite a storm of protesting letters against his proposal of a wheel tax designed to collect $200,000,000 from owners of passenger carrying automobiles, Congressman James W. Good has reaffirmed his opinion to the Linn County Motor Trades Bureau that that form of vehicle is a luxury.

"Webster defines the word necessity as a thing that is indispensable and certainly no sane person will contend that he cannot live without an automobile," says a letter to the automotive men of Good's home town. "In talking with highway commissioners in Washington at present, I find there is substantial agreement on their part that Federal aid for highways should continue and that the money necessary should come from an additional tax on automobiles. Nothing will stimulate the industry more than good roads. I cannot think of a more just tax to aid in road building than to tax the automobiles that use the roads."

The Linn County Motor Trades Bureau lost no time in replying to Congressman Good's letter, taking particular exception to his use of the word "necessity." It pointed out that President Harding in his message to Congress on April 12, said "the motor car has become an indispensable instrument in our political, social and industrial life." The Cedar Rapids dealers further emphasized the fact that the automobile industry is now the most taxed of the five main levies through income taxes, sales taxes, taxes on repair parts, State license and registration fees, scattering municipal and personal property taxes.

"We take the stand that all businesses should be taxed on the same basis and even now the automobile is the target of special levies both national and State," says the letter. "Now you propose on top of these five main levies to add another excessive burden to the automobile industry. We say quite frankly we believe you should give this further consideration."

OBENBERGER FILES SCHEDULES

MILWAUKEE, April 23—Liabilities of $858,972.79 are admitted and assets of $1,778,329.13 are claimed in the schedules filed by the John Obenberger Forge Co. of Milwaukee in bankruptcy court to-day. An involuntary petition was filed against the corporation on March 25 with the consent of the company, which has been in charge of a creditors' committee since December. The first meeting of creditors will be held May 2, at 10 a.m., in the government building here. J. F. Gerdis is receiver.

N. I. V. A. Establishes Farm Power Bureau

Will Combat Anti-Tractor Propaganda Through Publicity—Propose Federal Tests

CHICAGO, April 23—While the reports of actual business in hand now were not encouraging and manufacturers' representatives were reluctant to make any predictions of what the future would bring forth or when there would be a renewal of buying, a spirit of optimism pervaded the spring convention of the Tractor & Thresher Department of the National Implement & Vehicle Association held in this city yesterday. Most of the tractor manufacturers were represented.

No one was quite happy over conditions as they stand, but there have been a number of factors entering into the situation, principal among them being that of transportation and freight rates. Too, the mental attitude of the farmer has figured largely and whether the realization that the winter wheat crop—the first to be harvested, will be a bumper one and will cause a change of outlook, was a matter largely of conjecture. As yet, the farmer, sensing the importance of the approaching crop, has shown no disposition to come into the market.

Temporarily the buying power of the farmer has been destroyed. Unable to dispose of his crops or his cattle at a profit, from the standpoint of his expenditures, he is practicing the utmost rigid economy along all lines. Little blame was attached to the country banker for credit refusal with conditions as they are to-day. There is no need, according to the expressed opinions, to sell him on the tractor idea, for he is already sold. But he has no money to lend to finance tractor sales or any other kind of sales. In a recent survey of conditions among eighty-five banks in Central Illinois the fact developed that whereas a year ago the banks had on deposit $2,000,000, this year the deposits had dwindled to $430,000 and borrowings by the banks were approximating $2,300,000.

Farmer Attitude General

The situation in Kansas may be taken as indicative of the general attitude of the farmer. Despite the fact that the crops there promise to meet every anticipation and more and despite heavy rainfalls which have been experienced in that section, the farmer remains in a lethargic state of mind. He is not affected, and has not relaxed his position to the extent of coming into town to buy farm machinery.

Little was said at the meeting of means to meet the situation or of steps to remedy it unless it be in the statement of Finley J. Mount, the chairman of the department, who urged less talk and more hard work, or in the statement of other manufacturers that salesmen must become salesmen again and relinquish the position of mere travelers.

To cope with the misrepresentation by interests opposed to the tractor industry that has been made, and to present correct information to the farmer, to agricultural colleges and others through farm papers, country weeklies and other mediums, the association has established the Power Farming Bureau with headquarters in this city and it is felt that this department will do much toward setting the doubting farmer right when the time comes for him to invest in farm machinery. This department received the hearty co-operation of the manufacturers representatives present at the meeting.

At least one tractor demonstration will be held this year, the time and place to
(*Continued on page* 934)

N.A.D.A. to Get Hearing on New Revenue Bill

WASHINGTON, April 23—Notification was given to C. A. Vane, general counsel of the National Automobile Dealers' Association, that the organization's request for a formal hearing on the revenue bill had been granted. The notification was from Senator Boise Penrose of Pennsylvania, chairman of the Senate committee on finance.

Dates for the hearing will be announced later. It is the intention of the Senate committee to take up a number of general revenue propositions in connection with the new fiscal program and thence to proceed to the direct question of taxes and discuss the revenue law of 1918 section by section under the general titles of the former act.

Vane is now studying the tax situation here and will make a report to the directors of the N. A. D. A. at the meeting in Detroit, May 9. At that time the directors will determine whether the executive committee of the association will appear before the Senate committee, whether the entire board will go before or whether a number of the leading distributors of the country will be asked to go to Washington and present the tax case from the dealer's standpoint.

TIMKEN RESUMES OPERATIONS

COLUMBUS, April 23—The Columbus branch of the Timken Roller Bearing Co. started operations April 20 after a shutdown since October. Word was received by Charles N. Replogle, manager, to start operations in the screw, machine, grinding and inspection departments, and about 250 men were put at work. It is hoped to increase the number gradually to about 2500.

PILOT INCREASES FORCE

INDIANAPOLIS, April 23—Pilot Motor Car Co. has increased its working force 50 per cent during the past week. Orders are coming in in fair shape, according to Superintendent Van Etten, but in spite of a supposed surplus of labor, the company is finding it difficult to secure high class skilled labor.

Studebaker Control Not to Be Changed

Erskine Denies Schwab and Durant to Enter Board—Business at Best

NEW YORK, April 26—The fact that Charles M. Schwab and W. C. Durant recently have been heavy purchasers of stock in the Studebaker Corp. has given rise to renewed reports in financial circles that they are to become directors of the South Bend company. It is denied by both of them, however. President Erskine of Studebaker announced at the annual stockholders meeting that no changes in the management of the company were impending.

Studebaker stock continues its spectacular course on the stock exchange and is fluctuating between 86 and 89. Much of the movement in it is believed to be purely speculative, although the company is doing the best business in its history and is shipping cars at the rate of more than 7000 a month. Net profits for the first quarter of the year are estimated at more than $1,000,000 after taxes, and for the second quarter they are expected to greatly exceed this amount.

Another report in regard to Durant is that he has been buying into Continental Motors. This was said to be responsible for recent heavy purchases of stock in that company. Officers of Continental Motors declared, however, that there is no basis for this rumor, although the company is submitting estimates and doing considerable work on the motor for Durant's new car.

Reports that Walter Flanders soon would join the Durant organization also were denied at Durant's office here.

CAMPBELL RESIGNS COMET

KANSAS CITY, April 25—Robert H. Campbell has resigned as vice-president of the Comet Automobile Co. of Decatur, Ill., to become vice-president and production manager of the Farmers Mfg. Co., which has taken over the business of the Coleman Tractor Co. of this city. The new corporation intends to continue production of the Coleman tractor which will be redesigned. Officers of the company in addition to Campbell are: President and general manager, Frank Hamilton; vice-president, O. M. King; secretary and treasurer, James E. Dunn.

COLLINS DEFERS RETIREMENT

DETROIT, April 26—R. H. Collins, whose impending retirement from the General Motors organization was announced last week, has decided to remain as president of the Cadillac Motor Car Co. for the next few months. He undoubtedly will stay until the Cadillac company is settled in its new plant. Collins tendered his resignation to President DuPont of General Motors last January, but it has not been acted upon.

Minnesota Business Returns in Cities

Country Districts Out of Running Until New Crop—Trucks Good

MINNEAPOLIS, April 25—Week by week the automobile dealers are showing that business is on the gain. The returning prosperity is evident on the floors of most of the city agencies and branches. However, this business is largely from the cities of the State. The country districts are still out of the running so far as orders go. The money situation has not improved enough to allow the rural dealers to handle cars extensively.

A branch manager who has returned from the Cuyuna iron range reports that the automobile business is extra good in that part of Minnesota. This trade also is in the towns and cities. The truck business continues good with contractors who require more transportation facilities for jobs that are being let for road work and other construction activities.

Part of a résumé by the Northwestern National Bank reads: "We have a legacy of debts from the old year to contend with; bank reserves are frequently low, particularly in small country banks which depend exclusively upon a farmer clientèle; loans are apt to be of a size out of proportion to deposits. Although the accommodations given to member banks are still at a high point, the trend of late has been fairly encouraging, the total on March 31 amounted to $60,892,000 as compared with $58,184,000 a year ago, and $14,346.000 on March 31, 1919, at which latter date liquidation was moving along in a manner more nearly normal.

"Liquidation will continue gradually during the next few months. It is reasonably certain, however, that in lines of business which depend primarily upon the grain farmers, and in communities where credit has reached the dead line, there will be a lull until new money comes in. The varying conditions in the different sections are to be discerned in the shades of expression to be found in reports made to this bank. 'It is going to be tough until fall,' 'There will be no material change until we get a crop,' 'We cannot look for improvement until we get a crop!'"

FORD FLOUR MEETS DEMAND

DETROIT, April 22—Wheat raised on the Henry Ford farm in Dearborn and ground in the Dearborn Ford flour mill, now is being sold in the Ford stores at Highland Park, River Rouge and Dearborn. The flour is sold in 25 pound bags labelled Ford flour, and sells for $1.19 a bag.

The Ford mill at Dearborn, which was completed last fall, is one of the most modern in the country. It is located directly alongside of the Ford grain elevator where grain from the Ford farm is stored and cleaned. The mill is operating on such a basis as to supply the stores as fast as the flour is being sold. The wheat grown on the Ford farm is handled exclusively by Ford machinery and equipment. The ground is plowed and the wheat cut by Fordson tractors, and the grain hauled to the mill in Ford trucks.

Battery Companies Find Trade Outlook Improved

CAMDEN, N. J., April 23—Announcement was made by President Lloyd at the annual meeting of stockholders of the Electric Storage Battery Co. and the Willard Storage Battery Co. that since March 1 there has been a marked improvement in business and that the future looks promising. The new plants at Crescentville, which will cost in the neighborhood of $2,000,000, are nearing completion.

President Lloyd declined the request of the stockholders for information on the gross sales of the company. He said it would be unwise and against the best interests of the company to make the figures public. This stand was indorsed by the stockholders.

Lloyd said that an investment of nearly $1,000,000 recently had been made in the English Battery Co. All the directors were re-elected and the annual report was approved.

Propose Car Training in Indiana Schools

INDIANAPOLIS, April 22—Suggestions that the Indiana State Board of Education consider the needs of the automotive industry in trained automotive engineers, highway engineers, transport engineers and educated mechanics have been made to Elwood Haynes, of the Haynes Automobile Co., recently appointed to the Board of Education by Governor McCray.

The Indiana Automotive Trade Association, through its president, N. H. Cartinhour, appealed to Haynes, that as far as possible and as far as compatible with the best general interests of education, that courses of study in Indiana schools be broadened to permit the training of men for the automotive industry. Haynes, in answer to Cartinhour, pledges his "support of such an education as will conserve the best interests of the State," adding that the work is so new to him that he is uncertain of what its policies may be.

UNITED CUTS BODY PRICES

CLEVELAND, April 23—The United Automotive Body Co. has announced a reduction in prices ranging from 10 per cent to 25 per cent on all its Ford commercial and passenger bodies. The company has opened additional branch assembly plants at Detroit and Pontiac, Mich., to serve more efficiently the sales organizations of motor truck manufacturers located in these cities.

Motor Truck Sales Increase in Texas

Diversification of Use Brings New Demand—Freight Lines Buy Equipment

DALLAS, TEX., April 23—During the past two months 200 motor trucks ranging in value from $1000 to $6000, and most of them in the $2000 to $4000 class, have been sold and delivered by dealers in Dallas or through them. This, despite the period of depression, the dealers believe, is an indication that the motor truck has firmly entrenched itself in the minds of the industrial and agricultural world.

Of the total number sold during the past two months one third of them were delivered in the immediate Dallas territory and quite a few of them went to farmers who are using them in getting produce, butter and eggs to the city, cotton to the gins, wheat to the mills and corn to the cribs.

From Dallas quite a number of trucks find their way to the cattle country. Ranchers use them with trailers for hauling a car load of hay at a time from the railroad to the ranches, sometime seventy-five miles away. They use them for hauling calves and even cattle, alive to the railroads.

The Dallas dealers report also that many of the motor freight lines in the thickly settled sections of the state, are buying new trucks for handling increased business. They are also finding that many counties which have not already done away with horses and mules for the purpose of hauling road materials, bridge materials, and doing other things, are getting the motor truck habit along with the motor road building habit. In addition to these things the usual number of manufacturers and merchants are buying trucks for their delivery and other business.

Sales of passenger cars are picking up considerably, the show here performing an important part in restoring demand.

MULLINS TO STAY IN SALEM

DETROIT, April 22—Reports that the Mullins Body Co., Salem, Ohio, which has been beset by labor troubles, would move to Detroit, were confirmed in part to-day by company officials, though it was said labor troubles in Salem were nearing adjustment and in all probability the situation would be overcome and the plant would remain in that city. Officials said, however, arrangements had been made for plant space in Detroit, and for shipping machinery and equipment to Detroit by express on short notice when the trouble became acute a few days ago.

While the labor situation has not cleared entirely and the company still is in position to move to Detroit quickly, it was said there was every indication in Salem to-day that such a radical step would not be necessary.

Townsend Submits New Highway Bill

Embodies Features Recommended by Harding and Indorsed by Automotive Bodies

WASHINGTON, April 26—Senator Townsend, chairman of the Senate Committee on Post Office and Post Roads, has prepared a new highway bill after conference with organizations interested in highway development, which emphasizes practically all good roads features recommended by President Harding in his recent message to the Congress. The measure will be presented to the Senate late this week when the drafts are completed. The legislation represents the compromise of principles and methods, but it is regarded as the most acceptable at this time and one calculated to pass without formidable opposition.

The Senate bill contains many of the important features of the original Townsend bill, which was indorsed by the National Automobile Chamber of Commerce, the National Automobile Dealers Association, the Federal Highway Council and kindred organizations. The new draft creates the Federal Highway Commission, continues Federal aid to states with drastic maintenance clauses and other marked revisions intended to abolish abuse in the distribution of Federal funds.

The $100,000,000 fund which is appropriated for Federal aid each year is continued for two years, but provisions have been inserted which restrict the distribution of the money. Not more than 3 per cent is to be expended for the administration of the Federal Highway Act for carrying on necessary highway research and investigational studies independently of any co-operation with the State Highway Departments and other research agencies. It is provided that the commission shall, after making these deductions, apportion the remainder of the appropriation for each fiscal year among the states as follows:

Basis of Ratios Changed

"One-third in the ratio which the area of each state bears to the total area of all the states; one-third in the ratio which the population of each state bears to the total population of all the states, as shown by the latest available Federal census; one-third in the ratio which the mileage of rural delivery routes and star routes in each state bears to the total mileage of rural delivery and star routes in all the states, at the close of the next preceding fiscal year, as shown by certificates of the Postmaster General, which he is directed to make and furnish annually to the commission. Provided, That no state shall receive less than one-half of one per cent of each year's allotment. And, Provided Further, any amount apportioned under the provisions of this Act unexpended at the end of the period during which it is available for expenditure under the terms of this section shall be reapportioned, within sixty days thereafter, to all the states in the same manner and on the same basis."

The bill further provides: "That the commission shall establish an interstate system of highways, composed of primary interstate roads which shall, by the most practical routes and with due consideration for the agricultural, commercial, postal and military needs of the nation, afford ingress into and egress from each state and the District of Columbia. Such interstate system may include highways to and from important water ports, and highways connecting at the border with the main highways in countries adjoining the United States; but shall not include any highway in a municipality having a population, as shown by the latest available Federal census, of five thousand or more, except that portion of any such highway along which, within a distance of one mile, the houses average more than two hundred feet apart.

Must Provide Maintenance

In order to carry out the recommendations of the President, the Senate Committee has inserted a proviso to the effect that no project shall be approved by the commission in any state until the state has made adequate provision for the maintenance of the highway selected by the commission in that state. It will be noted that this provision fulfills the suggestion of President Harding in his message to Congress.

Because of the conflicts which have occurred between state highway officials and the Federal authorities, it is provided that in the case of any state failing to carry out the provisions of this agreement after construction or reconstruction of the highway, it shall be notified that after sixty days the commission will proceed to have the highway placed in a proper condition of maintenance and charge the cost against the Federal funds allotted to the state. This clause makes maintenance compulsory to the states, and is expected to do much towards overcoming neglect.

This program was reached after a conference here Monday with the Senate Postoffice Committee, in which Pyke Johnson represented the National Automobile Chamber of Commerce. A. G. Batchelder, executive secretary, and M. O. Eldridge of the American Automobile Association; P. M. Williams and H. G. Shirley of the Federal Highway Council; C. A. Vane, National Automobile Dealers Association, were spokesmen for the automotive and associated industries. Representatives of the farm organizations and American Association of Highway Officials were present.

ITALY EXEMPTS BRITISH CARS

OTTAWA, ONT., April 22—Italian customs authorities have been empowered to authorize the unrestricted importation without license of automobiles of British origin shipped from Great Britain, this applying to those of Canadian manufacture as well as those of the United Kingdom.

Bartlett Is Named Splitdorf Executive

Succeeds R. W. Sutherland As Managing Vice-President—Other Officials Change

NEWARK, N. J., April 27—M. W. Bartlett was elected vice-president and general manager of the Splitdorf Electrical Co. at a meeting of the directors here to-day. He will succeed R. W. Sutherland.

Bartlett is no stranger to the Splitdorf organization. He went with the company in 1911 as secretary and remained until 1919. During the war he handled all its export sales and built up a very substantial business. He resigned in 1919 to become Eastern manager of the Wire Wheel Corp. of America in charge of sales to manufacturers and dealers east of Buffalo, as well as export sales. He is popular in the Splitdorf organization and the directors are confident the company will show marked progress under his direction.

C. W. Brunnell was appointed sales manager of the Splitdorf company at the meeting to-day. He resigned from the Edison Lamp Works to accept the position. During his connection with the Edison company he developed all the sales of incandescent lamps for cars.

D. R. Walls was elected advertising manager to succeed P. A. Tanner.

Sutherland has not announced his plans for the future. He has been with the Splitdorf company since the Alvord interests obtained control in 1912, and has held various positions of responsibility.

Lower Price Rumor Malicious, Says Dodge

DETROIT, April 26—C. W. Matheson, general sales manager of Dodge Bros., denounced the report of a contemplated cut in Dodge prices as "a malicious rumor evidently started by competitors." "The price of the Dodge car will not come down until the manufacturing costs drop, and they are higher to-day than ever," said Matheson. "You can say there will be no cut now and none in the future insofar as we can see. We are building 450 cars daily and shipping only on orders, and we are selling them faster than we can build them."

Matheson also took occasion to deny a statement attributed to another member of the Dodge organization that the company would put out a new sedan May 1.

CHICAGO CUTS GAS TO 20

CHICAGO, April 28—A drop of 3 cents in the price of gasoline in Chicago and the Middle Western States was announced this week by the Standard Oil Co. of Indiana. This means a cut from 25 to 22 cents at the filling stations, and from 23 to 20 cents on tank wagons.

Hannum Appointed Oakland President

Saginaw Products Head Succeeds F. W. Warner, Voluntarily Retired—More Changes Likely

NEW YORK, April 26—George H. Hannum, general manager of the Saginaw Products division of the General Motors Corp., has been appointed general manager of the Oakland Motor Car Co. to succeed F. W. Warner. Hannum has played a leading part in the development of the parts group of General Motors and is regarded as one of the ablest executives in the organization.

While Warner has retired from the direction of the Oakland company, he remains a vice-president and director of the General Motors Corp. No announcement has been made either by Warner or the corporation regarding his future activities. It is evident from the fact that he remains an officer of General Motors that he will fill some place in the organization. It is understood that Warner's retirement from the Oakland plant was purely voluntary. Several other changes in the Oakland personnel are expected to follow his resignation from the company.

Reorganize Indiana Sales

INDIANAPOLIS, April 25—Reorganization of the retail plan under which the Oakland Motor Car Co. has operated in Indiana for some time is practically complete. State distribution of Oakland cars is to be taken over by the E. W. Steinhard Co., effective April 25, according to information obtainable to-day. Public announcement of the change is expected soon.

General Motors Accepts Collins Resignation

NEW YORK, April 28—General Motors Corp. announces that the resignation of Richard H. Collins as president and general manager of the Cadillac Motor Car Co., which was tendered on Jan. 14th, has been accepted.

Herbert H. Rice, formerly treasurer and now one of the vice-presidents of the General Motors Corp. has been appointed as successor to Collins and will take charge of the Cadillac in the near future.

The possibility of Collins' retirement has for some weeks been the subject of conjecture in financial and automotive circles.

N.I.V.A. Establishes Farm Power Bureau

(*Continued from page* 931)

be left with the Tractor show and demonstration committee. This is made up of J. B. Bartholomew, Avery; E. J. Gittins, J. I. Case Tractor Machinery Co.; G. B. Sharpe, Cleveland Tractor Co.; Harry Bates, Bates Machinery & Tractor Co.; J. A. Everson, International Harvester Co.; G. L. Gillette, Minneapolis Steel & Machinery Co.: Donald McDonald, Avery Co., and A. H. Gilbert, Rock Island Plow Co. There will probably be four demonstrations. The question of a show was touched upon and this matter will be left with the committee.

The consensus of opinion relative to state laws requiring tractor tests was that in any state where such laws were contemplated and recommendation should be made providing for the exemption from tests of tractors which had been tested in other states under similar laws. It was felt, at the same time, that, to avoid the multiplicity of state laws, which now seems to be on the decline, it would be better to enact a Federal law.

Willys Production to Be 450 Daily

(*Continued from page* 927)

taken home is that when one tries to run all the business in the world one only passes through about one such depression as we have experienced.

"I am selling out my interests in many of the other companies which I have taken to in the last few years and will give all my time to Willys-Overland."

Willys complimented Chrysler and said that although he was probably the highest salaried man in the automobile industry he was the cheapest man on the payroll because of the economy he had forced into the building of cars.

It was the most enthusiastic meeting of dealers here in many years. The bankers who were present at the meeting were particularly pleased with the showing.

Ford to Establish 50 Mexican Branches

HOUSTON, TEX., April 26—According to W. M. MacDonald, manager of the Houston branch factory of the Ford Motor Co., arrangements are being made for the establishment of fifty agencies of the Ford car in Mexico. MacDonald says the company is after the Mexican business and to establish connections in that country three men representing the Houston plant are in Mexico calling on the trade. These men will spend the next three months in the Mexican Republic and it is their intention to visit every part of the country they can reach to open markets for the Ford products.

RALEIGH BUILDS TWO MODELS

BRIDGETON, N. J., April 25—The Raleigh Motors Corp. is now building a four and a six-cylinder passenger car. The six is to sell for $2750 and the four for $2050. Details of the six cylinder model disclose the use of many standard parts such as Herschell-Spillman engine, Spacke axles, Westinghouse starting and lighting, Stromberg carbureter, Gemmer steering gear and Stewart vacuum system.

Renault Speeds Up on New Light Car

Goes Into Full Capacity on 10 H. P. Model Selling at 19,500 Francs

PARIS, April 14 (*By Mail*)—The Renault factory went into full production at the beginning of April on the modified 10 hp. popular car planned immediately after the armistice. There was considerable delay in getting this model on the market, and the price fixed in 1910 underwent many increases. Since the first series went through the shops several changes have been made in the design, and it is the new and definite type which is now in full production.

There have been no changes in the engine, which is a four-cylinder, 75 by 120 mm. The wheelbase is 111 in. and the tread 56 in., compared with the narrow tread used by some other French manufacturers of cheap cars. New and more powerful brakes are fitted. Both these are on the rear wheels, and are concentric internal expanding type.

Nickel plated fittings are now standard, as well as Michelin detachable steel disk wheels.

With the new type Renault carbureter it is declared that gas consumption is 32 miles to the American gallon.

Five body styles are standardized and produced in the former aviation department of the Renault factory. Storage batteries for starting and lighting are carried under the valence between running board and chassis frame. This space is also made use of for tool lockers. With four passenger body and complete equipment this car is listed at 19,500 francs, this price including the French luxury tax.

Renault officials declare that orders for 700 of this model have been received within two weeks, and that the factory is three months behind on deliveries.

France to Clear Out Two More Car Camps

PARIS, April 16 (*By Mail*)—Two more American automobile camps are being offered for sale as a whole. They are the camp at Bassens near Bordeaux, and remains of the Franchises camp, near Langres, in the Huate Marne. Individual sales have been carried on for some time at both these camps, but it has now been decided to clear out the material as a single lot. The Bassens camp contains 223 Holt tractors, 87 F.W.D. tractors and trucks, 208 5-ton Liberty trucks, 38 White trucks of various types, 52 Riker 4-ton trucks, about 30 Packards, and small numbers of Nash, Pierce-Arrow, G.M.C., Republic, Garford, and Mack trucks.

At the Franchises camp, near Langres, there are 85 Liberty trucks and about $2,000,000 worth of American automobile spare parts.

Sales of Equipment Show Gradual Gains

March Business Tops February 20 Per Cent—Dealers Maintain Normal Stocks

NEW YORK, April 23—Sales of automotive equipment in the New York district for March showed an increase of 20 per cent over February in retail selling and 22 per cent in wholesale, according to an investigation conducted by the research department of the Class Journal Co. Tire sales at retail showed an increase of 18 per cent and at wholesale 24 per cent.

The investigation showed a general tendency to maintain normal stocks of supplies, and in some cases, particularly among those handling equipment as a side line, there was a tendency to enlarge. In tires a movement toward more extensive use of cheaper grades was found, the feeling among the buying public being that higher-priced lines should be reduced.

Uniformity of complaint was found in the tire trade against the selling of reimported A. E. F. surplus tires as new stock. It is thought these tires will prove defective, owing to deterioration of quality through aging, and that the ensuing dissatisfaction will have an injurious effect on all tires bearing these brands.

Reports received by the research department indicate that sales of equipment began to pick up about March 1 in New York, Chicago and Minneapolis, and about March 15 in Boston. Sales are found to be still slow in Cleveland, Pittsburgh and through the South.

On the whole, business was found to be behind last year's figures in the equipment line in New York, the decrease ranging from 12 to 20 per cent. Practically all of the supply business was shown to be in the hands of regular equipment dealers, the sales in hardware, department and sporting-goods stores being negligible, except where distinct departments were opened.

NASH TO BUILD ADDITION

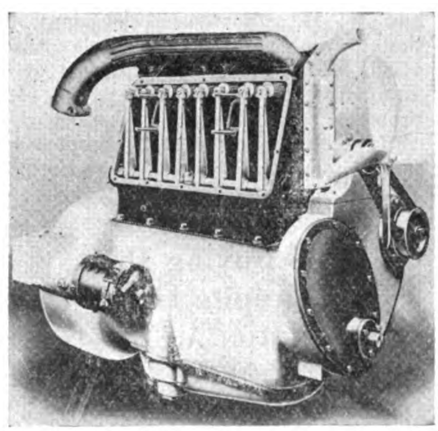
KENOSHA, WIS.. April 22—At the quarterly meeting of the directors of the Nash Motors Co. held here to-day it was announced that the company planned to build an addition to its plant in Milwaukee. The addition will be 100 x 600 ft. and three stories high, and will be large enough to provide for a large increase in the output.

WILCOX IN RECEIVERSHIP

MINNEAPOLIS, April 25—The H. E. Wilcox Motor Co. has gone into the hands of a receiver. Judge W. F. Booth of the Federal Court named Frank E. Satterlee, president and manager of the F. E. Satterlee Co., wood and iron working machinery and mill supplies. The petition was filed by the Standard Foundry Co. with claims of $9,545.08. Accounts outstanding against the company were said to total $50,000. Frederick E. Murphy, J. C. Compton and M. C. Barnum were named appraisers to estimate assets of the company. Creditors were given 45 days to make returns. Back wages of $5851.17 were ordered paid employees. The receivership was instructed to operate the repair department of the Wilcox factory to give service for 2000 Wilcox truck owners in the Twin Cities. The receiver's bond was put at $50,000. The company agreed to the receivership and admitted the claim of the complainant company.

Roamer Makes Record With Rochester Engine

DAYTONA, FLA., April 25—A regular stock Roamer chassis powered with the new four-cylinder, horizontal valve Rochester-Duesenberg engine and driven by L. F. Goodspeed, chief engineer for the Barley Motor Car Co., created what is claimed to be a world's record for a stock chassis by making the measured mile in 34.26 seconds, or at the rate of 105.08 m.p.h.



The Rochester Duesenberg

Designed by Fred S. Duesenberg, the engine was originally 4 x 6 in. and as such was raced all over America. Last year the Rochester Motors Corp. took over the production as a commercial proposition. The first engines turned out were powerful but not flexible enough for every-day use. The motor was redesigned and the size increased to a bore of 4¼ in. and a stroke of 6 in., and the power increased over 50 per cent above that of the earlier motors built. Flexibility was greatly improved, the motor was made quieter and generally refined down. The first motors to come through production were tested by engineers of the Barley Motor Car Co. in January of this year, and they decided to try some in their standard, stock Roamer sport models. The success of these led to the speed trials just held.

ROBERT J. DUBARRE DIES

MILWAUKEE, April 25—The death is announced of Robert J. DuBarre, assistant manager of sales of Geuder, Paeschke & Frey Co., manufacturers of galvanized sheet and steel ware.

Fordson Production on 200 Daily Basis

Wide Distribution Brings Gradual Increase in Production—Car Orders Exceed Schedule

DETROIT, April 22—Two hundred Fordson tractors are now leaving the assembly line at the River Rouge plant every day. The plant reached a daily production of 200 on March 24 and a few days later hit 225. Since the first of April, however, the output has averaged 200 daily, which schedule will be continued. Up to April 7, 2557 Fordsons had been built. There has been a proportionate increase in the number of men employed since production at the tractor plant was resumed in February.

Distribution has been scattered throughout the East and Middle West, with 305 Fordsons having been sent to Canada in the last two weeks. These were shipped to the Ford Motor Co. of Canada, and from there to the Ford branch at Toronto for distribution. Large numbers of Fordsons were sent to Connecticut, Pennsylvania, Wisconsin, New York, Indiana, Ohio and Illinois.

The big plant at Highland Park is increasing production of passenger cars and trucks daily, and while the schedule of 90,000 was fixed as the maximum for April, up to April 10, 107,719 cars and trucks had been requisitioned for the month. During the first three months of 1921 the demand for Ford cars and trucks greatly exceeded production, officials declare, and on April 1, with a total production during the three months previous amounting to 127,074 cars and trucks, the company had 102,000 unfilled orders on its books.

LOOK FOR MAY TRUCK BOOM

SPRINGFIELD, OHIO, April 21—"We are operating with the force we have maintained for the last few months filling orders as they come in," said A. K. Stewart, general manager of the Kelly-Springfield Motor Truck Co. "We are holding our own and prospects are better than they were. It is expected that there will be an increased demand for motor trucks in May." The force is gradually being reorganized, preparatory to meeting the improvement in business expected. James L. Geddes, chairman of the board of directors, who has been ill at his home for several weeks, is now able to be out for a few hours each day.

TO BUILD NEW STEAM CAR

CHICAGO, April 25—The Crossland Steam Motive Corp. of this city has been licensed by the Crossland Pfaff Engineering Laboratories to manufacture a steam car to be called the Crossland. The car is to have a wheelbase of 131 in., will sell for $3600, and will have a two-cylinder steam engine operating under a pressure of 600 lb.

Stockholder Action on Goodyear Delayed

Ratification of Refinancing Held Over to Monday—Quick Recovery Expected

AKRON, April 27—Postponements of the special meeting of Goodyear Tire & Rubber Co. stockholders, called to approve the refinancing program, follow in rapid succession. The latest ones were from Monday until to-day and from today until next Monday.

President F. A. Seiberling and Vice-President C. W. Seiberling have returned from New York where they spent several days in consultation with the bankers. F. A. Seiberling has declined to comment in any way on the passing of the company's control from his hands into those of the bankers. Representatives of the financial syndicate which has put over the $85,000,000 refinancing program will direct the affairs of the great tire plant for the 20 years which the new securities will run. The subscription books for the 8 per cent first mortgage bonds already have been closed and the issue oversubscribed.

It is understood here that no decision has been reached concerning who will succeed Seiberling as president of the company, or who will fill other positions in which it is expected changes will be made. It is not improbable that a financial man will take the helm until conditions are on a more satisfactory basis.

While it has been announced in New York that the Seiberlings will be ousted, it is hoped here that no such drastic step will be taken and that the new control will be more supervisory than active. The banking interests are expected to designate at least one vice-president for the company as well as the treasurer to prevent a repetition of what they regard as reckless expenditure which was considered largely responsible for the present plight of the company.

Akron bankers and rubber manufacturing experts, after a careful study of the refinancing program, have expressed the opinion that the company will be able easily to work out of its present financial position during the 20 years allowed by the life of the bonds. The increased capital charges added by the bonds, and prior preference stock if the total amount of bonds required remains at $85,000,000 together with sinking fund charges, will approximate $14,000,000.

Goodyear records show that the company's net earnings since 1913, up until last year, amounted to a total of $70,067,490, out of sales aggregating $576,109,108. The net earnings for the three years previous to 1920 were larger than during other years. In 1917 net earnings for the first time exceeded $10,000,000 and were about $14,000,000. In 1918 the earnings increased to $15,000,000 and rose to $23,000,000 in 1919.

Goodyear did a total business of over $200,000,000 last year, but due to contractual obligations and writing down of inventories, reported a deficit instead of a profit. The company is now working on a basis of 20,000 tires daily, as compared to normal production of 23,000 tires a day, and at this rate will do a business this year of more than $140,000,000.

(*Continued on page* 940)

Three Automobile Men on Hoover Committee

WASHINGTON, April 25 — Three representatives of the automotive industry have been invited to assist Secretary of Commerce Hoover in the reorganization of the Department of Commerce along lines that will make it useful to industry in the development of foreign and domestic trade. Thirty-six leaders will meet here Friday for conferences and business paper editors will gather on Monday for the second of monthly meetings with Secretary Hoover.

J. Walter Drake, chairman of the Foreign Trade Committee of the National Automobile Chamber of Commerce; John J. Raskob, chairman, finance committee, General Motors Corp., and W. H. Stackhouse, president, National Implement and Vehicle Association, will discuss the problems of the automotive and allied industries. It is proposed to change the personnel of the conferees in order to keep in touch with special men in all industries as the problems in their particular field arise.

Gasoline Buying Drops Despite Lower Prices

WASHINGTON, April 21—Price cuts failed to make any material difference in volume of gasoline consumption as the Bureau of Mines refinery statistics for February show that the daily average of gasoline production fell off by one million gallons but the stocks increased by 108,000,000 gal. The lessened demand was also reflected in increase of 18,000,000 gal. of lubricating oils in reserve with a decreased production of 185,000 gal.

The figures show that there were 680,540,351 gal. on hand at the end of February. Exports amounted to 52,497,051 gal., shipments to insular possessions 4,536,619, and domestic consumption 225,195,372 gal. The daily average consumption was 10,079,609 gal.

FEDERAL SPARK PLUG MOVES

WESTFIELD, MASS., April 26—The spark plug manufacturing plant of the Federal Corp. has been sold at auction to George N. Gray, representing the Shawmut National Bank of Boston on foreclosure of a mortgage. A statement was issued by the company that the business would be continued in a new location here and that a large manufacturing firm located in the eastern end of the State would come here and locate in the present plant of the Federal corporation.

Milwaukee Industry Has Turned Corner

Bank Review Shows Business Decidedly Better—Heavy Cuts in Inventories

MILWAUKEE, April 25—"The automotive trades seem to have turned a corner in the last month or two," says *Business and Financial Comment,* the monthly review of local financial and commercial conditions issued by the First Wisconsin National Bank of Milwaukee. "The month's sales for all Milwaukee industries were decidedly better than for the previous month. The gain was especially apparent in the automotive parts and equipment industries. Forward business shows a tendency to increase. Future purchasing commitments are still conservative. Few manufacturers are buying more than they need in the immediate future. The lessening of heavy inventories still goes on.

"In the automotive trades, sales last month were about 75 per cent better than the previous month, but probably a third under the same period of 1920. Inventories are still above normal and greater than a year ago, and consist mostly of raw material. As soon as it is possible to use up steel already bought and to take advantage of lower steel prices, the industry should better its situation materially.

"Manufacturers of rubber tires and products report a gradual improvement in orders. The mild winter and the approach of the season when motor cars are in greater use have promoted the unloading of tire stocks and the resumption of operations on a limited scale for replacement.

"As a rule, lines which use iron and steel products have been waiting for prices to reach a point of stabilization. The Steel corporation's latest reductions should go far to reassure buyers and stimulate business in machinery, farm implements, motor cars and trucks, public utilities and construction lines.

"It has been the experience of periods similar to this in the past that lower prices on iron and steel products promote industrial revival."

FORD BRANCH ON THREE SHIFTS

DES MOINES, April 21—The Des Moines Ford branch is working at full capacity and has three forces of 400 men each employed at full time. The plant is turning out daily 165 coupe and sedan bodies, 160 cars, and 100 tractors. Cars and tractors are being distributed in Iowa while the bodies are shipped into Southern and Western territory, according to W. K. Edmunds, branch manager. That the low priced car is the only one which is meeting with a ready sale in Iowa under present financial conditions, is shown by the fact that in the March registrations of Polk County, in which Des Moines is situated, nearly 80 per cent were Fords.

Crop Prices Slow Carolina Business

Manufacturing Sections Show Brightest Sales Prospects—Rural Buying at Standstill

CHARLOTTE, N. C., April 25—The avalanche of motor car sales precipitated under the stimulation of war prices when cotton sold at 40 to 46 cents a pound, and tobacco 95 to 125 cents, stopped abruptly last September. From September until February very few cars even of the cheapest makes were sold, but in the five weeks beginning March 1, there has been an unexpectedly heavy improvement in sales, particularly in cities of 10,000 population or over, of which there are eleven in North Carolina.

The western half of North Carolina is one of the best areas for motor car sales in the Southeast, if not in the entire South. On the other hand, the eastern half of North Carolina is perhaps the poorest sales area to be found, even the cities showing very little business. The State of South Carolina is completely dormant, no sales taking place in the country areas and few in the larger cities with the possible exception of Columbia, where the presence of Camp Jackson, into which flows $1,000,000 per month from the Federal treasury, has created business.

Retail sales in Charlotte are not so good at present as in some of the other towns in the western part of the State, due largely to the slowing down of cotton mills in the city and unemployment. This situation is more seriously reflected in Charlotte as many of the factories have headquarters here, and the city is more responsive to the industrial pulse than are the smaller cities in the western part of the State.

As is the case throughout the entire South local Ford dealers are practically out of cars and for some time have been picking up carloads from dealers in the territory and driving them 100 to 150 miles to the city. Through the territory many of the Ford dealers have stocks on hand.

Supply of Cars Not Heavy

With several local distributors there is not a heavy supply of cars on hand for the two Carolinas, whereas with some makes there are 90 days' supply in the territory. The Nash distributor has not over a 15-day supply. Oakland through the territory has a 30-day supply, as has Studebaker. Buick with its large dealer organization throughout the two states has not a 30-day supply. As with many others its sales in March were greater than those in December, January, and February together. Willys-Overland has a small stock in the territory. The low supply of several distributors is due largely to them not having taken cars from the factories since August. There are hundreds of dealers in the territory who have not taken a car from a distributor since August 1. These dealers are still in business carrying on a repair and garage business and endeavoring to sell the cars they have been stocked with since August.

The situation in eastern North Carolina and all of South Carolina, where business is at a standstill, can be grouped for trade considerations. It is difficult to realize how completely and continuously business has been suspended in this area. There are still no sales in such towns as Wilmington, Newbern and Elizabeth City where the average is not 10 per cent normal. There is no available money with which to buy cars, although there are hundreds of buyers if means to finance the purchase were at hand. The banks will not handle car or truck paper.

Tobacco Heaviest Hit

Before the slump in these places last September the dealer bought all of the cars he could secure. The tobacco prices were largely responsible for this. When the market broke in September car sales stopped as quickly. In Greenville, where a dealer of a medium-priced car sold 200 in 1920, that dealer has not sold a car since August. There are reports that the Ford dealer in Littleton has sold only two cars since January. There was only one car sold in Anderson County from December until April 1.

In the South Carolina area where long staple cotton is grown, which sold last year at $1.25 per pound and is now at 20 cents, business is at a standstill. Such towns as Chesterfield, Darlington, Marlborough and Florence in this area have suffered badly.

The conservative motor car dealers in Charlotte are not anticipating much business this year. There will be a pick-up in September and October when the crop is harvested but nothing approaching that might be designated as normal business in contrast to abnormal business of two years ago. It will be the crop of 1922 that should bring the normal fall purchasing. The crop of 1920 must be sold and the revenue from it will go to the bankers and merchants. It will not pay all their debts. It will not be until the crop of 1922 that the farmer will have surplus money for purchasing. Business will be improved by the money from the 1920 crop getting into circulation when it is sold.

No Truck Market Since August

There has been no truck business in this territory since August. What is true of all the Gulf states applies equally to the Carolinas, namely, that too many dealers took on truck lines in 1919 and to-day have $8,000 or $9,000 tied up in trucks which can only be moved with difficulty in perhaps a year. In not a few cases this money tied up in trucks is responsible for the hard pressed condition of the dealer to-day. Ford dealers are generally stocked with tractors which are not moving except in a few cases. Some dealers have 10 to 15 in stock, which is hampering their activities financially.

METAL MARKETS

CONDITIONS in the steel market have undergone very little change as the result of the Corporation's price revision. The "independents" are working on orders placed at the prices named by them before they raised their quotations to bring them up to those of the Corporation. The latter has benefited by its price announcement only to the extent of releases on tonnages that had been suspended pending just such a revision. Neither the Corporation nor the "independents" have booked any representative fresh business. From the very outset, the new price levels were looked upon as a sort of stop-gap. Taking stock of prevailing conditions, the powers that be in the steel industry recognized the fact that they would achieve very little by genuine price reductions at this time. Neither the railroads nor the building industries are in shape to place orders at this moment at any price. The chief demand is from the automotive industries. Many of the steel manufacturers, especially the sheet makers in the Youngstown district, are apprehensive lest the demand from the automotive industries become more halting in July. Meanwhile, they believe apparently that what automotive business is to be had can be booked at the prevailing prices and that there would be nothing gained by cutting these. A significant point in this connection is that the new price for sheet bars is $39, while that for billets is $37. Most steel men prefer orders for sheet bars to orders for billets and it is more than doubtful whether it costs more to roll sheet bars than billets. Sheet bar tonnages are usually far more satisfactory than those of billets. So that the only explanation why sheet bars should sell at this time at $2 above the price of billets is that the bulk of sheet bar production is intended for automobile sheets, and the traffic in these can stand the $2 premium over billets. From the steel producer's point of view this attitude is perfectly logical. In fact, it is based on a very fair appraisal of the class of orders that emanates from the automotive industry these days. Not a pound of steel is being bought that is not needed to maintain the actual schedules, and producers of steel are apparently of the opinion that price cuts would have to be much deeper to be fraught with immediate results in the shape of much larger orders. Before they can make such cuts, wages and freight rates must be pared.

Pig Iron—Foundry No. 2 and malleable are selling at $24 and upward, with the nominal quotation $25, valley. One Cleveland interest has made sales at as low as $26, local delivery. Lower wages are to be put into effect in some of the Midd'e West automotive foundries next Monday and spasmodic interruptions to production as the result of strikes are feared.

Steel—Both unshipped balances on account of old orders and new business in cold-rolled and cold-drawn steel bars are being billed at 3.10c. base, which makes the differential over hot-rolled, the latter based at 2.10c., $20 a ton. Several thousand tons of orders from automotive sources are hanging over the market. The sheet market is relatively steady.

Aluminum—The market continues quiet and more interest waits on a clearer picture of what tariff prospects are.

Lead—American Smelting & Refining Co. has reduced lead quotations $2 a ton to $4.35 New York and East St. Louis.

FINANCIAL NOTES

Stewart-Warner Speedometer Corp. declared a quarterly dividend of 50 cents a share payable May 15 to stockholders of record April 30. Previous quarterly dividends were at the rate of $1. The business of the corporation is reported to be running close to normal and better than anticipated. A quarterly statement of earnings is expected in a week or ten days.

Dunlop Tire & Rubber Co. will pass under voting control of the Dunlop Rubber Co., Ltd., by the exchange of 2,000,000 shares of the latter for 3,000,000 shares of the American voting trust. It was also reported that $8,000,000 would be required for initial working capital for the American company.

Kelly Reamer Co., Cleveland, has increased its capital stock from $60,000 to $250,000 and all shares offered were taken by present stockholders. The company has just held its annual meeting in the new factory building, the board of directors being returned to office.

Prather Wheel Mfg. Co. of Detroit has been incorporated with a capital of $1,000,000 by Frank M. Prather and Frank Eack. Prather is the inventor of a resilient wheel truck which it is proposed to build.

India Tire & Ruber Co., Akron, paid on April 1 a quarterly dividend of 1¾ per cent on its prefered stock and 2 per cent on its common stock.

H. H. Franklin Mfg. Co. has declared the regular quarterly dividend of 1¾ per cent on its preferred stock payable May 1.

INDUSTRIAL NOTES

Cincinnati Grinder Co., Cincinnati, has placed the sale of its line of grinding machine on an exclusive basis with the Marshall & Huschart Machinery Co. in the Chicago district; Motch & Merryweather Machinery Co. in the Cleveland, Cincinnati, Pittsburgh and Detroit district; Henry Prentiss & Co. in the New York and New England district, and will also maintain its own grinding specialists in the respective territories.

William F. Hudson, president of the Flexo Co. of America, is placing orders for materials to make up 30,000 Flexos (extensions for Ford trucks), and is also buying material for the Hudson Motor Truck Co. of America, which will turn out a line of trucks of 2½ tons up.

Black & Decker Mfg. Co. has moved its Atlanta branch office to 1508 Candler Building, where Thomas W. Peters, southern branch manager, will make his headquarters. The Detroit office has been moved to 27 Watson Street.

United States Rubber Co. directors have again chosen Samuel P. Colt, chairman; Lester Leland, vice-chairman; Charles B. Seger, president. The executive committee consists of James B. Ford, Walter S. Ballou, Nicholas F. Brady and James S. Alexander.

Hall Syndicate, Inc., Philadelphia, organized to manufacture and sell the Hall flexible wheel, Hall felt liner and other products, has opened sales and show rooms at 1838 Market Street here and in Camden.

Milwaukee Auto Engine & Supply Co., Milwaukee, manufacturers of the Milwaukee timer for Fords, reports operation at 100 per cent capacity. April is the biggest sales month in the company's history.

Kelly-Springfield Tire Co. has opened its plant at Cumberland, Md., and started manufacturing. The plant cost $11,000,000 and took three years to build.

Southern Motor Mfg. Assn., Ltd., Houston, has just completed another factory unit, which will be used as a paint and trim shop for Ranger cars.

Continental Car Co. of America, Louisville, Ky., has increased its capitalization to $1,000,000, to provide for extensive improvements to the plant.

American Tire Corp. promoters are under investigation by the Federal grand jury to determine the legality of the sale of the company's stock.

Ewing Bolt & Screw Co., one of the late additions to Detroit industries, has started operations in its plant at River Rogue.

Rome Wire Co., Rome, N. Y., has completed a weatherproof wire mill and has started operations.

Woodworth Mfg. Corp. has moved its factory from Niagara Falls and located at Binghamton, N. Y.

Reed, Tilley & Co., Inc., has removed to the Robertson-Cole Building, New York.

Masters Motor Co. will move its main plant from Saginaw, Mich., to Erie, Pa.

Interlocking Tires Sues for Balances on Stock

AKRON, April 22—Thirty-six separate actions against as many stockholders of the defunct Interlocking Cord Tire Co., of Akron and Mogadore, have been filed in the common pleas courts of Summit County by Elihu Harpham, receiver of the company, for recovery of the balances due on their unpaid stock subscriptions. The actions constitute the forerunner of 480 similar actions to be started, according to Harpham, for an aggregate of $290,000, claimed to be due on subscriptions for stock negotiated before the appointment of the receivership.

The thirty-six actions already started are for amounts ranging from $100 to $4900, and for a total of $21,417.

Immediate payment by shareholders of the unpaid balances due on their stock subscriptions is necessary in order to liquidate the company's affairs and to satisfy creditors whose claims exceed $200,000 according to Harpham.

RECEIVER CONTESTS CONTRACTS

TOLEDO, OHIO, April 25—H. R. Greenlee, receiver for the Erie Tire & Rubber Co. of Sandusky, has filed recommendations in Federal Court for the disposition of contracts on which part of the materials contracted for have been delivered. In all cases the materials were contracted for when war prices prevailed and before the receivership began. Some consignments were received and paid for at the inflated prices. The balance of them are being held pending instructions of the court.

ROCK ISLAND CUTS PRICES

ROCK ISLAND, ILL., April 22—The Rock Island Plow Co. has cut prices on all its products 10 per cent. The cut is effective immediately. Tractor and tractor tools cut 15 per cent a month ago are not affected by the new order.

BANK CREDITS

Written exclusively for AUTOMOBILE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, April 28—After the firmness of the previous week, the money market again eased last week. Call money, after renewing at 7 per cent on the first two days of the week, declined to 6½ per cent and finally to 6 per cent on Friday. The range for the week was 6 per cent to 7 per cent, the same as the previous week. "Outside" money was said to be available at 5½ per cent. There was little change in the time money market, where the demand was light, and quoted rates were unchanged from the previous week, with 6½ per cent bid and 7 per cent asked.

The week-end statement of the Federal Reserve System showed a continuation of the improvement which has been taking place since the first of the year. The ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 53.7 per cent to 54.1 per cent, the highest ratio since the first week of September, 1918. This was largely a result of the further increase in gold reserves of $11,192,000. Federal Reserve notes in circulation also declined $11,827,000, and at $2,856,700,000 are $548,231,000 below the high of Dec. 23, 1920. Bills discounted secured by U. S. Government obligations increased $13,479,000, while total bills on hand declined $5,828,000. Total earning assets declined $13,048,000, and total deposits $5,592,000. The ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against deposit liabilities, increased from 65.2 per cent to 65.8 per cent.

Changes in the condition of the New York Federal Reserve Bank harmonized with those of the entire System. Gold reserves increased $8,721,000, while total bills on hand, total earning assets, total deposits and Federal Reserve notes in circulation declined. As a result, the ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against deposit liabilities, increased from 69.5 per cent to 70.6 per cent. The week-end statement of the New York Associated Banks was also favorable, although excess reserves over legal requirements declined $6,847,860. Loans declined $68,630,000, and net demand deposits $42,558,000.

The foreign exchange market was featured last week by an unusually narrow range of quotations. The range for Sterling, for instance, was $3.92 to $3.94½, the latter being the highest quotation since July 17, 1920. On Monday of this week Sterling touched $3.95. The narrowness of the range of quotations, if continued, may be taken as an indication of a crystallization of opinion as to the actual state of affairs in Europe. About mid-week there was weakness in practically all the continental exchanges, with a slight recovery on Saturday. Marks declined from 1.60½ to 1.50½ on Saturday.

MEN OF THE INDUSTRY

Otis R. Cook was elected vice-president and director of the Howe Rubber Co., New Brunswick, N. J., at the annual meeting. Cook has purchased a substantial interest in the company and will take over all sales May 1 and handle them through his own selling organization. Headquarters will be in the Cook Building, Cleveland. H. H. Grobe will be general sales manager of the new company, coming with Cook from Kelly-Springfield, where the latter had been vice-president, director and general sales manager for ten years to Jan. 1, 1920. He resigned at that time to build the Cook Building in Cleveland, which is now completed. Cook succeeds E. A. Sattler with the Howe company.

W. M. Letts, managing director of Willys-Overland-Crossley, Ltd., of Manchester, England, sailed for home on the Olympic Wednesday after a brief visit to New York for conferences with the Willys executives. He is much gratified at the business done by his company in the face of discouraging conditions in England, and believes the outlook for the coming year is even more encouraging. Industrial affairs in England have run virtually the same course as in the United States, but there had been signs of improvement up to the time the miners' strike began and Letts is hopeful of a steady upward trend as soon as the labor difficulties are definitely settled.

H. D. Babney, who recently resigned as secretary of the National Association of Motor Truck Sales Managers, has been appointed assistant secretary of the Automotive Electric Service Association, with headquarters in New York, which was organized at Rochester last July by representatives of authorized service stations. The chief purposes of the organization are to encourage co-operation between its members and the manufacturers whom they represent and to encourage the use of only genuine parts for repair or replacement service. D. W. Burke, of Detroit is the president.

W. S. Doty, formerly of the Cleveland Tractor Co., has joined the Globe Motors Co. organization, Cleveland. He has acquired a substantial financial interest, will act as treasurer and have charge of operations. His connection with Cleveland tractor was as auditor, assistant secretary and assistant treasurer, in the order named. Doty's automotive experience also includes two years with the Torbensen Axle Co., two years charge of the general offices of the Denneen Motor Truck Co. of Cleveland, and several years as a retailer and distributor.

Edward J. Post has been appointed manager of the Chicago branch of the Oshkosh Truck Sales Co. of America, which has taken over the international selling rights of the Oshkosh Motor Truck Mfg. Co. of Oshkosh, Wis., and N. O. and S. S. Gilbert for many years identified with the motor truck business in Chicago, have been appointed mid-west distributors. Offices have been opened at 1509 South Michigan Avenue, Chicago.

Arnold Joerns Co. of Chicago has been appointed advertising representative for the King Motor Car Co. by A. Weber, president and general manager. The Joerns company has opened a Detroit office in the Kresge Building in charge of Robert Davis. Weber has announced also that a well-known Chicago man, who has been in charge of King distribution there, will join the factory staff as assistant to H. Alperin, sales manager.

D. Henry Bonner, recently in charge of the branch house organization of the Ford Motor Co., has been made sales manager of the Four Wheel Drive Truck Co., Clintonville, Wis., manufacturers of the F. W. D. truck. Bonner was associated with Ford for over seven years in various capacities. He was superintendent at Cambridge, Mass.; assistant manager at Rochester and assistant manager at Pittsburgh.

Hilton W. Sofield, former vice-president and general manager of the Keystone Truck Co. of Philadelphia, as well as builder and designer of the Keystone truck, has reentered the automobile field after a nine month retirement. Sofield has incorporated a new company, known as the Penn Motors Corp., to manufacture popular size trucks.

E. D. Shearman of Jamestown, N. Y., has been elected a director and secretary of the Collier Motor Truck Co. of Bellevue, Ohio. Shearman was one of the original organizers of the Salisbury Wheel & Axle Co. of Jamestown, and was its general manager until it was sold to eastern interests in 1919.

H. A. Wagner, formerly general manager of the Reliance Motor Truck Co., Appleton, Wis., has resigned from that concern but has not yet announced his future plans, although it is expected that he will continue in the motor truck industry, with which he has been so long identified.

T. G. Graham, formerly with the Goodyear Tire & Rubber Co. of this city, and more recently factory manager for the Inland Rubber Co. of Chicago, has been named factory manager for the Mason Tire & Rubber Co. of Kent.

George H. Stebbins has been appointed factory superintendent of the Continental Car Co. of America, Louisville, Ky. Stebbins was formerly with Ford. Irving Miller has been appointed secretary of the company.

E. J. Welch, assistant advertising manager of the Goodyear Tire & Rubber Co., has resigned to become identified with the advertising and publicity department of the Hudson Motor Car Co., of Detroit.

E. E. Stanford, purchasing agent of the Westcott Motor Car Co., Springfield, Ohio, has been elected vice-president of the Victor Products Co., also of Springfield.

R. L. De Voe has been appointed general sales manager of the Dawson Mfg. Co., Chicago, manufacturers of grease cups and equipment.

Lockwood Manufacturing Passes Back to Parent

KANSAS CITY, April 26—The Lockwood Mfg. Co., operating under receivership since April 9, this year, was sold, April 23, as a going concern, for $122,-100. The purchasers are W. C. Sommerville, president, and Walter L. Wilson, vice-president and treasurer of the Baker-Lockwood Mfg. Co., Inc., Kansas City—the Baker-Lockwood company being the "parent concern" from which the Lockwood interests withdrew in January, 1920. The obligations of the Lockwood company are said to have been about $400,000, and assets, including raw materials, goods in process, completed merchandise, machinery, and equipment, about $300,000

Albert Newman, vice-president of the Commerce Trust Co., Kansas City, was appointed receiver April 9 and continued operations, buying materials for manufacturing, producing goods, and shipping. There has therefore been no cessation in the activity of the Lockwood company, and it will now continue. The purchasers have not announced their exact plans with reference to it.

Minnesota Bases Fee on Factory Sales Price

ST. PAUL, April 25—The Minnesota legislature adjourned April 20 after finishing up the legislation required to make the Amendment No. 1 road law for building and maintenance of trunk highways in Minnesota workable. The automobile license fee was settled after long debate and consideration of many amendments at 2 per cent of the sale price of the car f.o.b. the factory, with down gradations proportional to the age of the car to be registered. This tax is expected to give some $6,000,000 a year.

Although it was the general understanding that this tax was to be in lieu of all other automobile taxes when the people voted for the amendment last November an opening was made by the leggislature for a wheelage tax, which, is already in operation in St. Paul and Duluth. At the final elimination it was found that the new law permits a tax of not more than one-fifth of the State tax, or 20 per cent. The law also now provides that the State ultimately will refund bonds already issued by the counties with approval of the State highway commissioner for building trunk roads, and will pay the interest thereon.

HAYNES STEVENSON DIRECTOR

INDIANAPOLIS, April 21—Elwood Haynes was elected a new member of the board of directors of the Stevenson Gear Mfg. Co. at the annual meeting of the stockholders here. Other members of the board who were re-elected follow: G. E. Stevenson, G. R. Stevenson, E. C. Jones, of Indianapolis; T. J. Stephenson of Anderson; Simeon McQuiston of Kokomo, and R. T. Wingo of Detroit. The directors decided at the meeting to build a subsidiary plant at Detroit. The company has perfected a machine for multiple gear cutting.

TO FORM OLD TIMER SECTIONS

NEW YORK, April 25—Directors of the Old Timers' Club at a meeting here decided to encourage the formation of sections in various parts of the country. The membership is rapidly increasing and the directors decided to promote annual reunions at the national shows and through local sections at other shows. The membership will be brought together for discussion of automobile projects which it will be fitting for the organization to support.

Calendar

SHOWS

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

FOREIGN SHOWS

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8 — International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Autòmobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 4-7 — Cleveland. National Foreign Trade Council.

May 6—Detroit, N.A.C.C. Advertising Managers Meeting, Detroit Athletic Club.

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N.A.C.C.

May 23-26 — Chicago, A.S.M.E. Spring Meeting, Congress Hotel.

May 24-28—West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

July 4-9 — Mackinac Island, Mich., Summer Meeting Automobile Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

RACES

May 31 — Indianapolis, International Sweepstakes.

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Dayton Section—May 3.

Indiana Section—May 5.

Washington Section — May 6, Shaped Piston Rings, Cosmos Club.

Midwest Section — May 13, Smoker, Dinner and Entertainment at Chicago Automobile Club.

Dayton Section—May 17, H. L. Horning.

Cleveland Section—May 20.

S.A.E. Sports Program Covers Many Events

NEW YORK, April 23—The sports program which has been arranged for the semi-annual meeting of the Society of Automotive Engineers at West Baden on May 24 to 28 will be one of the most ambitious ever planned by the organization. It will include everything from tug-of-war to croquet, with appropriate prizes. Golf, tennis and trapshooting tournaments are planned, as well as two baseball series. The women who attend the convention will be entertained by card parties, clock-golf, croquet and tennis. In addition to these there will be a dancing contest.

The reduced-fare plan which has been arranged with the railroads differs from the one in effect at the annual meeting last January. A reduced-fare certificate will be mailed by the society to its members about May 1. This must be presented when transportation to West Baden is purchased in order to secure a 25 per cent reduction. Round-trip tickets only may be purchased under this plan, no stop-overs are allowed, and the same route must be used in both the trip to West Baden and return. A map which will be mailed with the certificates will show the area in which this reduced-fare plan applies.

Light Cars Popular with Spanish Buyers

WASHINGTON, April 21—Reporting on automobile trade conditions in the Cadiz, Spain, consular district, American Consul B. Harvey Carroll has advised the Bureau of Foreign and Domestic Commerce that there are approximately 700 automobiles and trucks in active use in the district. The United States, England and France export to that market and a few cars of Spanish manufacture are also sold. Those of American manufacture are the most popular and outnumber all others used in the district.

Prices for automobiles vary from 7300 ($1460) pesetas for a light type runabout car to 30,000 ($6000) pesetas for the heavier touring cars. Cars of light type are the most popular owing to the poor condition of the roads off the main lines of travel and narrowness of the city streets.

Gasoline is expensive—1.30 pesetas per litre at the time the report was made, March 30, for a product of inferior quality. Lubricating oil for automobiles retails for 4.50 pesetas the litre. Gasoline may be bought in the Cadiz consular district in Cadiz, Jeres de la Frontera, Sanlucar de Barrameda and at Algeciras. Trade conditions in the automobile market are described as being in a chaotic state.

Truck Sales Managers Urge N.A.D.A. Benefits

DETROIT, April 25—The Motor Truck Sales Managers' Association has prepared for truck manufacturers a form letter which will be sent to dealers urging them to affiliate with the commercial vehicle division of the National Automobile Dealers' Association. The letter states that the N. A. D. A. is the best investment on the market to-day and that membership in it is certain to bring substantial business profits. The letter outlines some of the activities of the association and points out that the commercial vehicle division, devoted exclusively to truck dealers, gives advice in regard to employment, taxes, legislation, advertising, highway construction and trade information in addition to various other helpful activities.

E. A. E. A. TO HELP BOOST SALES

NEW YORK, April 25—The Eastern Automotive Equipment Association, composed of jobbers in the states along the Atlantic seaboard from Maine to the District of Columbia, decided to-day to conduct an educational campaign to assist dealers in merchandising car and truck equipment. A campaign of dealer helps and selling ideas will be worked out and placed in the hands of the jobbers' customers.

Stockholder Action on Goodyear Delayed

(*Continued on page* 936)

The net earnings naturally will be larger under the reorganization plan and new banking control, for complete revision of the company's office and factory personnel has made for materially increased individual and collective efficiency. At the same time overhead expenses have been reduced, non-essential and non-productive activities have been stopped, and the company is down to the cold business of making tires.

No funds will be needed for plant extension or new equipment. Wages and salaries have been reduced 15 to 30 per cent. Also, instead of issuing stock against surplus funds, as has been done in the past, these surpluses will become available for the funded debt.

The company will also, it is expected, curtail its advertising appropriations. Last year Goodyear became known as the world's largest advertiser, with an advertising appropriation originally of $5,000,000 but later increased and nearly doubled. The company is now reaping the reward of this extensive advertising campaign and is showing a more rapid return to normal production than any other tire company in Akron. With automobile factories back on a basis of 60 per cent normal, and with Goodyear furnishing a large percentage of all original tire equipment, the company is not only working on production tickets for heavy tire specifications from manufacturers, but on steadily increasing orders for Goodyear products from all parts of the world.

Goodyear's sales in 1919 were $169,-000,000, and for the first six months of 1920 reached $104,000,00, having reached the figure of nearly $1,000,000 a day when the slump came in the tire industry. With the company gradually climbing back to its normal production, it is a conservative prediction that Goodyear sales for the ensuing fiscal year easily will approximate $140,000,000.

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Taxes and Tariff Major Topics at U. S. Chamber Meeting

Largest business body is well under way on its newly found mission of interpreting business idea for guidance of government activities. Sales tax is not indorsed. Business-like solution of tariff problem.

By Clyde Jennings

MUCH headway was made by the Chamber of Commerce of the United States in its new program of serving as an intermediary between business and government at the ninth annual meeting at Atlantic City, held last week. Perhaps it would be better to say that the Chamber now hopes to interpret for Government the opinion of business as to how Government can best aid business. It was in keeping with this objective that the slogan of the meeting was:

More Business in Government;
Less Government (management) in Business.

Herbert Hoover suggested a third line to this slogan, which he stated something like this:

Better Government Assistance to Business.

This added phrase was much applauded, but it was evident from expressions made at other times during the meeting that the hope of the business man for more intelligent assistance to business from Government is based very largely in Secretary Hoover. Business men are frankly suspicious of other Government efforts to assist business, but they whole-heartedly approved of Secretary Hoover when he appeared before them, and of the pledges and views expressed in his talk to them in the general session held on Thursday evening.

The two big topics presented to the members of the Chamber present at the Atlantic City meeting were:

Taxes.
Tariff.

The idea was to arouse an interest in these two topics from the business man's point of view, which is probably a very different thing than the political view. The Chamber, very frankly, was cautious in taking up these topics because they are so completely involved in politics. The big idea behind the proposal to interest the Chamber in these topics was to transfer them from politics to business. Apparently an intense interest was aroused in this new view of both topics.

On Thursday afternoon there was a separate meeting of each of the nine groups, in which the time was evenly divided between Taxes and Tariff, and an effort was made to obtain the sentiment of those present by a ballot on certain questions relating to the subjects. This idea was so new to the Chamber practice that the compiler of the questions failed to make them clear, and also the various chairmen of the groups did not understand the suggested practice. The result was that the ballots were not authoritative and were only mildly informative. The explanation appears to be that in turning so large a vehicle as the Chamber toward a new goal that there was considerable disarrangement of the internal machinery. At

the last general session of the Chamber, President Defrees apologized for the conduct of some of the group meetings.

The study of taxes became the intense problem of the meeting, chiefly because of the insistence of the sales tax proponents that this particular form of tax be indorsed by the Chamber. All through the general and group meetings the sales tax appeared to be highly popular with those present. Any mention of it was applauded, while a speech by R. G. Rhett, which was one of the most logical arguments made in the meetings and which was well presented, opposing this form of tax, was received in silence.

It was apparent throughout the meeting that the taxation policy advocated by the National Automobile Chamber of Commerce was the idea of many of those present. This is, briefly:

> **A cancellation of excise taxes and excess profits taxes and a lowering (at least) of income surtaxes.**
>
> **The establishment of a sales tax, if governmental expenses cannot be reduced to a point where the taxes remaining will pay the bills.**

This tax policy includes the belief that those governed should have much to say about how much money should be spent for different departments of the Government and how quickly war obligations should be paid. There was no question as to the popularity of this program with those present, but when the resolution on taxation was read by the Resolutions Committee it did not specifically support this plan. The sales tax proponents obtained recognition and urged the adoption of their resolution.

A compromise was effected by an apology for the way in which the tax question had been handled throughout the meeting and for the previous referendum by the Chamber. It was admitted that the questions in this referendum were so vague as not to give definite information. It was promised that, if the sales tax proponents would not force the issue on the floor, a new referendum would be taken as quickly as possible in the plainest possible terms. The objection to a vote at that time was that there was no way of determining what proportion of those present at the meeting were entitled to vote for their organization, and what proportion of actual delegates were still present.

New Tariff Plan

The tariff proposal, which was second in interest and regarded by many as first in importance, was handled quite differently. The subject was outlined in these three questions, which were submitted to the various groups:

1. Should the tariff be framed with due regard to export trade as well as to the protection of manufacturing in the United States?
2. Should the economic needs of foreign countries and the fact that we are now a creditor nation alter our tariff policy with respect to protection?
3. Should the United States tariff offer trading or bargaining possibilities for international commercial treaties to encourage our export trade?

The solution offered by the Tariff Committee of the Chamber was so different from any previous consideration of the tariff problem that it created much interest. Because it was so different, the Resolutions Committee decided not to indorse it at once, but to suggest continued study by the Chamber's committee. The Board of Directors accepted this report, which was described at some length by H. M. Swetland before the Civic Development Group. This explanation, in part, follows:

"Tariff legislation has so far presented its apology for its interference in the right of any people to market their products in any country, either under the plea of raising funds for the government or the encouragement and protection of domestic industries. No doubt sufficient logic can be found for either argument to stimulate legislation, but in these days the production of $300,000,000 from tariff duties is almost insignificant in our governmental departments and protection to our industries, with rare exceptions, is a reflection on the efficiency of our productive capacity as compared with the production of other countries.

"Then we must not lose sight of the further fundamental that any duty paid on any commodity increases the price of that commodity to the consumer, and this consumer, therefore, pays the $300,000,000 revenue and also affords the protection demanded for production.

"Probably the greater necessity for tariff on imports lies in the protection afforded American labor. Unless we are willing that our living conditions of labor shall descend to the lowest level of foreign production, we shall need a protective tariff for many products. This will be most necessary on commodities requiring a large percentage of hand labor. This country can now compete in the markets of the world on commodities produced largely from automatic machinery and in large quantities. Gradually our industries, due to American inventive genius, will evolve into the sphere of greater and more economical production, lessening the necessity for protection and opening our products to the wider markets of the world.

"These fundamentals must be borne in mind in any consideration of any phase of tariff policy. For many generations this country has decided in favor of duties on imports. This decision has been largely sustained by a consideration of the living conditions of labor in this country as compared with other countries. In the activities of this meeting we must accept the tariff as an established fact and give our attention to certain fundamentals affecting this policy.

"**First Question:** Shall we frame our tariff with due regard to export trade as well as the protection of our industries? This is a simple problem in mathematics. Dr. Page, chairman of the Congressional Tariff Commission, will tell you that approximately 95 per cent of our manufactured products are consumed in this country.

"We will all readily concede that a low tariff will tend to increase our imports and to increase our exports, and that a high tariff will tend to decrease our foreign trade, both imports and exports. Having regard for export trade involves, therefore, a lower tariff rate, and the question becomes, will the increase in our 5 per cent export be balanced more or less by our imports affecting 95 per cent of our production?

"If we find our productive capacity lessened by the lower tariff, we have, then, also decreased our earnings, which, in turn, lessens our purchasing power. From this it seems clear that the determining factor is the ratio of our exports to our home consumption and that tariff should be formed with due regard to export trade.

"Illustrating these principles, we may observe the automotive industry, which, twenty-five years ago, was classed as an infant industry and has been developed under a protective tariff to one of our greatest lines of production. It has now reached the level of great quantity production and many large units are commanding trade from all parts of the world. The industry as a whole now appreciates the fact that a lower tariff is now necessary if foreign trade is to be extensively cultivated, and this industry has recently appealed through its Chamber of Commerce to have the import duty reduced nearly one-half.

"**Second Question:** The economic needs of foreign countries? The answer does not involve a philanthropic principle or motive, but requires the usual selfish business consideration. The argument is that these nations cannot buy from us unless they pay in goods.

"If we, as a creditor nation, sell to a debtor nation, they can only pay in goods, cash or credit. A greater extension of credit will increase the rate of exchange in which our price in their money becomes prohibitive. A two-thousand-dollar commodity in this country, sold in Germany under present exchange, would bring $28,000, based on normal rates. They cannot buy for cash, as such procedure would quickly drain their treasury of gold. It remains that we must take commodities in exchange for our goods. If these commodities compete directly in our markets with our own production we will have reduced our production solely for the benefit of the debtor nation. Plainly this procedure would lack any economic value to us. Therefore any exceptional lowering of duties to the people of a debtor nation must be confined to such articles as are not in direct competition with the products of our own people.

"In **Question Three** we have opportunity to pacify to some extent the objection raised in Nos. **One** and **Two.** If we may bargain we may meet conditions. Bargaining forms the basis of all our commercial activities. If all our sales and purchases were based on predetermined inflexible prices not open to discussion and investigation of changing conditions our total activities would be greatly lessened. This principle applies with even greater force to interchange between nations.

"No reason exists why a need for our special productions in a foreign country should not be exchanged for a necessity from them on a fair basis. Valuations must, of course, be considered and tariff regulations equitably adjusted to a lower level by treaty between the two countries. The difficulty of working up lists of characteristic products from all countries and the confusion of collection of different rates on a particular commodity are urged as objections. But such lists are readily available and an advance in clerical intelligence in our ports of entry will not detract from the general efficiency. Such bargaining power would probably put an end to French discrimination against our products and the Latin-American rates against our canned goods. European countries have long made their customs the basis of commercial treaties.

"The retention of our present rigid regulations will constitute a continuing barrier to the full development of American commerce. The advent of the report of the Tariff Committee of the Chamber of Commerce of the United States, which has been injected into the group meetings for consideration by order of the Board of Directors since the program was printed, demonstrates the potential possibilities of the Chamber. The readiness with which the directors received the unanimous report of the committee and not only referred it to the various group meetings but also passed it to the committee on resolutions, marks the report as of unusual importance and proves the readiness of the Directors to act promptly on a matter that offers constructive development. The Committee foresaw the necessity for prompt and permanent tariff legislation. They realize the inadequacy of permanent tariff rates to meet the changing business conditions which must follow a reconstruction period such as afflicts our country at the present time.

"The Committee fully comprehended that every business interest in this country will be affected by the findings of Congress on tariff legislation. They recalled the many periods in the past when commercial interests of the country have stagnantly awaited the final decree. They appreciated the progress made in recent years to give careful consideration of the nation's business by the establishment of the Congressional Tariff Commission. It is hoped that the business interests of the country may also be heard in an effort to assist in a constructive permanent tariff policy. To that end the committee has submitted the following report:

> *To the Board of Directors of the Chamber of Commerce of the United States:*
>
> Your Committee on Principles of Tariff Legislation report follows:
>
> FIRST: It is recommended that permanent tariff legislation should be so framed as to permit adjustment of individual rates or particular schedules of rates within prescribed limitations, and authorize changes therein from time to time without a general revision of the tariff, and thus afford reasonable latitude in the application of tariff rates to any commodity, or group of commodities, in order that there may be flexibility in the adjustment of said rates to the varying fluctuations of industrial and trade conditions.
>
> SECOND: It is recommended that such permanent tariff legislation should provide for and create a Tariff Adjustment Board, appointed by the President and confirmed by the Senate, with such emolument and tenure of office as will remove them from political influence and personal interest; that this Board shall be separate and distinct from the present Tariff Commission, the duties of which should be modified to require a report of its investigations to the Tariff Adjustment Board in addition to the reports it now makes.
>
> THIRD: It is recommended that in framing such legislation the principles hereinafter stated should control and that it shall be the duty of Tariff Adjustment Board to apply the Tariff Acts of Congress and fix just and reasonable rates within said limitations to meet changing conditions, in accordance with said principles, viz:—
>
> (a) Promotion of the interest of the American Public as a whole.
> (b) Reasonable protection of American industries that are subject to destructive competition from abroad, and that are, or compromise to be, of benefit to the country as a whole, or to any considerable section thereof.
> (c) Maintenance and encouragement of export trade.
> (d) Meeting discriminations, direct or indirect, against the products of this country.
> (e) The prevention of dumping of foreign goods into this country to the injury of our markets.
> (f) Due consideration of the relative standards of living, earnings, and efficiency of labor in this and in other countries.

"In operation under the plan submitted by the Committee, Congress will pass a law levying duties on a list of commodities within certain limitations and the tariff board provided for in the report will determine the specific rate. This rate may be changed by the board as frequently as necessary to meet changing conditions. It can be modified to meet bargain conditions desirable to treaty agreements. Within the prescribed limitations it offers the flexibility necessary to extensive trading with other nations.

"To some extent this plan follows the working of the Interstate Commerce Commission. This body is authorized to determine a just and equitable charge for railway service. The tariff board will execute the new tariff law with fairness to the parties interested. Legislation will determine the basic policy as to high or low, as to protection, as to revenue, with specific limitations. The tariff board will specify rates.

"Beside elimination from Congress a most obnoxious opportunity for the lobbyist it dignifies our legislative activity and relegates the clerical labor of legislation to experts who devote themselves exclusively to this work.

Full opportunity for hearings will be given by Congress on questions of principle or policy and by the board on questions of specific adjustment.

"If this measure offers relief from stifling complication and tends to a more elastic and comprehensive adjustment of our tariff it must not be ignored from the fact that it offers a radical departure from present practice. If we are bound to make and unmake tariff rates as we always have by periodic tinkering, with its consequent depressing effect on all our industries, then Congress is the one department of our government lacking susceptibility to modern progress and evolution.

"We should concern ourselves however more particularly to the merits or demerits of this plan. Does it not at least contain the elements of an improved plan for the manipulation of one of our most serious and most complicated activities? If so, it is plainly our prerogative, and we may say our duty to give it most careful consideration, determine how it may be improved and then give it wholesome support."

There was one other tariff thought that was well received. This was a suggestion by Secretary Hoover that all imported articles should be valued on the American market standards, rather than on the point of origin. The speaker used the illustration that corn might be worth $1 a bushel in this country, 80 cents in England, 50 cents in France and 30 cents in Japan, and when the bushels from the various countries were shipped into this country they would pay as duty 20 per cent of the value in their own country, rather than 20 per cent of the value of the corn with which they were to compete.

Of course there were other big thoughts in the meeting. Two of these were received with entire accord by all speakers, whether formal or impromptu. These were:

> **Stabilization of the entire world trade is necessary before trade in any country can reach a normal basis. Just now the indemnity problem and the status of Russia are the big factors.**
>
> **That the successful organization of the Foreign Trade Financing Corporation is the hope of the export trade of this country.**

The Wage Problem

There was a highly interesting and instructive session of the Fabricated Production Group devoted to the relation of wages to production and sales. Some very interesting charts were displayed by Magnus Alexander and others. The employers quickly seized upon these and statements were frequently made that it was going "to be necessary for employers to grasp the situation with a strong hand and adjust operating expenses."

But only one speaker in the discussion mentioned as important the methods of reducing wages. Clarence Howard, in the informal discussion, briefly advised employers that in all dealings with their employees The Golden Rule should be their guide. Howard made it plain that in his dealings, the feelings of the employee were more important to him than statistics: that statisics were of value only when they were understood by the employee as well as by the employer.

The Business Man's Creed

The new objective of the Chamber is very well stated in the preamble to the resolutions, which is described as the "basic philosophy of the American business man." This statement will probably do much to explain to the members who were frankly at a loss to understand the changed character of the meeting. The statement follows:

> This chamber believes that the relation of government toward industry and commerce is primarily that of preserving equality of opportunity. Laws and administrative acts should touch business enterprise with great care and only to preserve a fair field to all.
>
> A wholesome standard of living is essential to general contentment. That standard depends upon the intelligence, work and thrift of the individual citizen. Hence, restriction of production must necessarily undermine that standard. We therefore condemn avoidable strikes, lockouts and all combinations that needlessly limit output or curtail distribution on the part of workers, owners or managers of industry.
>
> The foundation of all enterprise is primarily that of service to the community, and this service is most effective under private initiative. The community's variation of that service, and its reward for it, are most fairly expressed when secured by individual initiative, under conditions of free competition. The value of and the reward for such service cannot be safely apportioned by the arbitrary decisions of government agencies.

An Automotive Director

Automotive interests fared exceedingly well in this meeting. A. J. Brousseau of the International Motor Co. was elected a director to represent the Fabricated Production group. The highway resolution favored by the automotive industry was adopted by the meeting. The industry strongly favored a resolution for the sales tax, but was well satisfied with the decision of the Chamber to have a new referendum on this question. The automotive speakers were well placed. C. C. Hanch, chairman of the N. A. C. C. taxation committee, spoke before the Foreign Commerce Group on this subject; C. A. Vane of the National Automobile Dealers' Association spoke on the same subject before the Civic Development Group, and J. Walter Drake, chairman of the N. A. C. C. Export Committee, spoke before the Fabricated Production Group on Tariff. This is more recognition than this industry has previously been accorded and there was a very strong feeling that the automotive industry would soon come into its proper station as the second greatest industry in the country.

An aeronautical resolution, which was submitted to the Resolutions Committee, was referred for further study.

The New S. A. E. Handbook

THE Society of Automotive Engineers has recently sent copies of the revised edition of Volume I of the S.A.E. Handbook to all of its members. Although the data contained in the revised edition are in general the same as those in the old edition, some new matter has been added, as for instance, complete physical characteristics of S.A.E. Steels, the report of the Nomenclature Division on automobile nomenclature and the report of the Research Division on passenger car performance tests.

The S.A.E. Standards and Recommended Practices consist of material, dimensional and test specifications, terminology, rules for procedure in the maintenance of parts, and provisions as to various closely related matters, which, according to the consensus of opinion of qualified experts, can be generally adopted with great advantage, and in no way interfere with or impede progress in the design and production of automotive apparatus and power units included in the field of activities of the Society.

The S.A.E. Standards and Recommended Practices have made possible economies in designing, in purchasing, in production and in maintenance, and relieved automotive engineers of much detail and routine work, permitting them to concentrate upon the more important engineering problems.

Commercial and Engineering Standards Discussed at Gear Makers' Convention

Several recommended practices are adopted. Cost accounting methods receive further consideration. Work on gear standardization proceeding. A standard form of gear tooth which can be made by several methods is proposed. Universal roller chain sprocket now under way.

By P. M. Heldt

AN important outcome of the fifth annual convention of the American Gear Manufacturers Association, held at Cincinnati April 27-30, may be the development of a standard tooth for spur gears which can be cut by any of the well-known methods, thus making interchangeable the gears produced by rotating form cutters, gear planers and gear hobbers. What led to the suggestion of the development of such a tooth form was the recommendation, contained in the report of the Spur Gear Committee, that the 14½ deg. involute tooth, as commonly used in the interchangeable system embracing 12 teeth to a rack, be adopted as standard for industrial gearing. It was the intention to make this a so-called adopted standard, and if it had been accepted it would no doubt have been proposed to the American Engineering Standards Committee as an American standard. The objection was raised by E. W. Miller of the Fellows Gear Shaper Co., that in order to make this form of tooth a standard, it would be necessary to closely define its form, and this the recommendation failed to do. He further objected that the 14½ deg. tooth as commonly used in the interchangeable system was not a true involute shape and that the description "the 14½ deg. involute tooth" therefore was really incorrect. Mr. Miller, moreover, made the point that there was a strong tendency away from this tooth form, and that it was not a good plan to standardize anything the stability of which was uncertain, as once a thing has become a standard it is a difficult matter to recall it. Mr. Miller did not object to the adoption of the 14½ deg. involute tooth as commonly used in the interchangeable system as recommended practice, and the recommendation was passed by a rising vote, but as the vote was not nearly unanimous the matter was referred back to the committee for further consideration.

In the course of the discussion Mr. Miller made the remark that it was quite possible to find a form of tooth that could be cut by any of the commonly used methods of gear cutting, the rotary cutter, the gear shaper and the gear hob, and he was not sure but that this tooth form was superior to any of those now in use. This statement aroused a great deal of interest among the members, all of them practical gear cutters. One member made the statement that it would be of little advantage to the gear cutting industry if the milled tooth, the planed tooth and the hobbed tooth had to be standardized separately, as these different types were already interchangeable among themselves, and the standardization work would not really advance the industry, but if pinions and gears made by all methods could be made interchangeable it would be of distinct advantage to the gear industry. No definite action was taken on the suggestion, but as the recommendation regarding spur gear tooth form was referred back to the committee it is to be presumed that it will be taken up at the next committee meeting, which is to be held in Buffalo within a month.

The meeting was held at the Sinton Hotel and was well attended. It was opened by the usual address of welcome and by President Sinram's address. The secretary's report showed that the association now has a membership of 90 companies, represented by 109 executive and 55 associate members, making a total of 164 individual members. The Baush Machine Tool Co. of Springfield, Mass., was elected to membership in the course of the meeting. An invitation was extended to the membership to attend the forthcoming meeting of the National Manufacturers Association, to be held at the Waldorf-Astoria Hotel, New York, May 16-18. J. B. Doan, president of the American Tool Works and also president of the local section of the Metal Trades Association, made an address in which he covered some phases of the machinists' strike in Cincinnati last year.

Roller Chain Transmission

During the afternoon session of the first day, April 27, G. M. Bartlett, chief engineer of the Diamond Chain & Manufacturing Co., read a paper on the Ideal Chain and Sprocket Drive. Mr. Bartlett explained that transmission by link chains is a relatively new development and is still in its infancy. It was first used extensively for bicycles, and later the development of the passenger car and motor truck gave it a great impetus in the direction of the transmission of increased powers. The design of sprockets for the chains to run on is complicated by the requirement that the sprocket must fit the chain when it is worn, and the pitch is consequently lengthened, as well as when the chain is new. Wear of the chain has been allowed for in the past by enlarging the spaces between sprocket teeth, with the result that only one roller of the chain is in contact with a tooth at a time. In a new form of sprocket tooth which is now being evolved by a joint standardization committee of the A. G. M. A., the Society of Automotive Engineers and the American Society of Mechanical Engineers, this difficulty is overcome, as the chain rollers of both new and worn chains can be in contact with a number of sprocket teeth at a time and the tendency of the sprocket teeth to wear hook-shaped is eliminated, contact of the rollers of a worn chain occurring further out on the teeth of the sprocket. Mr. Bartlett's paper was illustrated with lantern slides, and we expect to publish extensive extracts of it in a future issue.

Erik Oberg, editor of *Machinery*, brought to the convention a message from Secretary of Commerce Hoover. At a recent conference with business paper editors, Secretary Hoover announced his intention to make the depart-

ment a department of domestic as well as of foreign commerce, and to this end he desires the co-operation of the various branches of industry. The machine-tool industry, to which the message had been presented on a previous occasion, were of opinion that they could easily gather statistics of their own production themselves but that they would like the department to give increased attention to the gathering of statistics of the fundamental industries, such as the steel industry.

J. H. Dunn, chairman, made the report of the Uniform Cost Accounting Committee. He told the members that the object of this committee was to show them how unreasonable cut-throat competition could be eliminated by intelligent costing. There are now more than a hundred cost committees of industrial organizations in existence. It is generally recognized now that the manufacturers themselves will have to solve their own cost problems, as hundreds of thousands of dollars have been wasted by the employment of cost experts or efficiency experts. The National Lime Association has had a uniform cost accounting system in use for two years and figures that it has saved the members a million dollars already. Mr. Dunn laid emphasis on the fact that if the members of the Association should use a uniform cost accounting system they would not necessarily have all the same costs, as the overhead charges and the equipment of the different factories were different. At a previous meeting the Association adopted a uniform cost accounting system, but this was considered too complicated and cumbersome for the smaller concerns to put into use, and to meet this criticism the committee had prepared an abbreviated form in which several items in the longer form were combined under one head. In connection with its report the committee also presented some illustrations of how costs on gear jobs work out by the "direct labor cost," the "machine-hour overhead rate" and the "overhead prorated against direct labor cost" methods.

Mr. Wilson brought up the question whether it was right to let the production carry the entire overhead charges under such abnormal conditions as we are experiencing now. He did not think it was fair to charge the entire overhead if that suddenly jumped ahead 300 per cent or more, and suggested that the normal rate of overhead should be charged and the rest be absorbed in a special account. This would prevent the cost from suddenly increasing to abnormal values; and, moreover, the department did not become confused in preparing estimates.

Method of Apportioning Selling Cost

Another question that was discussed at some length was whether selling costs should be apportioned on the basis of manufacturing costs or on the basis of selling price. One speaker reasoned against the latter method in the following terms: Suppose your selling department secures one order at a profit of 10 per cent and another at a profit of 60 per cent; would it be fair to charge them with extra cost for getting the more profitable business? Upon motion of Mr. Kebler the report of the Committee on Uniform Cost Accounting was adopted, with the recommendation that the members be urged to put the system into use.

At the session on Thursday morning, April 28, F. B. Waterman, chairman of the General Standardization Committee, made a report for the A. G. M. A. Sectional Committee of the American Engineering Standards Committee and also a report for the General Standardization Committee. In the latter he mentioned the fact that five subcommittees would make reports containing suggestions for recommended practices and two would report progress.

The first subcommittee report was that on spur gearing and was presented by the chairman, F. E. Eberhardt. All recommendations related to industrial gearing and therefore do not concern the automotive industry directly. It was proposed to standardize the 14½ deg. involute interchangeable system, and proportions for the tooth elements were given. It was also proposed to standardize 20 deg. stub teeth for use where great strength or small numbers of teeth are required, and proportions for this form of teeth were also given. Rules were also given for the width of face, thickness of rim for spoked gears and diameter of hub. After prolonged discussion, as outlined in the first part of this article, the report with amendments was adopted by a majority vote, but was referred back to the committee for further consideration. One point that came up in the discussion was whether there was any necessity for standardizing 20 deg. pressure angle teeth for industrial gearing. In this connection J. B. Foote of the Foote Bros. Gear Co. made the statement that in the experience of his firm from 15 to 20 per cent of the orders for industrial gearing call for 20 deg. pressure angle teeth and the tractor industry uses such teeth exclusively. It was also brought out in the discussion that with the gear planing method it is necessary to provide a slightly larger clearance than is customary with gears formed with rotary cutters. John Christensen suggested that for large gears there should be certain standard numbers of teeth, so that more extensive use could be made of stock patterns.

Bevel Gear Recommended Practice

F. E. McMullen, chairman of the Bevel and Spiral Bevel Gear Committee, made a report for that committee which was adopted as presented. This report contains diagrams and tables for use in determining the dimensions of tooth elements and explains how the tabular values are arrived at. The report follows:

"Bevel gear teeth are treated in the same manner as spur gear teeth with the exception that the back cone radii (Fig. 1) are used instead of the pitch radii of spur gears. In Fig. 2, the pitch circles of a gear and pinion are drawn together with the base circle of the pinion determined by the pressure angle "a." Involute tooth contact cannot take place below the base circle, since the involute curve has its inception at the base circle, and any projection of the gear or pinion addendum beyond the base circle of the pinion at the beginning and end of the theoretical arc of action is useless in so far as tooth action is concerned.

"The problem is first to find the gear addendum which at the beginning of the arc of approach extends to the base circle of the pinion, labeled in Fig. 2, Maximum Theoretical Addendum. The values in Table I are obtained on this basis by solving the oblique angled triangle for various ratios and pressure angles. Examination of this table will show that the tabular values between ratios 3-1 and 8-1 do not change greatly, and for the sake of simplicity, we have assumed that there is no change in preparing the bevel gear tooth proportion tables.

TABLE 1

Maximum Theoretical Addendum of Bevel Gear Pinion

Back Cone Radius = 1 in.

Ratio	14½ Deg. In.	20 Deg. In.	14½ Deg. Spiral In.	20 Deg. Spiral In.
1–1	0.0899	0.1623	0.1159	0.2043
2–1	0.0699	0.1295	0.0909	0.1655
3–1	0.0659	0.1226	0.0859	0.1571
4–1	0.0645	0.1201	0.0841	0.1541
5–1	0.0638	0.1190	0.0832	0.1527
6–1	0.0635	0.1184	0.0828	0.1519
7–1	0.0632	0.1180	0.0825	0.1514
8–1	0.0631	0.1177	0.0823	0.1511

"A percentage has been added to the theoretical values, the purpose of which is to provide an ease-off. Reference to Fig. 3 will show graphically that unless this percentage is added, the tooth load on the gear at the beginning of approach will lie along the very top edge of the tooth, a condition to be avoided.

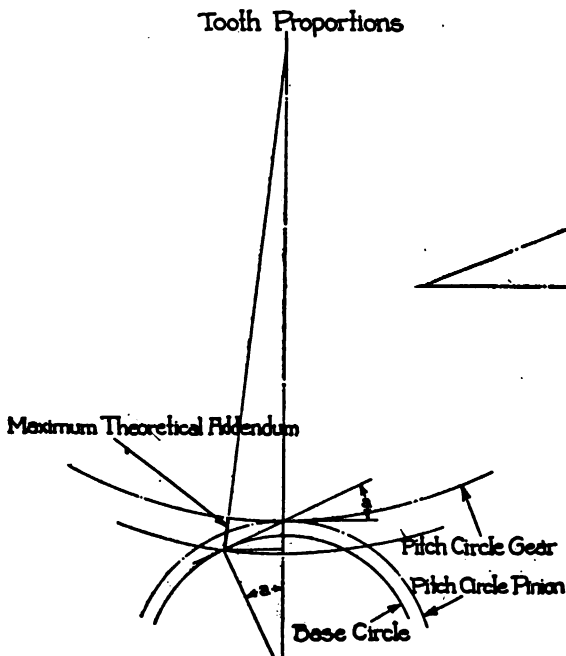


Fig. 2

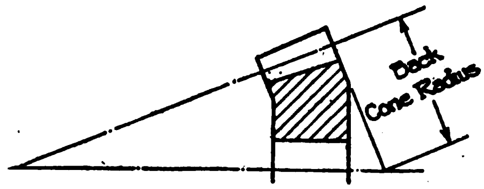


Fig. 1

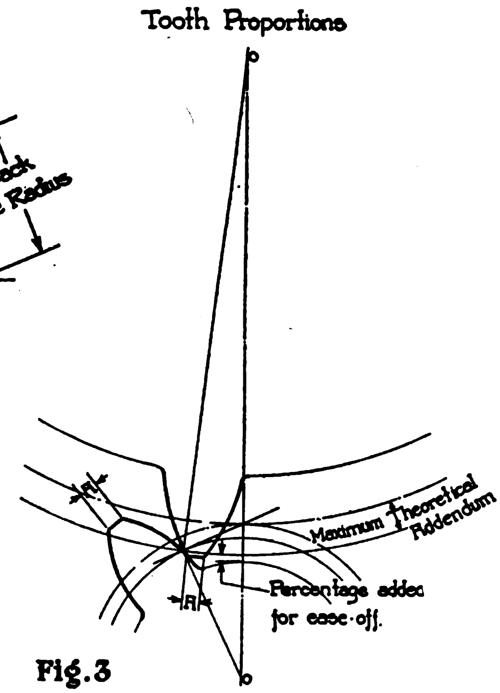


Fig. 3

TABLE 2

Straight Bevel Gear Tooth Proportions

Pressure Angle, 14½ Deg. Ratio 3–1 to 8–1.

Tabular values are for 1 d.p. For any other pitch divide by diametral pitch used.

No. of Teeth in Pinion	Addendum Gear In.	Addendum Pinion In.	Full Depth In.	Circular Thickness Gear In.	Circular Thickness Pinion In.
14	0.560	1.440	2.157	1.186	1.955
15	0.600	1.400	2.157	1.221	1.920
16	0.640	1.360	2.157	1.256	1.885
17	0.680	1.320	2.157	1.291	1.850
18	0.720	1.280	2.157	1.326	1.815
19	0.760	1.240	2.157	1.361	1.780
20	0.800	1.200	2.157	1.396	1.745
21	0.840	1.160	2.157	1.431	1.710
22	0.880	1.120	2.157	1.466	1.675
23	0.920	1.080	2.157	1.501	1.640
24	0.960	1.040	2.157	1.536	1.605
25	1.000	1.000	2.157	1.571	1.570

TABLE 3

Spiral Bever Gear Tooth Proportions

Pressure Angle 14½ Deg. Ratio 3–1 to 8–1.

Tabular values are for 1 d.p. For any other pitch divide by diametral pitch used.

No. of Teeth in Pinion	Addendum Gear In.	Addendum Pinion In.	Dedendum Gear In.	Dedendum Pinion In.	Full Depth In.	Circular Thickness Gear In.	Circular Thickness Pinion In.
10	0.500	1.200	1.420	0.720	1.920	1.2000	1.9416
11	0.550	1.150	1.370	0.770	1.920	1.2500	1.8916
12	0.600	1.100	1.320	0.820	1.920	1.3000	1.8416
13	0.650	1.050	1.270	0.870	1.920	1.3500	1.7916
14	0.700	1.000	1.220	0.920	1.920	1.4000	1.7416
15	0.750	0.950	1.170	0.970	1.920	1.4500	1.6916
16	0.800	0.900	1.120	1.020	1.920	1.5000	1.6416
17 or over	0.850	0.850	1.070	1.070	1.920	1.5500	1.5946

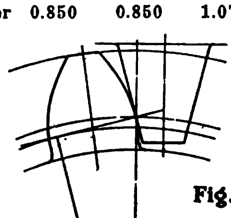


Fig. 4

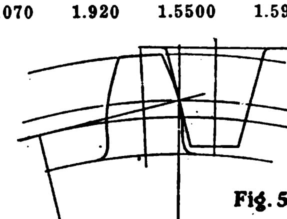


Fig. 5

(See Fig. 4)

14-Tooth Pinion, Straight Bevel, 3–1 Ratio or Greater

	Gear In.	Pinion In.
Pitch depth	0.560	1.440
Full depth	2.157	2.157
Circular thickness	1.186	1.955

Pressure angle, 14½ deg.

(See Fig. 5)

25-Tooth Pinion, Straight Bevel, 3–1 Ratio or Greater

	Gear In.	Pinion In.
Pitch depth	1.000	1.000
Full depth	2.157	2.157
Circular thickness	1.571	1.570

Pressure angle, 14½ deg.

"The shapes of the teeth specified in Table 2, of 14½ deg. straight tooth gear proportions, are shown in Figs. 4 and 5. The circular thicknesses given in the table were obtained from these layouts by giving consideration not only to strength but also to the width of the top land, and insure a width sufficient to prevent a complete carbonization and consequent brittleness in case hardening.

"The values given in the tables are for 1 d.p. throughout. For any other pitch, it is necessary to divide the tabular values by the given diametral pitch. No table is offered for the 20 deg. pressure angle, straight tooth gears, as the standard proportion where the addendum is one-half of the working depth has proved satisfactory where the number of teeth is not less than 12.

"For ratios below 3-1, either additional tables will be required or a formula offered to provide individual treatment of each case. The reason for this is apparent from a study of Table 1, where it will be noted that the tabular values change greatly among the lower ratios; in fact, the percentage change is so great that at least four tables will be required to properly cover the ratios from 1-1 to 3-1 for each pressure angle.

Spiral Bevel Gears

"Table 3 gives the tooth proportion for 14½ deg. spiral bevel gears for ratios between 3-1 and 8-1. The values are

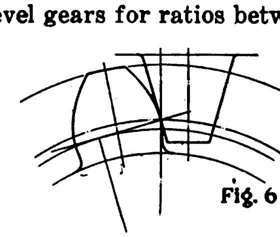


Fig. 6

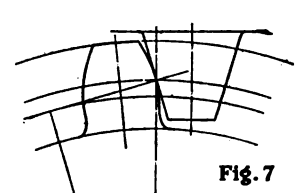


Fig. 7

(See Fig. 6)

10-Tooth Pinion, Spiral Bevel, 3–1 Ratio or Greater

	Gear In.	Pinion In.
Pitch depth	0.5000	1.2000
Full depth	1.9200	1.9200
Circular thickness	1.2000	1.9416

Pressure angle, 14½ deg.

(See Fig. 7)

17-Tooth Pinion, Spiral Bevel, 3–1 Ratio or Greater

	Gear In.	Pinion In.
Pitch depth	0.8500	0.8500
Full depth	1.9200	1.9200
Circular thickness	1.5500	1.5946

Pressure angle, 14½ deg.

obtained in the same manner as for straight tooth gears with two modifications. The working depth of spiral bevels is 85 per cent of that of straight tooth gears or standard depth for the normal pitch and the bottom clearance is 0.07 x the C. P. instead of the usual standard of 0.05 x the C. P. Figs. 6 and 7 show the tooth shapes of teeth based on the proportions given in Table 3.

Members and guests lunched together on Thursday and after lunch listened to an address by Senator George Wilder Cartwright from California, a member of the Senate's Industrial Relations Committee, on The Price of Success in America. During the afternoon members and guests took part in an automobile ride through the city of Cincinnati and surroundings, visits being made to the plants of the local members and to a number of machine tool plants. The cars for the occasion were furnished by the Cincinnati members and friends in the machine tool line.

On Thursday evening there was a meeting of the Cincinnati Section of the American Society of Mechanical Engineers, and as the two papers to be presented had to do with the subject of gear cutting, an invitation to attend has been extended to all delegates to the A. G. M. A. convention. O. B. Zimmerman, chief engineer of Gould & Eberhard, read a paper on Modern Methods of Gear Cutting, and Earle Buckingham, a paper on the Maag system of gearing. Practically all of the technical men at the gear convention attended the meeting, and some of them took part in the discussion.

Disagreement on Herringbone Gears

At the Friday morning session of the A. G. M. A., J. B. Foote presented the report of the Labor Committee, of which he is chairman. This was accepted as presented. A. F. Cooke presented the report of the Herringbone Gear Committee and asked that the report be referred back to the committee, as a disagreement had arisen between members thereof. The report recommended the use of diametral pitch hobs up to and including 1¼ in. diametral pitch, of a 20 deg. pressure angle measured on the axial section of the hob, of a 22½ deg. spiral angle of short teeth with 0.8/d.p. addendum and 1/d.p. dedendum and of a minimum width of active face of 16/d.p. The width and depth of groove in the center of the blank was given in the form of a table for gears cut with hobs at right angles to the axis of the gear, and in the form of formulæ for gears cut with planing or shaping tools. A table was also given of the angles to which the hobs should be set, a table of enlargements for pinions and a chart of strength of herringbone gears. A. A. Ross, a member of the committee, said that they were anxious to get the views of the members regarding the selection of 22½ deg. for the spiral angle. Although, in an effort "to get something accomplished," a motion was made by a member not connected with the committee that the report be adopted as read, on the protestation of another member of the committee that not even the committee members were agreed, it was voted to return the report to the committee for further consideration.

E. J. Frost, chairman, made a report for the Inspection Standardization Committee. This covers the same points as the report printed in the March 17 issue of AUTOMOTIVE INDUSTRIES, but the recommendations on some of these points were changed somewhat. Thus in connection with cylindrical holes it was recommended that cylindrical holes up to 3 in. in diameter should be inspected with "will and will not go" plug gages, the "will go" end to be the same as the smaller limit and the "will not go" end the larger limit given on the customer's drawing. Holes between 3 and 12 in. in diameter, bar gages should be used, in which there are two bars approximately at right angles to each other, held together by a handle pressed into a hole in the middle of each bar; one bar being the "will go" and the other the "will not go," the nature of the piece being inspected, principally the length through the bore determining the length of the handle, and whether the bars shall be close together, or at opposite ends. Larger holes than 12 in. in diameter should be inspected with measuring rods, or inside micrometers set to vernier calipers, or standard measuring machine. No wear should be allowed on gages beyond the limits on customer's drawings.

It was recommended that in case of disputes concerning matters having to do with inspection an arbitration committee of three should be appointed—one by the buyer, one by the seller and they to appoint the third member. The report of the committee was accepted as presented, with a number of changes over the printed text as indicated by Mr. Frost.

The next business to come up before the meeting was an amendment to the constitution whereby the number of members of the Executive Committee was to be increased from 8 to 12. It was explained that when the Constitution was adopted the Association had only the nine charter members, while now the membership had grown to more than ninety. The amendment was adopted unanimously and the convention then proceeded to the election of the new members of the Executive Committee. J. H. Dunn, John Christensen and C. R. Weiss were appointed tellers. The following twelve were elected members of the Committee: F. W. Sinram, E. J. Frost, Wm. Ganschow, J. B. Foot, C. E. Crofoot, Geo. L. Markland, Jr., R. P. Johnson, W. H. Diefendorf, Henry E. Eberhard, A. F. Cooke, F. D. Hamlin and B. F. Waterman.

At the same time that the number of executive committee members was increased it was decided to increase the number of vice presidents from one to two. Under the constitution of the Association the members of the executive committee elect the officers of the organization. F. W. Sinram was re-elected president, R. P. Johnson of the Warner Gear Co., Muncie, Ind., first vice-president, B. F. Waterman, second vice-president, and Frank D. Hamlin was re-elected secretary and treasurer. It was hinted that Mr. Johnson would act as an understudy to President Sinram during the year and would succeed him at the next annual meeting. Vice-president H. E. Eberhard, who was retired at his own request, was given a vote of thanks by the convention for his four years' services.

Next Meeting at Rochester, N. Y.

It was announced that an urgent invitation had been received from St. Louis to hold the next semi-annual convention in that city. The association, however, had already decided previously to meet in Rochester, N. Y., where they had been invited by officials of the Gleason Works. Under the heading of new business a motion was made that the association reduce its number of meetings from two to one per year. In support of the suggested change it was stated that it would work in the interest of economy, and also that, while the holding of two meetings per year might have been advisable when the association was young and had all of its work before it, much had been accomplished since then and it was no longer necessary to meet so frequently. The sponsor of the motion favored the fall meeting if his plan should be adopted. Another member was in favor of the spring meeting, for the reason that the committees could do much better work during the winter than during the summer, and therefore would be in better position to go before the Association with their reports in the spring than in the fall. Quite a number of members, however, voiced the opinion that interest in the work of the Association would flag if the frequency of meetings were reduced and it was voted to continue both meetings.

J. C. O'Brien, chairman of the committee on worms, worm gears and spirals, had been sick for some time and was not at the convention. In his absence W. H. Phillips gave a review of the state of the work of that committee. Ralph L. Dodge presented the report of the gear steels committee of which he is chairman. This report contained specifications of a series of steels recommended for gears. These are generally identical with the S. A. E. steels and are designated by the S. A. E. numbers. A No. 1100 steel had been in contemplation by the S. A. E. Iron and Steel Committee but was finally dropped. This steel therefore was also dropped from the A. G. M. A. list. It was suggested to issue two specifications which are intermediate between S. A. E. specifications, the A. G. M. A. 2350 and the A. G. M. A. 6150. Both of these have a carbon content of 0.45-0.55 per cent. Mr. Diefendorf wanted the S. A. E. No. 2320 included in the list, as it was widely used in gear manufacture, but he met with no support. E. J. Frost thought that a range of 10 points in the carbon content was entirely too great and expressed the view that steels at the extreme ends of the specification could not be properly heat treated at the same temperatures. In his plant they tested all steel for carbon content and never let bars with that wide difference go through. Mr. Dodge admitted that the range was rather wide for high carbon steel but said he did not consider it too wide for low carbon steel. That part of the report relating to the steel specifications was adopted as presented.

Standard Sprocket Tooth Under Development

C. B. Hamilton presented a progress report for the Hardening and Heat-Treating Committee dealing chiefly with the composition of gear bronzes. It had been proposed to change the name of this committee to Metallurgical Committee, and this proposal was adopted. A progress report of the Sprocket Wheel Committee was presented by C. R. Weiss, chairman. This committee is cooperating with corresponding committees of the S. A. E. and the A. S. M. E. Shortly after the fall meeting of the Association a meeting of roller chain manufacturers was held at the Engineers Club, New York, at which the new U. S. sprocket tooth form was agreed upon. This tooth form is still to be ratified by the S. A. E. and the A. S. M. E., and it is expected that it will be ratified at the spring meetings of these societies. Standard sizes of roller chain have already been adopted by the S. A. E. and will most likely be adopted also by the A. S. M. E. at its spring meeting. As soon as this is done the Sprocket Wheel Committee of the A. G. M. A. will be in position to issue information concerning standard chain sizes, details of cutters for standard sprockets and diameters for sprocket wheels. Two new members have been added to the committee recently, George M. Bartlett of the Diamond Chain & Mfg. Co. and Stanley P. Rockwell of the Whitney Mfg. Co.

The report of the Keyway Committee contained recommendations for the depth and width of keyways in shafts, the width to be made one-quarter the diameter of the shaft and the depth one-half the width. To avoid the need for carrying a very large number of sizes of key stock a table was incorporated in the report giving the sizes of keystock recommended for shafts from ⅜ to 12 in. in diameter, inclusive. All sizes of key stock are square. For taper keys a taper of ⅛ in. in a foot was recommended, which is very close to the British standard taper for keys, 1:100. The report also contained the S. A. E. square, spline and taper fittings.

B. F. Waterman thought that in the larger sizes the keys should be of rectangular instead of square section, of smaller depth than width. He said that many gear manufacturers had issued catalogues containing rules for width and depth of keyways, and suggested that all members having such keyway tables send a copy of same to the Keyway Committee. C. B. Hamilton, Jr., thought the table contained too many sizes of keys and suggested that some be eliminated. One member objected to the limits of 0.001 in. on the broached holes of the S. A. E. fittings. The report was referred back to the Committee.

John Christensen reported for the Committee on Composition Gearing. This Committee has completed its standardization work except as regards the strength of composition gears, and in this connection arrangements have been made with the Engineering Department of Purdue University whereby the latter will conduct a series of of tests on such gears.

A banquet took place at the Sinton Hotel on Friday evening, the speakers being Edward S. Jordan, president of the Jordan Motor Car Co., and Charles Woodward, vice-president in charge of personnel of the Hydraulic Steel Co. Mr. Jordan's subject was "Looking Ahead." He said few automobile companies are producing one-half as many cars as last year. During the past six months only 191,000 cars were built, as compared with 900,000 during the same period a year earlier. He was convinced that the present flurry would last only for a short time and that people generally would not pay the present prices. The man who expected to liquidate his inventory at the old prices would eventually discover that his overhead will net him as large a loss as if he took the loss on the inventory now. Mr. Jordan said there was a great upheaval going on in the automobile industry right now and many men were changing places, but he did not look for any consolidations.

Mr. Woodward spoke on the Human Element in Business. He dwelt upon the futility of the doctrine of the equal distribution of wealth and emphasized the great economic wastage due to the difference between what men can do and what they will do. If the difference be placed at 25 per cent of the former value, the wastage amounts to five billion dollars a year. Referring to the experiences of his own company, Mr. Woodward said, "Confidence is one of the big things you want to build in your workmen. One of the greatest troubles of our present system is that the superintendent insists on doing the thinking for his men, and until this condition is remedied no real progress can be made in the solution of the problems confronting capital and labor."

Loose Leaf Gear Handbook

At the final session on Saturday morning the report of the Library Committee was presented, by B. F. Waterman in the absence of chairman E. W. Baxter. This committee has in hand the preparatory work on a handbook on gearing which is to contain much of the so-called "useful information" that has heretofore been published in the catalogues of the individual members. A scrap book containing much of the material to be included in this handbook was shown. The question whether the volume should be in the form of a loose leaf book or a bound book was again taken up, and it was decided that a loose leaf book would best meet the requirements. The Metallurgical Committee, among others, expects to have valuable data from time to time which it will be possible to incorporate quickly in the hand book if it is of the loose leaf form. It would probably take years to get all the material for the complete handbook together, while a start could be made on a loose leaf handbook in the near future.

During this session two papers were presented, one by A. R. Mitchell of the Andrews Steel Co. on Industrial Gears from the Users Standpoint, and the other by J. B. Foote of the Foote Bros. Gear Co. on Worm Gearing. We expect to print extracts from Mr. Foote's paper in a later issue of AUTOMOTIVE INDUSTRIES.

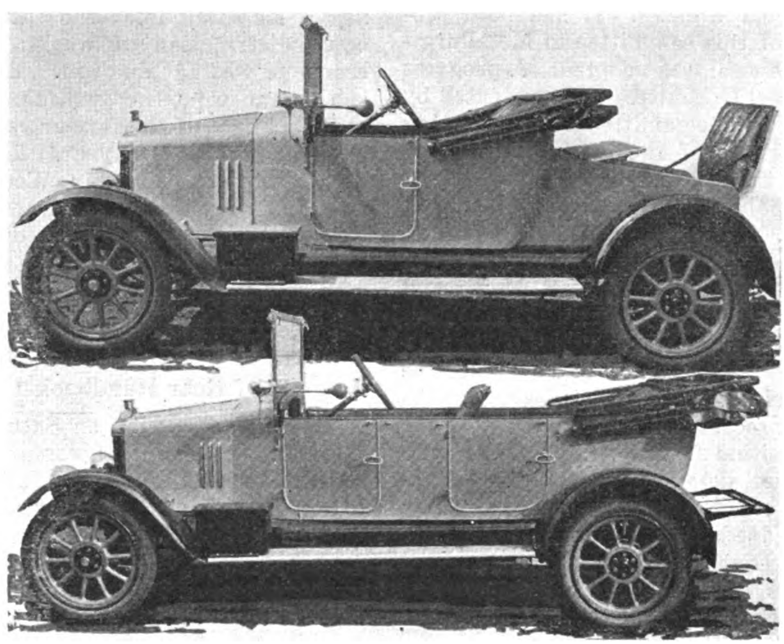
One Example of British Light Car Practice

The Standard, one of the early designs of light car produced in England is typical of one class of vehicle which has become very popular there. Has high speed 10 hp. engine, 108 in. wheelbase and 48 in. tread and weighs, with four passenger convertible body, 1820 lb.

By M. W. Bourdon

ALTHOUGH in certain of its features the Standard light car possesses pronounced individualities, it can be said to exemplify a type of chassis which, especially since the war, has increased amazingly in popularity among British purchasers. In its various stages of development the Standard has kept step with the light car movement in Great Britain. This movement began to make itself seriously felt at the end of 1913, a previous spell of popularity of small, two-seated cars having proved evanescent. The modern light car has its foundations in the various chassis introduced in 1913 with small, four-cylinder engines rated at 10 hp., having a capacity of under 1100 cu. cm. (approximately 67 cu. in.) and a normal crankshaft speed of about 3000 r.p.m.

The original Standard was one of these early light cars, having at that time a four-cylinder, water-cooled block engine of 62x90 mm. (approximately 2 7/16 by 3½ in.). The chassis had a wheelbase of 90 in., and obviously was not intended for nor fitted to accommodate other than a two-seated body, to which occasionally a dickey seat was added.

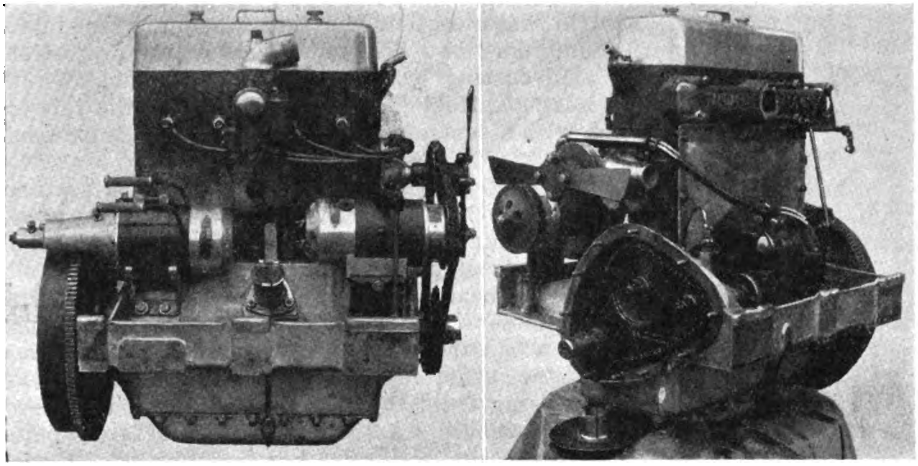


(Above)—Standard light car with two-passenger body and double dickey seat. (Below)—Standard four-passenger light car.

The 1921 Standard, apart from its engine, shows very few departures in fundamentals from the original of its type made in 1913. The chassis has, however, grown considerably, for it now has a wheelbase of 108 in., the track being 48 in., and the stock bodies include a four-passenger model as well as a two-passenger with a two-seated dickey. With this selection of body work, it is a type which is making a very forcible appeal and becoming exceedingly popular with a class of buyer looking for certain standards of comfort and passenger accommodation, with economy in running costs.

The following particulars of the Standard chassis (which has been worked up to an output of approximately 70 per week) will make it evident that the British light car is quite a different proposition from the type of vehicle known as a light car in the United States. Originally it was quite a microscopic automobile, while even now it is still smaller, particularly in engine capacity, than those cars designated "light" in the United States. The 3-litre type of engine and chassis, which to outsiders appears only just to be coming into its own in America, obtained a good foothold in England at least ten years ago, and at the present day this type is looked upon as something far removed from a light car.

The Standard has a four-cylinder, valve-in-head engine, with a bore and stroke of 2.7x4.3 in., which gives a cylinder capacity of approximately 97 cu. in. The valves have their seats directly in the detachable cylinder head, and are actuated by overhead rockers and push rods. Plain, spherical ended followers are used; they are set into cast iron guides and have cupped upper ends for the solid push rods, which apply through cupped extensions to spherical studs screwed into the undersides of the rockers. The accompanying illustration shows the design of the rockers and rocker shaft. The latter is carried in three bearing brackets and is bored and threaded internally at one end to receive the union for a connecting pipe to the engine lubrication system. Oil is delivered into the stationary shaft at this end and is led through a counter bore to a deep groove running along the upper surface of the shaft. The lubricant then serves for the rockers, not only their pivot bearings, but also their push-rod ends, the rockers being drilled to convey oil to a thick felt washer located around the spherical stud between the rocker and the push-rod cup.



(To the Left)—Right side Standard light car engine. (To the Right)—Half front view Standard light car engine with chain cover removed. View shows supplementary water outlet at front end of cylinder head.

All moving parts of the overhead valve gear are, therefore, lubricated under pressure, the excess of oil exuding from the rockers finding its way back to the crankcase through the space—enclosed by an aluminum cover—up which the push rods pass on the left side of the cylinder block. The latter is an iron casting separate from the crankcase, which is a three-part unit of aluminum, the lowest section forming an oil sump. The upper section of the crankcase is formed with a webbed bracket extension on each side, enabling the engine to be carried directly in the main frame.

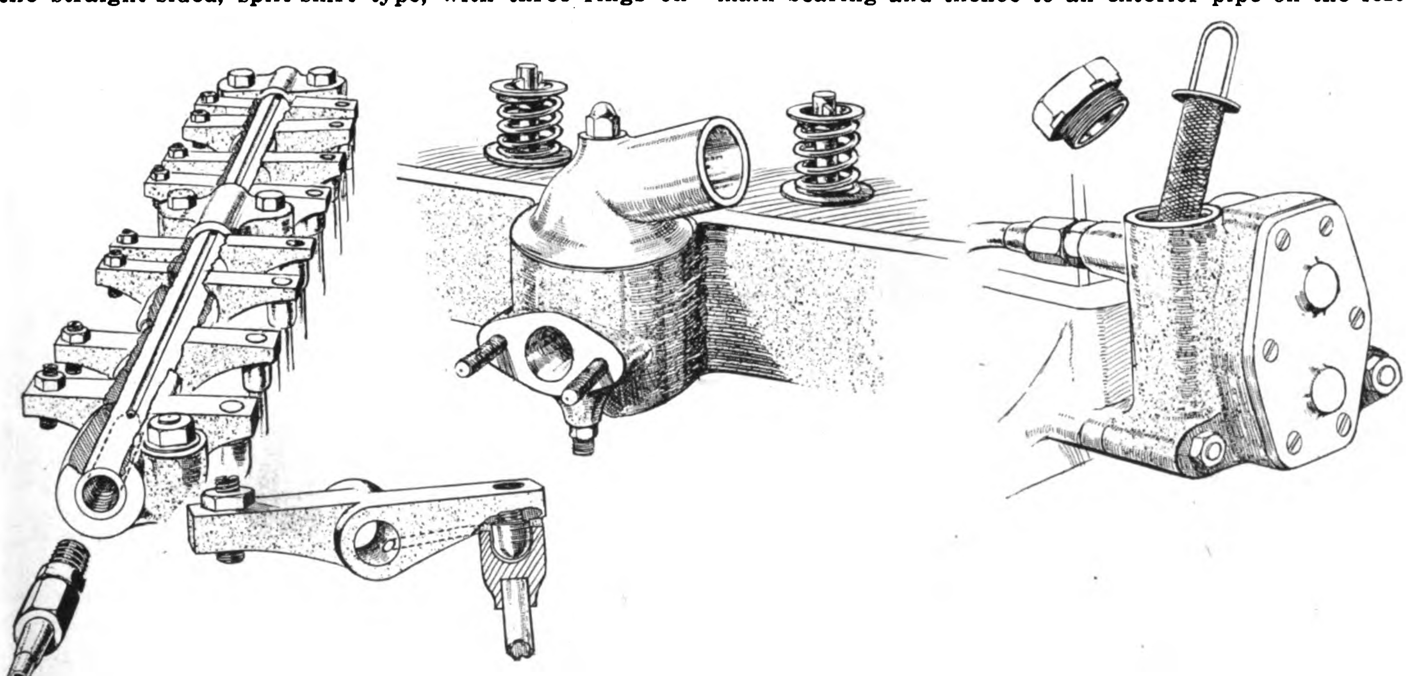
The crankshaft, having a flange to which the flywheel at the rear end is secured by four bolts, is carried in three white-metal bearings from the upper half of the crankcase. It is drilled for forced lubrication to the main bearings and crankpins, while leads from the main circuit are also taken to the three camshaft bearings. From the big end of each connecting rod 3/16-in. diameter copper tubing carries the oil to the piston pins; the latter are hollow, of 1 in. diameter and are a driving fit in the bosses of the aluminum pistons, which are of the straight-sided, split-skirt type, with three rings on the crown and one inside the skirt. To prevent axial movement of the piston pin, aluminum end caps are fitted. The big ends have two bolts each, and their anti-friction metal is carried in bronze shells spaced by thick, solid shims.

A single silent chain passing over three sprockets serves for the distribution, the third sprocket being that of the magneto drive shaft, which, together with the magneto itself, is carried by an aluminum bracket capable of being moved bodily toward either side for chain adjustment. This sprocket shaft is carried by two phosphor bronze bushings with a space between them into which oil is led from a branch pipe, a second branch delivering lubricant to toothed side of chain.

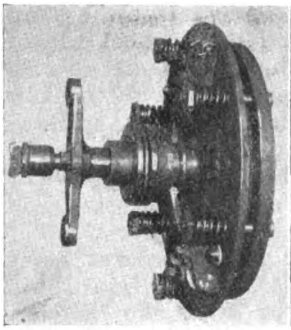
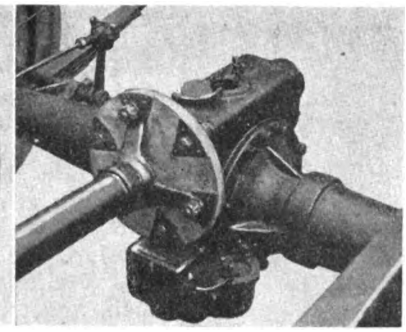
For lubrication purposes a gear type pump is used, driven by dogs on the rear end of the camshaft. The pump casing embodies a compartment for a small filter on the suction side, an exterior copper pipe from this chamber leading from an elbow located outside the sump and having attached to it a long, cylindrical filter projecting into the oil.

From the delivery side of the pump oil passes into a duct formed in the crankcase casting to the underside of a plunger which serves (1) to form a relief pressure valve when it is raised by oil pressure to uncover a port through which excess of lubricant returns to the crankcase and (2) to operate a vertical rod connected to an oil circulation indicator arranged on the dashboard. No spring has been found necessary to back this plunger valve, its own weight serving to maintain the oil pressure in the circulation system at the desired maximum.

From the relief pressure chamber (which is simply a hole drilled from above in the thickened rear wall of the crankcase) the lubricant passes to the rear end main bearing and thence to an exterior pipe on the left



(To the Left)—Standard overhead valve gear, showing details of forced lubrication. (Center) Combined inlet flange and water outlet elbow on Standard cylinder head. (To the Right)—Standard combined gear pump and oil filter.

(To the Left)—Standard light car single plate clutch removed as unit from flywheel, to which it is secured by three bolts. (To the Right)—Center of Standard rear axle showing rear end propeller shaft joint and oil sump at front of axle casing center

of the crankcase with the leads to the other journal bearings and to the camshaft. From the front end branches run to the overhead rocker shaft, the silent chain and the magneto shaft bearings. The last-mentioned lead has in its length a cock which, when moved to a horizontal position, diverts the oil passing through, and allows it to issue through a small hole to indicate that the lubrication system is operating at this end of the engine.

The crankcase sump, which is separated from the crank chamber by a perforated gauze strainer, contains approximately three quarts of lubricant, and is provided with two means of indicating the oil level, the first an overflow cock with an extension handle brought up to a point near the filling elbow, and the second a float-operated plunger pin projecting alongside a graded plate. It will be observed from this that both oil circulation and oil level indicators are duplicated.

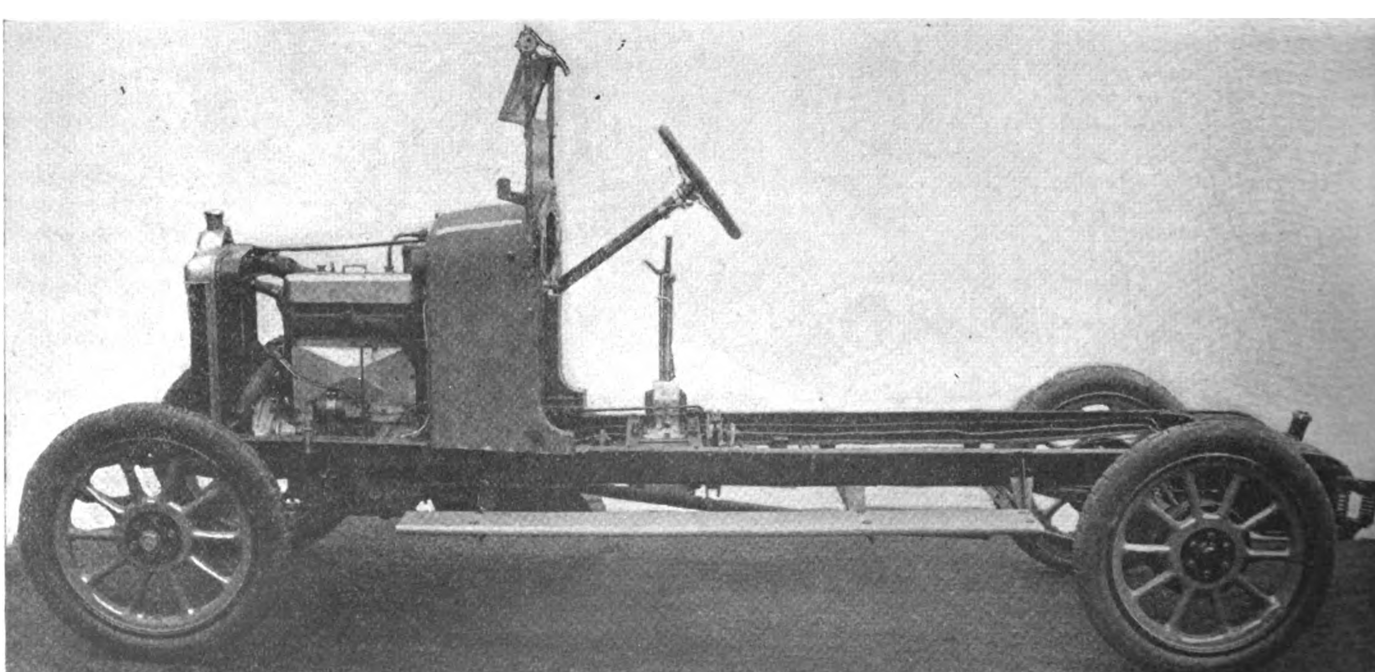
The carbureter, a horizontal type Zenith, with vacuum feed from an eight-gallon tank, has no provision for heating the ingoing air, but to assist vaporization the carbureter flange on the cylinder head is integral with the water outlet, and the entering mixture, before passing left and right within the head casting to the valve pockets, must pass round either side of the central water outlet, the latter being surmounted by an aluminum elbow held to the seat on the projection of the head casting by a single central stud and nut. The exhaust manifold is a separate unit on the left of the head, with a central outlet and flange for the exhaust pipe.

Water circulation is by thermo syphon, but a feature to be observed is that, while the main outlet to the radiator is through an elbow on the right of the cylinder head, there is a supplementary outlet of ⅜ in. bore at the front of the head casting, with a separate connection to the radiator tank. This arrangement appears to eliminate "pockets" in the water jacket; without the supplementary water outlet, head distortion and its accompanying evils arising from the formation of local hot-spots has been experienced. A simple two-bladed fan is belt-driven from a pulley at the front end of the crankshaft, this belt also serving for the dynamo, which is arranged on the right of the cylinder block on a bracket having lateral adjustment, the dynamo being secured to it by two vertical studs and a yoke. On the same side is the separate starting motor with a Bendix drive to the flywheel. The spark plugs are also on the right-hand side, being screwed into the cylinder head casting horizontally.

As may be inferred from the foregoing, the engine is a separate unit from the gear-set, the flywheel running exposed and enclosing the single plate clutch, to which the gear-set is coupled by a short shaft with a flexible disk joint at each end.

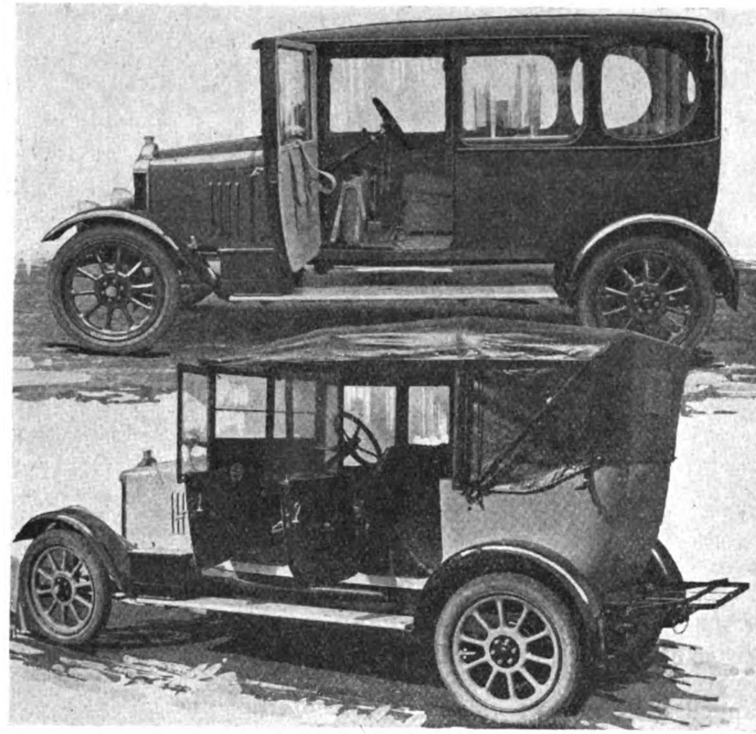
The single plate clutch is one designed and made by the Standard company, and has six direct-acting exterior springs separately adjustable. The driving plate floats axially upon the clutch shaft, having a hub boss internally splined to convey the drive to the shaft. Clutch withdrawal is effected by three exterior multiplying levers, each with adjustable studs taking effect upon thrust pins which abut the inner driving plate at their forward ends. This driving plate and the rear cover plate, which forms the second driving member, are faced with fabric rings, the driven plate being a steel unit.

The three-speed gear-set is slung by four bolts from two angle plates which form cross members of the frame. The gear shift lever shaft is carried in a bracket exten-



Left side Standard light car chassis.

sion of the lid of the box, the lever being on the right-hand side of the frame. All the gear shafts, with the exception of the reverse intermediate pinion, run on ball-bearings, though the pilot bearing is a phosphor bronze bush. There is nothing departing from usual practice in the general design of the gear-set, except, maybe, that its casing is a single unit with top and bottom cover plates and having its main shaft bearings housed in bolted-on cast-iron extensions. In assembling, the pinions are threaded over their shafts, the latter being entered through the bearing cap holes at either end. There is an external brake behind the gear-set, with deeply flanged shoes of aluminum with fabric liners. To the rearward extension of the drum is attached the front fabric joint of the open tubular propeller shaft, which has a similar joint at its rear end. The final drive is by overhead worm gearing with a straight worm (ratio 3.83 to 1), while the rear axle is of the semi-floating type with ball-bearings throughout.



(Above)—Standard chassis with sedan bodywork. (Below)—Standard four-passenger car with top raised and doors and side panels open.

The axle casing has an aluminum center with tapered steel extensions. To provide additional oil capacity the central casing has a forward extension or sump, in which a large filling orifice is arranged, in addition to one immediately over the worm. To prevent oil leakage from the central casing cast-iron flanged sleeves are provided at each side of the differential, backed by springs which tend always to keep the flange of each sleeve in good contact with internal webs of the casing provided to form a backing at each side for the ball thrust bearings. The rear wheel hubs are secured by nuts to the outer splined ends of the drive shafts, the hubs having flanges into which are screwed the studs holding the detachable wheels in place; over these studs and the hubs are threaded the brake drums, the studs thus taking both driving and braking torque. The rear wheel brakes are of the internal type, with a pair of cast-iron shoes, cam-operated, the open side of each drum being enclosed by a sheet steel cover plate to exclude dust and dirt.

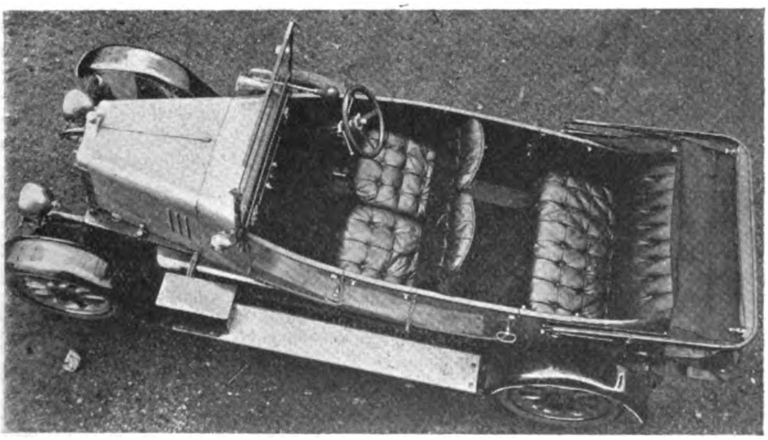
The front axle is of an H section steel stamping, through the single ends of which the pivot pins pass with plain bushings in the jawed swivel axles. A ball thrust bearing to carry the weight and having an adjustment is located below an aluminum top cap.

Semi-elliptic springs are used fore and aft, those at the back being underslung and supplemented by a pair of helical springs at the rear end of each, these coil springs displacing the usual shackle. Drive and torque are taken through the front halves of the rear spring.

The steering gear is of the worm and full worm wheel type and has nothing out of the ordinary in its design, unless it be that the steering column has the ignition and throttle rods running parallel alongside, with ball-ended levers extending below the wheel.

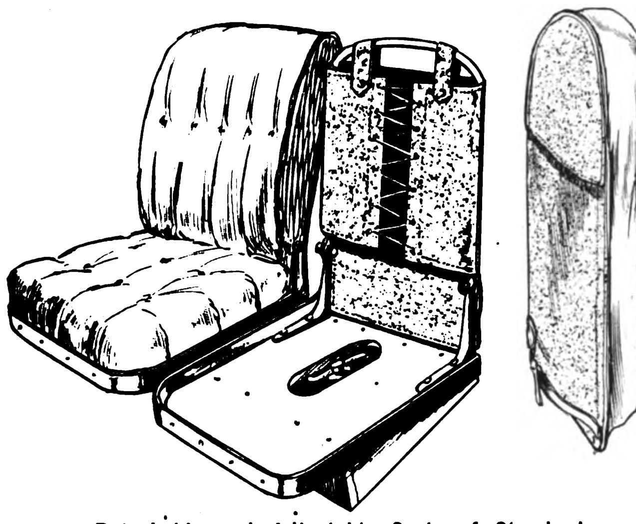
The frame consists of two flat-top, pressed-steel members narrowed at the front; cross members are numerous and varied, three of them serving also as stepboard supports, the remainder, beyond those already mentioned for the gear-set, including the one under the radiator, another with gusseted ends behind the axle and a cross tube, running between the rear dumb irons with extensions to carry the spring swivel plates.

In the four-passenger Standard bodywork are two special features, one of which is also found in modified form in the two-seater. In the first place, the separate front seats of the former are separately adjustable fore and aft and detachable. An accompanying sketch showing these seats is almost self-explanatory, but it may be said that there are no springs in the upholstery of the back rest, the flexibility in the hinged frame being considered sufficient to warrant the elimination of upholstery springs. The laced band allows for adjustment of the back rest to meet the ideas of individual owners, the loose upholstery having an inverted pocket which drops over the top of the frame and a strap below to prevent movement at that point. The seat cushion itself is square in plan, so that it can be turned about to bring any side to the front, and is upholstered with springs, as usual. It is of the same depth on all sides, the slope of the baseboard being sufficient to give the needed inclination from front to back.



Bird's-eye view of Standard four-passenger light car.

Two threaded sockets are fitted to the floorboards for each seat, and into each of these passes a T-headed adjusting and locking bolt through a slot in the baseboard of the seat. Thus a wide range of fore and aft adjustment is provided and a limited range without actually displacing the bolt.



Detachable and Adjustable Seats of Standard Light Car

The other special feature of the body is the provision of detachable and transparent side panels in place of the usual curtains. The panels have light, leather-covered metal frames, and those over the doors are arranged to open with the latter. The front one on the left, for instance, has a flap by which it is secured to the vertical frame of the windshield by two turn-buttons and a metal-edged slot which moves over a slide block on the door as the latter is opened; at the top rear corner is a spring catch which automatically secures the panel at this point when it is closed to the temporarily fixed panel alongside the front seats; in opening the door, this top corner lags somewhat and then clears itself from the catch.

The panel alongside the front seats has the rear door panel secured to it by an integral leather strip, which forms the hinge of the panel over the door. A similar slide block and snap catch are provided for this panel, and also for the corresponding one on the other side of the car. At each side of the rear passengers is a curtain of black material which folds back with the top. To prevent draughts from passing in between the side panels and the top, a separate "weather strip" is provided which can either be left in position when the top is folded or detached by releasing the snap buttons securing it in place. The two-seater body has a similar transparent panel over its door on the left, but the corresponding panel on the other side is a fixture for the time it is in use.

Provision is made for storing the side panels when out of use by forming a compartment behind the rear seat, which can be reached by lifting the hinged back upholstery, as shown in an accompanying illustration..

This special top, with its detachable side panels opening with the doors, is proving a great sales feature of Standard cars, for the arrangement not only overcomes the drawbacks of the usual side curtains when passengers are entering or leaving the car—there is no need to fasten or unfasten turn-buttons or snap catches—but the passengers are shielded from wind and weather almost as completely as in a sedan. There can be no question that a considerable proportion of sales are influenced to an appreciable extent by the fact that the top and the side panels provide, in the few minutes required to erect them, practically all the benefits of a sedan or coupé body.

The following are some particulars of the chassis and complete cars:

Weigh tof chassis, 1270 lb. Weight of two-seater, 1700 lb. Weight of four-seater, 1820 lb. Overall length, 142 in. Overall width, 60 in. Tire and wheel size, 710 x 90 m.m. (28 x 3½ in.). Ground clearance, 9½ in. Gear ratios. High, 3.83 to 1. Middle, 6.76 to 1. Low, 12.95 to 1. Reverse, 17.27 to 1. Maximum road speed, approximately, 50 m.p.h. Road speed on high at 1500 r.p.m., 32.6 m.p.h. Fuel consumption at 25 m.p.h., average speed on normal British roads, 29 miles per gallon

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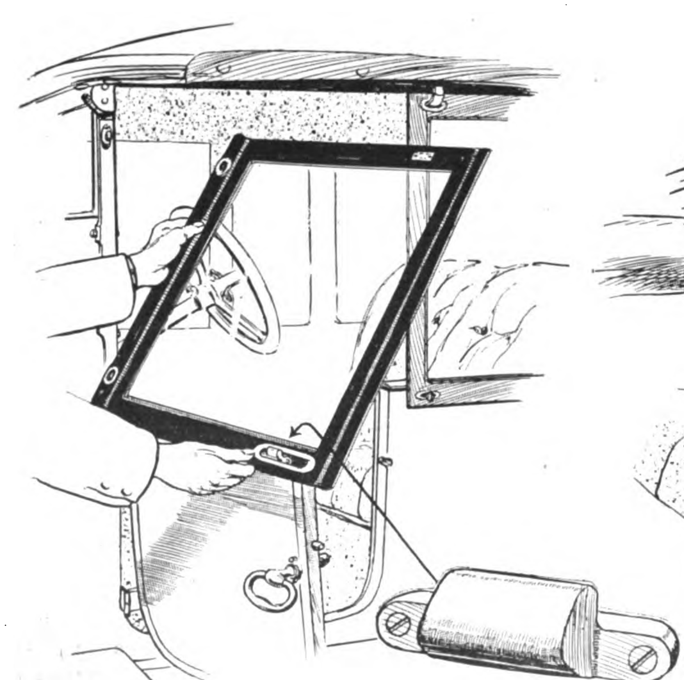
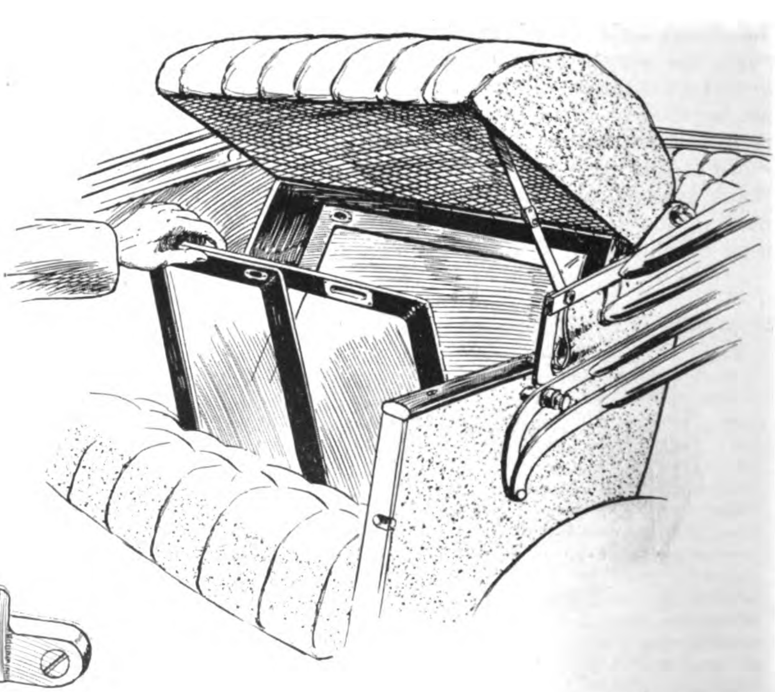
SEVENTEEN per cent of the March production of Harley-Davidson motorcycles was consumed by police and sheriffs departments in various states and cities.



Standard Detachable Side Panel, Which Opens with Door, the Free End Moving on a Slide Block Shown in Insert



Storage Room for Standard Side Panel Behind Hinged Upholstery of Rear Seat

The Tracking and Steering of Trailers Analyzed by a Graphic Method

Part I

An engineering investigation of factors bearing upon the steering and tracking of various trailer outfits. Free trailing more suitable for short hauling outfits; and steady steering for slow hauling.

By Marius C. Krarup

THE Trick to Trek in the Track of a Truck or a Tractor with a Trailer or a Train, such might have been the alluring caption of alliterative design placed over this page, but for fear of deluding prospective readers into the belief that the subject lends itself charmingly to light and literary discussion. There would be disappointment. The burden of the unassuming theme is purely utilitarian. Its interest depends a good deal on the fact that various systems for tracking are in use and that each of them is advocated with some show of favoritism based on conviction. A choice exists, and one may be called upon to express it in one's own behalf in the form of a purchase. The choice may even come up in a larger way calling for Congressional committee work and voting, for the subject has a military angle with a throw-back relating to motor trucks and exports.

On examination it may be found that each system has its special uses. One may be compatible with considerable speed, another preferable for slow vehicles. Then there is the weighing of an advantage which can be enjoyed only in exceptional circumstances, against a disadvantage which is normal.

The system permitting the closest tracking also permits the shortest turn, it is usually assumed, and ability to turn sharply when necessary is the main object in view. Hence find the closest tracking system, it may be said, and be done with it. But perhaps the assumption should not be accepted without reservation, since there is no tracking in a turn on the spot, for example. A "once over" of the subject in print and diagrams cannot help facilitating conclusions. Here and there among the trite and true something slips in which is good to think with and over when decisions must be made.

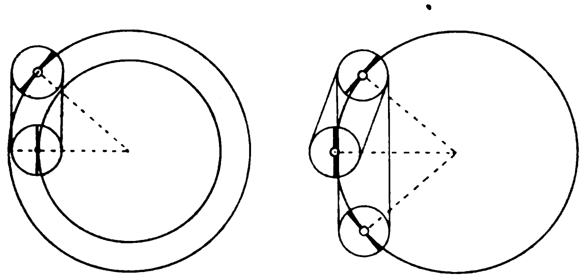
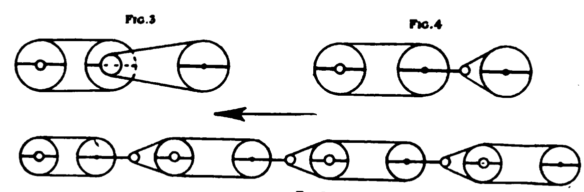


Fig.1 Fig.2

Figs. 1 and 2—Simplest forms of trailing, Fig. 1, and tracking, Fig. 2. In any ordinary automobile or truck the rear wheels, though they are the driving wheels, trail freely in the general direction of the front wheels. When the latter follow a circular path, they follow a smaller circular path. The vehicle, with all four wheels under steering control, tracks on one circular path, once it is there. It can make as short a turn as the ordinary vehicle with its wheels turned only half as much in relation to the vehicle body as the front wheels of the ordinary vehicle are turned. Or its wheelbase can be doubled and it will still run on the same circle with its steering angle the same as that of the free-trailing vehicle. The principle of steering leading wheels to one course and following wheels to another course to make both pairs describe the same course is the paradoxical principle employed for obtaining all tracking effects, with variation only in the mechanical means.



Figs. 3, 4 and 5—Fig. 3 shows the symbolic figure representing a tractor cab or short truck with a semi-trailer hitched to it by means of a fifth-wheel coupling approximately in line with the rear wheel axle of the tractor unit. Rear wheels trail freely after the front wheels and the semi-trailer wheels freely after the rear wheels. No tracking is attempted. Fig. 4 represents a truck or automobile pulling a two-wheel trailer. The trailer tracks more or less closely after the rear truck wheels, because the pintle hook swings to the left, in relation to the trailer, when the truck turns to the right. Fig. 5 represents a tractor with a train of three four-wheel trailers, which may have either fifth-wheel steering or automobile steering linkage. All rear wheels trail freely, but front wheels of next unit track after them approximately. The total effect is far from tracking, but trains of trailers are used only for very favorable conditions, excluding sharp curves and grades.

Perfect tracking is secured by rails and flanged wheels but by no other means in common use, although the flange can be on the rails or may be separate and adjustable. The railway method of mounting four or eight wheels as a unit restricts the freedom of each wheel somewhat but not vitally. For each wheel that skews the rail one way, on a curve, there is another that skews it oppositely. But on relatively soft highways skewing is in lesser degree permissible, and each wheel should be free to roll tangentially to its curve.

Tracking produced not by the road itself but by a mechanical connection whereby a leading wheel steers a following wheel is faulty at the outset, because steering of the rear wheel is begun too soon, starting at the same

moment as the steering of the wheel in front of it, instead of in the same place. Tracking in the space of the wheelbase is necessarily sacrificed for a brief interval after each steering gesture. The rear wheels of the ordinary automobile, motor truck and tractor begin at once to cut into the curve described by the front wheels when these are turned. The tracking of a trailer is therefore often understood as tracking with the rear wheels of the leading vehicle, but the rear wheels of the trailer will cut into the tracking curve unless they are also steered. If tracking with the steering wheels of the tractor is forced, the interval of non-tracking at the beginning of each turn is lengthened and aggravated, but it is conceivable that the front wheels of the trailer can be made to track with the front wheels of the tractor and the rear wheels with the rear wheels of the tractor, if the wheelbases of the two vehicles are alike, and this possibility is attractive enough to look into. The plan of over-steering the front trailer wheels in order to make the rear trailer wheels track better is in fact one of the two represented in practice. Something of this kind must be done to solve the rather intricate problem of making a steering gesture now and getting the desired result a second or two later. Putting the problem in these terms, one perceives readily that geometry alone offers no clean-cut solution. Both in thought and in practice compromise must have the last word.

The other plan represented in practice is to steer all the trailing wheels. With a vehicle having all four wheels steered, the rear wheels start a turn by crossing the front wheel tracks, joining them again where these begin to curve. A train of such vehicles, with all steering gears connected, would zigzag throughout at the beginning of every turn and until all train units were on the curve. The initial steering gesture would meet prohibitive resistance. But by connecting from the frame of one vehicle to the steering gear of the next, a workable combination is obtained.

Fundamental Facts in Trailing

Figs. 1, 2, 3, 4 and 5 serve to illustrate some of the fundamental facts pertaining to trailing and tracking.

Without simplifying the plan views of vehicles and of the tracks they make, one cannot make much headway in looking into the details of the subject, or inducing others to look into them. Each vehicle is therefore represented in the accompanying diagrams by a partly symbolic figure suggesting the nature of its steering elements rather than picturing them, and each pair of wheels is condensed into one wheel midway between those of reality and making a single track. The indispensable dimensions of the vehicles are represented, however. On this plan a much larger number of diagrams than there is space for in these pages may readily be made and tried out, representing different tracking methods, different turning radiuses and maneuvers for each combination of vehicles.

Fig. 6 illustrates the turning of a truck with a wheelbase of about 13 ft. at a right-angled corner, the front wheels turning with a radius of 27¼ ft. and the rear wheels with a radius of 24 ft. It is seen that the turn can be made without any portion of the vehicle getting farther from the curb on either street than 13 ft., leaving 17 ft. clear for other vehicles on streets 30 ft. wide. Little or nothing could be gained by turning at a sharper angle, involving an average reduction of speed. If a trailer of the same wheelbase were attached, the outfit could not make the same turn without encumbering both streets more or else being made to track with its rear wheels close to the rear wheel tracks of the truck, at least at the point where the corner *C* projects. The principle employed for delaying the turning of the trailer

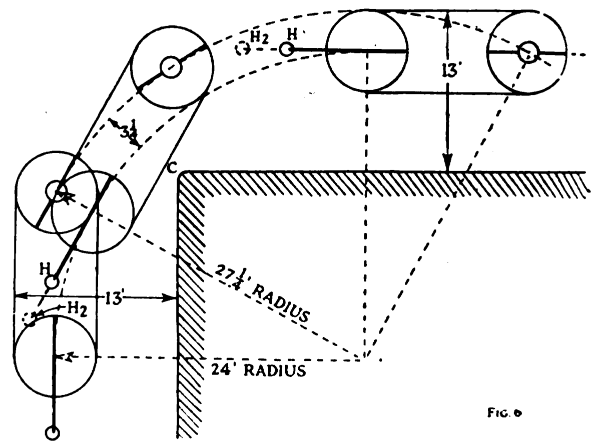


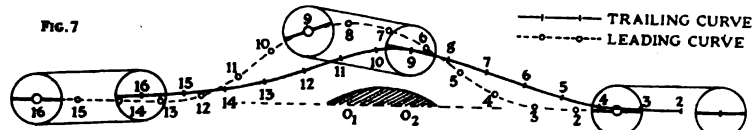
Fig. 6—A truck of 13-feet wheelbase turns a corner with one steering gesture and entirely on its own side of the road. The radius is 24 feet for rear wheels and 27¼ feet for front wheels. It is shown that a hook, H or H2, for attachment of a trailer, determines by its location how much trailer front wheels will be steered to the outside of the curve. And it is indicated that the overhang of the hook, in relation to the rear axle, must be very large to make trailer front wheels track after the truck's front wheels. To obtain this result, four-wheel steering of the trailer may be employed.

unit, and thereby obtaining the desired tracking, is indicated by the location of the hook *H* to which the drawbar of the trailer is attached. The greater its horizontal distance from the rear wheel axle, the farther the drawhead of the trailer is thrown to the left, turning the trailer front wheels in the same direction, when the tractor unit begins turning sharply to the right. If the tractor unit has a considerable overhang, as in many trucks, the hook may be at such a distance as that represented by *H2*, and the trailer front wheels are thrown to the left with notable velocity, involving a considerable overcoming of inertia and creation of momentum with reactions on the tractor unit taking effect in its materials and at the points of contact of its rear wheels with the ground, but these factors can be minimized by starting a turn gradually, which is, however, equivalent to making a less sharp turn and encumbering the road more. The principles are seen most clearly by contemplating a turn made as sharply as it is considered desirable to have turns made, in which respect the example of the truck alone is perhaps the ruling one or the ideal kept in mind.

Causes of Snaking

It is seen that turning the trailer front wheels in the opposite direction of the truck's turn immediately after a steering gesture results in snaking for a short period after each gesture, but the undesirable effects are minimized if the turn is evenly sustained and is made slowly. On the road, however, the driver frequently finds occasion, unless he anticipates every steering gesture required by the traffic or the nature of the road, to turn the front wheels of the tractor unit at an angle just as large as that which would produce a short right angle turn if sustained, and very shortly afterward he must make an opposite gesture whereby the snaking is prolonged; and his speed is likely to be considerably higher than at a deliberate turning of a corner.

Fig. 7 represents wheel tracks of a vehicle having free-trailing rear wheels and Fig. 8 those of approximate tracking in its simplest form. In both cases the path of the front wheels is chosen arbitrarily. Advantages and disadvantages for both methods appear plainly in these graphs, and it may be particularly noticed that the suc-



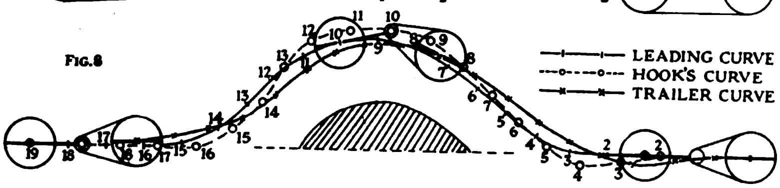


Fig. 7—Tracks of vehicle, with free-trailing rear wheels, making a turnout to avoid obstacle or hole in the road. Fig. 8—Tracks of leading and trailing wheels held in relation for approximate tracking and making a turnout, unnecessarily wide, around obstacle or hole in the road, and the path of the coupling hook which compels the tracking. The symbolic figure may represent a vehicle with four-wheel steering or the rear wheels of a truck drawing a two-wheel trailer. It is noticed that with tracking arrangement the trailing wheels travel more nearly the same distance as the leading wheels, but that the path of the hook is longer than either wheel path. The latter is true only for composite curves. By drawing the curves on a large scale and measuring distances between construction points on both leading and trailing curves, a comparison may be established giving interesting information on accelerations and retardations as well as the work of the drawbar spring, to equalize the varying inertia.

cession of at least four steering gestures, as required for a turnout on the straight road, causes more pronounced snaking than a single and sustained turning movement.

Certain conclusions are thus foreshadowed at the very first view of subject, to the effect that close tracking is suited mainly for slow hauling and that **the degree of forcible tracking employed for faster forms of transportation should be determined mainly by choosing the longest turning radius which is practically satisfactory and the smallest degree of forcing of the trailer wheels by which this radius can be realized.** A comforting mechanical possibility, yet to be exploited, lies in simple provisions for adjusting the tracking qualities to the nature of the service and the desired speed. A careful driver can naturally be trusted with a close-tracking outfit better than one who does not understand its effects after each steering gesture. An adjustment would consist in shifting the hook or pivotal connection of the two vehicles, on the principle that the farther it is from the rear axle of the tractor unit and the nearer to the front axle of the trailer the more the front trailer wheels will be forced outwardly from their natural trailing curve.

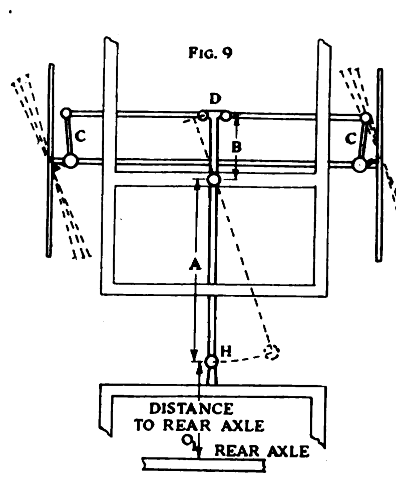
If the trailer is equipped with automobile steering linkage, double means are at hand for forcing the tracking. The overhang of the hook in relation to the truck axle may be reduced, and any desired effect in the steering of the trailer front wheels can nevertheless be obtained by varying the proportions in the elements of the linkage. In Fig. 9, the set of the arms *C, C,* in conjunction with the nature of the joints at *D* (or equivalent means used for moving the tie-rod laterally) takes care of the slightly different angles at which the two wheels must be turned on account of the axle being fixed—as in the use of the same system for automobiles and trucks—but the degree of turn effected by a given movement of *H*, the hook, is determined by the relative as well as the absolute dimensions of *A, B* and *C.* If the wheels are turned more than the drawbar, an effect of forcible steering, in addition to that caused by the overhang of the hook, is obtained, and a share of the stresses of various kinds due to such steering is shifted from the truck to the trailer, as compared with producing the same steering angle by means of axle steering (fifth-wheel) and a longer overhang of the hook. Evidently the equivalence of the systems does not extend beyond the limitation of the turning angle to which automobile steering linkage is subject, which is about 30 degrees, while axle steering has no inherent limitation of this sort, but aside from this reservation a formula for figuring the equivalent of one system in the other, for the same distance between the vehicle axles, can be reasoned out directly from a contemplation of the action and leverages involved, and it takes the following form:

$$O_2 = O_1 \times \frac{B}{C} \times \frac{O_1 + A \pm (B - C)}{O_1 \times \frac{B}{C} + A}$$

where O_1 is the distance of the coupling hook from the rear axle in the case of the automobile-steered trailer and O_2 the corresponding distance at which the hook must be placed in the case of the axle-steered trailer. The plus-minus refers to whether the draglink is behind or in front of the trailer front axle. If the distance between vehicle axles is to be longer or shorter, O_2 is simply to be lengthened or shortened in the same proportion. Applying the formula, one sees that if $B = C$, then $O_1 = O_2$. If O_1 is 4 ft., A 5 ft., B 1 ft. and C 9 in., then O_2 should be 4 = 24/31 ft. to make the steering effects the same in both cases.

(To be continued.)

IN calculating the cost of tractor work, the interest on investment, depreciation and storage charges per year should be divided by 45 (that being the average number of days' work of farm tractors per year) and to this added the cost of fuel, oil and wages per day. The cost of tractor plowing figured out to about \$2.50 per acre in 1920 and to from \$3 to \$3.50 for breaking. The U. S. Bureau of Agriculture recommends that interest charges be figured on one-half of the cost price of the tractor only, as the book value of the tractor decreases from year to year.



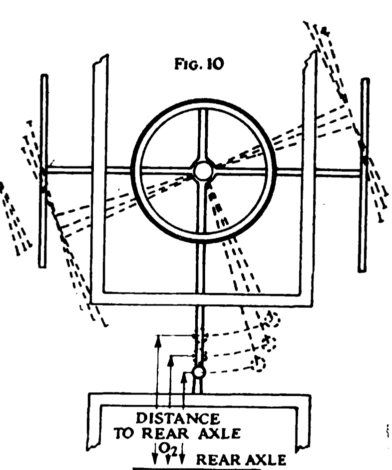


Fig. 9—Diagram of automobile steering linkage (same as Ackerman or wheel steering) for trailer. Fig. 10—Diagram of fifth-wheel or axle steering for trailer. In conjunction the diagrams are meant to show that diagrams suggesting axle steering can represent automobile steering as well, as with the same distance between axles identical steering effects can be obtained from the two systems. With a given relative movement of the hook H, in Fig. 9, different turns of the wheels can be obtained according to the leverages employed in the linkage. The same variations can be produced with axle steering, as indicated in Fig. 10, by increasing the overhang of the hook in relation to the rear axle of the leading vehicle, and thereby the movement of the hook. The formula for equivalent designs is given in the text.

Calibrating Carbureter Jets in Quantity by Actual Flow Measurement

Apparatus used by Zenith Carbureter Co. consists of a tank with constant head, device for holding jet, electrically controlled timing elements, and graduates for measuring volume of flow in unit time. Each operator can test 160 jets per hour by the use of one calibrating machine.

By J. Edward Schipper

ONE of the most important operations in the Zenith factory is that involved in testing fuel jets. The orifices in the jets are so small that ordinary methods of inspection are not applicable. The function of the orifice or hole is to meter the fuel and it is believed that the best way to find out whether or not these jets will measure out the desired amount when assembled in a carbureter, is to determine by actual test how much liquid under given pressure will be measured out in a given time. The accompanying view of the jet testing machine (Fig. 1) shows the apparatus used for this purpose. All Zenith jets are tested by this method. The machines consist of a large tank in which a float controls the inlet of the water (with which the jets are tested) in such a manner that the level is maintained at a given point A, Fig. 1. From this tank, four pipes extend downward and terminate in special valves B, under which the jets being tested are clamped. When the valves are opened, water flows through the jets into special glass graduates C which can be readily emptied by turning valves B at their lower ends.

The clamping of the jet is done by a lever, and a spring at the rear of the machine presses each lever into the valve, thus clamping the jet. Pedals D are provided for releasing and opening these clamps. In order to measure with accuracy the time during which the flow is taken into the graduate, a small sheet brass box, E, Fig. 2, is used. This can be swung under the jet and diverts the flow into a waste pan F. When this box is swung under the jet the water flows to waste, then the box is withdrawn for one

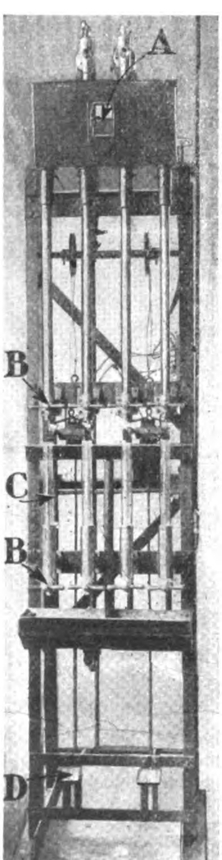


Fig. 1

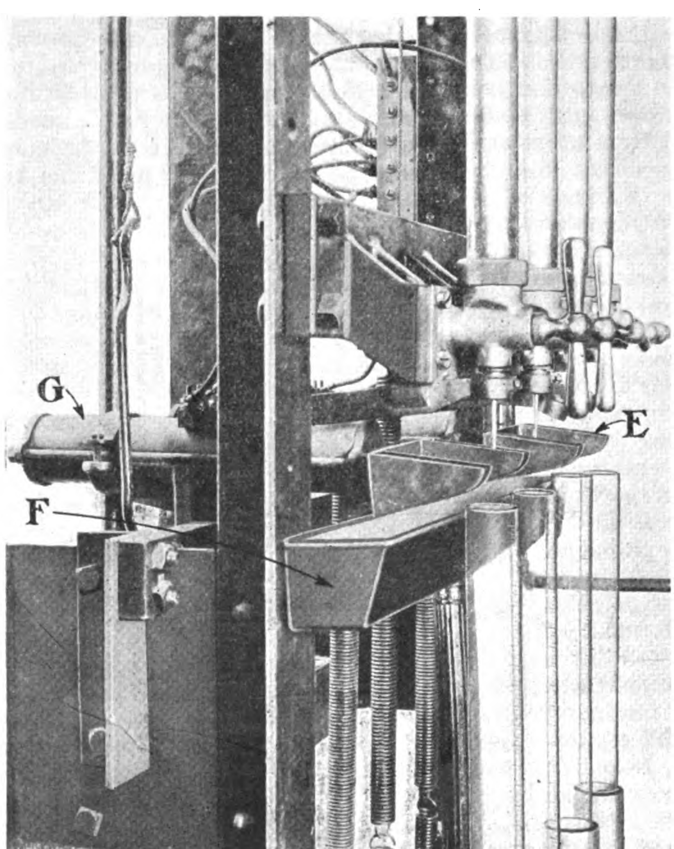


Fig. 2

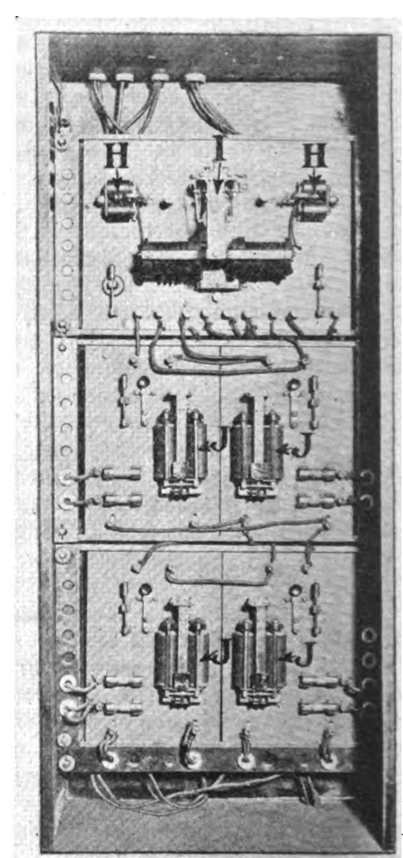


Fig. 3

Three views of the apparatus used in production tests of fuel jets used in Zenith carbureters

minute during which the water flows into the graduate. The movement of the box is controlled electrically by the use of armored solenoids G, two boxes being connected together and operated by the same solenoids, one solenoid for pushing the box under the jet and the other for withdrawing it.

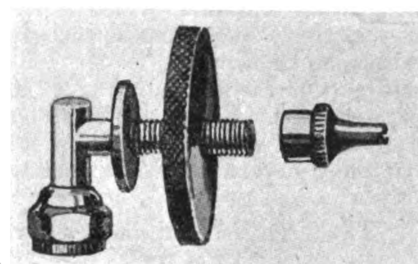
To control the time, the electrical apparatus shown in Fig. 3 is used. A master clock mounted in another part of the building, and having a standard pendulum, is used. The pendulum makes one oscillation per second, so that two contacts are used, one on each side of the pendulum; these contacts are connected to the telegraphic relays H which control the two solenoids of the distributor I. The armatures of the solenoids reproduce accurately the movements of the master pendulum, but with enough force to actuate, through suitable gearing, a distributor I, which sends impulses to one or the other of the four large relays J. These relays, in turn, actuate the solenoids of each testing machine.

On each machine the flow is sent to the graduates for one minute and diverted to the waste pan for one-half minute, thus making a cycle of ninety seconds. One-half of the machine is made to lag behind the other half by 45 seconds, for convenience in operation. One operator can, with each machine, test four jets in one and one-half minutes or 160 per hour.

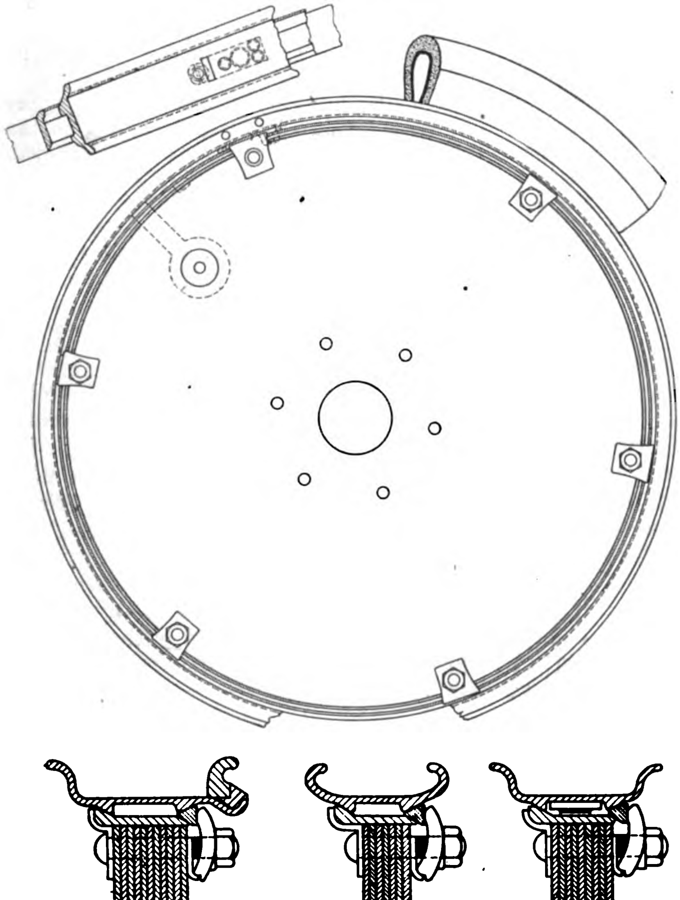
Laminated Wood Disk Wheels

WHEELS with laminated wood disks are manufactured by the Dayton Automotive Wheel Co. The disks are built up of thin, rotary-cut plies of wood glued together under pressure with waterproof glue. The grain of each layer runs in a different direction from that of the layer next to it. This process of lamination is said to make the complete disk very strong, non-warpable and resilient. The weight of these wheels is substantially the same as that of a spoked wood wheel, but the resistance to transverse shocks is said to be much greater.

In order to render inflation of the pneumatic tire convenient, a patented angle connection is furnished, which goes onto the tire valve stem and permits the tire to be inflated from the outside face of the wheel. The design of the wheel is such that the disk can readily be fitted to any standard hub and rim. The accompanying illustration shows the disk used in connection with a Firestone demountable rim. At the center the disk is clamped between the two hub flanges. The wheel is designed for use with demountable rims only and is not a demountable wheel. Among the advantages over spoked wheels claimed for this wheel is that road shocks are distributed over the whole wheel, instead of being localized at the felloe.



Angle valve connection for Dayton wheel



The Dayton wood disk wheel

Changes in the Bates Steel Mule

THE Model F Bates Steel Mule, made by the Bates Machine & Tractor Co., has succeeded the Model D. It is equipped with a Midwest engine. The fuel tank is hinged at the dash board, so that it can be raised when working on the engine valves. Different turning brakes are used than on the Model D. The braking system is now made so the operator can hold either crawler still and pivot around it with the other crawler. Other changes include the adoption of a water type air cleaner and a different make of carbureter. The rating is changed to 18 hp. on the draw bar and 25 hp. on the belt, and the weight is changed to 4850 pounds. A platform has been added and a few other modifications made to make the driver more comfortable.

The Model G is a heavy design built for industrial work exclusively. A power driven winch can be attached to the front end for logging and other work. The weight of the tractor is approximately 6500 lbs. and it has a rating of 25 hp. on the draw bar and 35 hp. on the belt.

As on the Model F, all working parts are encased against dust and run in an oil bath. Wheels, transmission and crawlers have roller bearings exclusively. The clutch is a hand operated, dry disk type. The driver's seat is made to swivel so that it can be pushed out of the way when the driver is standing on the platform. The pedals for holding either crawler still are located on the platform at the rear of the tractor. Hauling speeds are 2½ and 3½ m.p.h. and the reverse speed is approximately 2 m.p.h.

A BRITISH standard specification has been issued by the British Engineering Standards Association for benzol for motor fuel, commonly known as "benzole." The specification includes a definition of the term "benzole," and notes on its physical and chemical properties.

Use of Pneumatics Limited on Trucks of More Than 3½-Ton Capacity

This is general opinion among prominent truck and tire builders expressed in reply to recent questionnaire submitted by AUTOMOTIVE INDUSTRIES. There is wide difference of opinion upon almost every phase of the pneumatic tire question, especially as regards the attitude of the public.

THERE is considerable difference of opinion among authorities as regards the possibilities for usefulness of pneumatic tire equipment for trucks. Probably no question in the automotive field has aroused more discussion during recent years. A survey which has just been completed by AUTOMOTIVE INDUSTRIES brings to light some interesting opinions along this line, although much of the data collected serves chiefly to emphasize the great variety of opinion extant upon the subject.

Five questions were submitted to the leading truck and tire manufacturers of the country, and the replies brought not only considerable specific information but also some interesting discussion of the general topic. The questions were as follows:

1. What percentage of your 1920 output was fitted with pneumatic tires and what number of trucks would this represent?
2. On what capacity trucks were the pneumatics fitted?
3. What in your opinion is the largest capacity truck on which the pneumatic can be satisfactorily used?
4. What is the present attitude of the buying public with regard to pneumatics for trucks of capacity of 3 tons and up?
5. Is there likely to be gradually less use made of larger capacity vehicles and greater use of an increased number of medium capacity trucks?

There seems to be rather general agreement concerning the limitations of pneumatic equipment for trucks of more than 3½ tons. Only 11 per cent of those replying considered such equipment to be practicable on 5-ton jobs, while a number of these considered it advisable only under certain conditions. The answers as regards the maximum capacity on which pneumatic equipment is practicable showed the following results, the percentage figures indicating the proportion of those replying who considered the given capacity as the largest practicable for pneumatic equipment:

2½ tons	30%
3 tons	21%
3½ tons	19%
2 tons	17%
5 tons	11%
1½ tons	2%

These figures indicate that a majority of truck manufacturers believe 2½ to 3 tons to be the largest capacity on which it is feasible to use pneumatic equipment, while a considerable percentage place the limit at 3½ tons. The replies received, however, indicate that to a certain extent the opinion of the manufacturer is influenced by the limitations of his personal experience and by the type of truck which constitutes the bulk of his own production. This factor of error almost inevitably enters any such survey to a greater or less extent, but should be considered in analysing the results.

One company which has had a wide experience states: "We still believe that 3½ tons is probably the maximum size on which pneumatics can be particularly successful at present. As a matter of fact, we would not advocate the use of pneumatics on 3½-ton jobs unless the nature of the service was carefully analyzed and sufficient assurance obtainable that tires would not be badly overloaded and that operating conditions were such as to enable this equipment to justify its higher cost."

This comment is especially interesting since it comes from a company which has been extremely active in pneumatic tire propaganda.

Another interesting opinion states, in answer to this question: "As a general proposition, 2 tons, although for certain special applications pneumatics are satisfactory up to 3 tons."

There were numerous objections advanced to the use of pneumatics on the larger sized trucks, the most important of which are included in the following quotation from one letter:

1. "Excessive overloading. The pneumatic tire will not stand up under an excessive overload."
2. "Under inflation. A great many users fail to appreciate the necessity of high inflation pressures so that the tires fail in the same manner as when overloaded."
3. "Small cuts in tires, caused from sharp stones, etc., are neglected until they cause failure."
4. "Very few repair shops have proper equipment for repairing pneumatics, so that in many cases the user cannot get proper repairs even though he may be perfectly conscientious in the matter."

The general conclusion that might be drawn from the various statements and the statistics presented is that pneumatic equipment is generally accepted as desirable on trucks of less than 2-ton capacity; that a good proportion of manufacturers consider it feasible in most cases on 3 to 3½-ton jobs; but that a comparatively small number are sold on pneumatic equipment for trucks of greater capacity.

It is not possible to estimate accurately the percentage of trucks which were pneumatically equipped, since a majority of replies merely stated the percentage of their output which was pneumatically equipped without giving the output. A study of the percentage figures submitted, however, shows that out of 71 replies

10	equipped pneumatically under	9%			of total
10	equipped pneumatically between	10%	and	24%	of total
16	equipped pneumatically between	25%	and	49%	of total
11	equipped pneumatically between	50%	and	74%	of total
6	equipped pneumatically between	75%	and	89%	of total
18	equipped pneumatically between	90%	and	100%	of total

One of the tire companies states:

"Our deliveries of tires to truck manufacturers during the past year have run 75 per cent pneumatics and 25

per cent solids. However, the bulk of these pneumatic tire deliveries were of the so-called passenger tire sizes, that is, 35 x 5 and under.

"Our own estimates have been that about 50 per cent, at least, of all the trucks built were equipped with pneumatics."

Estimating as closely as possible on the basis of the data received, it would appear that about 60 per cent of the trucks of 2½ tons or less capacity were pneumatically equipped during 1920. This is, of course, only a rough estimate and would indicate that the figure of 50 per cent for all trucks is not far off, although it is probably high.

Attitude of the Buying Public

The replies as regards the attitude of the buying public indicated that very little analysis had been made of the problem from this angle. All degrees of enthusiasm for pneumatics were attributed to the public by different manufacturers. The three opinions in answer to this question cited here will visualize the varying ideas on this subject.

One truck maker who produces 1-ton, 2½-ton and 3-ton trucks says:

"Present attitude of the buying public toward pneumatic tires is that they are a good thing, and that more of them will be used as time passes. Undoubtedly pneumatic tires will be used on a larger percentage of motor trucks up to 3½-ton size in 1921 than ever before, and 1922 will certainly see a great increase in the use of pneumatic tires over 1921."

A somewhat modified view is taken by a manufacturer on a 1½-ton speed truck and a 3½ model. He states:

"From our experience we judge that the truck-buying public is in a fairly receptive mood toward pneumatic tires on heavy duty trucks, but until the truck manufacturer himself removes the question in the minds of the buyers as to the ability of the tires to stand up and prove their economy, we doubt if a very large active demand will be created."

While a third truck producer, who also makes three models, 1-ton, 1½-ton and 3½-ton respectively, takes an almost directly opposite view. He says:

"Personally I feel that the pneumatic tire proposition has been boosted very highly and has been overrated. . . . As far as I can see, I believe that pneumatic tires for heavy trucks is not looked upon as favorably to-day as it was a year or a year and a half ago."

This latter manufacturer is supported by another who states that he "must advise that we find a very decided reaction against the use of pneumatics of size larger than 38 x 7," which corresponds to the rear of a 1½-ton truck. And still another maker takes a still different ground with this statement: "We believe that they feel very favorable toward pneumatic fronts, however, they are very much against pneumatic tires for the rear."

With these typical and varying opinions from which to choose, it is impossible to state any decided trend as indicated by the replies on this point. The only trend which might be implied is that the public is equally divided in its opinion, and that there is no majority opinion among truck users on the subject at the present time.

More Light Trucks

The probability of an increase in number of light trucks to replace one heavy truck is not agreed upon very generally, although a majority of those replying to the questionnaire think the trend will be in that direction. Too much importance cannot be attached to this fact, however, since a majority of truck manufacturers produce medium and lightweight trucks.

The chief factors in bringing about the decrease in heavy trucks, according to the general opinion, are likely to be restrictive State legislation, excessive taxation, and inability or refusal to build roads adequate to stand up under heavy-truck traffic.

It is evident, however, that these factors can be controlled to a large extent. They are not inevitable developments, and will be influenced by the ability of the heavy truck to prove itself an essential factor of transportation. One producer says, for instance:

"The railroads are freely admitting that the motor truck is a logical solution of the short-haul problem and with this as only one incident, we believe, shipping by truck is on the increase rather than on the decline. This is naturally going to increase the wear on the highways and it seems to us that the solution is to build the highways to last."

Another statement is:

"Regarding the possibility of the future limitations in the use of heavy capacity vehicles with solid tires and the substitution of a larger number of pneumatic tired vehicles, I am of the opinion that such a result is hardly likely unless it is forced by unwise and ill-considered legislation. In that event, I believe the result will not be the deplacement of the larger vehicles by a proportionate number of smaller vehicles but will result in the curtailment of the old transportation by motor vehicles until such restrictions have been removed."

One heavy truck producer believes that "the reason so few words are spoken in favor of the heavy truck is because so few manufacturers are building heavy trucks." He goes on to say:

"Were we to keep silent and permit legislators to condemn the American public to the continuance of the short-sighted and extravagant policy of building flimsy roads and restricting freight transport to multitudes of light trucks, our business would not necessarily suffer, inasmuch as we build trucks down to 1½ tons."

An opposite point of view is taken by others, however, one of whom states on this point that "5-ton trucks and over will in several years be eliminated from our highways and the smaller trucks, preferably the 2½-ton size will be the common carrier." And this view is endorsed by another statement, as follows: "I am strongly of the opinion that eventually the greater majority of motor trucks will be pneumatically equipped and that the maximum capacities will be kept down to a reasonable point somewhere between three and five tons."

These replies have been quoted as being typical of the opinion expressed on both sides of the problem. None of the replies took up this phase of the question from the cost of transportation standpoint, considering the factors of speed and light weight, as opposed to large carrying capacity. The possibilities differ greatly, of course, in each particular case, yet the general transportation needs of users would seem to be at least an important factor in determining whether or not heavy trucks will increase or decrease in number. This is specially true when it is considered that truck users are also citizens and are likely to exert some influence in connection with legislation and highway building.

THE British Research Association for Liquid Fuels for Oil Engines Industry has been approved by the Department of Scientific and Industrial Research as complying with the conditions laid down in the Government scheme for the encouragement of industrial research. As the association is to be registered as a non-profit-sharing company the promoters have applied to the Board of Trade for the issue of a license under Section 20 of the Companies' (Consolidation) Act of 1908.

About Curled Hair for Car Upholstery

The bases, colors, uses and manufacturing processes of curled hair are briefly described in this article. The advantages of curled hair as an upholstery filler are pointed out, and the tools used are discussed.

By C. A. Podesta*

THE basis of all curled hair made is horse hair, cattle hair and hog hair. Horse hair comes from horse tails and manes, and there is a wide difference in the value and usefulness of tail hair and mane hair. Horse tail hair is stiff and straight, and its longer staple is used for hair cloth which goes into the lapels of coats for stiffening purposes, in which case it is woven with cotton thread; in some instances it furnishes its own woof and warp, in the making of a pure hair cloth with which to cover upholstery. It is also hackled or drawn into various lengths of brush hair, and is particularly suitable for this use because it lies straight and withstands the elements as well as oils and alkali soaps.

Probably the most important use of horse tail hair is as a basis for curled hair. Its stiffness when in spiral form gives it a great range of resiliency, and its ability to withstand constant depression and subsequent release, as well as its immunity to the deteriorating influences of the elements, makes it particularly good as a long lived upholstery filler.

Horse mane hair is less valuable than horse tail hair, because it is much softer, and its range of resiliency is much less. On the other hand, its affinity for other types of hair when mixed therewith makes it a good binder when used with cheaper, shorter hairs in various curled hair mixtures, and although of less value and less downright worth, it performs its function as above described well. Horse mane hair, because of its soft contact when used in curled hair, has recommended itself to a great many people as an upholstery filler, and has been in particular demand by our Government in the making of Navy mattresses.

Cattle tail hair, or the hair coming from the tassel at the end of the cattle tail, furnishes a most desirable curled hair material, in that it is longer lived than horse hair, possesses a wider range of resiliency, develops less breakage and is neither as hard as horse tail hair nor as soft as mane hair but rather a happy mean between the two.

Hog hair is obtained at the time of the slaughter of the animals and is thoroughly cured and sterilized before being used in the manufacture of curled hair. Hog hair is less valuable than horse and cattle hair only because of its shorter staple, and is used in various formulæ to assist in the reduction of price. If one were to take a piece of horse hair of the exact size and length of the hog hair, he would find them both of equal value, and the horse and cattle hair are therefore only more valuable than hog hair because of their greater length and the possibility of placing more convolutions in each long hair than one can in a short hair, thus increasing the range of resiliency in a mass of curled hair.

The three principal colors in which curled hair is manufactured and sold are black, grey and white. The hair of all animals necessarily grows promiscuously as regards color, and it becomes necessary to separate the white and black, leaving the balance of the colors to be known as "blend," "gray" or "colors," each of these names being used by people in various parts of the world to designate the mixed remainder. The mixed remainder necessarily represents the largest proportion of curled hair materials, and it therefore becomes necessary at times to dye some of these materials in order to have a sufficient volume of black, and sometimes a mixture of both is used.

White, on the other hand, is always a natural white, and is sometimes bleached for some fastidious user who fancies that white is the best grade of hair and is willing to pay a larger price for white according to its degree of apparent purity. White hair is invariably cattle tail hair, although some unconscionable sellers have told the trade that it is horse hair. By actual test we have found that only 3 per cent of the world's output of horse hair is natural white, and the labor involved in separating this small percentage from a large mass of materials would not be warranted.

The manufacture of curled hair consists in assembling various raw materials into a mass called a formula, thoroughly mixing them and spinning the mixture by hand and machinery into a rope, after which it is doubly twisted like a tourniquet and bound up in this form; it is next placed in a vat with chemicals designed to thoroughly sterilize it, and boiled for several hours with a view to setting the twist that has been placed in it, after which it is bundled and put in a room to season. The degree of rebound in curled hair is controlled largely by the length of time that it remains in rope form in the seasoning room.

Curled hair forms an ideal upholstery filler, and its use adds prestige to any car, for the reason that there is no substitute that will give the effect and result that curled hair gives between springs and tapestry or leather. Trimmers choose to use the newer type of woven curled hair, which consists of loose curled hair fastened to burlap cut to dimensions. Most of the cushion and back plaits are filled with woven curled hair, and it is possible to fill them with loose curled hair if desired, irrespective of whether the body is trimmed in leather or cloth, and it is conceded that this class of trimming is long lived and gives the desired comfort of riding.

Many types of stuffing tools are being used both for woven and loose curled hair, the most common type for woven hair being a flat metal stuffer in two parts which clamps the hair between them. When plaits are filled with loose hair this same implement is used, except that both parts are rounded a little. When cloth trimming is used, a high grade hair must be used, and because of the filling quality of this grade of curled hair, only a small quantity is necessary to give the desired result.

Curled hair possesses the three fundamental virtues necessary to make a perfect upholstery filler, namely, soft contact, resilience and self ventilation, and for this reason vegetable and metal substances have never successfully displaced it.

*Manager curled hair department, Wilson & Co.

Many Benefits in Scientific Analysis of Truck Markets

One naturally would expect more efficient salesmanship and greater profits in sales in a well-studied territory, but the Packard plan which is here described has developed by-products that are especially interesting.

By N. J. Ocksreider*

UNDER the new conditions of business throughout this country, which call upon the manufacturer for production and selling on a far closer margin than has been required in the "sellers' market" of the last few years, there is nothing of greater importance than the elimination of guess work, both in selling and in production. This is nowhere more vital than with the motor truck. In spite of its many proven advantages and the great economies that it has brought about, it is not yet through the struggle necessary to establish itself firmly in the minds of many who should be buyers.

The truck market in the last few years has suffered intensely from the "by-guess and by-golly" system, both in selling and production. Some parts of America have been flooded—others have been starved. There has been very considerable waste all along the line. This has resulted in abnormal costs and frequent dissatisfaction and has had a powerful influence in producing the unfavorable conditions of the last few months. The elimination of these evils must be one of the first steps in putting the motor industry on a firm foundation for expansion under the conditions that we have just begun to meet.

Some time ago the Packard Motor Car Co. decided that it would pay to get the real facts about the market. A system has been worked out, after various experiments in restricted territories, and is now being generally supplied. It gives us at the beginning of each year full information on sales possibilities in each district. It is also kept up to date throughout the year and gives accurate control of the selling campaign from day to day.

Record of Trucks

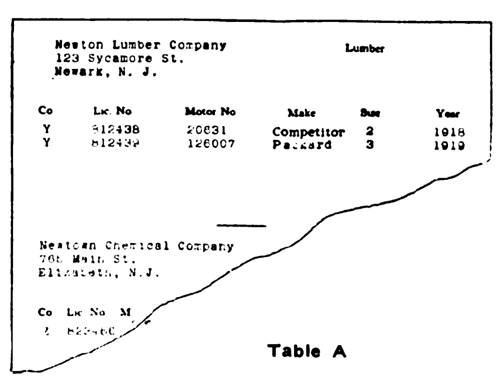
Roughly speaking, we get from this system the number of trucks operating in each territory, the proportion of our own and of each competitor's trucks in the territory as a whole and in each line of business, the probable need of replacements for each truck owner, and the probable expansion in business. As a result of these things it is possible to make a very close estimate of the business that can be done in that territory in the ensuing twelve months.

The light that this system has thrown upon market conditions has been a surprise even to ourselves in many cases. It has shown over and over again how little we actually knew about any particular market and about the performance of the salesmen in it. It has revealed sales possibilities that were never suspected.

As an example, there may be cited a case in one of the big Eastern cities where three men were covering adjoining districts. On previous performance, two of these men could be considered stars—the third man hardly even a good salesman. But the third man was outselling both of the others and it began to look as if they had slumped and he had developed sudden brilliance. When the market was analyzed, however, it was found how that, although the three territories were about the same in size and population, there were differences in commercial interests which made the third man's territory about a 400 per cent better market than either of the other two. It also showed that the man who had been making the high records was actually placing only about 4 per cent of the trucks that went into his territory, while the two men who seemed to have been "falling down" were, in fact, selling 20 per cent of all trucks placed in their territory. As a result of the analysis, one man took over the territory where two had been and two took the territory which the one had handled. Within three months sales in the districts involved had increased more than 50 per cent.

The advantages obtained from this system have already been great. It is being expanded rapidly, and successful experiments have been made and showed that an even more direct and detailed survey of territory will be valuable.

Our system in the majority of districts is based on the registration figures for trucks in that territory. In starting an analysis a card (Table "A") is made for each truck user in the territory, giving his address and



Newton Lumber Company
123 Sycamore St.
Newark, N. J.

Lumber

Co	Lic. No	Motor No	Make	Size	Year
Y	812438	20831	Competitor	2	1918
Y	812439	126007	Packard	3	1919

Table A

his trade, also his classification, the make and size of all trucks that he uses and the date his vehicles were installed. The next step is the construction of a "TRUCK REGISTRATION MASTER TABLE" (Table "B"), showing in every trade the Packard standing in comparison with each of our competitors and with the total of the trade in that city.

In the larger territories we have found it worth while to list no competitors who had less than 50 trucks running, but in smaller territories it is often desirable to establish a minimum showing 25 or even 10 trucks. In

*Chief transportation engineer, Packard Motor Car Co.

TRUCK REGISTRATION MASTER TABLE

MAKE	Farms No	Farms %	Stores No	Stores %	Lumber No.	Lumber %	General Manufacturers No.	General Manufacturers %	Building Materials No.	Building Materials %	Co[...] No	Co[...] %	Chemicals No.	Chemicals %	Metals No.	Metals %	Totals—Each Make No.	Totals—Each Make %
Packard	2	6.4	12	1.3	7	5.6	17	10.5	13	3.9	8	9.2	12	5.5	9	5.1	704	5.3
1st Competitor	1	3.2					3	1.9							2	1.1	114	.9
2nd Competitor	6	193	69	7.7	4	3.2	1	.6	16	4.9	12	5.1	30	139	15	8.5	1099	8.2
3rd Competitor												[illegible]	1	.5	1	.6	101	.7
4th Competitor	2	6.4	1	.1			4	2.5				0.7	2	.9	1	.6	80	.6
20th Competitor	2	6.4	46	5.1	1	.8	18	11.1	17	5.2	14	3.5	14	6.5	15	8.5	879	6.6
21st Competitor					1	.8	2	1.2	5	1.5		[illegible]	2	.9	1	.6	143	1.1
TOTALS Vehicles in Each Trade	31		900		126		162		328		206		215		175		13346	

Table B

TABLE OF COMPETITIVE INSTALLATION BY TRADES

BUSINESS	Packard Owners	Packard Percent	1st Competitor Owners	1st Competitor Percent	2nd Competitor Owners	2nd Competitor Percent	3rd Competitor Owners	3rd Competitor Percent	4th Competitor Owners	4th Competitor Percent	TOTAL OWNERS
Farms	2	10.5	6	31.6	1	5.3	4	21.0	1	5.3	19
Stores	3	7.9	4	10.6	4	10.6	4	10.6	13	34.2	38
Lumber	5	8 6	4	6.9	1	1.7	7	12.1	1	1.7	58
Gen'l Mfrs.	19	55.9	1	1.4	6	8.5	6	8.5	2	2.8	170
Bldg. M't'ls	9	5.9	11	7.2	13	8.5	15	7.9	6	3.9	153
Chemicals	8	7.6	24	22.8	12	11.4	14	13.3	4	3.8	107
Metals	5	5.2	12	12.5	6	6.3	11	11.5	5	5.2	96
TOTALS	368		624		364		306		246		4611

Table C

working from this table, inspection of the totals at the right shows immediately which competitors are the most active, and by running across the sheet it can be determined in which trades we are having the most success. The totals at the bottom of the table show those businesses which offer the best opportunities for the truck salesmen.

In making up this Master Table we have found it desirable to allow a total of 34 classifications, and of these groups several minor divisions are listed. The general classifications used are as follows:

- **Automotive**—Manufacturers and dealers.
- **Artisans.**
- **Bakers**—Manufacturers and dealers.
- **Brewers and Bottlers**—Manufacturers and dealers.
- **Building Material.**—Producers and dealers.
- **Chemicals**—Manufacturers and dealers.
- **Confectionery**—Manufacturers and dealers.
- **Contractors.**
- **Department and Small Retail Stores** (Except exclusive food and furniture stores).
- **Farms** (Excluding dairies).
- **Federal, State, County, City and Public Service Institutions.**
- **Feed and Cereal Products**—Producers or dealers.
- **Food, Prepared**—Manufacturers and producers.
- **Fuel**—Producers and dealers.
- **Furniture**—Manufacturers and exclusive dealers.
- **Grocers**—Producers and dealers (except farms).
- **Hotels and Amusements.**
- **Ice.**
- **Laundry and Dyers.**
- **Leather**—Manufacturers and exclusive dealers.
- **Lumber**—Producers, manufacturers and dealers.
- **Manufacturers, Machinery**—Manufacturers and dealers.
- **Manufacturers, Miscellaneous**—Manufacturers and dealers.
- **Marine.**
- **Meats**—Producers and exclusive dealers (except farms).
- **Metals.**
- **Milk and Milk Products**—Producers and dealers (including farm).
- **Paper and Printing**—Producers and dealers.
- **Passenger Transportation.**
- **Petroleum Producers, Refiners and distributers.**
- **Rubber**—Producers and dealers.
- **Textiles and Furs**—Producers and wholesale dealers.
- **Trucking.**
- **Unknown.**

For convenience in checking through the selling campaign there is also made up a table of competitive installation by trades (Table "C"). In compiling this the most active competitors are selected from the Master Table and it is then determined how many owners of vehicles each of these competitors has in each line of trade. This table shows those trades in which the most serious competition may be expected, because competitors have established a standing with a comparatively large number of the firms engaged in such trades.

As will be shown later, one of the most important functions of such an analysis is in making estimates for the next year's business, and for this purpose it is desirable to make a table showing the size of the fleets used in various lines of business (Table "D"). Finally, a statement showing the different size of trucks used in different territories is prepared (Table "E").

As an example of the concluding step in the operation, the following summary is taken from a survey actually made in one of the medium-sized cities:

Business	1 Truck	2 Trucks	3 Trucks	4 Trucks	5 or More Trucks	Total Owners
Farms	12	6	C	0	1	19
Stores	9	7	2	4	16	38
Lumber	34	6	10	1	7	58
Gen'l Mfrs.	40	13	8	2	7	70
Bldg. M't'ls.	89	28	14	8	14	153
Chemicals	64	24	7	3	9	107
Metals	58	23	8	3	4	96
Totals	2872	784	373	189	393	4611

Table D

Statement for Territory Number Seven

Truck Capacity in Tons

	1½-2	3	4	5	6	7	Total
Packard	11	18	6	8	9	0	52
1st Competitor	4	3	3	1	0	0	11
2nd Competitor	1	5	7	0	0	0	13
3rd Competitor	2	0	8	10	0	5	25
4th Competitor	3	0	10	13	0	0	26
5th Competitor	0	0	0	0	0	0	0
6th Competitor	0	0	0	1	0	0	1
7th Competitor	0	2	2	13	0	0	17
8th Competitor	0	0	0	4	0	1	5
9th Competitor	44	3	0	0	0	0	47
Miscellaneous	38	40	17	38	26	0	159
Total	103	71	53	88	35	6	356
Total Number of Packard Trucks							52
Packard Percentage							14%

Table E

Truck Market Summary

	Capacity in Tons ¾	1½–2	3	4	5	6	Total Heavy	Total Light
Packard	..	518	324	159	368	3	1,372	..
First competitor	510	437	228	..	209	..	874	510
Second competitor	37	273	11	..	2	..	286	37
Third competitor	..	29	71	42	73	..	215	..
Fourth competitor	..	76	38	5	24	..	143	..
Fifth competitor	..	60	1	..	69	..	130	..
Sixth competitor	..	51	23	..	33	1	108	..
Seventh competitor	..	63	23	2	7	..	95	..
Miscellaneous	1,279	940	337	14	161	12	1,464	1,279
Total	1,826	2,447	1,056	222	946	16	4,687	1,826
Per cent sizes to total all makes	..	52.3	22.5	4.7	20.2	0.3		
Per cent sizes Packard	..	38.5	23.4	11.3	26.5	0.3		

Potential Market for 1921

Total trucks over ¾-ton		4,687
Total Packard		1,372
Per cent Packard representation		29.2%
Annual replacement of all makes	at 25%	1,171
New owners	at 10%	469
Additional equipment	at 15%	704
	50%	2,344

Assuming that Packard will maintain its present per cent of representation, the allotment for 1921 should be 29.2 per cent of 2344, or 684 Packards.

From the table above the allotment by sizes should be:

38.5%	are 1½-2 ton or	261
23.4%	are 3 ton or	166
11.3%	are 4 ton or	76
26.5%	are 5 ton or	180
.3%	are 6 ton or	1
100.0%		684 Total

On this basis, allowing for no increase in business, the allotment for 1921 should be:

261 Size EC Packard
242 Size ED Packard
181 Size EF Packard

684 Total

Even this analysis, valuable as it is, has not seemed to us sufficiently complete, and we have been experimenting in one large market territory with a system even more intensive. This system has covered an entire State and has proven of such value that it is now being rapidly extended.

This second plan differs from the analysis based on registration in the fact that a direct house-to-house canvass is made to discover possible purchasers of motor trucks, whether or not they are now operating any. Canvassers cover both city and country, and by inquiry and personal conversation get the desired information. They frankly explain their mission and usually have no trouble in obtaining the facts desired. They make no effort to sell, but turn the reports over to the Sales Department, which handles prospects in the routine way.

In making this survey an area with a population of about 700,000 was divided into 15 districts and an analysis man was assigned to each district. At present about one salesman is used for every two analysis men and the salesmen's records show that they have great ease in marketing, due to the information they have on hand before they approach a prospect.

The information turned in is listed and handled by the same methods as are used for the registration survey.

As a result of this market analysis the chief advantages that have been gained on the selling end have been as follows:

First: The analysis makes possible a far more intelligent assignment of territory to salesmen, as in the case already cited. We have found some salesmen who had four or five times as many prospects as they could handle, others with too few to keep them busy. The analysis has resulted in far more efficient work from both classes.

Second: Our list of prospects is far more accurate and alive. We know quite definitely what men are, or should be, in the market, and we know exactly who in each territory should receive literature on any particular point.

Third: Learning the comparative value of different trades as markets. We have found that there are some trades which, from the nature of their business, have comparatively little use for the particular types of vehicles which we produce. We find that there are other trades for which our products are particularly useful. In several cases where we found that we were making no progress in certain trades we have been able, by a study of that trade, to develop special types which have not been previously used and which have been of great value.

Fourth: Keeping our mailing list thoroughly up to date and thoroughly alive. Working from accurate knowledge, we can carry on sales promotion that is effective without being overburdened.

The advantages of knowing territories in which different makes of trucks dominate are obvious and need not be enlarged upon. The advantages of being able to apportion direct-by-mail and other overhead expenses on the basis of business that will actually be done, instead of on the basis of rough estimates, is also obvious. Excessive guesses as to possible sales invariably lead to excessive expenditures for handling those sales.

Balance of Men and Prospects

In the same line comes the advantage of having our selling organization in each territory properly adjusted to possible sales in that territory. We know very closely how many salesmen can profitably be employed, how large an office staff will be required to support them, how much should be spent on advertising, on mail campaigns and on other adjuncts. This information makes it possible to unify and balance the entire organization.

An incidental advantage, but one of considerable importance when it was considered that trade-ins are involved in nearly half of the sales, comes from knowing market possibilities of second-hand trucks. Our lists show who in our territory are using each of the competitive makes of trucks and, therefore, give us a very definite knowledge which enables us to place vehicles of those makes with a minimum sales effort.

One of the greatest advantages that has come to us from this system is accurate knowledge of our strength compared with that of our various competitors in each trade field. In the fields where our competitors have succeeded in taking the lead this is particularly valuable. The analysis covers situations of this kind and shows us when it is desirable to take vigorous steps to meet a particular competition and how to properly direct our campaign.

The Neglected Fields

A recent example of this occurred in a city which had been considered a highly successful territory. The full quota alloted to that city was being absorbed steadily and without effort, and it had been very difficult to make the men there see that any advantage could come from a market analysis.

But when the analysis was completed it showed that there were 14 per cent of the trades in that city in which our products would have been useful, but to which we had not sold a single unit. It showed, also, that 60 per cent of all our units operating in that city were in a single trade. The advantage in almost every other line of business was held by the same one of our competitors. It was obvious that the salesmen had found a line of least resistance in the one trade where they were strongest and had been overplaying that part of the market. Special efforts were immediately directed toward other trades, with the result that during last summer and fall, while sales of all our competitors were falling off, we increased our sales between 15 and 20 per cent above normal and reversed our position in several lines of business.

The Production Advantage

From the production point of view the information received from accurate market analysis is equally valu-

able. About the most expensive of evils in manufacture is guesswork. A bad guess in regard to the amount of product that will be needed, whether it is too low or too high, greatly increases all the cost of production. If the guess is too high, then the end of the fiscal year will find overstocked inventories and seriously unbalanced shop operation. If the guess is too low, there will be a definite loss of sales and a very considerable expense involved in trying to scrape up materials and speed production to meet the unexpected demands.

Of course, a perfect production schedule is impossible. Many unexpected factors are sure to come in to alter any schedule laid down in advance. But the more nearly we can come to the actual facts the smaller the evils will be and the greater will be the reduction in cost and price that can be effected.

Although the cost of these evils falls on the production department, the evils themselves are directly due to the sales force, since it is the sales manager who has to lay down figures for the production. The usual method of reaching production schedules by stewing out a series of guesses from all parts of the selling field does not need discussion. The thing that has surprised us was to find out how great the errors were in these guesses.

Cost of Undue Optimism

There was one of our distribution points, for example, which estimated that it would sell 125 trucks during 1920. From the first it fell steadily behind its expectations, and an analysis of the market was ordered. This showed that in the city the company was selling about 10 per cent of all the trucks being placed and that up to 1920 it had sold a total of only 120 trucks. Our potential market, on the basis of the analysis, was only for from 60 to 65 trucks. The distributer had, in effect, by asking us to produce 125 trucks, demanded that we should produce a surplusage of 60 unsalable trucks, costing us, roughly, $200,000.

Of course, such serious errors are not frequent, but the error in estimates is almost always on the side of overproduction. There are also errors just as serious in regard to the type of truck that will be demanded, and these have an almost equally bad effect on the production situation. Taking these factors together it is safe to say that under the old guesswork system the variation from the actual needs ran from 50 per cent to as high as 100 per cent. The effect on the finances of a company which produces 50 per cent more goods than it can sell would, of course, be disastrous. But the general dislocation of production machinery that is sure to result when these excesses have to be corrected is extremely serious. Under the market analysis system there are, of course, still errors varying from 10 per cent to as high as 33 per cent—the difference is from 40 per cent to 66 per cent, an average increased accuracy of about 50 per cent.

What this saving amounts to in cash can be figured out roughly, and it runs close to 10 per cent of the actual cost of production. Saving on inventories, for instance, runs all along the line from the moment the outside purchases of all kinds enter the plant. It is a rough general rule that in manufacturing plants the total value of inventories is something over one-third of the annual turn over. When this is true the interest tied up in these inventories amounts to 2 per cent of the turn over. On this basis the loss on the one item of interest paid on the capital tied up in inventories, is equal to about one-fifth of the total profits. The reduction of inventories, of course, is only one of many obvious savings.

These are the advantages that have come from the system of market analysis based on registration of trucks, which is the one generally used. There have been certain additional advantages from the more intensive method prescribed. The chief of these is in more complete listing of prospects and selling, but this is only one of several.

The detail survey plan, for one thing, has brought in a great deal of information in regard to prospects for cars as well as for trucks. It has also proven a splendid training school for salesmen, so much so that the salesmanager in charge of this territory declares that as a source of material to fill selling positions, the plan has been worth everything it has cost. The system also results in opening new territory and putting trucks into parts of the country where they had never been used before. The analysis men keep in touch with all work that is going on, such as road and sewer construction, and from them we learn the prospects and have our salesmen at work even before the contracts are awarded. Finally, analysis men are educating farmers and business men who have always used horses or competing trucks. They are teaching them the fundamentals of value of transportation engineering which is nothing more or less than scientific truck selling.

In keeping in touch with the situation it has been found desirable to use a map showing graphically sales conditions in the territory. Installations of trucks are posted by means of pins which are colored to represent makes of our leading competitors. Where there are too many trucks in a given territory to make it impossible to put in a pin for each vehicle, a tack is used, on the head of which is written the name of the vehicles. From this map the sales manager can see at a glance the various kinds of trucks in the different parts of the territory. He can detect any change in conditions from day to day and see that special attention is directed where it is needed.

The advantages of this system in the period of vigorous competition and sales effort upon which we are entering can hardly be over-stated. They have been so great that the extension of the system to cover the entire country is inevitable. The cost has proven very small in comparison with the increased sales, increased earnings and decreased cost, both for selling and manufacture.

Less Gasoline from Natural Gas

DR. R. P. ANDERSON, chief chemist of the United Natural Gas Co., who spoke some time ago before the Western New York Section of the American Chemical Society on natural gas and the natural gas-gasoline industry, brought to light the interesting fact that the probable decrease of natural gas-gasoline during the next year or two will be felt in the gasoline industry, because natural gas-gasoline is a volatile constituent of many commercial gasoline mixtures. By the use of the highly volatile natural gas-gasoline, it is possible to make use of the gasolines of low volatility in even cold weather. The failure of natural gas through Ohio and Pennsylvania, which are the two leading natural gas States, is naturally going to have a similar effect on the natural gas-gasoline industry.

Dr. Anderson also pointed out the increasing use of the absorption methods of manufacturing natural gas-gasoline. This, he stated, is a result of experiments during the war on the high absorption qualities of charcoal. This development is going ahead very rapidly and plants using it are running at 50 to 75 per cent efficiency, which is higher than by previous methods. It is also found possible by this method to extract the gasoline from natural gases which are very lean in gasoline and from which it is practically impossible to get results with the compression method which was previously used.

Conditions in Bulgaria Favorable to the Tractor

In this interesting article the writer makes very clear the need of long term credits if we are to sell our products in the war worn countries of Europe. Here is a country that needs tractors, but cannot buy them.

A. M. Gheorghiew*

BULGARIA is essentially an agricultural country. Eighty-two per cent of her population are peasants and the economic life of this country depends in the first place on its crop. In spite of this the methods of cultivating land are relatively primitive and the use of modern machines is limited. The causes of this unfavorable situation are of different kinds. The short period since the liberation of the country from the Turks (1878), whose régime always paralyzed any development of productive forces; the division of the land into small parcels, resulting in the insufficient purchasing power of the farmers and the difficulties in using machines in a profitable way on such limited areas; the lack of technicians and adequate workshops.

Change in the Situation

Nowadays conditions are changing in many respects. Owing to the almost uninterrupted wars since 1912 to 1918, the country is economically exhausted; we need to increase production to the utmost and, conforming to our conditions, firstly by speeding up our agricultural activity, in order to cover our liabilities and to rehabilitate our finances. On the other hand, during the war a big percentage of our cattle was lost and must be replaced in some way. Our farmers already understand, that our ground, being fertile, requires intensive working. Lastly, the lack of transport facilities outside the railroads handicaps the development of export, especially of cereals. All these requirements could be satisfied by introducing on a larger scale up-to-date and proper agricultural machines, tractors and also trucks.

In the present article we shall consider only one of the most important machines of modern agriculture viz, the motor-plough. Bulgaria is now just entering the phase of "industrializing" her agriculture, a situation which has been experienced by more advanced countries many years ago. As we have already mentioned, there are serious hindrances in the way of modernization of agricultural methods, but the necessity of efficient machines is so evident that all obstacles will be overcome. It is also of importance that our present government created by the "Agrarian party" is paying particular attention to the strengthening of our farming activity.

Trials and Their Results

The first serious trials with motor plows were made in our country during the last war, especially on the Dobroudja, called the "gold" country and "granary" of Bulgaria. The results were excellent. Unfortunately, Dobroudja with its vast and fertile plains, highly suitable for motor plowing, no longer belongs to this country, as a result of the peace treaty. However, we have still important districts where motor plows could be utilized successfully. The principal point is to proceed systematically, to supply the farmers with the best types of machines for this country and to show them how to extract the largest profit from them. With this object in view, our government arranged in August last, in the neighborhood of Sofia, the first systematic trial of motor plows.

The following firms were represented there: Case, 10/18 hp., plow with three shares and 15/27 hp., plow with four shares; Fiat, Romeo, 24 hp.; Moline; Frick, 25 hp., plow with three shares and Traga, 40 hp., plow with five shares.

In these trials the Case tractor gave the best results, the second place being taken by a Fiat. The opinion of both the expert commission and the Director of the Agricultural Bank, who was president of the commission and with whom I had the chance to have an interview, could be summarized in the following statement.

1. In view of the particular working conditions in this country, tractors of medium power with plows of 2-3 shares are the most suitable.
2. The tractor system with detachable plow is preferable to the rigid one.
3. Apart from plowing, the tractor must be suitable for the transport of goods, driving of threshing machines, pumps, etc.
4. The consumption of fuel must be reduced to the lowest possible (very important), taking into consideration the extremely high prices of petrol, etc. (chiefly due to the depreciation of our money; the price of a litre of benzine rose from 0.35 Leva in pre-war time to the fantastic figure of 14 Leva). A more expensive machine with reduced consumption will be in general preferred to a cheaper one, which wastes fuel.
5. The carbureter must be adapted for benzine, benzol and kerosene.
6. The whole machine must be suitable for plowing in a rough country.
7. Two types of shares to each motor plow—one for heavy and the other for medium and light ground —are desirable.
8. In view of the lack of technicians, the construction, and especially the operating of the machine, must be simplified to the utmost.

In order to obtain the most efficient use of the motor plow, and for its rapid introduction, it will be also advisable to carry out the following suggestions:

a. Facilitate repairs in well-organized workshops, distributed in the most important centers of agriculture.

b. Provide a technical control by means of traveling mechanics.

*Mr. Gheorghiew is connected with government promotion of automotive equipment in Bulgaria.

c. Secure fuel and lubricating oils of good quality, at reasonable prices.

d. Propaganda accompanied by demonstrations. The best way for meeting the above mentioned suggestions will be, apart from the co-operation of the government institutions, the establishment of agencies of important manufacturers in Bulgaria.

After the trial in the past year the general opinion was that the introduction of motor plows in this country would give the best results. But the rate of exchange being greatly against us (the nominal value of the dollar is 5.25 Leva and during last year it rose on the average to 80 Leva), the prices of the machines and the fuel were too high and, therefore, motor plowing seemed to be, however, not profitable. Thus, the purchase of motor plows was postponed. But as the exchange remains still in the same state and the need of the machines in question for our farms is acute, the government decided to repeat the trial in May this year and then to start modernizing farming in our country.

The conditions in the judging of the motor plows will be almost the same as at the preceding trial. The strength and the suitability of the construction, the efficiency of the machine, working cost, quality and quantity of the work, repair facilities secured by the firms, will be of first importance.

The depth of the furrows will vary from 8 to 24 cm. when working on a gradient of 7 per cent, the required depth will be 17 cm. It deserves to be mentioned that the results of the trial, as was the case last year, depend, in a great degree, on the skill of the mechanics. It seems that the next trial will be organized on a larger scale and that more firms will compete.

Suggestions and Conclusion

As we have already stated, all the difficulties of a technical and financial nature in popularizing and extending the use of motor plows will be overcome by the necessity of increasing production by improved farming methods. This opinion will be endorsed, especially when one bears in mind that the general state of education in Bulgaria is very good. There are almost no illiterate people in Bulgaria so that the utility of the machines is rapidly understood by all the classes of the population. But manufacturers and dealers interested in this line could considerably facilitate and expedite the industrializing of Bulgarian agriculture both to the profit of the country and to their own advantage.

Besides the technical facilities needed for that purpose, it would be of great importance to hasten this process also from the financial standpoint. It is true that as a consequence of the war, the purchasing power of the farmer increased considerably in comparison with that of the citizens.

But, on the other hand, the depreciation of our money hampers the sale of foreign articles in the Bulgarian market.

The credits granted to our farmers by manufacturers of agricultural machines had, as a result, the remarkable increase of orders for such machines during the last years before the outbreak of the war. Such credits are now still more required (because of the unfavorable rate of exchange) in order to enable the farmers to acquire machines. On the other hand, the Bulgarian peasant and citizen were known in the Balkans as good payers, so that no risk would be faced, when allowing such credits, if conducted in the proper way.

Finally, we should emphasize that the Bulgarian market could play a much more important rôle in the near future than could be expected of it in proportion to its limited area. The nearness of Bulgaria to Southern Russia—this enormous field for agriculture, which, in normal times, feeds the great empire and in addition to that exports large quantities of cereals—could favor, firstly, the organization of the supply of machines to Russia (when she will open) and, secondly, **would allow her to make use of Bulgaria as a big trial field for farming machines destined for Russian markets.** Before the war (and undoubtedly some time later again) many Bulgarian peasants used to go to the Southern Russian districts for temporary work and they were there received always in the best manner as good agriculturists. Those people are also capable of facilitating the introduction of such machines in Russia as proved to be adequate in the Balkans. And it is doubtless that, when Russia recovers, its market will be of extreme importance for the exporters and in the first place for those interested in the agricultural machinery and implements.

We hope that the facts pointed out in this article will serve to awaken the interest of the makers engaged in the manufacture of agricultural machines to the attractive prospects of this country.

Trucks Used in Warehouse Industry

THE warehouse and transfer industries offer a lucrative field for the sale of motor trucks. *Distribution & Warehousing*, the business paper of the warehousing interests, recently compiled information for incorporation into its 1921 Warehouse Directory and in the questionnaire which was circulated there was included an inquiry as the use of motor trucks and horses in the distribution of manufacturers' products and in the transport of household goods. The responses indicated that the horse is being retired from warehousing and that the motor truck is generally favored.

The direct inquiry about teaming facilities was answered by 1064 warehouse and transfer companies. Every one of the transfer interests operates one or more warehouses.

This tabulation shows an average of nearly six trucks to a company. The inquiry as to teaming service was left unanswered by many of warehouse companies which are employing the commercial vehicle, but the tabulation is definite in its indication of the field that is there for the truck manufacturer.

The replies from these 1064 companies supplied the following statistics:

Tons Capacity	Number in use
1	952
1½	416
2	1343
2½	484
3	387
3½-5	716
Above 5	479
Unclassified	1272
Total	6249

Some warehouses are operating fleets which run as high as fifty or sixty trucks. These are used for distributing shippers' spot stocks held in the storage plants or goods which have arrived in carload lots. Some of this distribution is carried on in zones which extend several hundred miles from the warehouse.

In the 6249 trucks there were 176 different makes represented.

Why Southern Ports Cannot Compete for Export Shipments

Financial arrangements, say the practical men, are of more importance than the saving of freight costs by using the shorter and more direct route. Experience shows that rail shipments are preferred to water when rails reach the destination.

By H. H. Dunn*

THE fact that virtually all automobiles manufactured in the United States and sold in foreign countries are so sold to be paid for with drafts on New York, sent with the bills of lading, has practically eliminated the gulf ports as points of export for either passenger cars, trucks or tractors. During the period of freight congestion in New York, a few months ago, a number of Wichita trucks were shipped through New Orleans to India, being handled down the Mississippi on barges, and transshipped here, while about 100 Dodge, Ford and Hudson passenger cars were sent through New Orleans to Latin-America, but as soon as the congestion was relieved at New York these shipments stopped and no further shipments were made.

While shipment of automobiles and trucks from the factories in the upper Mississippi Valley, by the all-water route to New Orleans, and thence on steamer, especially to Latin-America and the Orient, is somewhat cheaper as regards freight costs than the shipment by rail to New York, with the added distance from that port to the Panama Canal, lack of suitable financial arrangements at Gulf Coast ports more than offsets this freight saving.

The majority of the automobile manufacturers of the United States maintain export departments or agencies in New York, and have no such departments on the Gulf Coast. The actual technical business of exporting, arrangements for packing and crating, and for short-time payment for exported cars and trucks, are thus far more easily carried on from New York, and until such departments are established in New Orleans, Mobile, Galveston, Houston, or other Gulf Coast ports, there is little prospect of automobile export traffic worth mentioning from any of these ports.

Recently the company which manufactures the Ranger car in Texas shipped a number of its cars to Mexico City dealers. Despite the fact that this company is located in Houston, and that Houston is virtually a deep-sea port, the cars in this consignment were shipped by train to the border and thence over the National Railways of Mexico to Mexico City and other points of distribution in the southern republic. This would indicate that, in addition to lack of financial and other shipping conveniences at gulf coast ports, automobile shipments by train are more satisfactory than by steamship.

These are the opinions of the shipping men and steamship agents of New Orleans, as voiced by A. N. Floyd, general manager of the New Orleans and South American Steamship Co., one of the principal lines operating into the ports of Latin-America, and connecting with Pacific Mail and other steamers on the western side of the Isthmus of Panama.

"We have tried, and other steamship companies and agencies in Gulf Coast ports have tried, to lay the foundations for an automobile export business from these southern ports," said Floyd, "but so far we have been unable to do so. We sent trained men into the automobile manufacturing centers through the upper Mississippi and Ohio valleys and around the Great Lakes, but we found that financial and shipping arrangements were so much better through New York that we could not compete with the north Atlantic port, at least until we had similar arrangements as to export departments and financing in the southern ports.

"All automobiles sent by sea have to be crated, costing approximately $100 for each car. The trucks and other cars shipped through New Orleans during the period of freight congestion in New York some months ago were sent unpacked to New Orleans, crated here, and then placed on board the ships.

"While the rate by barge line down the Mississippi River, from St. Louis to New Orleans, is some 20 per cent cheaper than the rail rate, the manufacturers seem to find that rail shipments to New York are more satisfactory than by water southward to these ports. Whatever the cause for this, there is little prospect of increased automobile export business from any of the Gulf of Mexico ports of the United States until payment can be made by drafts on bills of lading through the banks of these ports, and until export departments of the various automobile manufactories are established here."

The automobile dealers, and distributors, some of whom have tried, in a limited way, to export a few cars to Latin-America, hold the same opinions as the shipping men, but go somewhat further in their discussion of reasons for the lack of such exports.

"There is no use in attempting to export cars or trucks from the gulf ports," said one distributor, "until the gulf ports wake up to this great industry and are willing to operate 'fifty-fifty' with the would-be exporter of automobiles, the way the banks in New York do. If we handle cars out of here to any Latin-American country, instead of getting paid with New Orleans, or Mobile, or Galveston drafts, we have to take New York drafts on our bills of lading. This slows up the deal and inconveniences the New Orleans exporter.

"Then, too, the business of exporting automobiles, trucks or tractors to Latin-America is precarious because of the lack of facilities for making collections through New Orleans banks. Most of the dealers and distributors of automobiles in Latin-America, unless they are American

*Class Journal correspondent at New Orleans.

or British firms, want all the time they can get, and they figure on 30, 60, 90, or 180 days from date as exclusive of the time required for the automobile shipment to travel from the point of shipment to them, and as exclusive of the time required by their remittance to come from their city to New Orleans. In cases where such time amounts to 15 to 30 days each way, as it does between the gulf ports and some of the cities on the west coast of South Africa, or in the interior of Mexico or Central America, this is a serious matter. More frequently than not, the local exporter has to put up his own money for from 30 to 60 days, no matter how good the Latin-American firm may be or how promptly it may remit.

"If we had branches of the export departments of some of the automobile and truck manufacturers here in New Orleans, or even in Galveston, Houston, Mobile, or some other of the gulf ports, or if we had foreign bank connections here which would handle the paper of these Latin-American buyers, we might do some business, but as matters stand, I'm off the auto export end of it for life."

Still another dealer, who operates in New Orleans on larger capital than most dealers, and who has been able to swing some export deals through the use of his own money, talked along another line about the matter of exports from the gulf ports. Said he:

"I doubt if the shipment of passenger cars by boat to Latin-America ever will be as successful as their shipment by rail. Every day a car stays on the water damages it; there is no question about it, and I have had to knock many a hundred dollars off the price of cars I have sold in Latin-America because of rust and other damage from the salt water and salt air. This is especially true when shipments are made far south on the east coast of South America, or when they are made to almost any point on the west coast of that continent, involving trans-shipment at Panama.

"Experience has taught me that is is impossible to so crate or pack an automobile, whether entire or 'in the flat,' to protect it from the effects of this dampness, and, to be perfectly frank with you, I should like to have seen those trucks which were shipped through New Orleans to India a few months ago, though, naturally, the heavier and coarser metal of the truck or the tractor suffers less from this corroding salt air than does the finer passenger car."

A Removable Track for Rubber Tired Road Vehicles

THE present development of army combat transportation requires cross-country vehicles which are also able to travel on good roads at the speed of conventional motor trucks. Previous forms of caterpillar tracks were usually developed for low-speed agricultural purposes, and high speeds were difficult to maintain, due to the wear and the mechanical losses in the track itself. Increased efficiency is attributed to the fabric track illustrated. Running on its wheels, the car can make about 45 miles per hour. With the tracks applied, a maximum speed of 37 miles per hour on good roads has been attained, which, so far as is known, is the highest speed ever developed by a track-laying type of vehicle.

Each track consists of two rubberized fabric belts which are connected together by steel stampings riveted to the belts, the ends of the stampings being turned over to the inside so as to form a guide into which the tires fit. Any clogging material which may lodge on the upper side of the track is forced through the large opening in the track, which is a feature of this type of construction.

Ford Runabout Equipped with the Chase Track

In addition to the regular wheels of the car, there are provided four extra wheels, two on each side, of the same size as the regular wheels and located between the front and rear regular wheels. These extra wheels serve as carriers, the track under the regular wheels being normally off the ground. Standard regular 3½-in. pneumatic tires are used, and after 1300 miles of operation, under conditions which would have damaged the tires of a regular Ford, the tires and fabric track showed no wear. There was a nominal amount of wear on the replaceable steel cross links.

For steering, a pair of separate brakes is provided which permit of locking the driving wheel on either side. The regular gear ratios of the Ford are too high for this vehicle to operate satisfactorily in soft ground, deep mud, wet marsh, etc., and a commercial auxiliary transmission, which doubles the gear reduction, is introduced in the drive shaft directly in front of the rear axle housing. For operation on improved roads, the regular Ford ratios are used. For cross-country running, the lower set of ratios is used.

In the accompanying photograph a Ford car is seen equipped with the removable tracks to adapt it for use on deep snow, "bottomless" roads, plowed ground, etc. The track was developed for the Tank, Tractor and Trailer Division of the Ordnance Department by A. M. Chase, who is in charge of its Syracuse engineering office.

Belgian Exports and Imports for 1920

Country of Destination or Origin	Belgian Exports Cars	Belgian Exports Chassis	Belgian Imports Cars	Belgian Imports Chassis
Germany	7	20	466	62
United States	4	3	1,380	136
France	95	62	1,061	586
Great Britain	352	256	120	38
Italy	2	7	235	234
Spain	127	...	...	...
Holland	225	...	55	...
Portugal	134	...	...	...
Other countries	253	191	87	8
Totals	1,199	539	3,404	1,064

The FORUM

Tire Pressures as Affecting Car Life

Editor AUTOMOTIVE INDUSTRIES:

The following paragraphs in the February number of *The Automobile Engineer* attracted my attention:

"Although under-inflation of tires is in direct opposition to the most explicit instructions issued by the tire manufacturers, there is little doubt that harmful results are confined almost entirely to the tires of heavier cars, and the tires of lighter vehicles do not evidence the rapid depreciation threatened by tire makers. In any case, it is better that the tires should be damaged rather than that the chassis and components should suffer.

"Apart from the usefulness of the flat tire on demonstration cars, those who have driven cars with relatively under-inflated tires would on no account return to the old practice of running their tires at catalogue pressures. The point of road contact being the place where the shock commences, it is evidently the correct place to absorb any but the largest movements, and the contact spot on the tire, with its minimum inertia, is particularly suitable for this purpose. If tires as now produced are not manufactured to resist this continued flexing, then there is need of further development."

This is a subject I have talked about a great deal and which I believe is worthy of consideration.

Of course, I do not believe in carrying tire pressures ridiculously low, but at the same time I feel that the tire pressures at present recommended by the tire manufacturers are entirely too high. They may save on tires somewhat, but I believe that they do more damage to the car, and decrease the riding comfort so much that the extra tire mileage to be gained is not worth while.

On experimental cars, when we want to abuse them, we pump the tires up real hard, and when we want to ride with comfort, and travel for pleasure, we deflate them to 50 lb. pressure for a 32 x 4 cord tire.

I have seen owner's cars come into our service department that have been pumped up so hard as to give the impression of riding on solid tires. Give a man a set of tires inflated to the tire manufacturer's recommendation, and then put him on the average macadamized or paved road, in its usual run down condition, and he is pretty sure to find himself in the repair shop in a very short time.

RUSSELL BEGG,
Jordan Motor Co.

Suggestion to Bus Builders

Editor AUTOMOTIVE INDUSTRIES:

Having occasion to ride in various motor omnibuses of either the front-entrance type or such as have no open rear platform, I have almost invariably been conscious of a strong odor of exhaust gas, particularly in the after part of the body. Due to the peculiarities of the air currents about the moving vehicle, such gas enters the body chiefly at the back and somewhat through the floor, the sides being swept by fresh air.

Since this gas is lethal, I believe it should be obligatory on those who outfit buses to render them gasproof, even to the extent of sealing the floors and backs airtight; further, the chassis builders should pipe the exhaust to a point whence it will not be swirled along in the wake of the machine.

The next step, of course, is for the engine and carbureter makers so to adapt their products to the fuel as to secure more complete combustion with less noxious residue; but this will take time and cannot be counted on as an immediate palliative of the poisonous conditions in buses.

It would be a unique achievement if bus makers and owners both could take gas-exclusion measures on their own initiative before statutes and local ordinances compel them to; certainly, these considerations should not be overlooked.

KEITH ROLLIN MANVILLE.

Hempstead, N. Y.

Swash-Plate (Inclined Disk) and Z-crank Engines

Editor AUTOMOTIVE INDUSTRIES:

IT seems that at present a great deal of labor and money are being spent on the construction of engines, in which no ordinary crankshaft is used, but an inclined disk, fixed to a shaft, or a Z-crank with wobbling member.

This type of engine seems especially fitted for very high speeds, and may be designed to give very attractive engines. However, there is a hidden difficulty, and one so serious that these engines don't seem to have any future. As this difficulty may well escape even the attention of a thorough designer, and in most cases will only appear during tests of the completed engine, and as writer has himself for years been connected with the manufacture of such an engine, he thinks it useful to all who are planning in this direction to call attention to this difficulty.

To prevent the member, to which the connecting rods are attached, from turning, it is connected to the engine frame by some kind of universal joint. This results in the necessity for this member to perform very quick oscillations; as the frame does not revolve, and the axis of the wobbling member constantly changes its direction, it may be easily seen that because of the well-known periodical speed fluctuations of a universal joint, the wobbling member itself will slightly oscillate around its own axis. For each revolution of the engine the wobbling member oscillates two times to and fro. Though the oscillations are very small, in most cases only a few tenths of an inch, the forces which come into play are excessively high on account of the enormous speeds, and rather big inertia.

The problem of the construction of these engines is hidden in the construction of a universal joint which will transmit motion absolutely uniformly. H. C. O.

THE Geological Survey Branch of the Canadian Department of Mines reports that the oil fields of northern Canada comprise 300,000 square miles.

Uses and Abuses of Organization and Associations

We have organized ourselves into a confusion of effort that is likely to retard the adjustment of our own knowledge. Mr. Tipper commends an organization recently established for purposes of research, but points out the excess of organizations devoted to the development of systems.

By Harry Tipper

IN the March 31 issue of AUTOMOTIVE INDUSTRIES I wrote an article entitled "Standardization Without Understanding Is Harmful," and in the fore part of that article I quoted from the New York "Times" concerning a meeting sponsored by Mr. G. K. Parsons, which was apparently called for the purpose of standardizing methods of selecting individuals.

Since that time Mr. Parsons has brought the matter to my attention and explained the plan of the committee. The plan as it has been started is different from the report in the "Times," and it is evident that the account which was printed failed to secure the right attitude as to the proposals.

The committee was called for the purpose of considering all the different methods for selecting men adopted by various concerns and organizations, and attempting to evaluate these methods by research and experiment. The idea of the committee is to find out what elements of value there are in each of the methods adopted and suggest the use of the things which have been found of fundamental importance and the elimination of those things which cannot be considered in that light.

This purpose is a worthy one, and one which can be of benefit in connection with a study of humanity in industry. Glaring errors in our present methods may be determined by a series of researches along these lines, and whatever is done in this direction will be on the lines of progress.

The difficulties which face such a committee are very great. In order to evaluate there must be a basis of appraisal, and our knowledge of human qualities, variations and necessities is very meagre. The most difficult part of a work of this kind will be the discovery of any basis upon which the valuation can be determined, and it will be unfortunate if the weight of organized opinion approves a method without a careful determination of the basis upon which that method is valued. However, the object of the committee is worthy, and it is interesting to discover an organization which is gathered together for the purpose of research rather than standardization.

This reference to organization reminds me that papers concerning three new organizations, having to do with the human side of industry, have passed across my desk this week. The number was sufficiently interesting to induce me to trace previous records of such organizations. At least thirty have been formed in the last year, and at the present rate of progress they will reach over a hundred in a very short time.

This craze for organization is leading to such a multiplicity in the organized work connected with co-operation, management, employment, personnel, industrial relations, human engineering, so called, and other elements of the human side of industry that the present confusion of mind is likely to be greatly enlarged by these endeavors.

We have considered organized effort as so vital a part of research experiment and propaganda that every idea, every method and every suggestion must be made the object of a committee, a conference or an association with its formal organization and its formal methods of examination and development. In the belief that organization as such is necessary to progress, we have organized ourselves into a confusion of effort that is likely to retard the adjustment of our own knowledge. In reality this is another visible symptom of the way in which we have depended upon system and systematized work to take the place of understanding and thorough definition.

The functions of these organizations interested in the human developments of industry are very much alike, none of them covering the field basically, and most of them devoted to the development of systems and methods rather than of examination and research. Committees, associations and conferences are excellent organizations for the purpose of arriving at agreements upon known facts, standardizing known practices and developing orderly methods. They have not proved themselves of value in research and they are not likely to be of much service in this respect.

It is not in the number of authorities who may discuss a subject that new principles are discovered, but in the patient research of some man who is willing to devote his life to the development.

Discoveries and improvements in the mechanical arts have not been due to the efforts of committees or associations; they have been the result of individual research in each case. When the discoveries have been made and the basic elements of practice established, the organized bodies have been of great value in standardizing and developing the operations by which these discoveries could become valuable to the general public. There is no reason to suppose that the methods of advancement will be any different in our progress in the human side of industry. In fact, our ignorance of the matter, the meagre amount of knowledge we possess and the large amount of conjecture in our method make it unlikely

that organized bodies can be of any great value in the development of our knowledge upon these subjects.

Very few men in industry, even among those who are especially interested in the human side, have studied deeply the fundaments of human necessity, progress and reaction. The work of these men is not likely to be forwarded by the actions of organized groups composed largely of men who are versed in methods of examination, but have not studied the fundaments upon which those methods should be based.

We have so much machinery of co-operative organization that it has become unwieldy and cumbersome. The objects of our organized effort are but poorly defined, and in many organizations few of the members have a clear idea as to where they are going or what they are attempting to do.

Co-operative organization presupposes a co-operative object and method. In discussions with the officers and secretaries of many organizations it is impossible to discover any well-defined reason for their existence or any well-defined method for their development.

One good organization with a clearly defined object in front of it and with a definite method of development would be worth a dozen of the present organizations and of more value to business.

In the meantime it is well to remember that conclusions of an organization as to the validity of present methods and their use are the result of the average intellect in such an organization, and cannot be in accordance with the best practice of the most advanced students.

The man of sound knowledge and wide experience is ahead of any organization in the development of his practice. The value and purpose of the organization is limited to a comparison of individual methods and the general dissemination of those methods, so that all interested men may be able to avail themselves of the studies. So long as they are limited to discussion for the purpose of clearing the individual experience and practice, they have great value in enabling each practitioner to enlarge the horizon of his practice. So long as they are content to organize the known factors and to recommend methods valued upon known bases, they have their place in the industrial necessity.

Unfortunately, on the human side of industry, methods have been standardized without a proper knowledge of the fundamental bases, practice has been organized without the proper examination of its objects and purposes, and the present actions have tended to solidify the errors in the endeavor to standardize the values.

It might be an excellent thing for us in our co-operative associations in industry to consider the advisability of organizing our associations, eliminating those which are unnecessary and defining those which are of value so that the objects and purposes are clearly understood.

Good Roads Essay Contest

VARIOUS Government agencies and national organizations are announcing to-day the new Good Roads and Highway Transport national essay contest, to be open to all pupils of high school grade. The national prize is a four-year scholarship in the university or college chosen by the successful contestant. It is offered by H. S. Firestone.

The contest will be conducted by the Highway and Highway Transport Education Committee, Dr. P. P. Claxton, United States Commissioner of Education, chairman, who announced to-day rules governing the contest.

Essays must be not more than 500 words and must be written on the subject, "Good Roads and Highway Transport." All essays must be in the hands of local committees not later than June 15.

Local and state prizes are to be announced soon but, according to the committee, essays winning first honors in local and state contests will be eligible to compete for the four years' university scholarship whether local and state prizes are offered or not.

Among Government agencies and national organizations co-operating to make the contest successful are the Bureau of Public Roads, of the Department of Agriculture; the Bureau of Education of the Department of the Interior, and the National Automobile Chamber of Commerce; the Firestone Ship by Truck Bureau; the National Grange; women's clubs, chambers of commerce, and automotive associations everywhere.

The contest is a renewal of the Ship by Truck-Good Roads essay contest held among high school students last year, in which more than 200,000 essays were submitted.

Miss Katharine F. Butterfield, pretty 16-year-old high school pupil of Weiser, Idaho, was the victor in this contest and is enjoying the scholarship at a famous Eastern school. As a result of her conquest, Miss Butterfield will receive a four years' college education.

Back of the idea of the essay contest is the wish of the Highway Transport Committee and co-operating organizations to bring to the attention of the high school pupils of the country the urgent need for immediate improvement in the national highway system.

Training Office Employees

THE idea of training office employees is usually connected with the idea of a large organization employing a great number of persons. New employees in the small office, however, need training if the organization is to function efficiently. This training can easily be carried on without elaborate preparation and equipment.

Three fundamentals are suggested by W. H. Leffingwell, president of the Leffingwell-Ream Co.

1. Teach the worker the purpose of the business.
2. Teach him the purpose of the operation upon which you have started him.
3. Teach him the operation itself.

"These steps," Leffingwell says, "are necessary in all training, and every one of them can be undertaken in even the smallest office, but on the other hand, in very few offices will this training be found."

LANCIA, the Italian manufacturer, has evolved a construction, recently patented in England, by which the width of V-type engines is decreased. In a twelve-cylinder engine, for instance, the axes of the two sets of cylinders do not meet at the center of the crankshaft but a distance below the crankshaft about equal to the length of the connecting rod. The axes of the connecting rods at dead centers make an angle of 20 degrees and the cranks of each pair of cylinders make an angle of 40 degrees. In this way it is hoped to obtain a fairly good balance.

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Present Action Will Influence Future

THERE has been an almost universal increase in the efficiency of labor during recent months. This is due partly, of course, to the scarcity of jobs. It is, however, in some cases due to a more careful study of production problems, with a resulting weeding out of inefficients.

Other firms have taken this time as a definite opportunity to gain the active co-operation of their remaining workers and thus form a firm foundation for the future building up of an efficient working force. There has been very great variation in the attitude taken toward such problems by the various manufacturers. Speaking of efforts in connection with employees to reduce costs, for instance, one employer said he had adopted the method of trying to have the employees feel that they are working with him rather than for him. In reply to an inquiry along similar lines another said: "We are employing efficiency engineers to suggest efficiency methods," while still another believes the important thing is to "use great care not to reduce wages and salaries as fast as commodities decline. We did not raise them as fast as prices advanced."

The results of the various methods of handling the labor problem during recent months cannot be determined until sometime in the future. Much importance unquestionably attaches to the present approach to and administration of industrial relations matters.

Conscious and Unconscious Education

AN interesting statement appears in a bulletin recently sent out by the Department of Domestic Distribution of the Chamber of Commerce of the United States. The statement refers to the results of a questionnaire answered by two thousand business men through the country. It reads as follows:

"One-fifth reported that they had done away with bonuses. . . . This form of reward was, perhaps, very largely an outgrowth of war conditions, and it may be fair to guess that it is fast disappearing with return to more settled times."

The statement indicates what is probably true, that many of the bonus and similar plans installed during recent years were given not on a sound basis of reward for service or through any fundamental belief on the part of the manufacturer that the worker was entitled to a larger share in the profits of industry, but merely as a bribe. Bribery has often been known to effectively obtain temporary ends, but it is never of any value to the permanent progress of industry or society.

When wages are adjusted on this basis and in this spirit, the workman is almost certain to accept the adjustment in the spirit in which it is given. Judging on the basis of the facts presented, he comes to believe that wages are the result of economic power rather than service rendered, consequently he attempts to obtain wages on the former basis rather than the latter.

In discussing the matter of educating the worker, it must be recognized that certain factors and information go before the worker from the employer which the latter is perhaps unconscious of having given as well as does that "education" which the employer consciously transmits through speeches and house organs.

Speed Not Always Efficiency

THERE was a note in a recent talk made by J. B. Bartholomew before the Tractor and Thresher Group of the National Implement and Vehicle Association that is worthy of consideration by those connected with merchandising efforts for automotive products. Mr. Bartholomew, a veteran in the field of farm equipment operations, was speaking of salesmen. He is quoted as follows:

"We used to call them salesmen, but now they are travelers and some I call Cook's tourists."

His explanation of this was that too many of the

men on the road to-day judge their efficiency by the number of calls they make, or the number of towns they visit. Their sole ambition appears to be to jump from one town to another.

This view is not a new one to many executives. It has probably grown out of the call for more efficiency from salesmen. There was a time when salesmen were entirely too leisurely in their travel, but in making the change it is a frequent complaint that many of them are now moving about the country so fast that they really do not have an opportunity to get acquainted with their dealer customers and to learn what the dealer's troubles may be and why he has troubles.

During the period of order taking, many abuses of the merchandising systems gained a foothold and it is going to be difficult to eradicate some of them. Over speed and too little attention to the complete understanding of the deal was one of these evils. The best seal on a business deal is a complete understanding of it before signing on the dotted line, whether the customer be a consumer or a dealer. Especially is this true in Mr. Bartholomew's field. His consumers are farmers. They buy leisurely and the deals that lead up to the final purchase must be tempered with this knowledge. Some salesmen get so busy they do not have time for an understanding of business.

The Best S. A. E. Meeting

THE success of any convention depends largely upon the support and co-operation of the members of the organization who attend, and engineering meetings are no exception to this rule. At the coming summer meeting of the Society of Automotive Engineers there will be ample opportunity for recreation, but the prime object of the meeting is to afford opportunity for interchange of engineering information, and this fact should not be lost sight of by those who are planning to attend.

Members of the Society will shortly receive advance copies of most of the papers to be presented, and should come prepared to discuss these papers fully, for the life of a meeting depends largely upon the discussion, and the value of the paper often depends upon the discussion it creates. The Society and the author have discharged the bulk of their responsibility when the paper is placed in the hands of the membership. Then the responsibility of the member for making the meeting a success begins. In order that the interchange of information be carried into effect the membership must respond with pertinent comment or criticism. If the views or data set forth in the paper are incorrect or biased, let the fact be known. If they are incomplete or inconclusive, and you can supply from your own experience or records particulars which should be added, go to the meeting prepared to contribute for the general good. If you agree with the author, say so, for this adds weight to information given and assists those with less experience to arrive at safe conclusions. Finally, if you hesitate to speak at the meeting, or if you cannot attend, contribute written discussion.

Authors of papers and members of the staff of the Society spend many hours in preparing papers and arranging to place them in the hands of members prior to the meeting. After that it's largely "up to" the membership, if they purpose to make the forthcoming meeting the best in the history of the Society.

Facts and Fences

THROUGH basing every action in connection with employee relationships on utter truthfuness, as to facts, and fair reasoning, as to principles, the manufacturer can go far toward building up confidence among his workers and obtaining the good results which accrue from such confidence.

It does not assist in the ultimate solution of the labor problem to say in "boom" periods that labor costs are a very large part of manufacturing costs and that, therefore, the price of the product must vary directly in accordance with labor costs; and then to state in depression periods that labor cost is a very small part of total costs and that consequently a reduction in wages has a very slight effect upon the cost of the product.

Facts are not altered by the side of the fence upon which the speaker happens to be. The question is sometimes even given a different shade to the consumer and to the workman at the same time. Wages are reduced, and the consumer is told that wages are a small part of production costs and do not materially affect the price. The workman is told that wages must be cut so that the price can be reduced to meet competition.

Costs in one typical automobile plant are divided roughly something like this:

Materials 54 per cent.
Labor, 14 per cent.
Sales, 7 per cent.
Other expenses, 25 per cent.

This would indicate that wage reductions would not constitute anything like a dominating factor in the reduction of costs.

In any case the essential thing is to base actions upon considerations of fundamental justice and moral obligation as opposed to expediency.

Credit Standards

A NUMBER of manufacturers have been scrutinizing credits with more than usual care during recent months. Many are lowering overhead expenses partly by reducing the volume of their credit business. When asked about the methods he is using in accomplishing this reduction, one big business man said recently:

"We are more lenient on credits based on moral standards than those based on financial standards."

Here is a practical recognition of the fundamental necessity for a moral obligation between manufacturers. So strong is the interdependence of the various units of modern industry, that the whole structure rests primarily on the ability of these units to co-operate successfully. Such co-operation can be brought about only through a widespread recognition of the moral obligation in industry.

Mellon Proposes New Motor Taxes

Suggests Imposition of Federal License

Treasury Head Would Retain Excise Fees and Add Further Burden

WASHINGTON, May 1—Retention of excise taxes and establishment of Federal license taxes on automobiles was suggested by Secretary of the Treasury Mellon in recommendations for internal revenue revision which were submitted to the House Ways and Means Committee to-day. The application of these taxes was not explained in detail in the letter of submittal, but the Secretary announced that he would appear before the committee to supply further information regarding the Treasury tax program.

It will be noted that Secretary Mellon's proposals differ widely from those of his predecessor. Secretary Houston had suggested additional tax levies on the automotive industry calculated to yield $290,000,000 over and above the present rate of return. The Houston plan intended to double excise tax, levy a horse-power tax and two cents per gallon on gasoline. No mention was made of these propositions in the Mellon letter to Chairman Fordney, but it is expected that Treasury experts will discuss the suggestions in testifying before the committee next week. Dr. Adams, chairman of the tax advisory board of the Treasury under Houston, framed the former Secretary's recommendations, but did not include them in the latest report.

General Sales Tax Opposed

Mellon advised Congress that the only way to stop these additional internal taxes on automobiles and stamp assessments to an aggregate of between $250,000,000 and $350,000,000, would be to cut Federal expenditures. The Treasury believes the miscellaneous specific sales taxes and excise taxes, including transportation, amusement, tobacco and capital-stock taxes, should be retained, but fountain drink assessments and other minor tax should be abolished. The Secretary made clear that he could not recommend at this time any general sales tax, particularly if it were designed to supersede the highly productive special sales taxes now in effect on many relatively non-essential articles.

In proposing repeal of the excess profits tax, Mellon urged that loss of revenue should be overcome by modified taxes on corporate profits of a flat additional income tax on corporations with repeal of existing $2,000 exemption applicable to corporations. He said flat tax on corporate income at the rate of 5 per cent and exemptions removed would yield $400,000,000. Furthermore, the Treasury recommended readjustment of the income tax rates to a maximum combined normal tax and surtax of 40 per cent for taxable year of 1921 and 33 per cent thereafter. Secretary Mellon declared in favor of carrying forward net losses of one year as a deduction from the income of succeeding years.

The question of tariff levies was discussed briefly by the Secretary in connection with proposals for imposing sufficient new or additional taxes of wide application, "such as a license tax on the use of automobiles." He stated that if economies in Government operation were impossible, "it might be feasible to provide perhaps as much as $100,000,000 or $150,000,000 of the necessary revenue from new duties on staple articles of import, and the balance by taking more effective steps to realize on back taxes, surplus war supplies and other salvageable assets of the Government."

Would Stop Tax Exemptions

The Secretary deems it advisable for Congress to take action by statute or by constitutional amendment to prevent further issues of tax-exempt securities.

With the National Automobile Chamber of Commerce demanding that the floating debt be retired without delay, it is significant to note that the Secretary of the Treasury advised Congress that "if the country can not look to any plan for funding the floating debt to reduce the burden of internal taxes during the next two years. Substantial cuts in current expenditures offer the

(*Continued on page* 985)

TREASURY HEAD ASKS TAX ON HORSEPOWER

WASHINGTON, May 2—Secretary Mellon's proposal to place a Federal license on automobiles is a much discussed topic. Mellon said he understood about 9,000,000 automobiles would be subject to the tax, the number depending upon whether motor trucks were taxed. He believed that they should be subject to the Federal tax which he proposed.

The plan now being considered involved a tax of about 50 cents per horse power on the lower priced and lower powered cars, and a tax which might reach a maximum of $50 on high powered, expensive cars. Such an arrangement would call for a sliding scale of rates.

Aluminum Exemption Now Up to Congress

Final Appeal for Tariff Reduction Is Made by N. A. C. C. Representative

WASHINGTON, April 30—Automobile manufacturers made their final appeal to the tariff framers to-day for a reduction of the present rate of 2 cents on aluminum and crude aluminum. It was pointed out that manufacturers would find it difficult to fall in line with general price reductions, if higher tariffs were enacted, because of the increased cost of aluminum. Statistics were submitted by George F. Bauer, of the foreign trade committee of the National Automobile Chamber of Commerce, showing that the cost of aluminum in this country has increased in about the same proportion as the duty has advanced.

He declared that in 1914 when the tariff was fixed at 2 cents, aluminum sold at an average price of 19 cents per pound, and with a duty of 7 cents, under the tariff act of 1913 the average cost of aluminum was 23 cents per pound, representing a difference in the increased price of 4 cents, or nearly the amount of difference between the duty prevailing in 1914 and 1913 respectively.

Bauer stressed the fact that increases were reflected in the prices of automobiles. He submitted several illustrations showing the increased use of aluminum in the medium priced and high priced cars because of the lightness of the metal. The committee was informed that automobile manufacturers would be forced to turn to substitutes for aluminum and thereby put them at a disadvantage with foreign competitors.

Bauer accompanied Milton Tibbitts of the Packard company, and A. B. Whitbeck of the Chandler company in presenting their views to numerous Congressmen who have asked for information on the subject.

DESIGN AIRSHIP SLIDE-RULE

WASHINGTON, April 30—The design of a slide-rule for use in airship navigation has been completed by the Bureau of Standards and a report made to the three military and naval bureaus interested in this problem. Each report was accompanied by a model slide-rule. The report contained, in addition to the general description of the rule and its use, detailed instructions for laying off of all the scales and some thirty illustrated problems showing how to use the instrument. It is understood that a considerable number of these rules are being ordered by the air service.

Receiver Is Named for Austin Company

Insufficient Capital for Operation of Big War Plant Held Responsible

(*By cable to* AUTOMOTIVE INDUSTRIES)

LONDON, May 2—The appointment of a receiver for the Austin Motor Co. was not unexpected because it has been in financial difficulties for some time. The company has been handicapped since the war with too large a factory for the capital available, and it was unable to reach the heavy production needed to carry the burden. Its prospects were good and steadily improving as the output of tractors and cars increased. The Colonial trade also promised well.

Before the war the stock issued consisted of 400,000 ordinary shares and 250,000 7 per cent preference shares of $5 par value. This was increased by an issue of 1,000,000 6 per cent preference shares in 1919 and 1,500,000 10 per cent preferred shares in 1920. Ordinary stockholders last year received an allotment of 200,000 shares as a dividend. It had been said recently that the financial status of the company was assured by the backing of a private financier. Prospects improved on that statement, although creditors were none too hopeful of the situation. Quotations for ordinary stock have dropped to less than $1 and on preference stock to 50 cents.

An official legal statement reporting the negotiations for financing the company admits the difficulty in view of the continued stringency of the money market, but states that negotiations are proceeding, although it was considered necessary to conserve the interests of the business by appointing a receiver and manager.

Has Many Orders on Hand

Orders on hand are sufficient to keep the works going for some time. A special meeting of stockholders will be called to reconsider readjustment and finances.

The chief problem is to avert action by creditors, any one of whom may sue for compulsory liquidation which leaves the onus of resistance on other creditors.

The rapid fall in British car prices increases the difficulty of raising money for Austin. The outlook depends rather on personal confidence in Herbert Austin than on the economics of the situation for the coal strike is having an adverse effect on the demand for automobiles.

Austin recently announced that it had organized for the production of a light 10-hp. car on the lines of its 20-hp. model, which the new model would supplement. The new line was promised at a popular price.

Humbers have also introduced an improved and enlarged edition of their 10-hp. chassis, which has attained great popularity since it was originally put forward in 1913. The new model has an engine of 3 mm. larger bore (68 x 120 mm., 23 b.hp. at 2000 r.p.m.), and with both two and four-seated bodies is a production falling but little short of the highest grade in chassis, bodywork and equipment. It is, in fact, put forward very largely to meet a pronounced current demand for high-grade small cars.

First Mexican Show Stirs Wide Interest

(*Special to* AUTOMOTIVE INDUSTRIES)

MEXICO CITY, May 2—The first automobile show ever held in Mexico City opened at noon Saturday with a large attendance and every indication of being remarkably successful. There is keen enthusiasm among the exhibitors and dealers are optimistic over sales prospects. Even those dealers who contended it would be impossible to stage a successful show admit they are greatly surprised at the interest displayed.

Factory representatives from the United States also are delighted with the success of the exhibition, and declare the show would be a credit to New York or Chicago. There are numerous attractive displays together with a considerable number of special chassis cars.

Sales closed the first day totaled 32 passenger cars and six trucks.

The feature of the opening day of the show was a brilliant dinner in honor of President Obregon which was attended by all high Government officials, diplomatic representatives of the United States, England and France, presidents of all the chambers of commerce in Mexico City and prominent business men and financiers.

Exhibits 65 in Number

Sixty-five vehicles are displayed at the show, which is held in the New National Theater. This includes 48 passenger cars, 11 trucks and six tractors. The exhibition includes three Haynes, three Moons, three Overlands and two each of the following cars: Auburn, Cadillac, Chandler, Cleveland, Dort, Franklin, Kissel, Lexington, Lone Star, Mercer, National, Pierce-Arrow, Ranger, and Studebaker.

Single car displays are made by Apperson, Chalmers, Bour Davis, Essex, Hudson, Maxwell, McFarlan, Gardner, Mercedes, Premier and Willys-Knight.

There are two Federal trucks, two Rangers, two Service, one G. M. C., one Gary, one L. M. C., one United States and one Wichita.

The tractors shown are Ranger, Titan, Oilpull, Case, Hart-Parr and LaCrosse.

Fiat Workers Agree to Company's Terms

Factory Down Since April 1 to Resume Production—Berliet to Liquidate

(*By cable to* AUTOMOTIVE INDUSTRIES)

PARIS, May 2—Eight thousand of the 12,000 employees in the Fiat factory have signed an agreement to return to work under the owners' conditions, and it is probable that the factory, which has been closed since April 1, will resume operations in the near future. The lockout was declared by the management over the question of who should have authority to dismiss workers. The men asserted this authority should be vested in shop committees. The workers also protested against production of war material to be used against Soviet Russia. The Fiat company contended that this war material was for South America.

The Berliet company has made application to the courts for voluntary liquidation. Attempts to escape from its financial difficulties by abandonment of Marius Berliet's founder shares failed. The government opposed this plan because Berliet has not yet paid its war profits taxes.

The retail price of gasoline in France is expected to drop 20 cents a gallon this week when the Government will abolish the import monopoly and liquidate large war stocks at the present market prices, getting compensation for this loss by a tax on importation. A further drop is expected when the new law goes into effect.

The Packard Motor Car Co. is abandoning its French sales service organization.

To Reorganize Parts Service

NEW YORK, May 3—Officials of the Packard Motors Export Corp. here stated to-day that they had learned only yesterday of the discontinuance of the Packard service station at Paris. This station, which was quite extensive, has been under the supervision of the factory at Detroit and did not come within the jurisdiction of the export company. It was closed, according to information here, pending a possible reorganization by which it would come under the export division, whose general offices are centered here. The French market, it was said, would not be left unprotected long but it was too early yet to announce a definite policy.

Goodrich Sets Pace in Tire Price Cuts

Reduction of 20 Per Cent Restores 1913 Price Level—All Lines Included

AKRON, April 30—With the B. F. Goodrich Co. announcing a 20 per cent flat decrease in prices of cord and fabric pneumatic automobile tires, effective Monday, May 2, substantially all of Akron's tire companies are expected to make similar announcements within the next few days.

Admittedly the Goodrich action was entirely unexpected by other rubber companies at this time, and came as a surprise to most motorists and tire dealers. Inquiry at the Miller, Goodyear and Firestone factories reveals the fact that the Goodrich cut had not been anticipated and that these companies had not so far considered any similar action. With the Goodrich announcement, however, production and sales departments of all these companies were called into conference to discuss the advisability of following suit.

At each one of the three concerns it was stated that no prediction would be ventured as to what action may be taken, although from a standpoint of competition, if none other, it is regarded as apparent in Akron that all other tire companies will be compelled to drop prices to a level of the new Goodrich price sales.

The Goodrich price slash is admitted by officials to be a frank bid for additional business. Whether or not the cut is justified by decreased manufacturing costs is a matter of considerable debate. The cut is not regarded as justified, in view of the raw materials situation, although the price of raw materials has dropped substantially 100 per cent from peak. Small tire concerns may benefit by this, but such concerns as Goodrich, Goodyear and Firestone are known to have on hand large supplies of raw materials, purchased at peak prices last year, while Goodyear, and possibly the others, are obligated to pay the peak prices for supplies contracted for at that time, and yet to be delivered.

Price Back to Pre-War Basis

The Goodrich price reduction carries tire prices back to their pre-war level, and virtually restores prices existing in 1913. Tire prices dropped in 1913, but in 1914, due to the war, were slightly increased. From that time until last year they increased on an average of 37 per cent. Prices were cut within the last six months by practically all companies, the cut averaging about 15 per cent. Thus with the latest 20 per cent reduction, the prices of Goodirch tires, at least, go back to the 1913 level.

This is considered significant for the motorist, as the 1914 tire gave an average service of 4000 miles, while the tire of to-day has greater durability and gives a fair average of 8000 miles. A tire costing $50 in 1914, and giving 4000 miles service, made the tire cost per mile of motor travel one and one-quarter cents. The 1920 price of the same tire was about $70, but the tire gave at least twice the mileage, reducing the tire cost per mile to seven-eighths of one cent, despite the fact the tire cost $30 more. But with the present 20 per cent drop, in addition to the cut made a few months ago, the 1921 tire, giving an average of 8000 miles service, costs no more than the 1914 tire, which gave only half the mileage. This then reduces the cost per mile, per tire, to five-eighths of a cent.

The comparison of mileage costs is

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Jordan Prices Down $400 on All Models

CLEVELAND, May 2—Effective today, prices on Jordan cars are reduced $400. The new schedule of prices follows:

	New Price	Former Price
5 passenger touring	$2250	$2650
Roadster	2250	2650
7 passenger touring	2475	2875
4 passenger closed brougham	3300	3700
5 passenger sedan	3300	3700

Speaking of the reductions, President E. S. Jordan said:

"The automobile business is coming back. We are very fortunate in that we have liquidated all our inventory and we are buying and producing on a quantity basis.

"Our production has now reached 100 per cent and the new price will justify itself by doubling our production, thereby greatly reducing our overhead. We find that the purveyors of materials are willing to grant price concessions when a firm order for material is offered to them. The Jordan company always had been in a strong financial condition. In spite of slow production during the winter all obligations were met in a satisfactory manner."

W. D. Riley, sales manager, said salesmen and distributers would be instructed to emphasize that Jordan has made a bonafide revision of prices downward. "Since September, 1920," he said, "it cannot be shown that this company raised prices after announcing cuts."

VICTOR DEFERS PRICE ACTION

SPRINGFIELD, OHIO, May 2—Directors of the Victor Rubber Co. made an inspection of the plant here and were advised by President H. S. Berlin that prospects are encouraging for a busy season. The daily production is 500 tires, which is the normal output of the works. General conditions are excellent, according to Treasurer H. H. Durr. There is a good demand for cord tires, it was stated. All of the present policies of the company were confirmed by the directors at their conference Friday at Hotel Shawnee following the plant inspection. So far no reduction in the price of tires has been announced. Berlin said that some announcement would probably be made soon.

Marmon Cuts Price to New Cost Basis

Reductions Range from $1,015 to $1,400—Look for Business Stimulation

NEW YORK, May 2—Reducing the price of the Marmon 34, seven-passenger, four-passenger, and club roadster cars from $5,000 to $3,985, effective today, is the most important action in the price field that has taken place since the reductions last fall. The Marmon reduction of over $1,000 makes the new price of $3,985 one based on the lower production cost of the next eighteen months, and is a complete reduction rather than a series of minor ones, and as such should have a stabilizing influence. Reductions on the other body models are:

Model	Former Price	New Price
4 and 7 passenger	$5000	$3985
Speedster	5300	4185
Coupe	6150	4875
Sedan	6600	5275
Limousine	6800	5400
Town car	6800	5400

Commenting on the reduction, Vice-President Moskovics said:

"We believe that the spirit of our reduction is in keeping with the demands of the American public and in accord with the spirit of the times. We do not believe that any company can sit tight on its inventories purchased during the period of high prices and assist in starting the prosperity in this country.

"A stand-pat price policy is not in accord with the recent announcement of a 14 per cent reduction in steel.

"Material can now be purchased for less than was the case a year ago. Present inventories are worth only their reproduction value. So we have disregarded prices paid for present inventories and figured instead what materials and labor can be purchased for now or in the immediate future. We believe the public is entitled to purchase its needs at present day valuations and my company is willing to sell its motor cars regardless of the necessary sacrifices.

Increased Buying Expected

"Not only this, but Marmon believes that this radical price reduction will broaden its market four fold and enable it to utilize the tremendously increased manufacturing facilities of its Indianapolis plant."

Marmon has made no changes in discounts to distributers, sub-dealers or direct dealers under the new prices. One reason back of the heavy reduction is that of not making any provision for long trades and thereby encouraging the over-appraising evil at a time when the used car market is heavily overstocked throughout the country. From many parts of the country have come reports of too high appraisal on cars which has brought severe criticism from many distributers handling various lines, and a decisive price reduction should stabilize rather than disturb used car values.

Receiver Is Named for Hartford Parts

Friendly Action Is Undertaken to Permit Company to Continue Operations

HARTFORD, CONN., April 30—Judge Edwin S. Thomas in the United States District Court has granted the application for the appointment of a friendly receivership for the Hartford Automotive Parts Co. so that the assets of the company may be preserved from unfriendly creditors and the company be permitted to secure its finances. R. E. Carpenter, president of the company, and Cyrus C. Chamberlin of Southington, are named as temporary co-receivers. It is anticipated that application will be made shortly to have the receivers permanent.

The company has a factory in Hartford and another in Kalamazoo, and has a large amount of stock on hand and many orders. In the opinion of Peter A. Frasse & Co., who maintain a distributing office in Hartford, the Hartford Automotive Parts Co. could reestablish itself financially if permitted to complete its orders. The Frasse company through its attorney made the application for the receivership.

The receivers have been ordered to file their bonds of $100,000 and they are permitted to conduct the business as long as it can be conducted at a profit. R. E. Carpenter was recently made president of the company, which has been one of the leading manufacturing enterprises of the city. The company some time ago removed to the former Billings & Spencer plant.

URGES AIRCRAFT FOR NAVY

WASHINGTON, April 30—Establishment of a bureau of aeronautics in the Navy Department has been recommended to the Senate in the report of the Senate Naval Affairs Committee. The Keyes bill which the committee favored provides for a central authority with the bureau independent of the other aviation groups of the Government. Passage of the bill is expected at the special session, for nation-wide interest has been aroused by demonstrations of the efficiency of aircraft as naval auxiliaries for offense and defense.

MARATHON TAKES OVER BURLOCK

WAUSAU, WIS., April 30—The Marathon Rubber Products Co. of Wausau, Wis., a new $300,000 corporation, which takes over the plant and business of the defunct Burlock Rubber Co. of Wausau, has resumed the operation of the plant. The officers of the new company are: President, J. H. Elliott; vice-president, F. G. Schneider; secretary, Roy E. Chellis; treasurer, Harold E. Damon. E. B. Helwitz, an expert in rubber manufacture, has been appointed general works manager.

The company begins operations under favorable financial conditions, being free from debt and having from $75,000 to $100,000 worth of raw material on hand, paid for, besides some finished goods. Practically all of the 200 stockholders held shares in the defunct company and pooled their issues to purchase the property for $65,000 in cash at receiver's sale. The old Burlock company was a $250,000 corporation and its liabilities at the time of bankruptcy a month ago were $164,-507.65.

Small Stockholders to Advance $200,000

INDIANAPOLIS, April 29—Steps are to be taken immediately to rehabilitate financially the William Small Co. of this city, automobile manufacturers. At a recent meeting here of the stockholders it was decided to refinance the company immediately. The stockholders, after looking over the plant and seeing what has been done, agreed to subscribe the additional money on one, two, three and four-year notes, non-interest bearing to the extent of $200,000. According to William P. Small, founder of the company, this amount will enable the company to discharge the receiver through payment in full of the creditors and will put the plant back on its feet.

The stockholders, through the directors, declared, following the meeting, that the company was solvent and all it needed was some emergency money. Production has never been stopped and will be increased as the sales department is developed. The new directors elected at the meeting are William P. Small, Walter G. Todd, John Rau, Elmer E. Stout, J. F. C. Martin, E. L. Jacoby, T. A. Lavelle, D. L. Fryer, Carl Rost, W. A. Moore and D. H. Lockwood. Small, Todd and Martin were re-elected. The number of directors was increased from five to eleven.

Miniger to Continue As Auto-Lite President

TOLEDO, April 30—The election of C. O. Miniger as president of the United States Light & Heat Corp. has given rise to the belief that he had resigned as president of the Electric Auto-Lite Corp. On the contrary, Miniger retains his position at the head of the Auto-Lite, and D. H. Kelly, who has accepted the vice-presidency of the United States Light & Heat Corp., will take active charge of that plant at Niagara Falls. Kelly formerly was with Miniger at the Toledo plant.

TO BUILD NEW SNOW PLOW

MILWAUKEE, April 30—The Milwaukee Snow Conveying Co. has been incorporated with a capital stock of $25,000 to develop an invention of A. F. Krueger. This consists of a high speed rotary snow plow mounted on motor truck chassis. It plows a swath 10½ ft. wide, throwing the snow from 20 to 35 ft. to one side.

Ruggles Organizes New Truck Company

Will Start Manufacture with Two Models in Saginaw—Has $2,000,000 Capital

SAGINAW, MICH., April 28—Following the completion of the organization and the election of officers, announcement was made here to-day of the formation of the new Ruggles Motor Truck Co., with a capitalization of $2,-000,000, to manufacture a light truck and two-ton truck, which will be followed ultimately by a complete line. Frank W. Ruggles, former president and general manager of the Republic Motor Truck Co., is president of the new company.

Ruggles is recognized as a leader in the motor truck industry. Under his guidance the Republic company of Alma, Mich., grew to be the largest motor truck manufacturer in the world. The new company has ample financial backing, and, with Ruggles' truck manufacturing knowledge and experience, the new Saginaw enterprise looms as a new giant in the truck field. Production on the models will start immediately and the first truck models it is expected will be ready for showing in July.

The officers and directors elected are as follows: Frank W. Ruggles, president; W. J. Wickes, vice-president; Ezra L. Smith, secretary; Walter C. Hill, treasurer; Charles T. Kerry, assistant treasurer; John F. O'Keefe, counsel. The directors are Ruggles, Wickes, Smith, Hill, Kerry, O'Keefe, Benton Hanchett, Julius B. Kirby, H. T. Robinson, Otto L. Dittmar, John J. Thorne and Harry H. Price.

Connersville Factories Find Business Growing

CONNERSVILLE, IND., April 29—There is no longer question that business is coming back in this automotive center. The Rex Mfg. Co., the pioneer winter-top manufacturers, was nearly out of business sixty days ago, but the orders are weekly increasing. The engineering department has been exceedingly busy the past thirty days. Then will come the production rush. This company has now taken up in earnest the California top and the demand for it equals the old standard top.

The blower companies that produce more than 50 per cent of the world's rotary blowers, gas exhausters, etc., are holding to about a 33⅓ per cent basis. President John T. Wilkin of the Connersville company will visit Europe in June in the interest of his company.

The Wainwright Engineering Corp., makers of pistons, rings and cylinders, some two years ago saw the future in replacement pistons in rebored cylinders and now have the entire United States covered through the jobbing trade. It is the busiest shop here.

Farmer Buyers Back in Columbus Market

Good Crop Prospects Bring Return of Rural Business—Unemployment Lessens

COLUMBUS, April 30—With the arrival of better weather, followed by a period of heavy rains and changeable conditions, demand for automobiles in Columbus and central Ohio territory is showing quite an increase. All of the dealers located in Columbus report a gradual expansion in their business with much brighter prospects for the future. Business is more settled than formerly and it is the consensus of opinion that the worst of the slump is over and that there will be a gradual increase in business during the coming two months.

All lines of cars are selling better than was the case during the month of March and early in April. This applies equally to the higher priced cars as well as to the medium priced and lower priced machines. One of the best features of the trade is the fact that rural dealers are now experiencing better business as there is more buying among the farming population. With prospects for good crops this year, the farmers are now coming into the market. All rural dealers are more optimistic, and the remainder of the year is expected to show good results.

City dealers are also having a better run of business as industrial conditions are righting themselves slowly. There is not quite as large an unemployment problem as formerly and this is having a good effect on every line of business, the selling of automobiles included. It is found that not as much work is required now in the sale of an automobile as formerly, people are inclined to go ahead and are not playing a waiting game as was the case several weeks ago.

The enclosed car is still one of the most popular types of passenger vehicles. All of the local dealers report a big increase in the sale of enclosed cars, while touring cars are not showing as well as the enclosed models. Runabouts still continue rather popular, as is shown by an analysis of the demand.

With business slowly improving in every line and also because of the fact that Columbus was not as badly hit as some other cities by the depression, the automobile industry is now getting on its feet with a vengeance. Dealers who have been somewhat pessimistic during the early parts of the year are coming out and their sales forces are hustling for business. These things have caused a better feeling in automobile circles generally.

SNOW HITS DES MOINES TRADE

DES MOINES, April 29—The first half of April has been a disappointment to the motor car dealers of central Iowa and has not produced the business that had been expected after the March spurt. Des Moines distributors almost without exception declare that April business for the first fifteen days was considerably behind the pace set by March. The falling off is largely attributed to weather conditions as a greater part of the month so far has been rainy and cold. Last week it started to rain early in the week and kept it up until Friday night when the rain turned to snow, and Saturday Des Moines had the heaviest snowfall of the winter. Nine inches of snow fell Friday night and Saturday.

G.M.C. Makes Changes in Unit Management

NEW YORK, May 3—General Motors Corp. announces that John L. Pratt has been appointed general manager of the accessory division of the corporation, with headquarters in New York City. He relieves Alfred P. Sloan, Jr., vice-president of the corporation, of direct supervision over the activities of the accessory units as follows:

Hyatt Roller Bearing	New Departure Mfg.
Remy Electric	United Motors Service
Jaxon Steel Products	Delco Light
Dayton Eng'r'g Laboratories	Klaxon
Harrison Radiator	Champion Ignition
Lancaster Steel Products	Frigidaire
	Dayton Wright

Pratt was formerly special assistant to the president of the corporation and chairman of both the inventories committee and the appropriations committee. Prior to coming with General Motors he was director of the Motors Development Division of the DuPont Co. His position now is similar to that held by Sloan under the Durant regime.

E. F. Johnson has been appointed general manager of the inter-company parts division of the corporation, with headquarters at Detroit. Johnson assumes direct supervision over the activities of the inter-company units as follows:

Saginaw Parts	Canadian Products
Saginaw Malleable Iron	Northway Motor
Central Foundry	Central Forge
Michigan Crankshaft	Central Axle
Central Gear	Lansing Axle
Saginaw Products	Muncie Parts
	Muncie Products

KOKOMO NEARS 1000 A DAY

INDIANAPOLIS, April 29—Announcement was made yesterday by Randolph Mitchell, assistant secretary of the Kokomo Rubber Co., that the record production for one day since the recent resumption of operation was 998 tires, while each day during the past week averaged 950 tires, and they expect soon to produce 1000 tires a day.

REVERE TO BE REORGANIZED

FORT WAYNE, IND., May 2—A new organization to take over the plant of the Revere Motor Car Corp. of Logansport, Ind., is now apparently certain. The plan is for the organization of a company with a capital stock of $500,000 among the old stockholders. This plan is meeting with approval.

Perrin to Direct Stevens-Duryea Work

Noted Designer and Engineer Is Chosen Manufacturing Executive of Company

CHICOPEE FALLS, MASS., May 2—John G. Perrin, one of the foremost engineers and manufacturers in the automotive industry, has been elected a director and vice-president of Stevens-Duryea, Inc., in charge of engineering and manufacturing. He has been serving for several months in a consulting capacity and now has consented to become permanently identified with the company.

The business career of Perrin was started as a draftsman in the Lozier bicycle factory in Toledo. He soon evinced a desire to learn the practical side of shop practice and apprenticed himself as a toolmaker. He filled various positions with the Lozier company and at one time was in charge of the plant at Thompsonville, Conn., where its screw machine work was done.

In the early days the Lozier company built bicycles and marine engines, but Perrin's inclination was toward motor cars. He aspired to design a fine car and in preparation for this work made an intimate study of all foreign cars. He went so far as to spend six months in the repair shops of the larger New York companies selling foreign automobiles.

He then designed the first Lozier car, but as the company was not ready to take up its manufacture he went for a short time to the Waverly Electric Car Co. at Indianapolis and designed for it a new model electric. The Lozier company soon recalled him, however, as its chief engineer. He later was made vice-president in charge of engineering and production.

When the Lozier company went out of business, Perrin became chief engineer for the Timken Detroit Axle Co. During the war he served in various capacities and finally was called upon to help the Willys-Overland, Ltd., of Toronto to fill a contract for Sunbeam airplane motors. Under his direction the company reached a production of five complete 8-cylinder Sunbeam engines a day before the war ended.

Perrin left Overland last fall to devote his time to personal interests. He had made definite plans for the future, but became interested in Stevens-Duryea and now has cast his lot definitely with that company.

DELIVERIES HANDICAP TRADE

TORONTO, April 29—Much more grousing is heard in the trade regarding deliveries than sales. Indeed, a recent canvass showed that almost without exception distributors and dealers have been agreeably surprised with the "comeback" of business, several leading companies reporting better business than last year—"every month so far ahead of corresponding month of 1920."

Cotton Financing Cuts Car Credits

New Orleans Dealers Feel New Stringency as Crop Selling Plans Materialize

NEW ORLEANS, May 1—Somewhat improved conditions in the sugar market; the working out of cooperative plans for selling the $18,000,000 to $20,000,000 worth of cotton now held in warehouses in this part of the South; heavy planting of crops other than cotton and sugar, and the general feeling that Louisiana, Mississippi, Texas and Alabama have suffered less from the recent business depression than most other sections of the country, helped to keep the retail automotive business in New Orleans for April up to the good figure set in March.

Sales of standard cars were about 80 per cent of those of eighteen months ago; sales of the higher priced cars about 65 to 70 per cent, while, like Abou Ben Adhem, the Fords "led all the rest," with sales of between 95 and 97 per cent normal. There is no denying that Ford dealers, combined with Ford price-cuts, have "put one over" in the automotive industry in this part of the South. Scores, probably hundreds, of men in Louisiana who had intended to buy higher priced cars on time payments are driving Fords—the little sedan especially having been the hit of the season—for which they have paid in full about what they would have had to pay for the first payment on a more expensive car.

Reports from the country, and especially from the city centers of distribution outside New Orleans and Jackson, indicate that the dealers in those cities and in the country have not fared so well as their New Orleans brethren. The reason seems to be that the city dealer learned a rather expensive lesson on the used car during the war period and is cutting his allowances for used cars down to a minimum or not taking them at all, while the country and small-city dealer is still over-stocking himself with used cars, and is trying to get rid of some of them, to the exclusion of his new car business.

Used Cars Pile Up

This condition also complicates the used car situation, and the purchase of a car has become a matter of haggling on both sides, concessions on the part of the dealer, and a stiff position held by the prospective purchaser, since this is essentially a buyers' market, as it has been for several months. The banks have been calling on the dealers for close margins on their loans, and—despite the impression the bankers are trying to make, that they are "helping the automotive industry"—renewals are difficult, and the majority of the banks look with anything but favor on automobile paper. This being the case, the dealer who is loaded up on used cars simply HAS TO MOVE HIS STOCK.

Obviously this is a situation which is full of dynamite for the industry, but it has worked out in favor of the city dealer as against his country brother, because the city dealer, having taken in used cars at a minimum price and still held his figures on the new cars he has sold to these used car owners, is in a better position to put out "bargains" in used cars, and even to reduce prices under those of his bargain sales, than is the country dealer. One city dealer estimated to the writer that 65 per cent of the automobile dealers in Louisiana outside New Orleans are to-day overstocked on used cars.

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St. Louis Makes Ready for Big Buying Period

ST. LOUIS, April 29—A general survey of retail trade conditions in this city reveals the fact that the sales and and trend of indications of the past two months are leading dealers throughout the entire territory toward the expansion of their sales forces and the perfection of systems for the efficient handling of what they believe will be a great buying period. In preparation for the expected prosperity many local firms are holding special training schools for their new and veteran salesmen; many new service stations and gasoline filling stations are being erected, and many innovations are being intrdouced by various dealers.

Robert E. Lee, secretary of the St. Louis Automobile Dealers' & Manufacturers' Association, declared that the past seven weeks have given sufficient indication of a marked improvement in the motor car business.

"Many firms in this city," he said, "have done a larger business in April than they did in April of last year. And the sales are not confined to the small and inexpensive cars, many of the larger and more costly machines being greatly in demand. The banks are in a splendid condition. In fact, better than they have been for some time."

IMMEL PLANT TO BE SOLD

COLUMBUS, April 29—Robert H. Schryver, receiver for the Immel Co., makers of automobile bodies, has applied to the courts for authority to sell the plant and all assets. Schryver states in his petition that there are no orders on which work can be started. The plant has been closed for several months and the organization has been disrupted as a consequence. It is believed that the sale will occur about June 1.

DU PONT CUTS VARNISH PRICE

WILMINGTON, DEL., May 2—Substantial reductions on all lines of varnishes have been made by the E. I. du Pont de Nemours & Co., Inc., effective to-day. The reductions range from 25 cents a gallon on the lower grades to $1 a gallon on the high-class product. The company declares the reductions are warranted by the reduced cost of production and by the increased volume of sales.

April Selling Drop Mystifies Atlanta

Dealers Look to May to Bring Renewed Buying—Truck Sales Low

ATLANTA, April 30—Dealers and distributers in the Atlanta territory are at a loss to understand just what has happened to slow up automobile sales the past three or four weeks. There is no question but that sales have fallen off and even the most optimistic distributer will admit it, but none of them seem to exactly understand its cause. During and immediately following the Atlanta automobile show the early part of March sales were unusually good considering the period of depression the industry had just passed through, but early in April the Atlanta dealers began to note a decline in sales.

This has continued almost the entire month, and while April sales will compare favorably with March, considering the fact that the show was held during the latter month, April sales should have greatly exceeded March, in the opinion of most of the dealers. Warm weather has come in earnest and generally early spring witnesses an increased demand for motor cars. As yet, however, it is not noted in the Atlanta territory. The dealers are still optimistic enough as regards the future, and confidently believe that May will note a steady increase in the volume of sales.

Truck sales are at a very low ebb and have been for several months. While there may be some improvement in truck business the next month or two no great activity in that regard is expected until all lines of business in this section return to something like normal. Conditions are very bad in the lumber industry and the agricultural industry, two big users of motor trucks and tractors in the Southern field. Until conditions materially improve in these and other important industries of the South, there can be no great demand.

Saxon Sells Service on All Former Models

DETROIT, April 30—Through a deal consummated with the Saxon Service Corp. the Saxon Motor Car Co. relinquishes parts service rights on all Saxon cars running up to the time the Saxon Duplex was put on the market, in consideration of $550,000. The Saxon Motor Car Corp. has $500,000 outstanding bank loans of which it will pay $400,000 and also $85,000 to merchandise creditors.

This deal will permit the Saxon company to start production of its new model with the Gray engine immediately, President C. A. Pfeffer said to-day. Production on the new model is not expected to reach capacity output of 100 daily for some time. It is understood that the Saxon Service Corp. is controlled by Maurice Rothchild of Chicago.

British Competing for Japanese Sales

American Cars Dominating Market—Local Advantages of Both Cars Compared

SEATTLE, April 29—Of the 9000 automobiles now in use in Japan, fully 75 per cent are of American manufacture, in contrast to the situation before the war when British and Continental cars dominated the market. It is reported that British cars are again arriving (in very few numbers, however) in Japan and in other Far Eastern countries.

The average type of car used in Japan is medium-priced, open model, retailing on the market for from 7000 to 8000 yen (yen 50 cents normally).

A Japanese publication just received here from the Orient says that the typical British export model is a four-cylinder job, having a 15 horsepower, and actually developing 30. The L-head system survives. Ignition is by high-tension magneto, and the carbureter is conventional, with gravity feed from the gasoline tank, which is usually located in the dash. Lubrication is by force feed, with pump, and the cooling system is conventional.

The engine, on the whole, is of fairly clean design and very good workmanship, and accessibility is a feature. A cone clutch is used, and the transmission, which is placed amidships, provides four forward speeds and one reverse. Final drive is by propeller shaft to a bevel-geared rear axle. A great many cars of this type use an under-slung worm type of final drive. In either case a torque tube is employed, and the rear springs are cantilevers. The foot brake operates on the propeller shaft and the hand brake actuates expanding shoes in the rear wheel drums. The front springs are semi-elliptic and the steering is conventional.

American Type Most Powerful

The corresponding American type is described as a light six, rated at about 25 horsepower and actually developing about 50. The engine is of high-speed design. It is a block casting, with three bearings and all valves are on the same side. Ignition is furnished from the battery of the starting and lighting system, but many American manufacturers equip all cars for export with a high-tension magneto in addition. The carburetor incorporates some device for pre-heating the fuel, and feed is through a vacuum tank located under the engine hood, the gasoline tank being between the frame members at the rear of the chassis.

The cooling and lubrication systems are similar to those employed on the British model. The clutch is a dry-plate disk, and the transmission, which provides three forward speeds and a reverse, is a unit with the engine. Drive is by open propeller shaft through spiral bevel gears to the rear axle, both drive and torque being taken by the rear springs, which are semi-elliptic, very long, almost flat, and shackled at one end only. The rear springs are underslung from the rear axle. Both hand and foot brakes operate on rear wheel drums, the former expanding and the latter contracting. The front springs and steering system are similar to the English model.

Mechanically, the two models are described by the Japanese critic as quite different. The American is given credit for being far more powerful, and its flexible engine and low gearing provide a wide range of speeds in high gear. The British car is pictured as the better piece of machinery.

Exchange Rates Hurt South American Sales

BUENOS AIRES, April 1 (*By Mail*)—With the rate of exchange between Argentina and the United States at 131 per cent dealers in this country have been obliged to sell many cars at a loss partly due to the impossibility of competing with European cars that are now entering the market. Several makes of American cars have sold well notwithstanding this handicap. Many dealers of American cars are carrying large unsold stocks in their agencies and in the custom house as well.

The accessory business has suffered severely, due to the very large stocks on hand of practically all kinds of accessories. Some are trying to sell these at any price and there is good hope that the situation will soon improve and approach normal.

The sale of trucks in most of the South American countries is in its infancy but the conviction is general that there will be little extension of railway lines and that the building of highways and installing motor truck service furnishes a more flexible and cheaper scheme of transportation. In all countries of South America this phase of truck development is one of the most attractive. To-day there is in Argentina a total lack of good highways and truck use is largely confined to the cities and some of the larger farmers. Road building sentiment is on the increase. What is needed is some road promotion organization that will spread good roads propaganda.

The sale of passenger car tires has not diminished in cities like Buenos Aires due to the large number of cars used as taxis in the summer months of November, December, January and February. European competition is intense and some of them are offering their goods at very low prices.

PANAMA TO BUILD ROADS

NEW ORLEANS, April 30—The Republic of Panama has commenced work on a nation-wide system of good roads, according to announcement by the consul of that country in New Orleans. The plan is to connect Panama City, the national capital, with the capital of each State of the republic by an automobile road. "Good roads throughout the country will increase production and raise the buying power of the people."

Australia Suffers Wave of Depression

Little Buying Looked for Inside of Year—Automobile Stocks Six Months Ahead

SYDNEY, AUSTRALIA, April 11 (*By Mail*)—The wave of depression which swept across the United States in June, 1920, has reached Australia, which is now in the throes of the worst trade depression the Commonwealth has known. This general trade depression is bringing in its train a large army of the unemployed. It will be twelve months before this country is in condition to buy automobiles and before trade is back to where it was a year ago. Practically every automobile dealer in Australia is loaded too heavily with cars, and a conservative estimate shows that there is a six months' supply on the dealers' hands, which is too heavy for an industrial condition such as exists to-day.

The bottom fell out of the used car market and good used cars can now be purchased at one-third to two-thirds of what they sold for a few months previously.

Although Australia had a good wool clip there is not much market for wool. The wheat crop was a record one, but before the crop was harvested overseas markets had fallen, and to-day the Australian farmer is much like the American farmer, very short of cash, and not a potential buying factor for the next few months.

Another important factor entering into the automobile situation is the difficulty of New York and London selling bank drafts. Australian bank credits held by Australian bankers in London are exhausted. Consequently the only way to do business is a letter of credit of 30, 60 or 90 days' maturity, and the banks are very reluctant to issue such.

INDIA FIELD FOR TANKS

WASHINGTON, April 29—Consul Weddel, in a report to the Bureau of Foreign and Domestic Commerce, expresses the belief that a growing market for portable tanks could be developed in Calcutta, India, and surrounding district, if properly introduced. At present, he says, gasoline in Calcutta is distributed by the oil companies to dealers by means of small handcarts with a capacity varying from 10 to 30 two-gallon tins, drawn by coolies.

SOUTH AFRICA IMPORTS HIGH

WASHINGTON, April 30—According to American Trade Commissioner Stevenson of Johannesburg, South Africa, official figures for the first 11 months of 1920 show imports of passenger cars into South Africa numbering 9150, valued at $18,378,765 at the normal rate of exchange. Lorries to the number of 239, valued at $601,205, were imported during the year.

Collins to Build New High Grade Car

Durant Stockholder But Company Will Be Independent—Merger Story Denied

NEW YORK, May 2—The following statement in reference to the future plans of R. H. Collins, whose resignation as president and general manager of the Cadillac Motor Car Co. was accepted last week, was authorized to-day:

"The Collins Motor Car Co., a Michigan corporation with a capital of $10,000,000, is being organized to manufacture a high grade car bearing the name Collins. The car will be ready for the inspection of the public Jan. 1, next. Collins, with a few of his former associates and personal friends, will control the company. The plant will be located in Detroit."

This statement, prepared in the New York headquarters of W. C. Durant, shows that there has been a sudden change in the original plans under which Collins was to head the Michigan subsidiary of Durant Motors, Inc., which was to be known as the Durant-Collins Co. There will be a Durant-Michigan company, but it will produce the Durant four-cylinder car. The original plan called for the production of a high grade car to be known as the Collins, and this part of the program has not been abandoned, although the car will be made by an independent company. Durant will be a large stockholder in the Collins company.

While Durant will be intimately associated with Collins in the new company, the corporation will not be, strictly speaking, a subsidiary of Durant Motors, although the business relationship between the two is expected to be close. No details of the corporation's plans are available beyond those contained in the statement. This would indicate that there is no basis for the report from Cleveland that the company would locate a plant in that city.

Plant Location Indefinite

It is understood that the Cleveland story, printed under scare heads in the newspapers of that city, was given publicity under a prearranged plan whereby it was to be printed as soon as acceptance of Collins' resignation from the General Motors Corp. was announced. This was done without consideration of possible changes in the plans.

The program, as it was understood in Cleveland, called for the location there of a large factory by the Durant-Collins Motor Corp. According to the Cleveland story, the car which it was proposed to manufacture there would compete with the Buick.

No details in regard to the Durant car have been made public, but it has been announced it would sell for less than $1000 and several officers prominent in the Chevrolet company have joined the Durant organization. The latest to go with him was M. J. Lahey, who has retired as sales manager of the Chevrolet Motor Co. of New York to become sales manager of the Durant Motors Co. of New York, which recently acquired the Goodyear plant in Long Island City. Lahey's successor has not been appointed by the Chevrolet company.

There was a sharp advance to-day in Pierce-Arrow and Studebaker stock on the stock exchange on reports that Durant was planning a merger of his company with them. It was emphatically denied at Durant's office that he had any interest whatsoever in Pierce-Arrow. So far as Studebaker is concerned, he recently has become a large stockholder in that company, but so far as can be learned there is no probability of it coming under his control.

Charles F. U. Kelly Now with Quaker Tires

PHILADELPHIA, May 2—At a meeting of the directors at the office of the Quaker City Rubber Co., Philadelphia, Pa., Charles F. U. Kelly was elected director of sales of the tire division of the company, which also manufactures a full line of mechanical rubber goods.

Mr. Kelly has been engaged in directing tire sales practically all his life. He began selling tires to the bicycle industry in 1893 and with the exception of a much needed rest during the past year has been continuously engaged in tire selling. His experience is far reaching, having been associated in the past with such concerns as Goodrich, Pennsylvania, Racine, Continental and Lee.

Sales offices have been opened at 1664 Broadway under the name of the Quaker City Rubber Co., Tire Sales Division, from which address Mr. Kelly will conduct the selling campaign.

Mr. A. H. Thomas, formerly associated with Mr. Kelly, has again returned to his old employer and will assist in the promotion and sale of the Quaker City tire products.

NASH OUTPUT 79 PER CENT

KENOSHA, WIS., May 2—The plant of the Nash Motors Co. is operating at 79 per cent of normal and the new factory in Milwaukee is increasing production daily. Orders for May show a healthy increase over April. Low ebb in Nash production was reached in December with a total of 714 cars. The tide began to turn in January and production in March had jumped to 2081. The production schedule for April called for 2311.

CANADIAN FORD RESUMES

DETROIT, May 2—The Ford Motor Co. of Canada has resumed full time operations with a normal force of 2900 men, according to Wallace R. Campbell, secretary of the company. The plant has been closed on Fridays and Saturdays each week for the last six months.

Eaton to Push Plans to Restore Standard

Resigns as Joint-Receiver of Company to Further Reorganization Work

CLEVELAND, May 2—J. O. Eaton, who has for some months been a joint receiver of the Standard Parts Co. with Frank A. Scott, yesterday presented his resignation to Federal Judge D. C. Westenhaver. It was stated that Eaton resigned to devote himself to bringing about a reorganization of the big $20,000,000 automobile parts concern that has been in the hands of a receiver since last September. Eaton will cooperate with the creditors' committee, which has presented a plan for placing the corporation on a permanent business basis.

At the same time it was learned that within the next ten days letters endorsing the creditors' plan probably will go to stockholders from their special committee that had been named to consider the proposal. From now on special effort will be made to complete the reorganization. Prompt action is regarded as highly necessary, in view of the satisfactory conditions in the automobile trade and the demand for products made by the corporation.

Cyrus S. Eaton of Otis & Co., originator of the creditors' plan, has issued a statement to stockholders, in which he urges them to support the latest proposal. In his address he first calls attention to the fact that a distinction between creditors and stockholders must be borne in mind. The creditors loaned to the company money which became due last September, and the stockholders contributed money for an indefinite period in the hope of obtaining profits from the business; so that they assumed the risks of the enterprise.

Creditors Suspend Payments

The new financing plan which has been formulated provides for the formation of a new company to take over all the properties of the old corporation and for the issuance of $6,500,000 of 8 per cent first mortgage notes, maturing Jan. 1, 1924, and of 100,000 shares of no par common stock, all of this to be turned over to the creditors in payment of the company's debt to them. Inasmuch as the company's total outstanding debt is $10,000,000, this means that the creditors thus suspend collection of 65 per cent of their claims for the period of three years and accept stock in the company for the remainder. The plan also provides that stockholders in the old company are privileged to purchase from the creditors' stock of the new company.

"The plan involves a sacrifice by the creditors," said Eaton. "But an overwhelming number of creditors have been persuaded to accept it. If this plan miscarries no one is prepared to suggest an alternative."

Goodrich Sets Pace in Tire Price Cuts

Increased Mileage Makes Tires Cheapest in History—Other Companies Reduce

(*Continued from page* 978)

even more striking if made with 1910 tire mileages, and tire prices.

In 1910 a 34 x 4 tire cost about $53.40. The 1920 price for the same tire was $40.10, while the price up to May 2 has been $36.10. The Goodrich 20 per cent cut brings this tire down to $28.88, which means a difference or saving of $24.52 per tire, as compared to 1910 prices, and yet the tire of to-day gives three times the mileage given by the tire built in 1910. Figuring on this basis, the 34 x 4 tire to-day gives three times the 1910 mileage and costs more than 40 per cent less.

W. O. Rutherford, vice-president of Goodrich, in charge of sales, in discussing the company's announced tire price reduction, states:

"I presume that the reduction in tire prices was not unexpected by the motoring public. But it is safe to say that it is a much greater reduction than the consumer anticipated. The only question is whether or not it is too low.

"Putting business on a normal basis is not a job for one man or one concern. The public can do this better than any other force, and it will find both manufacturers and dealers more than ready to co-operate. Conditions in the automotive industry seem to be much better, and the outlook much brighter, and of course this will be reflected in the tire industry. Fair wages, honest products, right prices and a square deal all around are what will give producer, distributor and public real confidence. Recognizing this, we put our prices at the point we have announced."

Mason Makes Price Cut

AKRON, May 2—Mason Tire & Rubber Co. has reduced the prices of heavy duty cord tires 20 per cent and other prices in proportion. Preferred and common stock of the Mason Rubber Plantation Co. will be acquired by the Mason Tire & Rubber Co. of Kent, according to notices being sent to all stockholders. The exchange will be made on the basis of preferred stock share for share plus the accumulated dividends to July 1, and one share of Mason Tire & Rubber series "B" no par common stock for two shares of Plantation common, fractional shares to be adjusted on the basis of $20 per share for the Mason Tire & Rubber stock.

Goodyear Doubles March Sales

AKRON, May 2—Sales of the Goodyear Tire & Rubber Co. for April represented an increase of 125 per cent over March sales, with prospects bright for a continued increase in dealer and automobile manufacturers tire specifications for May, officials announce. The company had anticipated a 75 per cent increase in April sales and, working on this basis, added 1200 men, increasing production to 17,000 tires a day. But with the steady pouring in of orders it was necessary to put on several thousand more men, to reinstate the third or midnight factory shift and to speed production to 20,000 tires a day.

Firestone on 20,000 a Day

AKRON, May 2—The Firestone Tire & Rubber Co. to-day advanced to a production of 20,000 tires a day, which is equal to the company's normal production of last year, and is above the Firestone pre-war production record. Firestone during April increased production from 10,000 to 15,000 tires a day, putting on several thousand employees.

Increased tire specifications from automobile manufacturers and heavy demand for tires from all dealers necessitate the big jump in production, officials state.

President Harvey S. Firestone announces, in connection with the re-employment of many men, that all employees of the company now are stockholders. As far as is known Firestone thus becomes the only large concern in the country with 100 per cent of its employees owning stock in the company.

Cotton Financing Cuts Car Credits

(*Continued from page* 981)

While the cotton producers have not sold their cotton, both they and the bankers are working together on plans to sell it through cooperative methods, and by the aid of the Edge Bank in New Orleans, to the mills of Middle Europe. To do this the bankers have agreed to finance the cotton planters, but to do this financing they must have money, and the first man to fall under this search for money is the automobile distributer and dealer.

Before the automobile industry of the South can be put back on its feet firmly, there must be a break in this chain, so that fresh money can come in. The financing of the crops is now the vital issue in the territory around New Orleans, and while the automotive industry is a vital factor in the production and movement of those crops, it appears to be in the position of having to wait for a real revival of business until the crops are in and sold.

United States Cuts Price

NEW YORK, May 4—A general reduction in prices on tires has been made by the United States Rubber Co., which will become effective at once. The extent of the cut and its application to the different tire products is now being determined at the factory.

Pennsylvania Prices Down

JEANNETTE, PA., May 2—Pennsylvania Rubber Co. has reduced prices on all tires and tubes 20 per cent, effective today.

Commission Declines Rail Rate Change

Lower Charges on Shipments to Intermediary Points Are Refused

NEW YORK, May 4—In a decision of great importance to passenger car and motor truck manufacturers and to dealers on the Pacific Coast, the Interstate Commerce Commission has dismissed the complaint of the Intermediate Rate Association, which sought to require lower freight rates to intermediate points than to Pacific Coast points on shipments from the East.

This case is the latest development in the long debated question of how to adjust transcontinental rates so that railroads may fairly meet water competition. In this instance the carriers proposed an adjustment, one feature of which was to cancel the special (or so-called commodity rates) on passenger cars and motor trucks in carloads and apply on such shipments instead the class rates. This would also have increased the carload minima.

Carriers pointed particularly to the fact that class rates apply on such shipments generally in all other territories. The examiner condemned the class rates as too high for the long overland haul and suggested a scale that would have resulted in about the same rates on automobile shipments under class rates as now apply under the commodity rates, but these charges are not included in the final order.

The proposed readjustment would have affected Eastern shipping interests generally, and the case attracted wide attention and many protests. The proposed cancellation of automobile and truck rates became known through a report submitted by the railroads as to the commission about a year ago, as a basis for meeting the complaint of the Intermediate Rate Association. The National Automobile Chamber of Commerce at once intervened, engaged counsel, and with the assistance and cooperation of members and Pacific Coast dealers gathered data, submitted evidence at the hearing in New York, May 5, 1920, and final argument before the commission at Washington, Dec. 3, 1920.

The N. A. C. C. was able to show that no traffic, certainly none of like character, moves in as great quantity as motor cars; that in 1919 shipments amounted to 31,500 carloads, the total freight on which was $15,000,000, and that the proposed rate adjustment would have added $3,000,000 to this amount through increased freight charges.

RESERVE BANK LOWERS RATE

NEW YORK, MAY 5—The Federal Reserve Bank of New York announced yesterday a reduction in its rediscount rate on commercial paper from 7 per cent to 6½ per cent. The rate has been at 7 per cent since June 1, 1920.

Mellon Proposes New Motor Taxes

Believe Intelligent Tax Revision Will Encourage Production—Hearings Next Week

(*Continued from page* 976)

only hope of effective relief from the tax burden."

Emphasis was given to the fact than "an intelligent revision of these taxes should encourage production and in the long run increase rather than diminish revenues."

The Senate Finance Committee will open hearings on internal revenue revision next week. Witnesses will be asked to express their opinion of the proposed sales tax and other propositions, including the Treasury plan. The unmistakable hostility to a general sales tax, as revealed in the Mellon letter, will have a tendency to block the bill in Congress. It is understood that the Treasury would not speak without the consent of the President and the Chief Executive could not logically, at least, favor a proposal which his financial advisors had opposed.

The testimony taken at the Senate hearings will be forwarded to the House Committee on Ways and Means to save time. This departure will not detract from the importance of fiscal legislation originating in the House, but is adopted purely in the interests of expediency. It is quite likely that the tax committee of the N. A. C. C. will be among the first representatives of industry to be called.

Associations Prepare to Urge Tax Reform

NEW YORK, May 5—Presentation of its taxation program will be made before the Senate Finance Committee next Tuesday or Wednesday by the National Automobile Chamber of Commerce. The hearing has been granted earlier than had been expected and only a half hour will be given for presentation of motor vehicle manufacturers' arguments.

Charts will be used to illustrate to the Senators the heavy burden of taxation already borne by the industry and to demonstrate that additional imposts would be an injustice.

The taxation committee, headed by C. C. Hanch, is in session in Detroit in connection with the monthly meeting of directors of the organizaton and is working out in detail the plan for presentation to the committee. The arguments will be made by Roy D. Chapin and George N. Graham.

Recommendation of Secretary of the Treasury Mellon that a Federal license fee be imposed on automobiles as a means of providing additional revenue probably will result in a recasting of the N. A. C. C. argument. It has been contended that the industry now pays more than its share of taxes and it will be argued that a further Federal tax would be distinctly unfair.

The National Automobile Dealers Association, through C. A. Vane, its general counsel, has been assured by the Senate Finance Committee that it will be granted a hearing on the excise tax provision of the present revenue law. The date for this hearing has not been set, but it will not be simultaneous with that of the N. A. C. C.

Directors of the Motor and Accessory Manufacturers Association in session here to-day will determine whether that branch of the industry will ask a special hearing on taxation.

Application for a hearing already has been made by the Rubber Association of America and its program will be similar to that of the N. A. C. C.

Townsend Bill Hearings to Begin Week of May 8

WASHINGTON, May 3 — Arrangements have been made for hearings on the Townsend Highway bill beginning next week, before the Senate Committee on Postoffices and Post roads. Farmers' organizations and certain groups of highway officials have announced that they will fight the Townsend bill both in committee and on the floor. The fact that President Harding has approved the principles contained in the proposed measure, which was designed after his suggestions were received by Congess, is expected to have a great influence in securing favorable action in the Senate and House.

The American Association of Highway Officials has submitted another plan of highway legislation differing from the Townsend bill in that it does not call for Federal Highway Commission appropriations and adopts another formula of distribution of Federal funds. In other respects, every point contained in the highway organization's bill is carried in the Townsend measure, indicating that they will not have many strong points for argument against the bill. The Highway Commission's measure provides for distribution of at least 60 per cent of Federal funds for the development and maintenance of highways of inter-state importance and the balance on roads of State importance.

The Chamber of Commerce of the United States, at its annual meeting in Atlantic City last week, endorsed the principles contained in the Townsend bill, Senator Townsend expects to conclude the hearings and report the measure to the Senate before June 1.

MEXICO INCREASES TIRE DUTY

WASHINGTON, May 3—According to a cablegram from Consul Cornelius Ferris, Jr., Mexico City, under date of April 30, a decree promulgated April 19, effective April 23, increased the Mexican duty on rubber tires for automobiles from 1 peso (50c.) per gross kilo to 1.50 peso (75c) per gross kilo of 2.2 pounds, and on rubber tires for motor trucks from .50 peso (25c.) to .75 peso (37¼c.) per gross kilo.

Anti-Dumping Change Makes Mellon Judge

Senate Would Bestow Power Upon Treasury Head to Apply Special Duties

WASHINGTON, May 4—While no specific provision has been made to cover the reimportation of motor trucks or war supplies in the anti-dumping bill, Senate leaders believe that this unfair competition may be checked by imposing the dumping duties upon merchandise in cases in which the Secretary of the Treasury, after due investigation, has instructed the appraising officers to apply the anti-dumping provision.

The Senate to-day took up the consideration of the bill as reported by the Senate Finance Committee. This committee reported that it remains for the secretary to determine that the importation of dutiable or free foreign merchandise is injuring or is likely to injure an industry in this country, or is likely to be sold here or elsewhere at less than its fair value.

The situation is not entirely satisfactory to the automotive industry, which had been assured by Senator Smoot that no anti-dumping bill would be passed which did not specifically cover the reimportation of American made motor vehicles and equipment. The chief difficulty foreseen in connection with the bill as it now stands is the interpretation of what constitutes foreign merchandise. Whether American made goods sold abroad and then reimported into the United States by foreign purchasers could be placed in this category remains to be seen.

C. A. Vane, general counsel of the National Automobile Dealers Association, has asked for a hearing on the subject and will endeavor to have the bill so amended that there will be no loophole through which this automotive equipment can be slipped into the country and injure home industry.

American airplane manufacturers will seek the same protection, and the Manufacturers Aircraft Association also has asked for a hearing.

Must Equal Market Values

As the bill stands, a special dumping duty is provided in cases in which the Secretary determines that there is likely to be dumping. The duty imposed will be determined as follows:

"If the merchandise is sold by the foreign seller to an American purchaser having no interest in the business of the foreign seller, and the American purchaser purchases the merchandise at less than the foreign market value, the special dumping duty will be the difference between the foreign market value and the purchase price."

In case the merchandise is sold by a foreign seller having an interest in the American purchasing agency or by a

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Industry's Production $3,594,814,620 in 1920

Exports Double Figures for Previous Year—Registrations Increase 22 Per Cent

NEW YORK, May 3—All records for the automotive industry were shattered in 1920. The remarkable showing made last year, notwithstanding the serious depression which came in the later months, is shown by statistics contained in the 1921 edition of "Facts and Figures," issued by the National Automobile Chamber of Commerce.

The total wholesale business in motor vehicles, parts, tires and accessories in 1920 amounted to $3,594,814,620. This included car and truck sales of $2,232,927,678, parts and accessories of more than $725,000,000 and tire replacement business of $636,750,000.

Many pages of the pamphlet are devoted to research supporting the statement of President Harding that "the motor car has become an indispensable instrument in our political, social and industrial life." It is shown that 3,000,000 motor vehicles are used by farmers, 100,000 by doctors, 30,000 by state governments, 10,000 by municipalities, 12,000 by rural schools, 4000 by packing companies.

Exports formed a larger part in the automobile business than ever, with 1920 having 7½ per cent of the total output, as compared with 4 per cent the year before. The total number of motor vehicles exported was 170,765, or more than double the 1919 figure of 82,652. The United Kingdom, British India, Canada and Cuba were the largest buyers.

The automobile to-day pays more special taxes than any other industry. Total levies upon the automobile in 1920 exceeded $316,720,000. More than $148,000,000 of this was in Federal taxes.

Enclosed bodies formed 17 per cent of the passenger car production as compared with 10 per cent in 1919.

Automobile registration in the United States in 1920 totaled 9,211,295, or 22 per cent more than 1919, according to the N. A. C. C. figures. Approximately 990,000 of these vehicles were motor trucks. South Dakota now has one automobile for every five persons. Iowa one for every five and a half, and Nebraska one for every 5.9.

Remarkable gains were made in the fuel supply during the year. Although threatened with a shortage in the spring, production was increased to a point where it reached 4,882,546,699 gal. of gasoline for the year, an excess of 626,118,674 gal. over the demand.

ITALY LIFTS TARIFF BAN

WASHINGTON, May 2—The Department of Commerce has been advised by the commercial attache at Rome that the Italian prohibition on the importation of American made passenger automobiles was removed April 19.

Outstanding Automobile Facts of 1920

Volume of Motor Vehicles, parts, tires and accessories, wholesale business	$3,594,814,620
Value complete car and truck output	$2,232,927,678
Value parts and accessories output	$725,136,942
Value tire replacement output	$636,750,000
MOTOR VEHICLES PRODUCED	2,205,197
Number cars	1,883,158
Number trucks	322,039
Per cent gain over 1919	12%
Per cent exported	7½%
REGISTRATION IN U. S. A.	9,211,295
Per cent gain over 1919	22%
Number automobiles on farms, approx	3,000,000
MOTOR VEHICLE MANUFACTURING BUSINESS:	
Capital invested	$1,204,378,642
Number of employees	325,000
Wages and salaries	$482,950,000
TIRE AND FUEL FIGURES:	
Gasoline produced, gal.	4,882,546,699
Gasoline consumed, gal.	4,256,428,005
Tires produced	32,400,000

Exports of Automobiles, Airplanes, Trucks, Farm Tractors, Motorcycles and Parts for March and 8 Previous Months

	Month of March				9 Months Ending March			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	....	......	1	$15,000	39	$206,480	54	$401,955
Airplane parts	....	$159,783	...	10,921	....	381,543	....	143,444
Commercial cars	3,127	4,616,467	606	868,230	15,806	28,333,413	16,132	27,364,882
Motorcycles	4,285	1,164,049	859	291,599	24,099	6,597,843	22,769	7,154,087
Passenger cars	14,005	15,267,732	2,019	2,348,378	73,429	79,396,208	77,518	95,824,913
Parts, not including engines and tires	....	9,143,156	...	3,097,890	....	43,688,748	....	58,797,090

Engines

	Month of March				9 Months Ending March			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas.	4,423	$675,171	1,433	$270,559	28,605	$4,309,261	11,321	$2,064,863
Marine, gas	1,076	323,841	345	131,988	6,965	2,481,931	5,733	2,211,109
Stationary, gas	2,508	527,876	759	121,745	19,983	2,935,009	21,085	4,132,178
Tractor, gas	2,220	2,121,258	379	350,319	13,748	12,493,622	13,555	13,253,739
Total	10,227	$3,648,146	2,616	$874,611	69,301	$22,219,823	51,694	$21,661,889

Exports of Automobiles, Airplanes, Trucks, Farm Tractors, Motorcycles and Parts for February and 8 Previous Months

	Month of February				Eight Months Ending Feb.			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	3	$44,000	..	.....	39	$206,480	53	$386,955
Airplane Parts	..	6,494	..	24,213	..	221,760	..	132,523
Commercial Cars	2,894	4,161,494	1,120	1,952,736	12,679	23,716,946	15,526	26,496,652
Motorcycles	3,449	920,403	1,000	333,437	19,814	5,433,794	21,910	6,862,488
Passenger Cars	11,221	11,604,622	2,492	3,165,170	59,424	64,128,476	75,499	93,476,535
Parts, not including engines and tires	..	7,208,373	..	3,426,517	..	34,545,542	..	55,699,200

Engines

	Month of February				Eight Months Ending Feb.			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	3,315	$488,421	881	$153,258	24,182	$3,634,090	9,888	$1,794,304
Marine, gas	550	245,504	530	216,058	5,889	2,158,090	5,388	2,079,121
Stationary, gas	1,913	310,151	951	326,398	17,475	2,407,133	20,626	4,010,433
Tractor, gas	1,353	1,247,431	772	827,694	11,528	10,372,364	13,140	12,862,698
Total	7,131	2,291,507	3,134	1,523,408	59,074	18,571,677	49,042	20,740,556

Standard to Produce Steam Car and Truck

Company Is Organized in St. Louis to Build Vehicles Designed by Scott

ST. LOUIS, May 3—A manufacturing corporation to produce in St. Louis the steam vehicle designed during the past three years under the auspices of the Standard Engineering Co. has been formed under the name the Standard Steam Corp. A steam motor truck is added to the passenger car which was the first product designed by the company. All the assets of the company are taken over by the newly formed organization.

A number of prominent St. Louisans are interested in the corporation. The officers are: W. J. Parrish, formerly the Packard distributor in this city, president; Charles A. Lemp and L. L. Scott, vice-presidents; A. J. Lindsay, secretary and treasurer. The other directors are: Charles L. Holman, R. L. Hedges and J. L. Johnston. Among the stockholders are Russell E. Gardner, Jr., Benjamin Gratz, Anderson Gratz, John L. Moran, G. H. Walker, W. B. Dean, John H. Holliday, W. H. Bixby, W. K. Bixby, Fred W. Gardner, L. M. Rumsey, E. C. Stuart, Edward Beecher, Samuel Fordyce, John R. Carroll, H. D. Condie, Lewis B. Ely, Kurt V. Moll, Frank Wyman, W. H. Whitton and George B. Evans.

The chief interest centers in the steam motor truck which the corporation plans to produce, in view of the fact that it will be the first concern to manufacture this type of vehicle. L. L. Scott is designer of both the passenger car and the truck and has embodied many new principles in the new engine.

The Fifth Avenue Coach Co., which operates 300 motor buses in New York City, sent its general manager, G. A. Green, and two engineers to inspect and test the steam truck with a view of inaugurating the use of the steamers in their bus system. The final result of their investigations in this respect have not as yet been made known here.

Moline Plow Shows $1,935,289 Deficit

MOLINE, ILL., April 30—The effect of the readjustment in the implement industry last year, heightened by a reorganization, is reflected in the annual report of the Moline Plow Co. For the year ended Dec. 31, 1920, the company showed an operating deficit, after charges, of $1,320,289, and a total deficit, after preferred stock dividends, of $1,935,289. For the fourteen months ended Dec. 31, 1919, the operating income was $48,115, but after preferred dividends there was a deficit of $720,635. The current report shows the surplus reduced to $61,587, as compared with $1,996,876 at the end of 1919, while the surplus Oct. 31, 1918, was $2,717,511.

FEBRUARY SALES TOTAL 77 PER CENT OF 1920

NEW YORK, May 2—Additional evidence that the purchasing power of the United States has not been curtailed to such an extent as has been supposed, is found in the fact that total purchases of merchandise in February last averaged 77 per cent of the purchases for February, 1920, which probably was the largest February the merchants of the country ever had.

Statistics compiled by Roger Babson show that in the States of Arizona, Maine and Oklahoma the purchases in February, 1921, equaled or exceeded those in the same month the preceding year. States in which the percentage was 90 or over were Arkansas, California, Maryland, New Jersey, New Mexico, Pennsylvania and Texas.

States in which the percentage was more than 80 but less than 90 were: Connecticut, Delaware, Florida, Illinois, Indiana, Iowa, Louisiana, Mississippi, Nevada, New York, North Carolina, Ohio, Oregon, Utah, Virginia and Wisconsin.

States which had the lowest percentage were Colorado 63, Georgia 63, Idaho 64, Kansas 68, Tennessee 63, South Carolina 58, and Washington 65.

DUPONT INSPECTS UNITS

DETROIT, May 5—President Dupont, Vice-Presidents Sloan and Haskell and other heads of divisions of the General Motors Corp., are in Detroit this week inspecting the more important units of the corporation in this territory. The trip was made simultaneously with a regular meeting of the operations committee. Various questions of policy have been discussed but no announcement regarding them has been made.

CLARK MAKES NEW PISTON

LOS ANGELES, May 3—The Clark-Turner Piston Co. of this city has placed on the market an oversize piston which is cast on a special oversize core, so that the wall thickness is no greater than in the regular piston and the weight is only a fraction of an ounce greater. It is explained that most oversize pistons are cast exactly the same as the stock pistons, so the wall thickness is increased by one-half the oversize.

MIDLAND FORECLOSURE SOUGHT

OKLAHOMA CITY, May 2—A petition seeking foreclosure on property owned by the Midland Motor Co. of Oklahoma City has been filed in District Court by the Union Trust Co. of this city, alleging failure to pay interest on $52,000 worth of bonds. Date for hearing the suit has not been set. The Midland plant has been leased to the Wichita Truck Mfg. Co.

METAL MARKETS

IN both the ferrous and non-ferrous metal markets there is evidence of a very modest broadening in the consuming demand. The tonnages involved in the orders actually placed, are, however, light. Invariably after the metal markets have been in the doldrums for a period of several months, the first orders that break the deadlock between sellers and buyers are grossly exaggerated. This time-honored, though none the less misleading practice is due to the inherent shortcomings of market reporting. A sheet producer has an inquiry for 5,000 tons of sheets from an automotive consumer. He tells the truth about it. So does his competitor who has the same inquiry. Still another sheet mill is asked to quote on the same tonnage by the same consumer. By the time the inquiry gets into the market reports, it is presented as 15,000 tons of sheets being asked for, when, in fact, the tonnage, on which figures were requested, was only 5,000 tons. It frequently happens that a consumer, when in need of 25 tons of aluminum, sends a form letter to a dozen brokers operating in the "outside" market. By the time all of the brokers have told this or that market reporter of this inquiry, the demand for aluminum appears imposing when, in truth, only 25 tons are wanted. Especially under prevailing conditions producers are not finding any fault with this optical delusion. It may help to quicken the momentum of demand. Steel producers figure, and probably correctly so, that news of the buying of impressive tonnages by one passenger car builder will beget orders from others. As stated at the outset, the consuming demand is expanding but expanding slowly and, on the whole, tonnages involved are still subnormal. There is more inquiry for sheets than for other steel products. All of this is admitted and even emphasized but reports conveying the impression as though sheet mills were once more unable to fill the many orders for immediate delivery which they are credited with having received in the last few weeks are utterly deceptive and fraught with harm. There has been no over-night change in conditions, in fact, some of the inquiries emanating from the automotive industries which are for deliveries spread over the second and third quarters are strictly tentative and were intended as an encouragement to the steel industry to hasten wage readjustment.

Pig Iron—A more steady tone prevails with buying by automotive foundries on a hand to mouth scale. Everything depends on downward revision of freight rates. The Studebaker Corporation, Detroit, is inquiring for about 500 tons of foundry iron for July delivery.

Steel—On the new price basis of 3.10c., Pittsburgh, automotive consumers are taking up what cold-finished steel bars they still have due on old contracts but fresh buying is seemingly in abeyance. Rumors are afloat that some business in sundry steel products is getting onto books of the smaller "independents" at below the "stabilized" price levels.

Aluminum—The general feeling in the aluminum trade is that quickening of the demand from the automotive industry is not very distant.

Copper—Large consumers are picking up odd lots when they can get them at bargain prices. In one quarter, curtailment of production, as the result of shut-down of mines is placed at only 50 per cent as against 75 per cent heretofore accepted.

FINANCIAL NOTES

Studebaker Corp. has reduced its bank loans to $4,000,000. Production for the first quarter of the year as predetermined in January was at 50 per cent capacity. The company expects to make and sell 21,000 cars in the second quarter, which will break all records. Profits for the first quarter were $2,110,577. The latest balance sheet shows inventories sharply reduced.

Rogers Auto Sweeper Co. has been incorporated with a capital of $50,000 to manufacture automobile street sweepers. Howard C. Rogers was elected president and W. H. Duffy, secretary and treasurer. Duffy is director of public service of Columbus, while N. A. McCoy, one of the directors, is head of the Columbus street cleaning department.

Motor Products Corp. reports total assets to Dec. 31 as $8,185,724, in which is included inventories totaling $1,698,155 and cash of $411,340. The surplus totals $4,335,939.

Hess Mercury Carburetor Co., Valparaiso, Ind., has been made defendant in a bankruptcy action instituted by employees.

Bull Dog Tractor Co. has reorganized as the Bull Dog Tractor Corp. and the capital reduced from $750,000 to $250,000.

Perfection Tire & Rubber Co. will proceed with its recapitalization plans following ratification by stockholders.

Nash Motors Co. paid the regular quarterly preferred dividend of 1¾ per cent on May 2.

INDUSTRIAL NOTES

Manley Mfg. Co. has taken over the inventory, dies, jigs, fixtures and patents of the J. B. S. Mfg. Co., Elmira, N. Y., manufacturers of the Ellis-Smith line of automotive equipment. The Manley company plans to continue the manufacture of the line practically in its entirety in this city.

H. P. Rhodes, formerly with the Howe Lamp & Mfg. Co. and the New Era Spring & Specialty Co., and T. F. McMurray, former manufacturer of Indianapolis, have formed a company at Fort Wayne, Ind., to act as manufacturers' sales agents.

Motor Wheel Corp., Lansing, Mich., has established a branch office at Detroit in charge of H. H. Crawford, who will represent the Gier Tuarc Steel Passenger Car Wheel in Michigan and Ohio.

Motch & Merryweather Machinery Co. of Cleveland has taken over the sales of the Gordon cam turning lathe, which is now being manufactured by the Willard Machine Tool Co. of Cincinnati.

W. D. Blood & Co., Inc., exporters and importers, New York, have opened a branch office in Boston for the exclusive purpose of looking after the trade in the New England States.

Sterling Tire Corp., Rutherford, N. J., has opened a western branch in Chicago. It has announced a policy of keeping its branch houses to as low a number as possible.

Hines Combine Harvester Co., Hutchinson, Kan., has adopted the Climax model "T" 5½ x 7-in. engine as standard power equipment for its combined harvesters.

Alvord Reamer & Tool Co. has opened a branch office in Chicago, where it will carry a complete stock of products. O. B. Cole is manager.

Automotive Gear Works, Atlanta, will establish a branch in Seattle to serve Pacific Coast points. H. M. Clark will be manager.

Gill Mfg. Co. has established branches at Spokane, Wash., and Houston, Texas., bringing the total of company branches to 41.

Lafayette Tractor & Machinery Co., Lafayette, Ind., will add three units to its plant to increase distribution and production.

Franklin Automobile Co. reports orders on April 28 for 885 cars for May delivery. Production for the month will aggregate 920 cars.

Pennsylvania Piston Ring Co., Inc., Cleveland, beginning with May 9, will run a full night shift in the production of piston rings.

Stewart-Warner Speedometer Corp. reports April sales as equalling those of the first three months of the year combined.

George H. Gibson Co., consulting engineers, has removed to the Hide & Leather Building, New York.

United Automotive Body Co., Cleveland, has acquired new plants at Streator, Ill., and Evansville, Ind.

Oakes Co., Indianapolis, has acquired the Toelle patent covering lock housings for screws and bolts.

Iron City Products Co., Pittsburgh, has changed its name to the Rees Mfg. Co.

Keystone Rubber Co. reports a $500,000 loss by fire at the Erie, Pa., plant.

Spafford Co., Inc., Boston, has removed its offices to 10 Arlington Street.

Continental Piston Ring Co., Memphis, has moved into its new building.

Ford Reaches Schedule of 4000 Cars Daily

DETROIT, May 3—Announcement is made by the Ford Motor Co. that production at its Highland Park plant has reached a schedule of 4000 cars a day, equaling the number produced at the peak last year. The force of workers is being increased daily and nearly 40,000 men are now reported employed. At the beginning of April the company had orders on hand for more than 200,000 cars.

GENERAL TRACTORS BANKRUPT

MADISON, WIS., May 4—General Tractors, Inc., a Delaware corporation with plants at Watertown, Wis.; Bramford, Ont., and Paulsboro, N. J., manufacturing the Monarch creeper type tractors, has been adjudicated a bankrupt. The referee is C. F. Lamb of this city. The last balance sheet of the company showed assets slightly in excess of $2,000,000.

ARMY SALE NETS $150,000

JEFFERSONVILLE, IND., May 2—Twenty-seven hundred trailers, two-wheeled, one-ton capacity, sold for an average of $55 in lots of five in an auction at the quartermaster's depot here. Motorcycles and side cars in lots of ten sold for $100.00, none in good condition. Passenger cars sold for $60 to $80. A total of 3500 motor transport units were sold for a total of $150,000.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, May 5—Call money was again unchanged last week with a range off 6 per cent to 7 per cent and with a ruling rate not above 6½ per cent until Friday, when 7 per cent was quoted all day. The firmness of the week-end carried over until Monday of this week. Preparations for the month-end settlements and the report of the New York Associated Banks, showing reserves $3,455,360 short of legal requirements, were factors partly responsible for the firmer rates toward the close of the week. There was little business done in the time money market. Nominal quotations for 90 days' to five months' paper were 6 per cent to 6½ per cent, while six months' paper commanded 6 per cent to 7 per cent. The previous week, 6½ per cent to 7 per cent was quoted for all maturities. Commercial paper rates receded in the latter part of the week to 7 per cent to 7½ per cent for 60 to 90 day indorsed bills and six months' paper with choice names.

In accordance with its new policy, the Federal Reserve Board published its weekly statement as at the close of business on Wednesday of last week instead of Friday, as heretofore. The System gained $19,498,000 in gold reserves last week, while cash reserves increased $11,959,000. Total bills on hand decreased $50,960,000, and total earning assets $55,580,000. Total deposits also declined $23,452,000, and Federal Reserve notes in circulation $26,580,000. As a result of these changes, the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 54.1 per cent to 55. The ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against deposit liabilities, increased from 65.8 per cent to 67.2 per cent. A corresponding gain was made by the New York Federal Reserve Bank.

The week was marked by several features of an unfavorable character. The Pennsylvania Railroad reduced its dividend from 6 per cent to 4 per cent—the lowest dividend paid by this road since 1891, while at least 6 per cent had been paid since 1900. The report of the Steel Corporation for the month of March revealed earnings smaller than for any month since April, 1915. Operations during the first few months were said to be at the rate of 90 per cent in January, 75 per cent in February, and 51 in March.

There were, nevertheless, signs of reviving confidence in many quarters. The stock market showed evidences of renewed interest by the public, with larger trading and rising prices, while the bond market absorbed a $230,000,000 joint issue of the Great Northern and Northern Pacific Railroads, and at the same time the general list showed a stronger undertone with slightly advanced prices. The foreign exchange market showed a decided upward trend, Sterling reaching a new high point.

MEN OF THE INDUSTRY

Norton H. Van Sicklen has been elected president and general manager of the Reliance Wheel Co., manufacturer of a steel double disk wheel. The company is preparing to increase production and has under option a manufacturing plant equipped with the necessary machinery. Van Sicklen formerly headed the Van Sicklen Speedometer Mfg. Co., which was recently sold to the Stewart-Warner Corp. He is known to the iron and steel trade as a former official of the American Steel & Wire Co. J. M. Crenan is director of sales of the Reliance company and Charles T. Gaither, prominent member of the Youngstown Automobile Dealers Association, and president of the Youngstown Auto & Repair Co., is elected vice-president of the Reliance Wheel Co.

H. R. Hyman, advertising manager of the Cole Motor Car Co., of Indianapolis, will be one of the speakers at the annual convention in June of the Associated Advertising Clubs of the World. He will talk before the screen advertising department on "Merchandising Through Motion Pictures." The Cole company was one of the pioneers in the automotive field to use motion pictures for advertising purposes, through the production of "The Porcelain Lamp," a film that deals with the transportation problem from the first time wheels were invented down to the modern motor car.

L. F. Hosley, has been appointed production engineer of the Kelly-Springfield Motor Truck Co., Springfield, Ohio, and will be in charge of all production and assume responsibility for the quality of the product. Hosley was formerly assistant engineer of the Mercer Automobile Co. and prior to that was in the engineering department of the Locomobile Company.

Russell B. Reid, for several years with the Edward R. Ladew Co. as assistant sales manager, has been made manager of sales for the Sharon Pressed Steel Co., Sharon, Pa., manufacturer of motor car frames, industrial trucks and pressed steel automobile parts. Reid will direct the sales of the company from the New York office at 66 Broadway.

George E. Meurs has been appointed manager of the New York export branch of the Miller Rubber Co. He will be directly responsible to the Akron export department, which is in charge of C. E. Wagner. Meurs has had a varied export experience covering a period of thirteen years in Latin-America and New York City. He is succeeding Victor Roth.

J. J. Lowcher has resigned as credit manager of the Eisemann Magneto Corp. He has made no definite plans for the future. Lowcher went with the Eisemann company two years ago after his discharge from the army. He served seven years with the American Smelting & Refining Co. as travelling auditor and acting agent.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, completed his spring trip among the dealers with an address at Rochester. In his itinerary from Omaha to Boston he addressed 9000 dealers and bankers in the larger trade centers. Reeves will now turn his attention to tariff and taxation matters.

Stephen A. Howell, formerly in charge of the Chicago branch of A. Schrader's Son, Inc., has been promoted to the post of manager of the Schrader Toronto branch, succeeding Harold R. Cole, who is now at the main office of the company at Brooklyn. Howell joined the Schrader company at Brooklyn in 1915.

Clifford Holder of Illinois has been appointed chief engineer for the North Carolina Highway Commission. Nine district engineers have been elected as follows: J. C. Gardner, R. E. Snowden, Will Morson, F. E. Schanpfe, John D. Waldrop, J. D. Pridgen, C. E. Currie, H. E. Noell and Wythe M. Peyton.

J. A. Benell, formerly assistant general manager for the Haynes Automobile Co., has been appointed district sales manager for California, Oregon, Idaho, Nevada, Washington and Arizona.

Howard K. Ford has resigned as manager of the Hastings Mfg. Co., Hastings, Mich., and has accepted a position as manager of the Winter Stamping Co., Goshen, Ind.

Harold E. Taylor, who was previously with the Gemco Mfg. Co., is now acting as sales manager for the Las-Stik Patch Mfg. Co., Hamilton, Ohio.

Blake Named President of Paragon Motors

CUMBERLAND, MD., May 2—Philip M. Blake of this city has been elected president and general manager as well as a director of the Paragon Motor Co., which has removed its plant here from Connellsville, Pa. The engineering department, which has been located at Cleveland, will be moved here at once and will be under the direction of P. F. Hackethal, the chief engineer. During the past year the engineering department has designed, built and tested four model Paragon cars. The Paragon engine is of four-cylinder design and has 12 valves operated by a single camshaft. Aluminum is used extensively in its manufacture.

Charles E. Barley, the sales manager, says that orders now on hand will consume a considerable portion of the first years production. The Paragon car will be produced in several body models built upon a standard chassis with a list price ranging between $3000 and $3500.

M.A.M.A. to Develop Membership Groups

NEW YORK, May 4—A new group plan of inter-organization is about to be established by the Motor and Accessory Manufacturers' Association. The plan will divide the membership of the association into a number of groups, each of which will comprise manufacturers of a certain product and each of which will have officers and meetings of its own.

The plan is designed to offer members of the association "an apportunity to meet with others in the same lines of manufacture, at periods as often as they themselves may determine, provided that not more than six consecutive months elapse between such meetings."

A detailed plan for the establishment and conduct of the new inter-organization has been approved by the Board of Directors and General Manager Heminway of the association and has been submitted to members for approval. Many replies have been received from different parts of the country, all of which indorse the plan heartily. General Manager Heminway states that the plan is certain to go into effect and that it will undoubtedly make for greater unity.

Highway Traffic Body to Hold Open Sessions

NEW YORK, May 4—The annual meeting of the National Highway Traffic Association will be held at the Automobile Club of America, this city, on May 13. A dinner will be served at a nominal cover charge for which reservations should be sent to Secretary Elmer Thompson at the Automobile Club. The public has been invited to attend the dinner and also to take part in the discussions scheduled.

Addresses will be delivered by J. E. Pennybacker, secretary of the Asphalt Association, on "Relation of Methods of Financing Highway Improvements to Present and Future Traffic," and by Prof. Arthur H. Blanchard of the University of Michigan, on "Highway Improvements Should be Based on Transportation Surveys."

Annual reports of the officers and standing committees will be received and acted upon and officers will be elected for the year 1921 and 1922.

April Car Shipments 27 Per Cent Over March

NEW YORK, May 4—Figures compiled by the National Automobile Chamber of Commerce show that shipments of automobiles in April, exclusive of Fords, increased 27 per cent over March. Last year April decreased 23 per cent under March. Shipments from 50 factories indicate that the April total will be 20,000 carloads, 13,800 driveaways and 1134 shipped by boat. This is 71 per cent of the shipments in April, 1920.

While the railroads carried more automobile shipments in April of this year than last year, because of the lack of car supply and strikes, the difference in production is accounted for in driveaways.

WESTCOTT SHOWS MAY GAINS

SPRINGFIELD, OHIO, May 2—Shipments of automobiles from the plant of the Westcott Motor Car Co. during the month of April doubled that of any previous month since last fall, according to official announcement. "There has been a pleasing revival of business in almost every section of the country," said E. H. Gilcrist, sales manager. "While our business has shown a constant improvement since the first of the year we were hardly anticipating such an increase in April. Our advance orders now on hand for May delivery indicate a larger number of shipments for the next month, although the proportionate gain will not be so large."

Calendar

SHOWS

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8 — International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

CONVENTIONS

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N.A.C.C.

May 23-26 — Chicago, A.S.M.E. Spring Meeting, Congress Hotel.

May 24-28—West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

June 20-25 — Mackinac Island, Mich., Summer Meeting Automobile Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

RACES

May 31 — Indianapolis, International Sweepstakes.

June 3-5 — Reno, Nev., First Annual Nevada Highway Road Race.

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Metropolitan Section — May 3, Car Theft.

Midwest Section — May 13, Smoker, Dinner and Entertainment at Chicago Automobile Club.

Dayton Section—May 17, H. L. Horning.

Cleveland Section—May 20.

Anti-Dumping Change Makes Mellon Judge

(*Continued from page* 985)

foreign seller in which the American purchasing agency has an interest, at a price below foreign market value, the special dumping duty will be the difference between the foreign market value and the exporter's sales price.

If there is no foreign market value the special dumping duty will be the difference between the cost of production and the purchase price. It is believed that it will seldom be necessary to use this method except in cases in which the article is only sold for exportation to this country.

There has been much debate as to what constitutes the export value of these American trucks, sold abroad and reshipped by foreigners to American markets. The Senate has defined the term "export value" to be the price at the time of exportation to this country at which the article or similar article is sold or freely offered for sale for exportation to the United States to all purchasers in the principal markets of the country from which exported.

Truckmen "Hope for Action"

DETROIT, May 4—The motor truck committee of the National Automobile Chamber of Commerce spent some time here to-day discussing the anti-dumping bill now before Congress, and hope was expressed that action would be taken to protect the industry against the reimportation evil.

Most of the time at the meeting was devoted to a general discussion of conditions. A report on legislation was read and it was said that with only six state legislatures still in session only ten states have failed to adopt legislation providing that 800 lb. per inch of tire shall constitute a standard motor truck load.

Plans were formulated for promoting store door delivery by motor truck, and representations on this subject will be made to the Interstate Commerce Commission. It is hoped to obtain the cooperation of railroads in having short haul business turned over to motor trucks.

The highway committee of the N. A. C. C. at a meeting yesterday discussed the redraft of the Townsend highway measure now pending before Congress. Roy D. Chapin and George M. Graham were delegated to go to Washington to appear before the committee, probably next week. The committee approved the principles of the Townsend bill as it has been redrafted.

Maxwell Stockholder to File Amended Suit

WILMINGTON, DEL., May 3—Permission to file an amended bill of complaint against the Maxwell Motor Co., a Delaware corporation with its principal factory in Detroit, designed primarily to stop the sale of the assets to a new corporation which was formed to take over the Maxwell and Chalmers companies, has been granted Holmes Jones of this city, a Maxwell stockholder, by Chancellor Curtis. Jones alleges that through "reckless waste and dissipation" the Maxwell Motor Co. lost $25,933,194 in sixteen months.

Jones filed a bill of complaint with the court of chancery on Dec. 11 last, asking for the appointment of a receiver for the Maxwell company on the ground of insolvency. Application was made for demurrer, and while this was pending Jones asked permission to amend his complaint. Meanwhile the United States courts at Detroit, Indianapolis and Columbus granted friendly applications for a receivership under which President W. Ledyard Mitchell will take over the affairs of the Maxwell company.

BUS LINES SUPPLANT TRAINS

ALBANY, GA., May 2—Automobile buses are fast supplanting passenger trains as carriers in the southern half of Georiga. The buses are meeting with unusual success.

Corsican Grand Prix Won by Bignan-Sport

PARIS, April 23 (*By Mail*)—Albert Guyot, driving a special 183 cu. in. Bignan-Sport, won the Corsican Grand Prix yesterday, covering the distance of 274½ miles in 6 hours 7 min. 51 2/5 sec., or at an average of 45 m.p.h. This race was the first ever held on the island of Corsica, and was limited to cars having a piston displacement of not more than 183 cu. in. with four-passenger bodies of given dimensions, with fenders, windscreen and touring equipment. A cash prize of $20,000 was awarded the winner.

Only nine cars were entered, these being 2 Bignan-Sport, 4 Turcat Méry, and 3 Chanard-Walcker. Three laps of a most difficult and varied course had to be covered, the road varying from a 30 mile dead level stretch by the side of the sea to a wild climb over the mountains where the rough surface made fast going impossible.

Guyot took the lead on the first lap and held it throughout the race. During the initial lap he was closely followed by his team-mate, Nougué, but this car dropped out on the second lap, and the running was taken up by Dauvergne on a Chenard-Walcker, and then by Rougier on a Turcat-Méry, who finished second, 35 minutes behind the winner.

FORM AIR PILOT ASSOCIATION

TORONTO, April 29—During the winter months there has quietly come into existence an organization, named the Commercial Air Pilots' Association of Canada, which has for its aim the elevation of aviation standards in general, and the best interests of the flying man and his employer in particular. The intention of the association is to link together the commercial pilots of the country as a united body, who, in working for the advancement of aviation, will benefit themselves at the same time. The association will keep on file all the latest and up-to-date information on aircraft and other details.

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Long Credits Greatest Need, Voice of Export Meeting

World's buying needs only temporarily halted and sales will quickly be revived if we can grant terms, is the sentiment of Eighth Annual Foreign Convention. Domestic finances ample to aid situation

By David Beecroft

NO words spoken to the 2000 delegates of the Eighth National Foreign Trade Convention, during the four-day session at Cleveland last week, struck a stronger sentiment or was received with more zest than those of W. P. G. Harding, Governor of the Federal Reserve Board, who, in speaking on the financial and industrial situation of to-day, declared:

> **"We are on a very much safer basis today than a year ago. The Federal Reserve Banks are to-day in a strong position, with an average reserve percentage of gold and lawful money against deposits and note issues of 55 per cent as compared with 42 per cent a year ago. The reserves of the Federal Reserve Banks are now on a higher basis than they have been since the fall of 1918 before floating the fourth Liberty Loan."**

Governor Harding followed this declaration with the suggestion to industry that liquidation has proceeded as far as necessary and that many industries having liquidated to the bone, the Federal Reserve Banks are now able to take part in the movement to stimulate business with a view of liquidating credits that have not been ready previously for this operation. He added:

"The present is a time for courage. In the present situation, when many institutions find credits formerly liquid now in a frozen state, it is important that something be done to start a movement to stabilize business by liquidating these frozen credits. The banks that are carrying these frozen credits have assets back of them to protect them, but they are in turn called upon to furnish new credits for productive processes. Any loan made to-day on a basis of current values is necessarily a sounder and safer one than loans made a year ago on the basis of values then obtainable. Frozen credits can best be thawed by a movement to do business, and in that new movement should not be overlooked the necessity of building up our foreign trade.

"With liquidation as it has taken place in the past year behind us, those industries that have liquidated should be encouraged to build themselves up, and herein is the reason to-day for renewed courage and confidence. We will reach and are reaching every day a safer basis on which to do business. Production cost will be reduced; certain prices will be badly depressed, some to below costs of production and even below the 10-year average, and then will advance to the common level, and the prices of other products will come down to meet them."

Business Dishonesty

Not less important as signifying the attitude of the delegates was the warmth with which the statement of Fred I. Kent, Bankers' Trust Co., to the effect

that the result of the devastation to industry wrought through business dishonesty has probably been more detrimental to the world at large than the devastation caused directly by the war. Kent was not the only speaker of the convention to refer to the deplorable lack of business integrity that has exhibited itself since the armistice. It was a very recurrent convention topic, coming to the surface in the general sessions of the convention as well as in the group sessions. The total loss of respect for contracts had ramifications not appreciated by many. Kent looks for business improvement just as soon as moral improvement occurs, and the speed of business improvement will largely depend on the speed of moral improvement and the speed at which pre-war respect for contracts returns.

Speaking specifically on this subject, Kent contrasted the trade relationships between the American producer and the foreign buyer previous to the war with recent relationships, saying:

"Under ordinary conditions, with law and order enforced throughout the world and integrity and purpose as it once existed, general letters of credit as used previous to the war answered all the demands of foreign trade. Then the foreign trade of the world was carried on as successfully as domestic trade, and the danger involved in time and place between buyer and seller was practically eliminated.

"Under conditions as developed since the war, the importer of American products has not been properly protected. He could not force shipments by the manufacturer. During times of rising prices the exporter could break his contract and neglect to make shipments, notwithstanding that the importer had sales made against such purchases and, when the goods did not arrive, could not make deliveries and was obliged to break his contract under penalty.

Shipments As Prices Fall

"The difficulty of the importer was further aggravated when prices began to fall and foreign exporters, who had letters of credit in their possession which had not yet expired, took advantage of the situation and made shipments. In many cases importers, not expecting to receive goods because of previous default in shipments, had contracted for other goods. This form of dishonesty on the part of exporters was exercised in many cases where satisfactory relations had been carried on between the manufacturer and importer for four years.

"As a result of this situation, seaports are clogged with goods which cannot be disposed of without great loss and which have aggravated stagnation in trade. Unfortunately, foreign exporters and importers have not been the only delinquents, as many Americans have been just as bad. During the time of falling prices, repudiation in connection with domestic trade was as general as in foreign trade. While prices were rising, manufacturers and producers failed to make deliveries; when prices began to fall, purchasers refused to accept goods contracted for.

"That such a development should occur in the United States shows the depth to which the level of integrity had fallen, due to the world-wide propaganda that has been carried on by those who would destroy the institutions of civilization in order that they might become possessors of goods which they claim others have not the right to hold. This vicious propaganda has reached its height and the morals of the people its greatest depth. A turn has taken place in the minds of men that will continue with growing force until the re-establishment of business integrity has been effected.

"As the moral forces of men gather it will again become possible to carry on trade in a normal way except that it is going to take time to overcome the effect of the devastation in industry which has been wrought through dishonesty. That has probably been more detrimental to the world at large than the direct devastation caused by the war.

"During this period of reconstruction a longer period than usual is going to be required for payment of goods imported by the nationals of many countries of the world. If such additional time is not allowed, the return to normal trade is going to take longer than otherwise need be true, during which time the difficulties of all peoples will continue."

Longer Credits

Of prime importance for the stimulation of foreign trade, which has been falling off for several months, longer credits are necessary. **The fallacy of considering cash against documents at seaport as the ideal scheme for foreign trade has been exploded.** European nations are in the market, and the necessity of any country engaged in foreign trade, buying as well as selling, has taken hold. Foreign trade consists essentially of buying and selling. You cannot have it unless these two factors are present. It is not possible for any country to be unto itself any more than it is possible for any man to live unto himself, for any family to live unto itself, or for any community to live unto itself.

Profits are an essential of foreign trade, but need not be the motive. There can be no real development of any nation unto itself. Under such a condition retrogression will start.

As an example, witness certain interior provinces in China which for nearly 2000 years have lived unto themselves and to-day are not as far advanced as at the birth of the Christian era.

A still further necessity for foreign trade is that the natural resources of the world must be united before they can best serve the world. As this is accomplished through foreign trade, the general level of nations will rise slowly during the year. Foreign trade is essential to the intellectual development of the people.

How long credits will increase foreign trade was suggested by W. C. Redfield, president of the American Manufacturers' Export Association, who said that he knew of orders waiting for $20,000,000 worth of American goods to be sold in the foreign field just as soon as extended credit under the Edge act could be established. The machinery for extended credit is one of the prime requisites of foreign trade. It is impossible for the United States, with a file and saw as its tool equipment in foreign trade, to compete against European nations which have modern machinery for financing their foreign trade. Redfield declared that we have reached the end of our financial power in export trade and unless something is done by way of improving the machinery for financing this trade, we have reached the top of our foreign trade. A British exporter, continued Redfield, can go to five or six places and obtain credit for one to six years on export goods.

Senator Edge Speaks

Senator Walter E. Edge of New Jersey, father of the Edge law, establishing debenture banks by which long-term credits in foreign trade are possible, speaking at the annual dinner at the close of the convention, urged the establishment of confidence at home and the extension of credit to the foreign buyer as the best method of stimulating domestic production. He re-echoed the words of Governor Harding of the Federal Reserve Board when he stated that national prosperity is dependent on pro-

duction in industry and that the first medicine for the buyers' strike must be confidence, and for the foreign situation it must be the provision of credit and the transmutation of that credit into dollars to pay American producers and labor and agriculture. The foundation of all business is confidence and credit is the cornerstone. There can be no confidence among the people while uncertainty prevails as to the nature of the remedies to be provided for the present uncertainty and apprehension.

Senator Edge believes buying power exists both at home and abroad and that this can be stimulated at home by a return of a confidence that can be brought about only by a realization that men can develop, can make a reasonable profit on their enterprise and then retain that profit. The foreign market can be stimulated by an extension of credits, and the nations seeking to buy have the necessary security to protect such credits. With the Webb Act, legalizing combinations for export business, and the Edge Act, providing for extended credits, American industry has the necessary facilities for foreign trade.

Foreign Investments

American investors will have to be educated to the advantages of foreign securities much as the investing public of European countries were previous to the war, according to George R. Meyercord, president of the Illinois Manufacturers' Association, who declared that millions of dollars' worth of export business is at present being lost to America because of our attitude toward foreign investments. If this prospective trade was written into orders many of our idle factories could operate at capacity.

Under the Foreign Trade Financing Corporation the American investing public, which now loans vast sums on the security of a farm, a house or factory, will place its money abroad with more security than the mortgages just referred to. Back of the debentures will be the huge capital guaranty, and back of that again in each case will be the large variety of collateral which will, in the aggregate, create a law of averages that will be so certain to insure repayment to the corporation as to make the risk infinitesimally small to the investors.

Meyercord cited numerous examples of how foreign trade is being lost to-day because of inability to handle credits such as can be handled when the Foreign Trade Financing Corporation is operating. One example was that of a total order of $20,000,000, consisting of fifteen different varieties of merchandise, which order could not be accepted, due to existing banking conditions. Another example was that of a large pulp and paper company in Scandinavia desiring to purchase $500,000 of logging machinery. This company was willing to store enough of its manufactured product to guarantee ample security if the necessary credit could be established. The order was lost. Another example was that in which the proposed purchaser was a Scandinavian municipality. The city offered as security for credit city bonds and tax warrants, due six to nine months later. The amount of the tax warrants were many times in excess of the amount of the purchase. It was not possible to give the nine months' credit necessary and the purchase was made in other countries where such credit was obtained.

Frank H. Taylor, president of the S. S. White Dental Manufacturing Co., expressed the belief that it will be a reflection on us as manufacturers and bankers if we cannot get together and establish some machinery for international trading. Our customers in foreign lands need our goods and cannot pay for them to-morrow or the next day, and they have a right to ask for long credits because we have become a creditor nation and should be able to give them financial assistance. Foreign credits must not be granted by chance, and it is our responsibility that a stabilizing plan be set up to regulate such.

As to how lack of credit is affecting the export lumber situation, J. J. Donovan, vice-president of Bloedel-Donovan Lumber Mill, said that under present conditions the foreign buyer is required to furnish a letter of credit to accompany his order, which means that his credit has to be such as to enable him to pay for the cost of the cargo two, three or four months before shipment, which would mean four or five months before delivery is made to him in the foreign port. He must also pay freight in cash not later than the delivery of the cargo, which is another restriction to trade. America has the lumber to sell, the world desires to buy lumber, the buyer is solvent, but has neither cash nor goods immediately available for payment. His record for honesty is good. He has paid in the past, he will pay in the future. How can we tide over the present? The banker must come in to provide for continuance of necessary business by arranging credits which his reserve capital warrants. It is a question of credit for these foreign firms of established reputations. Without these credits business stops. A better understanding of the problem of credit will revive trade.

Legislation

As to how American foreign trade is being hampered in certain portions of the world by unfavorable legislation the present situation in China is an example. Our present Revenue Act of 1918 requires American citizens doing business in foreign countries to pay the same income taxes that are paid by resident citizens. This is working as a serious handicap on our foreign trade in that rival countries, such as Great Britain, do not require their nationals engaged in trade in other countries to pay such taxes. The British merchant resident in practically every port and market of the world has been encouraged by the government, and his freedom from home taxation has been an important factor in putting British overseas commerce into its commanding position. A more specific example of the hardship worked on American merchants resident in other parts of the world is that of the American citizen doing business in the Philippine Islands. He is required to pay his income tax to the United States, whereas the merchants of other countries resident in the islands are relieved from such. Very frequently this tax represents the difference between success and failure, and if such tax could be put into a reserve fund, as is done by the nationals of other countries, American commerce would benefit materially. The importance of this in the Philippines will be clear by an example:

On an income of $600,000 the United States income tax is $375,190. The Philippine income tax, which a national of another country would have to pay, is $77,735. This means a difference against the American merchant of $297,455. On an income of $100,000 there is a tax difference against the American merchant of $24,205. No American can establish a business in any foreign country to-day without facing a fact that the disadvantage worked on him by this income tax requirement may nullify his efforts and leave him at the mercy of his more fortunate rivals.

In connection with this handicap on the American merchant resident abroad it should be borne in mind that the Philippine Islands front directly on China, which is considered by many to be the greatest field in the whole world for commercial development. The Port of Manila has one-half of the population of the globe

within a radius of 3000 miles, and there are many of the big centers of the East, such as Singapore, Hongkong, Shanghai, Yokohama, etc., etc., within a radius of 1500 miles, or a five-day sail.

Daniel R. Williams of the American Chamber of Commerce, Manila, declared that unless the discrimination worked by the Revenue Act of 1918 against our merchants in the Philippines is promptly and effectively relieved, the inevitable consequence will be to paralyze and destroy what we have already accomplished in the islands and render abortive every project formulated or in prospect for the future.

The serious character of the Revenue Act of 1918 is that it falls on Americans doing business there, while Filipinos, British, Japanese, Germans and trade rivals of every other race and color are not so taxed. As these latter pay no tax to their home governments on their Philippine income, it results that in our own dependencies and under our own flag we penalize our countrymen in favor of foreigners. Further, Americans in the Philippines have no voice or participation in the enactment of our laws, and taxing them for the benefit of the home government is not without analogy to certain events connected with the early history of our country when Great Britain attempted to impose certain stamp acts on the colonies.

A sentiment favorable to having Congress pass what is known as the China Trade Act of 1921 was expressed by the convention. J. B. Powell, Shanghai, in mentioning the necessity for the passage of this act, showed how an American merchant desiring to do business in China must organize a company under the laws of one of our forty-eight states, which laws are not satisfactory for such a purpose.

A $500,000 Handicap

The case is similar to that of taxation in the Philippines. A case in point being that of a Boston concern, doing business in Shanghai, paid $500,000 in taxes to the United States in two years, whereas rival British concerns did not have to pay $1 to their respective governments during the same period. We have to-day a good American selling personnel in China, and the China Act is designed to place United States nationals on a basis of equality in the matter of trade with the nationals of other countries doing business in China. During the war we increased our trade with China from 6 to 17 per cent, but now that European countries are back in the field there is grave danger that our trade will fall back to 7 per cent unless Congress passes legislation such as the China Act.

At present 67 per cent of the total foreign commerce of the Philippine Islands is with the United States, but there is no reason why this should not be 95 per cent, according to the wishes of the natives, if due regard is made for trade requirements. The Filipinos have a feeling that American citizens resident in the United States should invest in Philippine bonds, such as those needed to improve the Port of Manila. There is objection on the part of the Filipinos to certain trade restrictions on products of the Philippine Islands, particularly as the Philippine legislature has no voice in tariff relationships between the islands and the United States. This function rests entirely with Congress, which is considered highly unfair by the Filipinos. There is a strong demand for the restoration of normal exchange with the islands, as well as a demand for long credits until conditions become normal. The putting in commission of several ships between our Pacific Coast and the islands during the past year had a favorable influence on trade, but unfortunately at the present time the cable between the islands and the United States is not working and messages are sent by way of Europe.

Merchant Marine

A serious situation in connection with our foreign trade was voiced by James A. Farrell, chairman of the National Foreign Trade Council and president of the United States Steel Corporation, as the future of our merchant marine. He said that serious consideration must be given the problem of maintaining it under present handicaps. The steel ships constructed by the Shipping Board are as good as those built by any of our allies, he said, but constructive legislation must be enacted if we are to benefit by these ships as we should. Farrell declared a serious error was made in 1919 by the Shipping Board not disposing of a large portion of the fleet at prices bearing a fair relation to moderately depreciated cost.

An opportunity to realize at least $800,000,000 was lost, this sum representing the difference between the value the ships that might have been sold at that time and their value to-day. It is questionable whether under present conditions any part of the merchant fleet could be sold to-day except at a sacrifice.

He recommended laying the ships up rather than making such a sacrifice, and declared that the United States should never again be placed in the position of being without sufficient ships to support its army and navy. There is too much ocean tonnage at present, and Farrell recommended an international laying-up of ships program on the basis of relative percentage of tonnages owned by the different nationals.

As a direct bearing on our foreign trade, Farrell urged American exporters to ship by American ships, even if the cost is higher than on ships of other nations. He urged American exporters of bulk commodities to sell their goods on a cost-insurance-freight basis, thereby controlling the ocean freight and allowing American ships a reasonable rate. He did not urge this as an appeal to patriotism but an appeal to reason, since our producers cannot know their markets, nor the laid-down paraty of their competitor's prices unless they include in their sales price the cost of their goods, the insurance and ocean freight to the ultimate destination. It is up to American producers to support our shipping in this crisis. It will be necessary to repeal the navigation laws which are not only strangling our ocean-going shipping but affecting our carriers on the Great Lakes. One of these laws requires the engine room crew on an American freighter to be 30 per cent larger than on the steamships of any other nation. The extra cost of labor on an American ship represents 5 per cent more on the capital investment than the labor on ships of other countries.

Exchange

Exchange, which is an important factor in foreign trade, did not receive so much attention at the convention this year as last, due largely to the fact that it is a more definitely known factor to-day, whereas it was largely speculative, so far as a solution was concerned, a year ago. Thomas R. Taylor of the Latin-American Division of the Bureau of Foreign & Domestic Commerce, made an elaborate presentation of the exchange situation, particularly with regard to Argentina, Brazil, and Chile, but what he had to say applies equally to practically all of the Latin-American countries. He looks for a rather restrictive market in this field for some time to come, which applies to practically all parts of the world as evidenced by other speakers. The possibility of trade with Europe did not receive any atten-

tion this year, Latin America and the Far East being the centers considered.

Taylor based his entire conclusions with regard to the present situation of Latin-American exchange on three fundamental causes which brought about the present collapse of exchange with these countries:

1. The change from a period of heavy excess of exports to a period of abnormally low excess of exports, or of excess of imports. The change in imports from these countries to the United States is indicated by the following figures; which show the amount in which the imports from these countries into the United States exceeded our exports to these countries.

1913	$185,000,000
1918	400,000,000
1919	358,000,000

During 1920 conditions reversed themselves and the balance of trade became unfavorable to them. In other words, they were exporting more than they were importing. In the last quarter of 1920 exports from the United States to Latin-America exceeded the imports from these countries by $69,000,000.

2. The second reason for the collapse of their exchange was that the flow of foreign capital to these countries ceased, Latin-American countries found their exports decreasing because of the sudden cessation of demand caused largely by the inability of Europe to buy and by the world-wide reaction in high prices leading to the so-called consumers' strike.

There was a heavy slump in the price of raw materials exported by these Latin-American countries. Sugar declined from 16 to 10 cents per lb. in the third quarter of 1920; coffee declined from 26 cents to 12 cents in the first half of the year; wheat declined from $2.58 per bu. to $1.80 per bu.; wool declined from 59 cents per lb. to 24 cents. This slump in prices together with the decline in volume caused a remarkable decrease in the export trade of these countries.

3. The third cause for the collapse of exchange is given as impaired credit. The currency in many countries has depreciated and in some government finance is not sound. Some of the countries have not yet paid interest charges on their debts. There is little accumulative reserve to fall back on in periods of depression such as the present as Latin-Americans are not a saving people, and much of the money earned easily was spent during 1919 and 1920.

The possibilities for an increased flow of foreign capital to Latin-American countries are fairly good. An American firm has recently closed a contract of $8,000,000 for the construction of a railroad in Bolivia. Marconi Limited has contracted with the government of Peru to operate the post office, telegraph and radio-telegraph services of the country. We have made loans of $30,000,000 to the State of Sao Paulo, Brazil, and $25,000,000 to Chile. Activities of this character indicate an improvement, but some of the countries confront a period of low receipts, and some of them will have a lower credit rating for the next year or two than they have recently enjoyed. The value of exports from these countries will increase on account of the quickened demand in Europe and the United States, which is already apparent, and also because of the large crops in Latin-America just now coming on the market.

Unsold Stocks

Although the trade between the United States and Asia increased five fold since 1914, there are in certain countries in Asia great stocks of unsold United States goods in ports due to cancellation of contracts. American importers, resident in China, have been literally swept off their feet and what is known as the mushroom trader and importer of the Far East has gone and stable business considers his elimination a good thing. After the war when there was no demand for our goods in Asia, belated shipments were pouring into that country in the greatest volumes. At present the markets of China and India are clogged with goods that must be sold at a loss and until these goods are sold the demand for new goods from this or any other country will be small. There are certain signs of improvement in trade with the Far East which will resume slowly. If China were on a gold basis instead of a silver standard, the Shanghai tale which in 1919 was at $1.22 and to-day is at 62 cents, would it is believed have a more stable character. This unit of value has never been controlled by the government and has always been subject to fluctuation. If the value of silver could be controlled, it would have a stabilizing influence, but there seems little possibility of this. Japan is on a gold standard, and India on what might be designated a gold exchange standard.

Notwithstanding present exchange rate in the Far East, M. A. Oudin, Far East representative of the International General Electric Co., believes the markets of the Far East constitute the world's greatest prize. He said that the number of American firms doing business in the Far East has decreased in contrast with the present activities of English and German firms, at a time when the necessity for aggressive American activity is greater. If American business expects successfully to compete with other nations in the Far East, it must exert itself primarily in three directions:

1—It must freely co-operate with the native business and local enterprises.

2—It must liberally invest its surplus capital in the development of industries, natural resources and public works.

3—It must insist that American economic interests be upheld by an American diplomacy as alert and vigorous as that displayed by other countries.

One way in which investments in China can be handled is through a group of American and foreign bankers known as the Consortium. This Consortium is prepared to loan money to China for public works, including railroads and other national purposes whenever China desires such assistance. The Far East is essentially a battleground on which many nations have engaged and probably will continue to engage in a hard struggle for commercial advantage, and not only must American residents doing business in the Far East be placed on a basis of equality with the nationals of other nations competing for that business, but the necessary arrangements for extended credits must be made.

Foreign Advertising

Advertising as a means of securing foreign trade was the subject of one group session. The policy of the home factory directly controlling the advertising copy and practically selecting the mediums in which it is to appear in foreign countries, as compared with leaving the writing and disposition of this copy in the hands of the distributors in the different countries, was advocated by Frederick Dickinson, advertising manager of the Hupp Motor Car Co. In the early days of the Hupp export experience the distributor, no matter in what country he did business, wrote his own copy and selected his own advertising media, and determined the size and extent of the advertising schedule, the factory dividing the expense on a basis of appropriating a definite amount per car shipped. This situation has been discontinued.

Under the new plan, the factory pays the entire cost of its advertising campaign. It makes up the list of publications. The reason for the change of policy was that the company wanted to be sure that the factory's story was being told regularly and steadily throughout the

market and told in its own words. The plan was to guard against misstatements, exaggeration and insufficiency of statement. Although opposition on the part of distributors to this plan was expected, none materialized. The Hupp company is still handling its foreign advertising in this manner, and is satisfied with the plan. The machinery and routine of the work is handled through an agency.

The necessity for studying the psychology of the different nations you are doing foreign trade with was emphasized by Fred Cardway, general manager of the Packard Export Corporation. Cardway is emphatic in the statement that no exporter should attempt to do business in any market until he knows thoroughly its distinguishing characteristics, its peculiarities and its sales potentialities. Psychological truths are independent of time, place or race. Human nature is the same the world over. All men are actuated by the same desires for food, clothing and shelter, so our problem in interpreting the psychology of the races of the world resolves itself into a matter of familiarizing ourselves with the racial surface differences that persist as a consequence of tradition, habit and geographical location. It is for the salesman to trace these varying qualities, these customs, morals, prejudices, fashions and social and national standards back to their source. Having studied these, he is then in a proper frame of mind to approach his prospects.

Foreign Trade Education

J. Walter Drake, Hupp Motor Car Co., and chairman of the Export Committee of the National Automobile Chamber of Commerce, Inc., recommended the establishment of a government training academy to be devoted exclusively to the preparation and education of men for the government foreign service. Such an academy would rank with West Point or Annapolis. This academy should have sufficiently large classes at all times to supply the necessary men for any possible demand on its service. A thorough and intensive course of training, both commercial and diplomatic, should be provided. There would be interchange of duties both before and after entering actual service, so that a man upon finishing his course would have acquired a sufficient knowledge of diplomatic usages to enable him to fill a consular place if necessary. There would be a fundamental training in the necessary requirements to fit the men to meet upon foreign ground the trained experts of other nations.

An academy of this character would do much to prevent the loss to the foreign service of men who through long training and experience have dropped out because of lack of adequate funds to carry on the work. The government foreign service requires special training and capacity in its men, which can only be produced through an academy of this character.

Drake believes that some movement of this kind is needed to correct the situation of to-day. We must come to a quick and full understanding of the fact that a proper and adequate organization of the government service is vitally necessary as a foundation for the new enterprise of the great world trade for which we are actively bidding. As a nation we must recognize and acknowledge the fundamental necessity of foreign trade. There must be built up in this country a public opinion that will force Congress to accept foreign trade as a part of our national policy and provide for its adequate support as for other essential parts of the government program. Diplomacy is inseparably linked with foreign trade. The government should have a foreign service adequate to fulfill its responsibilities for the success of the national enterprise. It is the duty of the government to establish the contact with prospective buyers through diplomatic relations; thereafter through the same means to insure the continuance of an attitude of friendliness and good will that the channels of trade may be kept free. The influence of diplomacy must be exerted from the very beginning and continued to the end.

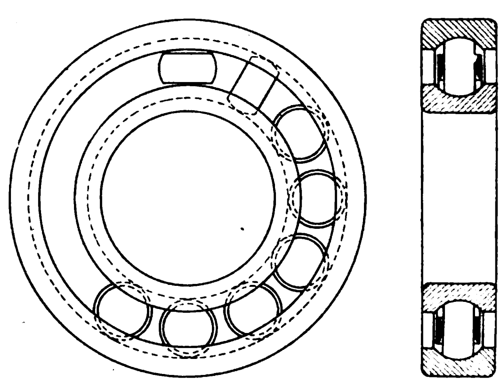
A New Disk Type Bearing

A NEW Swedish disk bearing for motor vehicle and other purposes has recently been introduced in this country. The disks are not cylindrical but, on the contrary, are central sections of an ellipsoid of revolution. The bearing comprises two race rings provided with grooves in which the disks run. It is possible to completely fill the space between the race rings with disks by inserting the disks with their axes perpendicular to the bearing axis and then swinging them around into their correct position.

One of the advantages claimed for the NKA bearing is that the disks are self guiding, that is, do not require a cage to guide them. A cage is used only because the disks must be held apart in order to reduce the friction. It is obvious from the sectional view of the bearing that a bearing of this type is capable of taking both radial and thrust loads, the latter, of course, to a far greater extent than the ordinary annular ball bearing.

It is claimed that this bearing known as the NKA can withstand as high speeds as an annular ball bearing, and that as the disks have less mass than balls of equal carrying capacity, the centrifugal force on the disks is less. High carrying capacity is obtained in this bearing by reason of the fact that the pressure on the disks is greatest at the center of the disks and very small at the edges, hence there is no tendency for the edges to become damaged. When the disk bearing is subjected to thrust loads the disk reaction automatically assumes a certain angle which depends on the amount of pressure.

Section and side view of the NKA disk bearing, latter showing method of assembling.



In these disk bearings the grooves of the races and the rolling surfaces of the disks do not have the same radius. The radius of the disk rolling surface is slightly smaller, being so calculated that when the bearing is under full load the entire width of the rollers is in contact with the bearing race. The manufacturers of this bearing are the Northern Ball Bearing Co.

Germany Reveals Extent of Automotive Exports

Statement issued by official statistical bureau tells the extent of trade for the first eight months of 1920. Figures show that trade reached many parts of the world. Domestic business is much hampered by taxes and operating costs.

By Benno R. Dierfeld

DURING the first eight months of 1920 Germany exported 14,024 passenger car and truck chassis. During the same period there were imported into Germany 122 passenger cars and 50 trucks.

This information is contained in the first statement issued by the German Statistical Office on automotive exports and imports. The figures cover the period from Jan. 1, 1920, to Aug. 31, 1920. The figures are not accompanied with descriptions that the American manufacturers would like to have for comparison, but they are done in the method of the German Statistical office.

Export—It is regretted that the export figures make no distinction between car and truck chassis and no distinction between a chassis and the complete vehicles. The only information available as to these shipments is the total number of vehicles, the weight and total value. The distribution to the several countries is compared, in the report, only by weight. To this is added an unofficial computation of percentage.

The total exports were 14,024 passenger car and truck chassis, listed at 28,764,500 kilograms, value 883,116,000 marks. A kilogram is 2.204 pounds. Owing to the variations of exchange during the period under discussion, an estimate of the value of a mark is impossible. The point of consignment of the chassis and the weight to each country during the period reported on is as follows:

Country	Kilograms	Per Cent
Belgium	658,100	2.30
Denmark	2,871,900	10.00
France	489,300	1.70
Great Britain	3,272,200	11.40
Italy	131,000	.40
Netherlands	6,025,700	21.00
Norway	1,235,900	4.30
Poland	394,600	1.30
Switzerland	4,160,500	14.50
Spain	5,655,600	19.70
Southeast Asia	520,800	1.80
United States	833,000	2.90
Central America	148,800	.50
South America	563,000	1.90
Other America	597,400	2.00
Other countries	1,206,700	4.30

The percentage of exports to the late enemy countries as shown by this table is interesting, to say the least. In the main, it may be said, that the trade has about followed the lead of the unofficial estimates made recently by American exporters, who have been watching Germany closely. Just what is meant by "Other" American countries after setting forth United States, Central America and South America is not clear.

Imports—In the accounting for imports into Germany, the figures are much more satisfactory, but these imports are so small as to be a negligible factor in trade. They are about what might be expected.

Of the 122 passenger car chassis imported, with a total weight of 263,000 kilograms, the division of the trade follows:

Country	Chassis	Per Cent
Austria	78	64
United States	10	08
Other countries	34	28

The 50 motor truck chassis are given a weight of 137,100 kilograms. The statistics are:

Country	Chassis	Per Cent
Austria	15	30
United States	22	44
Other countries	13	26

Motorcycles—The motorcycle trade is rather insignificant. The exports were 2839 machines of a total value of 19,657,000 marks. The country of consignment and the number of machines is:

Country	Number	Per Cent
Denmark	531	18.75
Netherlands	893	31.10
Sweden	372	13.30
Switzerland	537	18.95
Other countries	506	17.90

The imports were 17 motorcycles with a weight assigned of 2400 kilograms.

Parts—There is no mention of imports of parts during this period and the exports of parts are listed by weight, with no distinction as to kinds of parts or whether for cars, trucks or motorcycles. The total weight of these exports is 1,188,700 kilograms. The countries of consignment and the weight in kilograms follow:

Country	Weight	Per Cent
Belgium	170,800	14.00
Denmark	141,800	11.00
France	77,700	7.00
Austria	55,200	5.00
Poland	5,900	.50
Portugal	1,600	.10
Finland	27,400	2.40
Sweden	239,800	20.00
Switzerland	205,800	18.00
Spain	16,100	1.40
Southwest Asia	3,800	.30
United States	3,800	.30
Central America	3,200	.20
South America	8,900	.80
Other countries	226,900	19.00

Tires and Tubes—The exports in the rubber section of the automotive report show that tubes, tires and tire protectors were exported to the value of 36,838,000 marks, with a total weight of 249,200 kilograms. The country of consignment, with the weight to each country, follows:

Country	Weight	Per Cent
Denmark	51,800	20.80
Italy	10,300	4.20
Netherlands	52,500	21.00
Switzerland	73,000	29.20
Southeast Asia	13,100	5.30
South America	15,400	6.20
Other Countries	33,100	13.30

The imports are listed differently. First come 56,876 air tubes with a weight of 119,400 kilograms. The country of origin and number of tubes are:

Country	Number	Per Cent
Belgium	12,200	21.50
France	20,072	35.30
Great Britain	3,896	6.85
America	16,485	28.99
Other countries	4,223	7.36

Next come tire casings, of which there were 95,158 with a weight of 446,700 kilograms. The country of origin and the number of casings follow:

Country	Number	Per Cent
Belgium	19,083	21.01
France	18,209	19.12
Great Britain	10,744	11.30
United States	11,326	11.32
Other countries	35,796	37.25

These figures appear to reflect Germany's position as to raw materials for tires at the end of the war. It must be remembered that German tire exports before the war were a considerable amount.

Domestic Trade Retarded

The German automotive industry is practically without hope of important domestic business in the near future. This is partially due to the present 15 per cent sales tax, which operates double on the exchange of a used car for a new one, as the sale of the used car is taxed also. This has practically ended the exchange sales, for in the case of a trade of a used car on the basis of a $500 value, for a new car of $3000 value, the tax on the deal would be on a $3500 transaction.

In addition to this there is the severe wheel tax and the high price of fuel to be considered. Dealers also anticipate a very heavy tax on personal property. It is feared that with all of these taxes on the car, and the additions of heavy property taxes, there will not be much money left for motor cars. The sales tax on the purchase of a large car at present often amounts to 30,000 marks.

It is true that the sales tax law, which was passed as a luxury tax, operates to the benefit of the professional or business use of the car. But the tax collector is taking no chances. His method is to collect the entire amount of the sales tax and then remit parts of it from time to time, as he is convinced that the vehicle is used for the exempt purposes. The difficulty of this is that the physicians and others who would most benefit from this law have a very serious trouble in finding the money with which to pay the tax at the time of the sale.

This sales tax is not imposed on cars sold for export, unless the customer comes to Germany to make the purchase. If the car is bought in person in this country then it must pay the local luxury or sales tax.

Despite this feeling as to domestic trade, the automotive industry is proceeding with plans for an automobile show this fall, the dates being from Sept. 23 to Oct. 2. This show will be held in the large building erected in 1914 by the Automobile Manufacturers' Association and the Automobile Club of Germany, especially for a show that was planned for the fall of that year but which was not held because of the outbreak of the year. The building is a one-story structure, especially planned for industrial exhibitions and has a floor space of 20,400 square yards and is the largest exhibition hall on the continent. The show regulations as announced in part are:

As exhibits, only products of German firms, having their residence in the German empire, shall be permitted.

The announcements are to be delivered until May 15 at the Geschäftsstelle der Ausstellung (show office), Berlin, W. 9 Leipziger Platz 16. Announcements coming to hand later are taken into consideration, too, if space is available. However, for such announcements an additional rental of 25 per cent is required. The rent for a show stand, including the uniform stand equipment, is 500 marks for the square metre area and 250 marks for the square metre wall surface without area. All exhibits are distributed among the stands by lot within the following groups:

1. Passenger cars, shown by automobile factories.
2. Passenger cars, shown by body works.
3. Commercial vehicles of all kinds.
4. Motorcycles (if not shown together with motor vehicles).
5. Material, spare parts and accessories for motor vehicles.
6. Equipment for automobilists, clothing, cars, books, magazines, etc.
7. Special tools and machine tools, used in manufacturing of motor vehicles or their parts and accessories.

It is expected that this show will bring many new models to notice and that it will really show to the public the vehicles with which Germany hopes to compete for the world trade.

Ups and Downs of Industry

The story of the German automotive industry since the war is interesting. The second half of 1919 was a period of progress for the industry and in the first quarter of 1920 the industry had set itself for a period of progress, but in March came the reactionary commotion, called here the "Kapp-Putch," which caused a general economic and political confusion and was followed by a period of depression. To make the situation even worse, it was during this period that the serious change in the rate of marks took place. This financial flurry was accompanied by the rise of prices of cars on the domestic market and the complete loss of the export trade that had been well started.

It was not until September of 1920 that the automotive market again reached a stage equal to that of the end of 1919. During 1919 there had been a fair market for used cars and trucks, mostly army vehicles overhauled for civilian service. But this trade ended with the March break-up of business, and at the end of 1920 there the trade had not recovered. At the close of the year used car prices were about 30 per cent lower than at the beginning of the year and trucks were fully 45 per cent lower than at the end of 1919.

The trend of prices of passenger cars and trucks is well shown in the minimum prices at which a vehicle

can be listed for export for the purposes of collecting duties. The Government committee revises the minimum prices frequently. The Convention of Truck Manufacturers advises as to the prices of trucks. It must be remembered, however, that the prices quoted in these tables are the minimum, applying only to the cheaper cars and trucks of each class. The more carefully manufactured cars are listed at much higher prices. The prices given do not include export duty, but are the office price for an export shipment. Only three sizes of vehicles are mentioned for this comparison. The prices follow:

Passenger Car Chassis Value

	Engine Brake Hp.		
	15 Hp.	30 Hp.	45 Hp.
	Marks	Marks	Marks
Jan. 10, 1920	18,000	32,000	41,000
Feb. 4, 1920	31,500	56,000	71,750
May 1, 1920	39,375	70,000	89,687
June 11, 1920	40,000	75,000	95,000
Sept. 3, 1920	37,500	70,000	98,000
Dec. 21, 1920	40,000	77,000	92,000

Convention Values for Motor Trucks

	Load Capacity		
	2 Tons	3 Tons	4 Tons
	Marks	Marks	Marks
Jan. 10, 1920	60,000	70,000	75,000
Feb. 4, 1920	80,000	88,000	93,000
May 1, 1920	120,000	130,000	140,000
June 11, 1920	120,000	130,000	140,000
Sept. 3, 1920	102,000	112,000	122,000
Dec. 21, 1920	210,000	112,000	122,000

Licenses Are Restricted

Another very serious factor in the matter of sales has been the attitude of the Government toward the issuing of licenses. The owner of a motor vehicle is required to present a good reason why he should use his vehicle. The Automobile Dealers' Association published this estimate of the number of licenses in effect February 1, 1920. The percentages are a comparison with the number of permits in effect January 1, 1920:

Passenger cars	53 per cent
Motorcycles	42 per cent
Trucks	204 per cent

The increase in the number of trucks indicates the development of motor freight transport during the war, when the railways were required for military purposes. Toward the end of 1920 the number of licenses were increased. While more vehicles are permitted this year, the exact number is not published.

Fuel Prices

Fuel prices also have had a retarding effect, as can be seen by the following table of prices:

Gasoline-Consumer Prices for 100 Kilograms

	Delivering Firm	
	German-American Petroleum Co., Hamburg.	Rhenania, Düsseldorf.
	Marks	Marks
December, 1919	505.00	590.00
January, 1920	510.00	528.70
February, 1920	660.00	814.00
March, 1920	876.50	956.00
April, 1920	800.00	823.00
May, 1920	937.00	1,062.00
June, 1920	772.00	1,062.00
August, 1920	745.50	804.00
September, 1920	745.50	775.00
October, 1920	745.50	775.00
November, 1920	761.50	793.00
December, 1920	761.50	793.00

Benzol-Consumer Prices per 100 Kilograms

	Marks
May 17, 1919, to Jan. 5, 1920	142
Jan. 6, 1920, to May 19, 1920	310
May 20, 1920, to end Feb., 1921	560

The excessive sales tax, 15 per cent on passenger cars, whether the vehicle is a new or a used car, is a severe sales resistant. But this is paid only once, and a more serious factor is the wheel tax levied by the Federal Government. This tax, unlike the sales tax, applies alike to all vehicles, whether used for commercial, professional or recreation purposes. The present cost of operating a car in Germany is shown in the following table, which is accepted in this country as an average of all costs:

Operating Costs per Kilometer

	Marks
15 B.hp. passenger car, without driver	3.00 to 3.50
45 B.hp. passenger car with driver	7.00 to 7.50
4-5 ton truck with driver	9.00 to 9.50

The existing decrees of the Government have practically excluded foreign cars from the German market.

A Battery Meter

An instrument which when mounted on the dash of an automobile and properly connected to the electric system shows the operator not only at what rate the battery is charging or discharging, but also the state of charge of the battery, has been placed on the market by the Edward A. Cassidy Co., Inc., under the name of Cell-O-Meter. It is of the same size as an ordinary dashboard ammeter and is designed to take the place of the latter on the instrument board. The connections are the same, except for one extra connection from the Cell-O-Meter to ground.

The Cell-O-Meter embodies two distinct instruments and has a two-part dial. On the left side is the ordinary ammeter scale, showing both charging and discharging current. The right-hand half of the scale, marked "Battery Condition," is divided into three sections; the red section denotes that the battery is nearly discharged and should not be used; the yellow section denotes that the battery is about half charged and is safe to run with, while the green section shows that the battery is fully charged.

Ordinarily the instrument acts as an ammeter, but by pushing a button on the dial the battery condition indicating mechanism can be brought into action. The instrument evidently operates on the voltage measurement principle. It is claimed that when this instrument is fitted it is not necessary to use a hydrometer. At present the instrument is made in four models and the model to be used depends upon the battery voltage and ampere-hour capacity.

S. A. E. Summer Meeting Program Includes Many Important Papers

Five professional sessions and one business session, together with Standards Committee meeting will occupy greater part of last week in May, but allow ample time for usual sports and recreation. Aeronautics, highway transportation, research and standardization the important subjects.

DEFINITE announcement concerning the time and nature of the several sessions to be held during the semi-annual meeting of the Society of Automotive Engineers at West Baden, Ind., May 24 to 28, has recently been made and is summarized below. The convention will open, as usual, with a meeting of the Standards Committee, which all members and other engineers interested are invited to attend. Many important recommendations formulated by the various divisions of the committee will be considered. In the evening of the same day, Tuesday, May 24, the usual business meeting will be held. This will include a brief address by President Beecroft and election of members of the Nominating Committee.

The morning of Wednesday will be given over to simultaneous sessions devoted, respectively, to Highway Transport and to Aeronautics. The need for Federal legislation and other phases of aeronautics bearing upon commercial air transportation will be considered, while existing types and trends in aircraft engines will be discussed from the standpoint of military and commercial requirements.

Wednesday, Thursday and Friday afternoons and evenings will be given over to sports and recreation, for which elaborate provision has been made. Many members will be accompanied by their wives, and the program of sports includes many events for ladies.

Thursday morning is to be devoted to a general research session, at which two of the papers will contain descriptions of the facilities possessed and methods followed by two research organizations, those of the University of Michigan and the General Electric Co. The two other papers will deal with subjects of immediate practical interest to all automotive engineers. One of these will discuss lubrication, the author, C. W. Stratford, of the Associated Oil Co., being well known because of the extensive research and development work he has conducted in connection with lubricants and lubrication for automotive engines. The remaining paper at this session has been prepared by Herbert Chase of AUTOMOTIVE INDUSTRIES' Editorial Staff and deals in a comprehensive way with Practice and Theory in Clutch Design. Over twenty-five designs of American and British clutches are illustrated and discussed, the advantages and disadvantages of the various types pointed out and the principal design factors outlined.

The Combustion Session, to be held on Friday morning, May 27, will include three papers, at least two of the authors being well known among engineers who have made a study of automotive engines and their combustion processes. Dugald Clerk is prevented from attending the meeting, but his paper, summarizing his notable achievements in gas engine work over a period of nearly forty years, will be presented in his absence. Harry L. Horning, whose previous papers on combustion chamber design will be well remembered, is to present many interesting facts regarding the influence of combustion chamber shape on turbulence and the effect of turbulence on combustion and engine performance. The physical and chemical characteristics of flame are not generally understood by engineers, though they are important to a clear understanding of combustion phenomena. The paper on Flame by C. A. French should, therefore, be timely and instructive.

The concluding session of the meeting will be held on Saturday morning and be devoted to Fuel Research subjects. The Bureau of Standards will, as usual, contribute valuable information, this time through the medium of a paper on the Elements of Automobile Fuel Economy by W. S. James, with appendices by Dr. H. C. Dickinson and S. W. Sparrow. This paper contains much valuable basic information which should be studied and applied by all automobile engineers. A second paper, showing what can be done in the way of improving the fuel economy of an automobile engine by improving manifold design, is to be presented by George P. Dorris. F. C. Ziesenheim, whose contributions to these columns will be favorably remembered by readers of AUTOMOTIVE INDUSTRIES, will discuss the Development of a High Compression Oil Engine, a subject which he has long been giving intensive study.

The program, except the business and standards committee sessions, is:

Aeronautic Session, Wednesday, May 25, 10 A. M.

Mead, G. J. and L. E. Pierce—Aviation Power Plant Development.
Clark, V. E.—Air Transportation and the Business Man.
Philbin, S. H.—Need for Federal Control in Commercial Aviation.

Transportation Session, Wednesday, May 25, 10 A. M.

Goldbeck, A. T.—The Vehicle and the Road.
Tilden, C. J.—Transport Engineering Education.

General Research Session, Thursday, May 26, 10 A. M.

Hawkins, L. A.—Industrial Research.
Stratford, C. W.—Lubrication.
Chase, Herbert—Practice and Theory in Clutch Design.
Lay, W. E.—Co-operation in Research.

Combustion Session, Friday, May 27, 10 A. M.

Horning, H. L.—Turbulence in Theory and Practice.
French, C. A.—Flame.
Clerk, Sir Dugald—Cylinder Actions in Gas and Petrol Engines.

Fuel Research Session, Saturday, May 28, 10 A. M.

Ziesenheim, F. C.—Development of a High-Compression Oil Engine.
Dorris, G. P.—Manifold Development.
James, W. S.—Elements of Automobile Fuel Economy.

New Life for Roadster Body Design

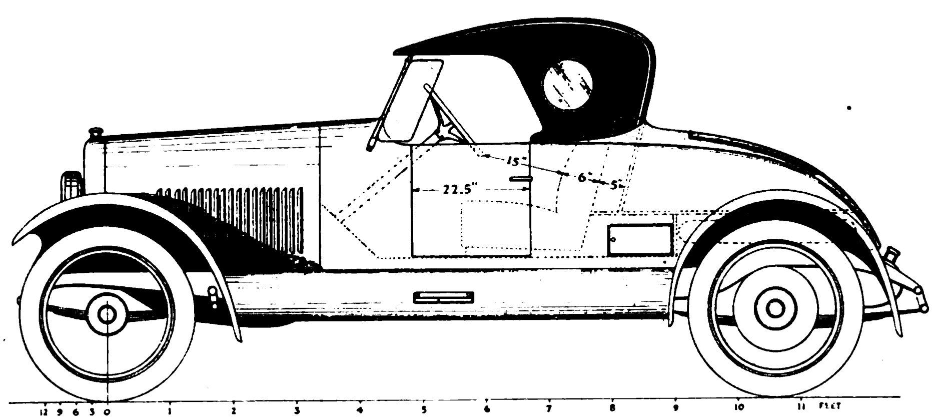
This article describes a typical roadster of the new design brought out this year. It is confined to a seating capacity of two persons and is rather massive in comparison with older designs. The top is permanent, while steps replace the usual running-board. Extra tire is carried in compartment.

By George J. Mercer

THE current year has brought what may be termed a rebirth of the roadster. During the last few years interest in the roadster has been a constantly decreasing factor. Each builder made a roadster to suit his own trade, without much regard to what his competitor was doing. Designers in general seemed to be giving considerably less attention to roadsters than to any other model.

The lack of interest in the roadster can probably be attributed largely to the increased use of the four- and five-passenger touring body. This tended to discount the use of the roadster and to center designing attention on other models.

New types of roadsters which were exhibited first at the New York show this year, however, indicate a new life for this body model. The new designs are strictly limited to two seats in most cases, although three seats are provided in rare instances. This makes the roadster a distinct model and takes it out of conflict with the four- and five-passenger touring models.



An up-to-date design of roadster. Note space provided for carrying spare tire.

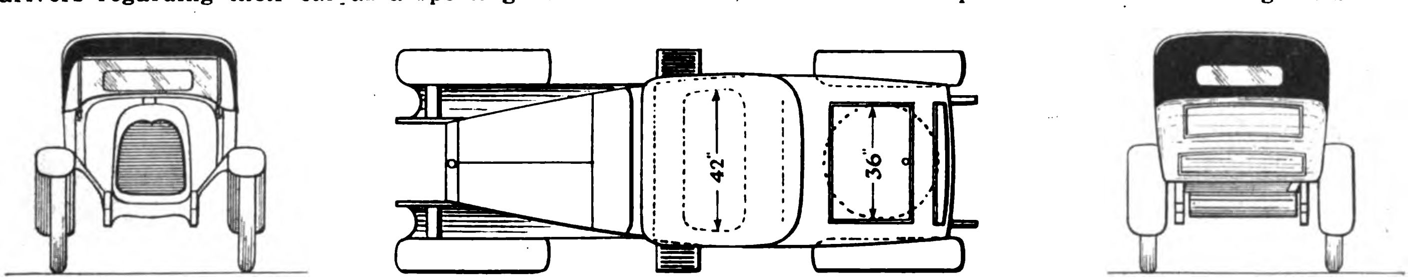
A typical roadster of the new type is shown in the accompanying illustration. The principal change from the older roadster models is comprised in the more massive construction and increased comfort of the present models. The sides are high, the seats are low and the height of the seat-back has been increased. Thus the rider is given a genuine sense of being hugged in the seat. The seat close to the floor meets with the approval of those desiring this type of car, since they are usually drivers regarding their car as a sporting as well as a transportation vehicle. Making the seat-back high is an easy matter, of course, when the seat itself is placed close to the floor.

The rear carrying compartment is made as commodious as possible. The line in the center is almost to the top of the seat-back. It is continued in a generous sweep to cover all the chassis frame, and is free of gasoline gage and filler. The top view shows that the width of this rear end is made to cover the inner line of the mudguards and that there is a wheel house, as with a touring body.

The appearance of this large rear is much better than one would think when looking at a finished body before it is mounted on the chassis. Formerly the writer favored a rear end the top line of which was nearly horizontal. Now that the width has been increased, however, the line as illustrated presents an excellent appearance; especially when the extreme back end is wide enough to just lap over the inner line of the guard.

The appearance from the side indicates that the top line of the body side is featured to some extent on the corner of the rear and forms a side panel line to the rear, as indicated. The corner where the top and side sheets blend is of small radius, and, as the top line of the body has a small radius to the outer edge, there is almost a true line from body top to back.

The extra tire is carried usually in supports at the back and in plain view, but where there is abundance of room, as in the design shown, the tire can readily be carried in a compartment. This method gives better



Front, plan, and rear views of the roadster illustrated above and described in the text.

protection all around. The floor, as indicated by dotted lines, is above the tire space, while the door at the side gives access to the small separate compartment forward.

The division back of the seat is similar to that in the average coupe; a loose lid gives access and it is a handy place to carry small parcels. But the primary reason for adding the space back of the seat is for the better appearance of the top. The top is given length from back to front and thereby makes the whole car look lower. It is surprising to note how much improvement is made by the addition of this 6 inches to the length of the top. The space thus provided is convenient for carrying the storm curtain and allows room for parcels as well.

The top in the design shown has been made permanent. We have not yet reached the point of having genuine approval for a stationary top even on touring cars, though it is quite general. But the trend is slowly marching in that direction, for a large number of such cars are used with the top up most of the time. The permanent top has the disadvantage of furnishing increased area for wind resistance, but, on the other hand, the appearance remains good for a longer time. Windshield side wings should be used with a top, as shown. The side window is round, because such construction better simulates a Victoria top feature.

The mudguards shown indicate the general design adopted. On some of the new cars there is a tendency to supersede the runboard with steps. This has been done to a limited extent, of course, for several years, but there are more cars so equipped at the present time than ever before. Several new car manufacturers, not yet hampered by tradition, are using this as regular equipment. For the roadster, steps are ideal, as a better vision of the road is allowed, and the car has more the sport-type appearance than with the runboards.

The shield meets both the front and rear guards, and the step is a large grill, 12 by 14 in. long by 10 in. wide. It is usually a casting of aluminum composition and is bolted flat against the splasher, behind which are brackets supported from the frame.

The doors in the rear compartment are always the cause for disappointment on account of water leaking through when the car is washed. This difficulty is hard to overcome, but a minimum of leakage can be assured if the opening has a combing or lip of the metal projecting ¼ in. above the level of the metal sheet, with the lid or door cupping over this, and with rubber tubing or flexible packing to make the connection tight.

The hinges for these lids are the concealed type, and the spring box lock is generally used.

Electrically Heated Japanning Ovens

An electrically heated japanning oven which possesses several features of general interest has been installed at the McCord Manufacturing Co. plant.

The oven is of the continuous conveyor type, and is double-decked, having two compartments, one over the other. The work after being dipped is carried on a conveyor through the lower compartment, then back and through the upper, the exit of which is just above the entrance to the first. Both compartments have the same dimensions, 10 ft. 4 in. wide by 5 ft. 10 in. high, by 60 ft. 10 in. long. It is equipped with General Electric Co. heaters, and automatic control, the total connected load being 324 kw. at 220 volts, three phase, 60 cycle. The baking capacity is 3000 lb. of radiator shells, the time being 45 minutes from extrance to exit. The oven is a Young Bros. installation.

The heat is divided into three zones, regulated by automatic control panels located just above the entrance to the ovens (Fig. 1). The lower compartment is equipped with comparatively few heaters, which are concentrated at the rear end. This gives a preheating zone in the forward end through which the work passes, before being subjected to the maximum heat of the compartment, 250 deg. F. The work is then carried to the upper chamber, which is equipped with heating units for its whole length. The temperature in this compartment is 450 deg. F. which is required to complete the bake.

An interesting explanation of why farm tractors are not built with four-speed transmissions like many automobiles was given in a popular lecture recently. The speaker said that the maximum drawbar pull which could possibly be obtained from a tractor depended upon its weight, and this determined more or less the lowest speed to which it was practical to gear a tractor. At very much higher speeds the tractor had so much unnecessary weight that it became an impractical proposition, and this was the reason that these higher speeds were not provided.

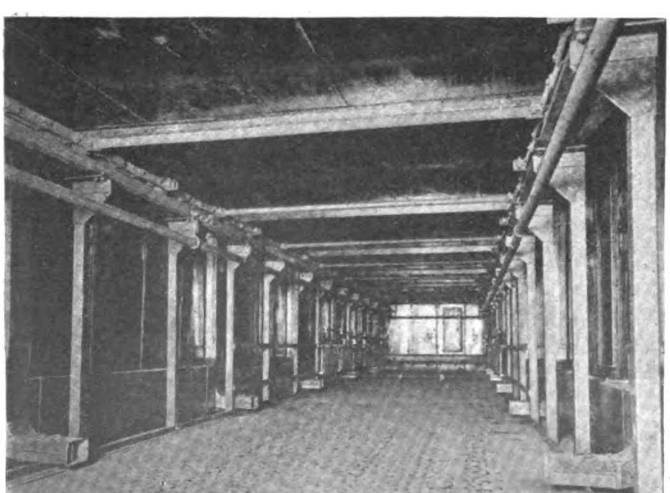


Fig. 1—Lower compartment and entrance end to first heating zone. Continuous conveyor japanning oven. Electric heaters shown in background.

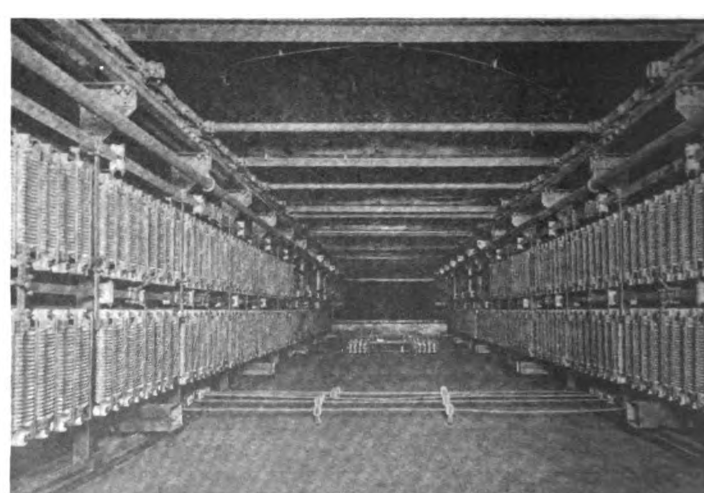


Fig. 2—Upper deck of continuous conveyor japanning oven looking in direction of exit end. Automatic temperature control instrument shown in foreground.

The Influence of Various Fuels on Engine Performance

Part III

This instalment of the report on the author's investigations gives definite data regarding the maximum temperatures and pressures at the end of compression which can be used without resulting detonations. The use of inert gas as a diluent to prevent detonation is also covered.

By H. R. Ricardo*

IN order definitely to establish the relative importance of temperature and pressure at the end of compression upon the tendency to detonate, hexane was evaporated in a small steam boiler and admitted to the carbureter. The temperature of the entering gases was then controlled by means of the electric heater fitted in the carbureter air intake passage. When working in this manner it was found that the compression ratio could be raised by 0.1 for every 10 deg. C (18 deg. Fahr.) drop in temperature from 70 deg C. (158 deg. Fahr.) to 30 deg. C. (86 deg. Fahr.), the corresponding ratios being from 4.8:1 up to 5.2:1.

This test is important, because it establishes a definite relationship between the temperature of the charge and its tendency to detonate. Nor is the issue confused by any question of a further drop in temperature after entry to the cylinder due to the latent heat of unevaporated liquid. So long as no evaporation takes place within the cylinder the temperature of compression at any given speed—and cylinder temperature will always bear a definite relationship to the temperature of the entering fluid over the range of compression ratio explored—the final compression absolute temperature may be taken as approximately 1.7 times the absolute temperature at the commencement.

Thus an increase in the temperature of compression of 17 deg. C. (30.6 deg. Fahr.) necessitated a drop in the compression ratio of 0.1.

If, as is generally supposed, detonation were a function of temperature alone, then the variation in compression ratio corresponding to the variation in inlet temperature would have been nearly five times as great, for the difference between the final compression temperatures at compression ratios of 5:1 and 6:1 is only 38 deg. C (68.4 deg. Fahr.) if the inlet temperature is constant.

These direct, and other less direct experiments, all confirm the statement made previously that the detonation point of a fuel is more closely dependent upon compression pressure than upon compression temperature.

Relationship Between Detonation Point and Spontaneous Ignition Temperature

It has generally been assumed that the detonation point of a fuel would be dependent upon its spontaneous ignition temperature as determined in air or oxygen. While, broadly speaking, the results showed that the temperature of spontaneous ignition of a fuel might be taken as a very approximate indication of its tendency to detonate, it was found to be quite unsafe to rely upon this relationship.

Table VI shows the compression ratio at which certain samples were found just to detonate. The table also shows the temperature of spontaneous ignition, in air and oxygen at atmospheric pressure, as determined by Harold Moore.

If detonation were a function of compression temperature alone, then a closer relationship might be looked for between the temperature at which detonation commenced and the temperature of self-ignition. In any event, however, the conditions obtaining in an engine cylinder in which the gases are in a state of violent turbulence are very different from those under which the tests for spontaneous ignition were carried out.

It seemed probable that the temperature of spontaneous ignition of a fuel would form a tolerably true indication of its readiness to pre-ignite, as distinct from the tendency to detonate. This seemed to be borne out in the case of those fuels which pre-ignite without preliminary detonation, such as the members of the aromatic series, methyl alcohol, etc., but the following experiments with mixtures of the paraffin series and carbon bisulphide tended to corroborate this theory. Experiments on the self-ignition temperature of carbon bisulphide when ignited as a stagnant mixture by adiabatic compression showed that this fuel would ignite spontaneously at a temperature of about 275 deg. C. (527 deg. Fahr.). When this fuel was tested alone in the variable compression engine heavy pre-ignition occurred at the lowest compression ratio, and at the lowest inlet and water temperature, with the result that it could not be used at all.

The pre-ignition was, however, unaccompanied by any trace of detonation. When carbon bisulphide was mixed with aromatic free gasoline in proportions up to and even exceeding 50 per cent, it was found to raise the detonation point as compared with that of the gasoline alone. A mixture of aromatic free gasoline and carbon bisulphide in equal parts was found to detonate with a compression ratio of 5.15:1, while pure aromatic free gasoline detonated at a compression ratio of 4.85:1. So far, therefore, as detonation is concerned, carbon bisulphide may be said to have a positive toluene value of about 18 per cent. When running with such a mix-

*From a preliminary report on research work conducted by the author and other investigators for the Asiatic Petroleum Co. and published in *The Automobile Engineer*.

ture at a compression ratio of 5.15:1 there was no trace of pre-ignition, and it was not until the proportion of aromatic free gasoline was still further reduced that pre-ignition first became apparent.

The inference to be drawn from these experiments is that carbon bisulphide, while pre-igniting very readily, will not detonate, whereas any paraffin gasoline will detonate, but will not readily pre-ignite. Tests carried out on the special machine designed for ascertaining the self-ignition temperature of fuels when ignited by adiabatic compression showed that carbon bisulphide ignited under compression at a gage pressure of about 185 lb. per square inch and a compression temperature of about 275 deg. C. (527 deg. Fahr.), while the aromatic free gasoline ignited under the same conditions at a gage pressure of 320 lb. per square inch and at a temperature of 353 deg. C. (668 deg. Fahr.). The initial temperatures before compression were 15.0 deg. C. (59 deg. Fahr) and 15.6 deg. C. (60.1 deg. Fahr.) respectively.

In the case of those fuels which pre-ignite without preliminary detonation, it was found very difficult indeed to determine the pre-ignition point, because, in practice, this clearly depends largely upon the temperature of the exhaust valves, sparking plug electrodes and other insulated parts within the combustion chamber. As might be expected, variations in the design, or in even the condition of the sparking plug, exerted so great an influence upon the tendency of the fuel to pre-ignite as to render anything more than a very approximate determination impossible.

It is hoped, later on, that the results of tests of the spontaneous ignition temperature and pressure, when both temperature and pressure are raised by the adiabatic compression of a stagnant mixture, will be sufficiently advanced to enable them to be fully dealt with, and their relation to the detonation point shown.

It may be argued from the test results given that so far as existing engines are concerned, no advantage would be obtained from the use of a fuel of high toluene value, because very few engines, other than aircraft, have a compression ratio as high as 5:1 which in the variable compression engine requires* a toluene value of only 5 per cent.

It must be remembered, however, that in this engine every effort has been made to reduce detonation. The form of the combustion space is the most efficient practically obtainable. The charge is ignited from two points at opposite sides of the combustion chamber, and the time of the passage of the spark perfectly synchronized. Turbulence of the charge in the cylinder is at a maximum, and there are no pockets or recesses where unburnt gas can become entrapped and detonated.

Finally all comparative tests were run at a speed of 1500 r.p.m. corresponding to a piston speed of 2000 ft. per minute.

In the ordinary car or commercial vehicle engine these ideal conditions do not apply, but on the contrary the combustion chambers are in many cases so designed as to encourage detonation. Check tests were from to time made on various standard engines on different test beds at the laboratory. One engine, designed and built by one of the best known makers of commercial vehicle engines, afforded an excellent illustration of the effect of combustion chamber design upon detonation. Had the designer of this engine set himself the task of trying to induce detonation, he could hardly have been more successful. This particular engine had a compression ratio of 3.95:1, corresponding to a compression pressure of only 78 lb. per sq. in., yet the engine detonated alarmingly even on a fuel of toluene value 10 per cent, while the variable compression engine using the same fuel would run perfectly smoothly, and at maximum efficiency,

Table VI.

	A	B	C	D		E		F		G	
		Detonation Point in the Variable Compression Engine				Self-ignition Temperature as Determined by Adiabatic Compression with Air		Self-ignition Temperature at Atmospheric Pressure as Determined by Moore			
								With Oxygen		With Air	
Fuel	Specific Gravity at 15 Deg. C. (59 Deg. F.)	Compressure Ratio	Compression Pressure (Lbs. per Sq. In. Gage)	Compression Temperature Deg. C.	Deg. F.	Deg. C.	Deg. F.	Deg. C.	Deg. F.	Deg. C.	Deg. F.
Aromatic free gasoline	0.718	4.85	105.5	392	738	353	668	—	—	—	—
"A" gasoline	0.782	6.0	148.5	430	807	367	693	—	—	—	—
"B" gasoline	0.723	5.7	133.5	422	792	—	—	—	—	—	—
"C" gasoline	0.727	5.25	118.0	407	765	—	—	—	—	—	—
"D" gasoline	0.760	5.35	121.5	410	770	—	—	—	—	—	—
"E" gasoline	0.719	4.7	100.5	387	729	—	—	—	—	—	—
"F" gasoline	0.704	5.05	111.5	400	752	—	—	272	521	383	722
"G" gasoline	0.750	4.55	96.0	381	718	—	—	—	—	—	—
"H" gasoline	0.767	5.9	140.5	428	803	—	—	—	—	—	—
Heavy aromatics	0.885	6.5	163.5	438	820	—	—	—	—	—	—
Kerosene	0.813	4.2	86.0	369	696	—	—	252	485	—	—
Paraffin Series											
Hexane, 80%	0.685	5.1	113.5	401	754	366	691	—	—	—	—
Heptane, pure	0.691	3.75	72.0	353	668	330	626	—	—	—	—
Aromatic Series											
Benzol, 98%	0.884	6.9*	179.0*	450*	843	419	787	566	1050	—	—
Toluene, 99%	0.870	>7.0	>183.0	>452	844	422	792	516 (90%)	960	—	—
Xylene, 91%	0.862	>7.0	>183.0	>452	844	—	—	484 (Coml.)	904	—	—
Naphthene Series											
Cyclohexane, 93%	0.786	5.9*	140.5*	427	800	387	729	—	—	—	—
Hexahydrotoluene, 78%	0.780	5.8	136.5	425	797	378	713	—	—	—	—
Hexahydroxylene, 60%	0.744	4.9	107.0	394	741	—	—	—	—	—	—
Alcohol Group and Miscellaneous											
Ethyl Alcohol, 98%	0.798	>7.5	>204.0	>424	795	514	959	518	965	—	—
Methyl alcohol (purified wood naphtha)	0.829	5.2*	116.5*	342*	648	457	855	—	—	—	—
Methylated spirits	0.821	6.5*	163.5*	382*	720	—	—	—	—	—	—
Ether	0.735	2.95	47.5	305	581	256	494	190	374	347	657
Carbon disulphide	1.270	—	—	—	—	275	627	—	—	—	—

Notes.—The sign * denotes that the value given for compression could not be exceeded owing to pre-ignition occurring before audible detonation.

Column D. The compression temperatures given in this column are calculated, taking into account the fall or rise in temperature due, respectively, to the latent heat of evaporation of the fuel on the one hand and a constant heat input of 65 B.T.U.'s per minute on the other.

Column E. The figures given in this column are the temperatures at which samples of the fuel were found just to ignite spontaneously when a mixture of fuel and air of a strength to give complete combustion was suddenly compressed, without initial turbulence, the ratio of compression being adjusted until self-ignition just occurred. This machine, which will be described later, has only recently been brought into operation and some uncertainty still exists as to the true value for the exponent of the compression curve. There is no reason, however, to doubt the relative accuracy of these figures.

Columns F and G. The figures given in these columns are taken from Harold Moore's paper on the Spontaneous Ignition Temperatures of Liquid Fuels for Internal Combustion Engines read before the Society of Chemical Industry, December 1st, 1916.

with a compression ratio of 5:1. To enable the particular engine referred to to run smoothly on any fuel having a toluene value of less than 20 per cent, it was necessary to employ an over rich mixture and to considerably retard ignition, sacrificing both power and economy.

It is estimated that the majority of engines now in use can run at the maximum efficiency on a fuel of toluene value of from 15 to 20 per cent.

In the summer of 1919 the Shell Marketing Co., realizing that the existing methods of specifying the quality of their motor spirit by determination of the specific gravity and boiling-point range, while affording useful information in certain respects, were of minor importance compared with toluene value, inaugurated the system of so blending their shell spirit as to give a high uniform toluene value. During this period a census was taken of the experience of fifty users of a total number of nearly 200 cars and commercial vehicles. An analysis of this census showed an average increase in the mileage per gallon of no less than 17 per cent as compared with other brands of gasoline, while over 80 per cent of the users canvassed volunteered that they noticed a very marked increase in power on hills, due clearly to the fact that absence of detonation enabled them to run at slow speeds with an efficient ignition timing. Guided by these results, the Shell Marketing Co. have determined to maintain a definite toluene value standard for their Shell spirit, and they now always blend this brand with this object in view.

This practical experiment proved strikingly that it is the tendency of a fuel to detonate, which in practice controls the efficiency and power output obtainable from it, even when it is used in the relatively low compression engines such as are general to-day.

Tests carried out by the Royal Aircraft Establishment and most of the manufacturers of aero-engines have shown also that both the power output and economy of aero-engines can be increased by the addition of benzol to fuels of low toluene value, not because it contains greater internal or potential energy, for, as will be shown later, it does not, but simply because the addition of benzol checks the tendency to detonate and so permits of the more efficient use of the fuel. The Air Ministry's existing specification for an aircraft spirit insists upon a gravity and boiling-point range which limits the toluene value to from 12 to 14 per cent, and necessitates a low aromatic content for the fuel. Such a fuel will cause violent detonation in some of the most important existing aircraft engines. The aromatic content, therefore, is often raised by the addition of benzol, which is composed chiefly of benzene and which, curiously enough, is the heaviest and least effective member of the aromatic group. Such a state of affairs illustrates how little the essential characteristics of a good fuel were understood.

It will be shown later that, compared with the question of detonation, all other considerations and differences, in so far as they control the power output and efficiency, sink into insignificance.

Certain rigid requirements must, of course, be fulfilled. The fuel must contain at least a minimum proportion of highly volatile constituents with a high vapor tension in order to facilitate starting; these, however, can be added to any fuel, and need not influence appreciably its toluene value. Again, the final boiling point must not be so high that liquid fuel will condense upon the cylinder walls, and so ultimately find its way into the crank chamber. These and other points will be dealt with later on, but it is well to emphasize at this stage that, compared with the tendency of a fuel to detonate, they are of secondary importance.

In the course of the investigations upon the subject of detonation certain other experiments were tried, some of which are of sufficient interest to be worth recording.

Since detonation is presumably a function of the rate of burning of a fuel, experiments were carried out with a view to ascertaining how far the efficiency could be improved, when the rate of burning was controlled by means other than varying the composition of the fuel. For this purpose the addition both of cooled exhaust gases and of water was employed.

It was found that by the addition of cooled exhaust gases to the standard aromatic free petrol, detonating normally at a compression ratio of 4.85:1, the compression could be raised up to 7.5:1, or even higher, without detonation or pre-ignition. This increase of ratio corresponded to an increase of compression pressure of from 105 lb. per sq. in. to 203 lb. per sq. in. gage. In these tests the variable compression engine was run up on the standard aromatic free gasoline, until all con-

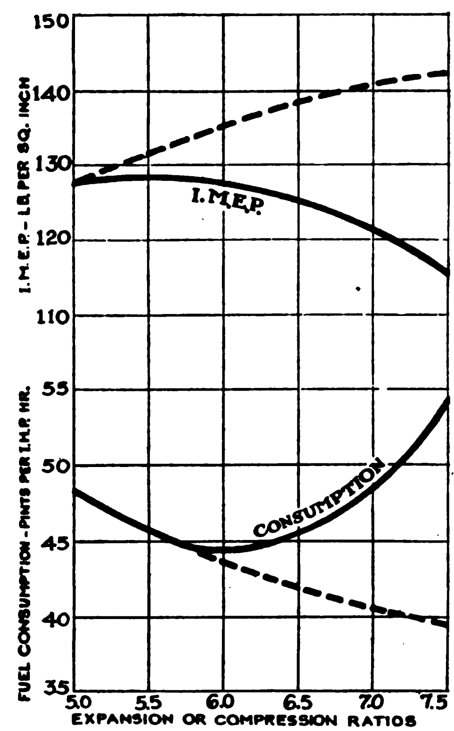


Fig. 7
Full line curves show the results with a fuel of low toluene value with cooled exhaust gas added. Dotted lines show the corresponding values of I.M.E.P. and of fuel consumption for a fuel of high toluene value requiring no dilution with inert gases

ditions had become normal. The compression ratio was then raised till the detonation point was reached, when readings of torque and fuel consumption were taken, the mixture strength being adjusted until the most economical proportions had been found. A cock admitting cooled exhaust products to the air intake of the carburetor was then slightly opened and the compression raised until detonation again became apparent, when readings of torque and fuel consumption were taken at the higher compression ratio. The procedure was repeated at frequent intervals at compression ratios ranging up to 7.5:1, in each case just sufficient exhaust gas being admitted to check detonation. The results obtained are shown in Fig. 7, in which the full lines show the torque in terms of indicated mean pressure and the dotted lines show the torque obtained without exhaust gas added, at the same compression ratios and with a fuel of the same

energy content but of sufficiently high toluene value to withstand the highest compression. The divergence between the two mean pressure curves indicates approximately the proportion of exhaust products required to check detonation at each compression ratio for aromatic free gasoline. The lower curves show, in full lines, the fuel consumption in pints per i.h.p.-hour, with the exhaust gas added, and in dotted lines, the consumption obtained with a fuel of exactly the same calorific value per pint, but of sufficiently high toluene value to need no exhaust gas added.

It will be observed that in spite of the addition of inert gases, the net power increases with the increase of compression up to a ratio of 5.5:1. This is due clearly to the higher efficiency of the "air cycle." Above 5.5:1 the quantity of inert gas required to check detonation more than balanced the improved efficiency due to the greater expansion ratio, and the power output declined again. The economy increased with increase of compression up to 6:1, in spite of the high specific heat of the exhaust products, but above this compression it declined rather rapidly, due in part to the rapidly increasing proportion of exhaust products required, and in part no doubt due to incomplete combustion.

Similar tests were carried out using steam in place of cooled exhaust gases. The results obtained were generally similar in characteristics. It is hoped to carry out further tests with nitrogen and carbon dioxide.

The results given are interesting in that they indicate clearly:

(1) That under normal conditions pre-ignition, in the case of ordinary gasoline containing a substantial proportion of members of the paraffin series, is always brought about by persistent detonation.

(2) That if detonation be prevented, pre-ignition will not readily occur, even though the compression pressures be raised to double that permissible under normal conditions.

(3) That detonation is a function of the normal rate of burning, and that if this be delayed by employing inert gas to act both as a brake and as a cooling agent, much higher compression pressures can be used.

Another experiment, also of some interest, was carried out in order to determine the compression pressure at which detonation takes place when a high compression is used and the engine is throttled.

Experiments with Compression Varied by Throttling

For these tests the same standard aromatic free gasoline was used, and after preliminary running at full throttle, the latter was partially closed, and the compression ratio raised to say 5.5:1. The throttle was then very gradually opened until detonation just became apparent, a reading of torque was taken, the throttle was locked securely in position, and the supply of fuel cut off; the engine was then driven by a motor at the same speed, and the actual compression pressure recorded by means of a modified form of Okill indicator, which was found to give very accurate readings. The same procedure was repeated at a number of different compression ratios varying up to 7.5:1, and the results obtained are as shown in Fig. 8.

The full lines indicate the observed results with varying throttle opening, and the dotted lines show what would have resulted if the fuel had permitted of full open throttle being used at all compressions. It will be observed that while under these conditions of throttling the indicated mean pressure, and therefore the power output, naturally falls very rapidly, the actual compression pressure at which detonation first became apparent is nearly constant. Owing, however, to the relatively small proportion of charge taken in at the higher speeds, the proportion of exhaust gases in the mixture is slightly greater at the higher compression, and this no doubt accounts for the fact that the pressure at which detonation commenced is higher at the higher compression ratios, instead of slightly lower as would otherwise be expected due to the higher compression temperature.

As a practical and ready means of determining the toluene value of a fuel, it is interesting to note that the new aniline test employed by chemists for determining the aromatic content of a fuel responds also to the naphthene content, and therefore this test affords a fairly accurate measure of the tendency of the fuel to detonate. The reason for this is shown by reference to Table III (which was printed in the preceding article on this subject), giving, for various fuels, their observed toluene values and also their approximate compositions. It may be seen from this table that the average toluene value of the paraffins present in petrol is roughly — 10 per cent. The average for the naphthenes is + 30 per cent.

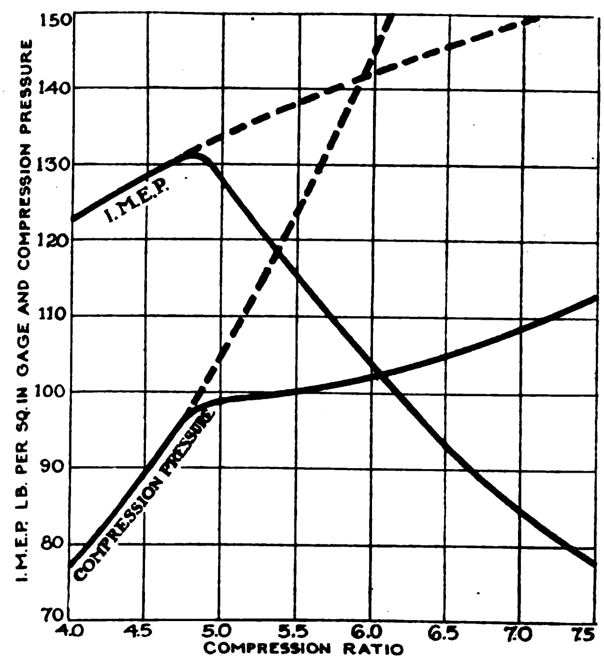


Fig. 8

The full lines show the indicated mean pressure obtained and the corresponding compression pressure (taken by modified Okill gauge) for varying compression ratios, and the throttle closed just sufficiently to prevent detonation of a fuel of low toluene value. The dotted line continuations show what would have been the resulting mean pressures at the various ratios had the toluene value been sufficiently high to admit of full open throttle at the highest compression ratio

The average for the aromatic is + 75 per cent—the toluene value of benzol being 67 per cent, of toluene 100 per cent and of xylene 85 per cent.

Although the results obtained from this series of investigations into the factors controlling detonation permit of certain fairly definite conclusions being drawn, the writer feels that much still remains to be done, for many discrepancies still remain to be cleared up. The following conclusions and inferences may, however, safely be drawn:

(1) The one outstanding factor, limiting both the power output and the efficiency obtainable from any fuel, is the tendency of the latter to detonate. This controls not only the compression ratio which can be employed, but in most cases it controls also the efficiency at which the fuel can be burnt, even at relatively low compressions.

(2) The tendency of a fuel to detonate appears to be a direct function of its normal rate of burning.

(3) No evidence of any kind has been adduced to show that the normal rate of burning of any fuel can be too low. This point will be discussed further when dealing with the power and efficiency obtainable.

(4) Of all the constituents of natural gasoline the most effective in checking detonation is toluene, followed by the other members of the aromatic group.

(5) Although compared with the other constituents the aromatic series have a somewhat lower calorific value per lb. (but not per gallon), the gain in efficiency due to their presence, even in quite small quantities, is so large as to render the small difference in heat value insignificant.

(6) The classification of a fuel by its specific gravity and boiling point applies only when the fuel is composed entirely of pure paraffins. No such fuel is, or ever has been, available outside a chemical laboratory.

(7) Any specification for a fuel should be so drawn as to encourage the inclusion of as large a proportion of the aromatic series naturally present in the crude petroleum as possible.

(To be continued)

Development of Aeronautical Engines by the Army and Navy

DEVELOPMENT of certain types of engines by the Army and Navy Air Services has been recently approved by the Secretary of War and the Secretary of the Navy upon recommendation of the Aeronautical Board.

Class (a)

Of mutual interest to the Army and Navy Air Services.

50-60 HP.—An engine of this power is available but further development of this type has been assigned to the Navy Department.

350 HP. Air-Cooled Radial Engine.—This engine is placed in this class on account of the maneuverability that can be given to an aircraft equipped with it, reduction in area of vulnerable parts, and a wide range of atmospheric temperature in which it will probably be capable of operating. The development of this engine is now in hand under army cognizance.

550 HP. Water-Cooled Engine.—For medium weight heavier-than-air craft. An engine of this type is in process of development in commercial hands. Tests are being conducted under Army cognizance and modifications are being recommended by the Army Air Service.

700 HP. "W" Type Water-Cooled Engine.—For heavier-than-air craft of large size. This type of engine is in process of development under Army cognizance.

1000 HP. "W" Type Water-Cooled Engine.—For aircraft of heavier-than-air type of extremely great size, now in process of design by the Army Air Service.

Engine to operate on heavy oil fuel, probably about 500 hp. The development of this engine is of mutual interest, in view of the existing fuel situation and in view of the desirability of eliminating, to as great an extent as possible, fire hazards existing in the use of present type aviation (airplane) engine fuels. The development of an engine of this type has been undertaken under Navy cognizance.

160 HP. 6-Cylinder Water-Cooled Engine.—This engine is being developed under army cognizance for installation in aircraft used in training. The development of this engine and of the engine noted under class (b) of approximately the same horsepower but of radically different type is being carried on with a view to determining which of the two types is the more suitable for this purpose.

300 HP. Cannon Engine.—This engine is being developed under army cognizance, for installation in an aircraft where it is desirable to have a gun firing directly ahead through the propeller hub.

350 HP. to 375 HP. Water-Cooled Engine.—For installation in pursuit airplanes. The engine contemplated is of the highest performance type, will be highly stressed, of very light weight, and probably of only moderate durability.

300-400 HP. 6-Cylinder Water-Cooled Engine.—Engines of this type are being developed under Navy cognizance for installation in rigid airships, or in large non-rigid airships.

Class (b)

Engines primarily of interest to the Army Air Service.

140 to 160 HP. Air-Cooled Engine.—This engine is being developed under Army cognizance for aircraft used in training.

Class (c)

Engines of primary interest to the Navy Air Service.

200 to 230 HP. Radial Air-Cooled Engine.—This engine is being developed under Navy cognizance as a step toward the development of a durable, relatively cheap engine for training purposes, or for small shipboard aircraft. Its development is desirable for training purposes, since greater powers are needed in aircraft for training than are required by the Army Air Service. Likewise, it is desirable to have available an engine of domestic manufacture of about this power corresponding with certain well-known engines of foreign manufacture, for use in small shipboard and other type aircraft.

250 to 275 HP. Engine.—This engine is to be developed for use in a twin-engined airplane or seaplane designed as a torpedo carrier, bomber, or spotting machine. For a twin-engined installation the total power of these engines is approximately equal to that of the 550 hp. engine noted under class (a), but the development of the smaller engine appears to be desirable from considerations of maneuverability and ease of installation in naval aircraft designed as torpedo carriers.

650 to 750 HP. Water-Cooled Engine.—The development of a larger type engine for rigid airships appears to be desirable, and at present it appears that 650 to 750 hp. represents the maximum power and weight that are practicable to concentrate in a single unit for this purpose. To be developed by the Navy Department.

Steam Engines.—The development of the steam engine is to be continued at once and worked to a definite conclusion as rapidly as possible.

Geared Engines.—The Navy is now engaged in the development of the geared engine for use in its aircraft. Detailed development of numerous types is extremely necessary at this time in order that the non-availability of engines of a given type may not prevent the development of types of aircraft of the greatest utility.

The importance and possible value of the development of an internal combustion engine of turbine type is being followed by the War and Navy Departments and there are some indications that increased progress in aeronautics will warrant its development in the near future.

The Tracking and Steering of Trailers Analyzed by a Graphic Method

Part II

Factors which affect the steering and tracking of various trailer outfits are further discussed and the graphic method of analysis is applied in concrete cases. Driver's skill in handling equipment is important.

By Marius C. Krarup

IN a comparison of the two systems from a mechanical viewpoint there would be room for other observations, but so far as tracking is concerned they can both be represented by the same diagram, with the understanding that in reality one or the other may be preferable according to the peculiarities and dimensions of the vehicle bodies, the roughness of service, the length of the coupling wanted, the preference for draft from frame to frame or from frame to axle.

The equivalence referred to does not merely permit simplification of diagrams. It also makes it clear that all tracking can be plotted as free trailing after a leading point—the hook or joint—so located in fixed relation to the leading vehicle (or pair of wheels, in the case of four-wheel steering) that it is moved to the outside of the curve to be described, the side opposite to that of the turn. By the use of automobile steering linkage the actual displacement of the leading point can be moderated, as when small overhang of the hook or joint is structurally desirable, and the desired tracking effect nevertheless obtained, but the plotting of the track can be done with a simplified diagram showing the equivalent theoretical displacement. The requirements for easy and rapid plotting of vehicle movements are thus reduced to: Simple diagrams of vehicles and a simple method for constructing any free-trailing curve. The latter is shown in Fig. 14.

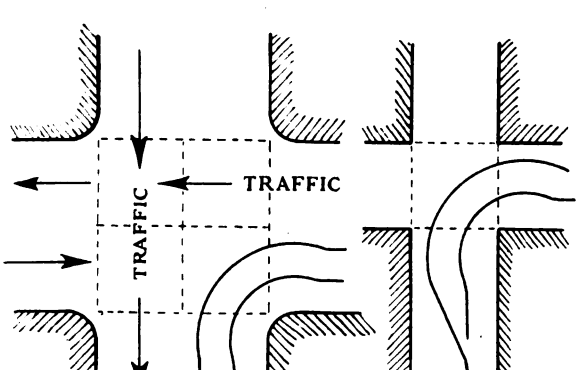


FIG. 11

There is shown a crossing of city street 60 feet wide and one of country roads 30 feet wide, and it is indicated why the steering requirements must normally be almost the same for both conditions. A wide turn and a close turn are traced in both cases. On the country road (or narrow city street) a trailer outfit must return to its side of the road after a wide turn, while on a wide street it does not leave its own side. The sharp turns are identical, except for the easement from rounded city corners

A comparison of city and country conditions, to both of which most trucks and trailers must conform, is illustrated in Fig. 11, with a view to establishing a working idea with regard to the shortness of turn that is required for operating comfortably in normal circumstances. Wider or sharper turns may be preferable at times, but for comparison of different systems for securing whatever degree of tracking is necessary it is obviously best to select a standard radius. Taking city streets to be 60 feet wide, with rounded corners, and the dependable roadbed in the country usually not over 30 feet wide, a turn in the city has only the advantage of the rounded corners over a turn on a country road, assuming that traffic rules normally restrict a turn to one of the four 30-foot squares of the street crossing, while in the country a hauling outfit can normally take the whole road for a turn. On this basis it may be said that the minimum demand to be made of a hauling outfit is ability to turn comfortably and without much reduction of straightaway speed from one 30-foot street or road to another, at whatever front and rear radius for the tractor unit may be found to be required for this purpose, and that preferably the outfit should be capable, with suitable speed reduction, of making such a turn on its own side of the road in the same manner as the truck of 13 feet wheelbase was seen to make it in Fig. 6, with a radius of 24 feet for rear wheels and 27¼ feet for the front wheels. To conform with the diagrams, radius is taken as the mean radius for the two wheels of a pair.

In Fig. 12 there is shown a turn made with a truck of 10 feet wheelbase drawing a trailer of 15 feet wheelbase, the distance from truck rear axle to trailer front axle being 10 feet and the hook about midway between the axles. The turn is made by a single steering gesture at the beginning and another at the end. The trailer steering may be either by axle steering or wheel steering, the location of the hook representing either form, as explained. The radius of the turn is made 30 feet for the rear wheels of the truck, and the figure shows that with this radius the outfit cannot quite turn the corner on its own side of the road of 30 feet width. The corner of the road is indicated in different locations to make the possibilities clear. One can always hug the side of one of the roads if the whole width of the other road is at disposal, but it is not possible to place the corner so that the incumbrance of both roads will be less than 16 to 17 feet. By forcing the tracking of the rear trailer

wheels it may be done, however, even with a turning radius of 30 feet, since the figure shows the hook leading the trailer on a circle slightly larger than the circle of the rear wheels, and the front of the trailer tracking almost exactly with the latter. Nothing but the rear trailer wheels prevent hugging the side of the road more closely.

For comparison the same outfit is shown in Fig. 13 with longer overhang of the hook to track more closely, and making the turn with a radius of 20 feet for the rear truck wheels. And it is here observed that the trailer in this case snakes perceptibly, while in the first instance it was turned only very little to the left at the beginning of the right turn.

It is also noticed that the long trailer wheelbase makes trouble. The trailer body drags into the curve of 20 feet radius worse than into that of 30. The front trailer wheels are turned at an angle that cannot be realized unless the wheels will turn under the vehicle. More diagrams than it is practicable to print here would be needed to demonstrate definite conclusions from these observations and others which Figs. 12 and 13 may suggest. It is useful to remember, however, with regard to all the diagrams that they express a relativity only and are applicable with a change of scale. Figs. 12 and 13, for example, are applicable to shorter vehicles turning with shorter radius on narrower roads.

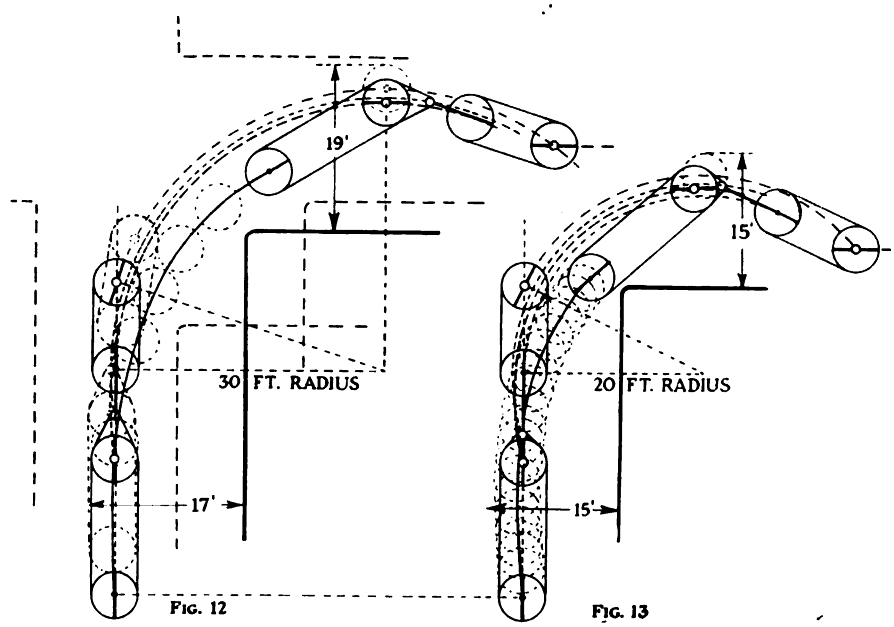


FIG. 12 FIG. 13

Turns made with a trailer outfit on a 30-foot road with turning radius of respectively 30 and 20 feet. The outfit is in both cases a truck of 10 feet wheelbase drawing a four-wheel trailer of 15 feet wheelbase, but the overhang of the coupling hook is made longer in the second instance to produce closer tracking. The length of the trailer wheelbase operates to the contrary, however. Snaking effects appear plainly in the diagram of the sharper turn. By considering the corner of the road for different locations, as indicated in broken lines on Fig. 12, an idea can be formed of the best place to begin a turn for different conditions of traffic, or when the question is of turning from one road to another of different width, the expedient of moving the corner on paper being applicable to any diagram drawn. Some trailers of 15 feet wheelbase will not be able to make the sharp turn in Fig. 13, because their front wheels cannot be turned to an angle as large as that here required

The matter of greatest interest in the whole subject lies perhaps at present in devising a method by means of which trailer curves can be readily shown on paper for any kind or dimension of outfit and with reference to any width of road that may be of interest. If applicable to the curves produced by backing and maneuvering, it seems evident that such a method can be turned to good account for familiarizing drivers with the results obtained in maneuvering by various steering gestures, since a considerable number of frequently occurring situations could be diagrammed and studied. The fundamental principle for such a method is indicated in Fig. 14, which shows a leading point, A, describing a curve and the curves described by three trailing points, B, C and D, starting from different relations to A, and the manner in which the three trailing curves are constructed. In Figs. 12 and 13 the truck front wheels make a leading point in relation to the truck rear wheels and the hook, the hook a leading point in relation to the trailer front wheels, and the latter a leading point in relation to the trailer rear wheels, but the construction is simplified for a simple and sustained circular turn with a known center and no change of radius. The curve of the leading point in Fig. 14 may be composite and of any degree, and the points, 1 to 14, selected for determination of corresponding points on the trailer curves, need not be equidistant. The data for construction are two, (1) that the trailing point is a given distance from the leading point, and (2) that the trailing point wheel follows a curve to which it can be at every point tangential. From each of the points on the leading curve there is, therefore, described a circle with the distance to the trailing point as radius, and, beginning with the original position of the trailer point, the shortest course from one point on the trailer curve to the next one is determined by a tangential arc from the already determined point on the trailer curve to the distance circle for the next one. In practice it is more satisfactory to make the arc intersect the distance circle at two points close together and draw the trailer curve midway between the two points of intersection. A straight line from any given point on the leading curve to the corresponding point on the trailer curve will be found tangential to the latter in all cases, but these lines are not shown here.

The construction approximates geometric accuracy in the measure as the spaces on the leading curve are reduced in length by increasing the number of construction points. If not enough are used, the trailer curve slips inwardly a little, but slip of very similar nature occurs in reality on the roads, because the drag, due to traction resistance, tends to flatten every curve a little, especially where the turns are sharp.

In this diagram the leading point, A, may be taken as representing the front truck or trailer wheels in relation to B as the rear wheels, but the initial relation of A to C, and particularly to D, is such as will occur mostly with semi-trailer outfits, in which case A can be taken as the fifth-wheel joint. The application to two-wheel trailers, dollies and trailers with fifth-wheel or axle steering is equally obvious, and it is noticed that curve D represents a backing movement followed by a go-ahead.

To see whether the method is fully applicable to backing movements of four-wheel trailer outfits, one must take cognizance of the practice so far followed, consisting in locking the front wheels when the outfit is to be backed up while unlocking the rear wheels and steering them by hand. The steering by hand should only consist in preventing the wheels from whirling around to their most extreme position and thereby blocking further rear-

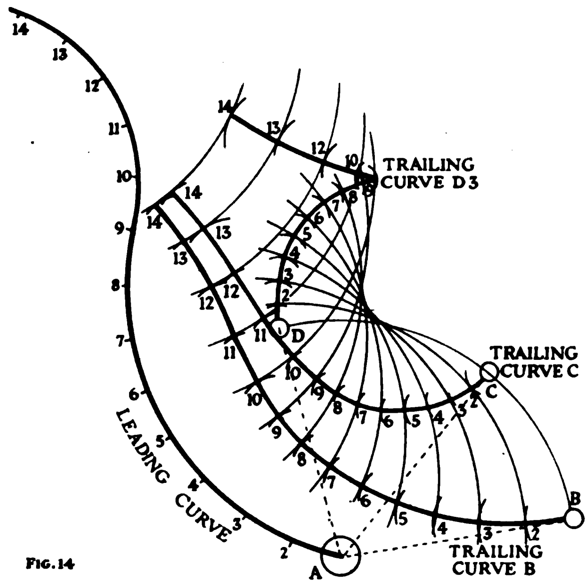


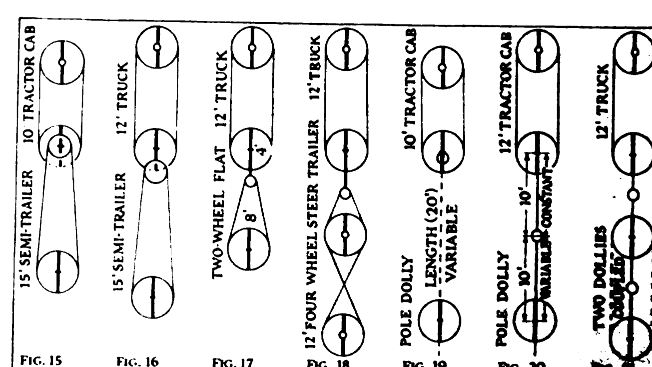
FIG. 14

Fig. 14—Diagram showing how the tracks of trailing wheels can be easily plotted, when the curve described by leading wheels or by a relatively fixed point, such as a coupling hook, is known or assumed. By this method and symbolic figures for the vehicles (the figures drawn to scale) all movements in turns and maneuvers of semi-trailer and trailer outfits, as well as of trucks, can be put on paper and be made to serve the needs of drivers, designers, owners of transportation outfits and others interested. For explanation see text

ward movement of the outfit. On this assumption, the curve of the rear trailer wheels can be laid out in a diagram as a trailer curve determined by the curve described by the fixed front wheels. In practice some deviation from this course can be effected by forcing the unlocked rear wheels to a path not quite consistent with the path of the hook which pushes the locked front wheels, but some skewing, skidding and strains are involved which can scarcely be considered desirable. On the other hand, some drivers have acquired the knack of performing the simpler backing-up movements with a four-wheel trailer outfit without first reversing the functions of the trailer wheels. By holding the angle between truck and trailer drawbar down to a maximum of, say, ten degrees, they manage to push the trailer back, if the road is good enough, without having the push take effect first in turning the steering wheels of the trailer around to their limit. Possibly the locking and unlocking method is not the final one, since it interferes with one-man operation, and possibly the driver's method can be systematized and developed on safe lines.

For the present the regular method remains of superior practical interest, and, as it can be plotted with reference to the most frequently demanded maneuvers, it probably should be so plotted in order to help drivers to perceive quickly, in every arising case, how and how early the jockeying for place should begin if a certain desired position of the outfit is to be reached expeditiously and without alternation of backward and forward movements. The whole subject of backing and maneuvering with trailer and semi-trailer outfits could perhaps be covered sufficiently for the needs of drivers' training schools in a hundred diagrams, but is too large to be taken up here, although its relation to questions of steering and tracking is evident. Contractors and others having work on hand demanding maneuvering with transportation outfits day after day in the same places and in the same manner might find it advantageous to plot such maneuvering in advance for the particular outfits to be used. Such a development would only be one among several which have accompanied the general introduction of haulage by motor power.

Even in the simpler matters of turns and turnouts on the road, the driver's share in making his equipment work satisfactorily is conspicuous. Figs. 7 and 8, as well as Figs. 12 and 13, reveal some of the points to be observed. The free-trailing outfit may be turned with some abruptness and without much reduction of speed if the leading vehicle is turned widely some distance before it is seemingly necessary. The closely tracking outfit, on the other hand, may turn much less out of its course, but should either reduce speed considerably—assuming that it has been run fairly fast on the straight stretch, where all tracking gear is dormant and harmless—or follow the gentlest possible transitions from one curve to another. As if to compensate, these transitions always can be gentler than with free trailing, since the turnouts of the leading vehicle can be smaller. And it is the driver's business to take this advantage to gain time and avoid snaking, with its irregular and alternating lateral strains and jolting. The lengths of the wheelbases and of the couplings influence the driving results so much, however, that very little can be said in terms of generality without a likelihood of errors or erroneous impressions. No sharp line of demarcation separates the free-trailing outfit from the forced-tracking outfit. Excepting only the truck alone and the tractor cab with semi-trailer, which are pure free-trailers, all outfits have couplings which force the next pair of wheels more or less and couplings which don't. And the results are a blend more or less happily conceived. The driver requires practice with each type of outfit and with different dimensions of units, and the only available auxiliary and part substitute for such practice would seem to be the study of diagrams, under suitable direction, the diagrams being preferably on a large scale with specified dimensions and distances, but with all superfluities of construction omitted. Perhaps it could be taken for granted that a somewhat general



Figs. 15 to 21—Symbolic figures adapted for use in plotting curves for the hauling outfits which they represent. In Fig. 16 the small overhang shown for the fifth-wheel coupling should be changed if the investigator has a different position of the coupling in mind. All other dimensions are similarly subject to change. Fig. 18 and Fig. 21 produce very similar curves, with the same dimensions for vehicles and couplings, the only material difference being that the wheelbase in Fig. 18 is constant, while that in Fig. 21 fluctuates slightly, getting shorter at sharp turns, with the rear bolster sliding as well as swivelling in its base. The positions of bolsters in the dollies is not indicated, as it does not influence the tracking, but in Fig. 19 the pintle hook is supposed to be so nearly in line with the front bolster that no provision need be made against longitudinal shifting of the load, or, if the load is lashed, the hook coupling may be slidable or the pole may be omitted, as suggested by showing it in a broken line

use of such diagrams would react favorably upon design and disposals.

All the trailer types and combinations diagrammed in Figs. 15 to 21 should now perhaps be shown turning a corner with a 24-foot radius for the driving wheels, also describing the composite curves required for turning off a straight course and back again, and possibly even for completeness in backing and maneuvers. The reader, however, can do this on a larger scale and for the specific dimensions which interest him most, and so nothing is done here but to present the symbolic figures which, it seems to the writer, can be suitably used for the work.

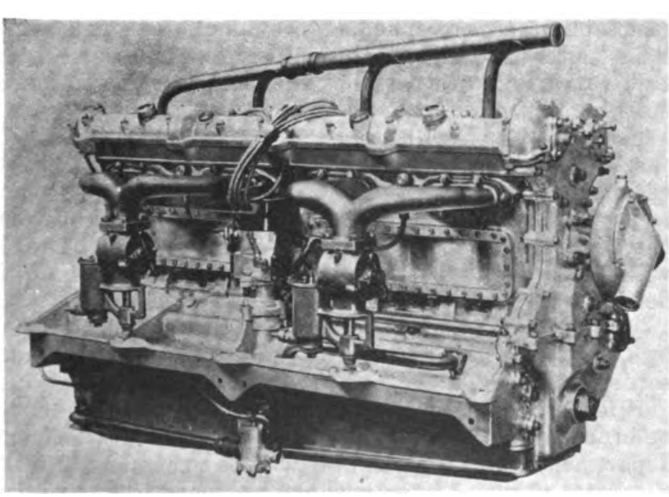
Ruts in the road can, of course, be troublesome for trailer outfits on account of the length of these in comparison with the length of those vehicles by which the ruts were formed, the difference naturally resulting in curves for the ruts conflicting more or less with those which trailer wheels should follow, and it is not evident that free-trailing wheels are always better off in this respect than wheels which track after those in front of them. There is likely to be some skewing and dragging. A yielding element is provided in automobile steering linkage in the buffer springs in the joints, and these may help somewhat. The worst case, on the other hand, seems to be where two pairs of wheels, not very far apart, are steered to opposite sides, as in vehicles with four-wheel steering. The matter, while perhaps of minor importance, suggests at all events that the introduction of a suitable yielding element in the steering mechanism may become one of the requirements of the future, if trailer outfits are to ply largely on common roads, on a par with trucks in many classes of work. The remedy now must lie mainly with the driver and in the form of preventing the wheels from dropping into ruts wherever it is not clear how they can be taken out again.

The application of brakes to trailers in downhill driving is another matter connected with the subject and on which some development must be expected in order to make four-wheel trailers compete effectively with semi-trailers outside of the limited field where four-wheel trailers now show superior economy. The types represented in Figs. 18, 20 and 21, which are close trackers under pull, plot less determinate curves when they go from pull to push, as in downhill driving and backing-up movements, though the jointed and slidable pole for the dolly, in Fig. 20, is doubtless stiffened considerably by the load lashed to the swiveling bolsters. These are matters for consideration in the evolution of trailer service, but the writer is only suggesting a method for investigating them. As said at the outset, the subject also has a military angle and another one, both military and civil, relating to the use of caterpillar tractors —with some sidestepping ability not shared by other tractors—with either trailers or semi-trailers.

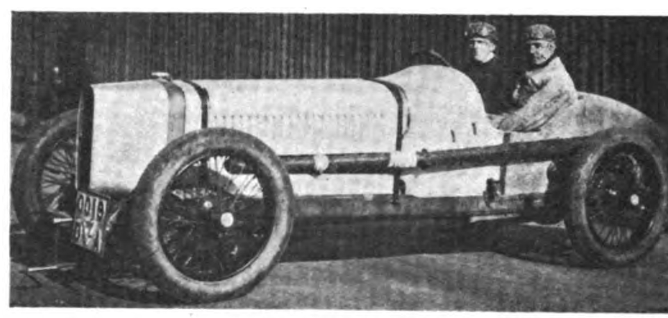
The Sunbeam Car for Indianapolis Race

ACCOMPANYING illustrations show the engine and complete car which the Sunbeam Co., Wolverhampton, England, has entered in the Indianapolis race to be held on Memorial Day. It is, with a few variations, a replica of the three cars entered for the French Grand Prix. The eight cylinders in line have a bore and stroke of 65 x 112 m.m. (2.56 x 4.41 in.), giving a total cubic capacity of 2957 c.c. There are four valves per cylinder, operated by two overhead camshafts, each driven by a train of gearing at the front end, where also the water pump receives its drive direct from one of the intermediate pinions.

Originally four carburetors were fitted, but better results have since been obtained with two Claudels with branched manifolds belled out at the flanges of the ports of each pair of cylinders. The compression ratio is 5.7 to 1. Delco ignition is used.



The Sunbeam 3 litre racing engine has 8 cylinders in line, and uses four valves per cylinder. The latter are operated by two overhead camshafts



The Sunbeam car entered in the Indianapolis Memorial Day Race

On the Grand Prix cars a four-wheel braking system is used, but on the Indianapolis car the rear wheels only are braked. The latter car is also peculiar in having the chassis as a whole mounted out of center in relation to the wheels, being closer to the left than to the right to assist cornering, which of course occurs in one direction only on the track.

The final gear ratio on top has not been decided upon at the moment of writing, but it is claimed that 130 b.hp. has been developed by the engine and that 100 m.p.h. has been attained at Brooklands track on the third speed of the four ratio transmission.

VOLUME 1 of the Technical Report of the Advisory Committee for Aeronautics (Great Britain) for the year 1917-18, has recently made its appearance. It covers general questions, airships and general airplane research, and is a collection of reports issued separately during the war. A second volume will deal with propellers and full scale work on air planes and a third on strength of construction. These volumes constitute a record of the aircraft research done in England during the war.

Idleness and Its Relation to Industry

This paper takes up the question of industrial idleness in its various phases and discusses it chiefly from the cost accounting standpoint. It contains, however, a remarkably clear analysis of the entire problem which will interest executives of every kind. Here is a pioneer effort in this field.

By T. W. Dinlocker and A. W. Wainright*

IDLENESS is to the industry as disease is to the body. It does not depend upon recognition for its existence. In fact, the less it is recognized the more likelihood it has of thriving and spreading. Like disease, it must be treated or the body suffers. A diagnosis must be made to determine the extent of idleness before remedies are applied. It is the purpose of this paper to discuss the philosophy and classifications of idleness and to point out their source and effect on industry and suggest methods of reflecting the expense of idleness in such a manner as to bring it under control.

Idleness within the limitations of this paper may be defined as to the expense in connection with idle facilities of any nature whatsoever. The methods for securing this control will be discussed under the following subjects:

I. Classes of idleness,
II. Terminology—Cause and Control,
III. Recording and Report,
IV. Philosophy and Application,
V. Accounting for Cost of Idleness.

The sources of idleness are usually found in management, men and outside influences. These sources may be due to either normal or abnormal conditions, which may be controllable or uncontrollable. These conditions fall into many divisions, which are usually reflected in idle facilities.

Classes of normal or controllable idleness are as follows:

Management

1. Excess facilities
2. Unequalized facilities
3. Obsolete facilities
4. Shortage of raw materials
5. Absence or lateness of men
6. Men waiting

Men

(a) for work or material
(b) for instructions
(c) for set up
(d) for helper
(e) for power
(f) for crane
(g) for repairs
(h) for tools
(i) for miscellaneous

7. Men absent for welfare activities.

Classes of abnormal or uncontrollable idleness are as follows:

Outside influence

8. **Business depression**
9. **Strikes**
10. Labor shortage
11. Material shortage

*Mr. Dinlocker is assistant comptroller, S. K. F. Industries, and Mr. Wainright is works auditor, Skayef Ball Bearing Co. The paper was presented before a recent meeting of the New York section of the Industrial Cost Association.

In the last analysis the management should determine what constitutes idleness, and the following discussion on terminology is offered in the hope that it will be of some assistance in reaching this decision.

Excess Facilities: To meet possible demands of customers for immediate delivery one of two conditions must exist: The stockroom must either be well filled with finished product ready for shipment and finished parts ready for assembly, or else there should be sufficient facilities in excess of the amount required for normal sales to produce without delay the increase in demand.

It is a question whether or not the manufacturers are willing to invest in excess facilities or prefer to keep a surplus stock of finished product on hand. The uncertainty, no doubt, is caused by the necessity of providing additional capital in either case and the resulting increase in carrying charges.

Without attempting to determine which of these methods the management should follow, we shall assume, for the purposes of this paper, that the method of providing excess facilities has been followed. If the excess equipment is evenly equalized throughout the producing departments, it is logical to assume that idleness will occur when the demand returns to normal.

The question of whether or not interest should form a part of cost is a subject which, for the sake of brevity, it is not proposed to treat in this paper.

When companies are established it frequently happens that additional land and floor space is provided which is in excess of immediate requirements. This is usually done for the purpose of allowing for the expected expansion of the business. In enumerating the various divisions of excess facilities, items in the nature of unused real estate and floor space might be included. It is sometimes necessary, also, to install excess facilities to provide for breakdown or some unexpected interruption in machine capacity.

Unequalized Facilities: Facilities become idle in cases where a regular flow of production is not possible because all the departments have not been synchronized to produce flow of work. It happens in some cases that one department is over-equipped and is in need of work, while another department is under-equipped and is flooded with work.

This class of idleness is usually a dead manufacturing loss, although these facilities might be utilized under several methods.

FIRST: Production in the lagging departments should be brought up to an even capacity with the most efficient departments, and to do this it will be necessary to make a careful survey of the product by operations, together with a study of machine capacities.

SECOND: Where the efficiency in all departments is

brought up to its highest point and it is found that a regular flow of production is not prevented by inefficiency in some departments, it is logical to assume that this condition is caused by unequalized facilities. A decision should then be made as to whether the excess facilities should be disposed of or whether additional facilities should be purchased in the lagging departments.

Before purchasing additional facilities a study of the market for the product should be made. Limited markets often make it exceedingly dangerous to counteract unequalized facilities by equalizing and throwing more production upon the sales department. To expand the production to a point over the maximum that could be expected in the particular trade would be violating the theory of demand and supply. In cases where the market is practically unlimited the point should be borne in mind that the securing of additional facilities would not only increase sales, but would also place into active operation facilities that are at present idle.

THIRD: To run overtime work in the lagging departments for a sufficient length of time to bring up the departments' output to the capacity of the departments in need of more work.

Obsolete Facilities: It is possible for facilities that have become obsolete to be permitted to remain standing in the plant. Unless they were put to work they would be reported idle and would consequently incur a certain amount of cost of idleness that is not offset by production. Whereas, if they were replaced by active facilities, production would increase and the cost of idleness would disappear, resulting in decreased cost.

Shortage of Raw Materials: Idle facilities may be caused by failure to receive raw materials when needed, which may be due to errors—either clerical or of judgment in planning and purchasing—which results in delay in shipping on the part of the vendor or uselessness when received at the plant.

Shortage of raw materials due to causes other than those above mentioned would probably fall into the classification of abnormal idleness and will be discussed under that heading.

Absence or Lateness of Men: Facilities become idle through absence or lateness of men. This might or might not be serious, depending upon the particular circumstances of the case. Some of the factors causing this idleness may be enumerated as follows:

(a) Personal or family illness
(b) Transportation delays
(c) Weather conditions

There is another class of idleness, known as waiting time, which arises in the case where operators are present and are prevented from functioning for various causes, usually involuntary on their part. Waiting time, then, in our meaning may be defined as all time spent by productive workers in idleness for any reason whatsoever. Waiting time may be classified under many headings. In general, however, it is thought that the most important headings may be referred to and defined as follows:

Waiting for Work or Materials: Under this classification the operator may be idle due to:

Faulty arrangement of facilities,
Imperfect planning which results in poor routing and trucking of work,
Improper stockkeeping methods causing delays in the arrival of material at the production centers.

Waiting for Instructions: Under this heading reference is made to idleness that develops in cases where workmen have carried their work as far as they can go and are waiting for specific instructions, such as:

Instructions lacking or missing,
Defective or incomplete,
Absence of blueprint,
Absence of service card.

Waiting for Set-Up: Under this heading reference is made to idleness upon the part of workmen in cases where jobs are changed and it is necessary to readjust the facilities to new specifications.

Waiting for Helper: Idleness is caused in cases where it is impossible for a workman to proceed with the job in hand until he secures the services of a helper. This delay might be caused through the improper control of the workmen available.

Waiting for Power: Idleness is caused through lack of power, which may be due to internal or external causes.

Waiting for Crane: In some industries, where the product worked on is difficult to handle because of bulkiness and weight, it necessitates the use of cranes and other hoisting apparatus. In cases where these are not temporarily available idleness results.

Waiting for Repairs: Idleness results from facilities which are in the course of repair, some of the cases of which are as follows:

Dilatory maintenance,
Insufficient repair men,
Careless and inefficient workmen,
Lack of instructions to workmen,
Defective facilities,
Where the unit in a group is being repaired and another unit is idle,
Lack of material with which to do repair work.

Waiting for Tools: In cases where it is necessary to use machine tools or tools for bench work, idleness is often caused by improper planning regarding the manufacture of the tools or by unsuitable design which could only be discovered after the tools were put into operation. Other causes are an insufficient quantity, tools in the course of repair and tools lost through negligence.

Waiting for Miscellaneous: It is customary to provide miscellaneous accounts to take care of items not applicable to subjects outlined and to provide a catch-all. It is sometimes the case that miscellaneous items deserve much consideration. This particularly refers to the idle facilities and to the apparent detail of the methods used in having workmen report their time.

An example might be based upon a factory of 100 working on a 10-hour day at an average wage of 30 cents an hour. It is also assumed that the workmen change jobs at an average of five times a day, taking approximately five minutes in the task of having their time reported closed on one job and started on another. The time lost for each day for each employee would be 25 minutes. This would represent 2500 minutes for the entire plant and, calculated at the average of 30 cents an hour, would result in a daily expense of $12.50. This expense, carried on at this rate for an average working year of 300 days, would total $3,750.

Modern timekeeping appliances permit the workmen recording their time without leaving their machines, and some planning systems are based on methods whereby truckers move jobs to and from workmen's benches and inspection cribs, having the time elapsed recorded by time clerks centrally located.

Another instance of miscellaneous idleness would be where workmen are allowed time off to wash up and ring out. A calculation of the expense of this nature can be made on the same basis as that cited above. It was not so much the intention of the writers to indicate

that a few minutes idleness of this nature would have a large effect upon increasing the expense of idle facilities. Very probably it would be impossible to make allowances in these cases and would be included in the time used, in which case no idleness would be reflected.

Another argument that might be advanced against the recording of such miscellaneous idleness might be that of the detail necessary in recording such small periods of elapsed time. However, inconvenience should not be the deciding factor in anything that is necessary and would prove of constructive value. There would be no rebuttal to this argument if the records were not utilized to prevent this indirect class of idleness. If the mere reporting of this information were but to call to our attention an occurrence which had heretofore remained undiscovered, it is felt that any expense incidental to gathering this information has well been capitalized in the subsequent correction of such leaks.

Men Absent for Welfare Activities: It is the custom in some establishments to conduct activities incidental to the welfare of the employees. Meetings of shop committees, athletic and beneficial associations would be examples. During the world war it was customary to conduct Liberty Loan rallies, and it is yet the custom to permit speakers to address employees, these affairs being held during working hours and on the company's time.

Business Depressions: Many reasons have been advanced as causes of our financial panics and business depressions, some of them the result of much study and thought. It is generally conceded that the most important factor is traceable to over-speculation and a consequent over-extension of credit. It is a noteworthy fact that business depressions have occurred in the past at approximately regular intervals, and, while history need not necessarily repeat itself, it is felt that idleness will always be caused by this factor. Industry receives its first tangible notice of depression in the form of cancelled orders, deferred shipments and a shrinkage in new orders received, resulting in curtailed production. While idleness resulting from depression cannot be directly controlled, its effect may be modified by operating the facilities that would ordinarily remain idle. Should it be determined to continue production, such decision would probably be based on reasons similar to the following:

FIRST: The willingness of the market to absorb product at manufacturing cost, thus eliminating the expense of idle facilities.

SECOND: Forcing sales at prices that will only return prime cost, ignoring burden consisting of fixed charges. The object contemplated by this method is the maintenance of the manufacturing organization, rather than the elimination of the expense of idle facilities, which would exist whether or not this procedure was adopted.

THIRD: Building up inventories by utilizing the facilities which would otherwise be idle for the purpose of being in a strategic position at the resumption of normal sales conditions. Production at such times would increase inventories which probably would not be readily disposed of if the depression was of protracted length. In such cases the ability to negotiate loans and to carry the resulting charges would be an important factor.

Strikes: Strikes may be defined as a form of manufacturing paralysis. It is usually temporary, and may be serious or trivial. During strikes labor and management may be said to be out of alignment. Most strikes are, in the last analysis, based on wage questions.

Strikes may be traced to many causes. As a general statement, however, it is thought that the following causes are fairly representative:

1. Unfair hours and wages,
2. Loose employment methods of hiring and discharging
3. Improper methods of work.
4. Poorly qualified foremen.
5. Improper inter-relation of workers,
6. Lack of provision for safety and health,
7. Antagonism of labor organizations,
8. Agitation by radical influences,
9. Sympathetic strikes.

Since the strikes are more or less controllable, it is felt that the following policies would do much to reduce the hazard of idleness from this cause:

1. Sound wage plans,
2. Encouragement of employees,
3. Provision for advancement,
4. Mutual understanding.

Labor Shortage: Idleness is found in cases where local labor conditions are such that sufficient labor cannot be secured to operate the full capacity.

Material Shortage: Idleness under this heading is presumed to mean idleness resulting from delay in receiving material caused by forces outside, such as:

1. Inability of vendor to meet contract.
2. Transportation strikes.
3. Transportation embargoes.
4. Shipments lost in transit.

Recording and Report

In order that the management may be in a position to realize the significance of idle facilities, after which they may consider reasons and remedies, it is first necessary to provide practical methods of recording upon which proper reports or graphs may be based.

The recording of idleness will necessarily entail some detail work and consequent expense. It is usually customary in the industrial world to greet a statement such as this as being closely related to "red tape." It is assumed that management is always desirous of ascertaining factors causing loss.

Records are either useful or useless. To be useful a record must produce results, by which is meant pointing the way to increased profits. Records are inanimate and cannot of themselves produce profit. The best they can do, and all that may be expected of them, is a true reflection of conditions. Resulting action depends upon the management.

Recording of idleness may be accomplished through clerical or mechanical means. It is not advocated that workmen report idle time, as it necessitates temporary interference with his work and retards production.

In recording idleness the vital factor is the cause and mechanical means do not easily accomplish this result. Another objection attached to the use of mechanical means of recording is the expense incidental to the installation of equipment necessary. In view of the fact that all productive work is not machine work, and that all machine work cannot be automatically recorded, it is recommended that the recording of idleness be accomplished by clerical means.

In most establishments some method has already been devised for recording labor activities. It is suggested that the recording of idleness be assigned to the same authority. In order for them to properly record idleness they should be acquainted with the various classifications of idleness and the causes as enumerated above.

A form should be provided for reporting idleness and should contain what the management requires for forming an intelligent decision. In addition to such informa-

tion, it is thought that the following information must be included on the form:

Date
Facility number and name,
Duration of idleness,
Cause.

Idleness is the difference between possible or standard hours and used hours, which should be supported in detail on the above forms.

By possible or standard hours is meant the hours the facilities would be normally expected to operate. In computing possible hours, Sundays, Saturday afternoons and holidays would be omitted. For instance, in an establishment operating a ten-hour day in a month in which there are 22½ working days the total possible hours would be 225 hours.

Having recorded the total amount of idleness in its various classes, the matter of preparing reports will now be briefly discussed. As idleness is either normal or abnormal, it seems advisable to prepare the report in such a manner that would reflect the total applicable to each class, analyzed into its subdivisions.

A report prepared along the lines of the attached form would seem to provide information enabling the management to realize the extent and seriousness of idleness in his plant and would aid him in surmounting his difficulties.

Philosophy and Application

In an earlier part of this paper idleness was divided into normal and abnormal classifications in order to explain what was meant by idleness that was controllable and that which was uncontrollable. Controllable idleness is governed by the manufacturing organization, while uncontrollable idleness may be traced to shortcomings on the part of the general or sales departments of the company. On the other hand, some items of uncontrollable idleness are caused by factors entirely beyond the regulation of any department.

If no distinction were made between these two classes the expense attached to each would probably be absorbed in manufacturing costs. The opportunity is taken at this time to point out that it might be profitable, from the standpoint of management, to charge manufacturing costs with the expense incident to controllable idleness and to relieve manufacturing costs for the expenses incident to uncontrollable idleness.

The reason both classes of expense have heretofore been considered as a proper charge to manufacturing cost may be found in the thought that accountants have not fully appreciated the problems of manufacturing and the viewpoint of the operating officials.

For this reason it has been the common conception of many manufacturers to feel that the average or unit cost increased as the volume of output decreases. This conception is technically correct, but there are many objections to absorbing into manufacturing costs the entire burden when the diminished output is caused by business depression. Fixed charges, such as depreciation, taxes, rent, insurance and administration, are items of expense which accrue regardless of idleness or activity. To reflect the general effect of fixed charges upon volume of output we shall assume a case where a manufacturer has two plants making the same product. We shall further assume that plant No. 1 is idle, while plant No. 2 operates at full capacity. Other things being equal, manufacturing costs at plant No. 2 would be normal. The fixed charges of plant No. 1 would continue and might entirely eliminate the profits of the business as a whole, but the cost of manufacturing the product would not have been increased by the fixed charges of plant No. 1.

On the other hand, we may consider these two plants as two departments under the same roof; that is, plant No. 1 now becomes department No. 1 and plant No. 2 becomes department No. 2, both component units of a single organization; department No. 1 is still idle and department No. 2 is operating to capacity. Working under the common conception, the overhead would not be relieved for the expense of idle facilities, and the fixed charges of the idle department would be absorbed in the output. The result would be that the cost of manufacture in department No. 2, which includes the cost of idle facilities in department No. 1, would be higher than the cost in plant No. 2, where all the facilities were busy. This would be true, although all the facts are identically the same, with the exception of the treatment of fixed charges. This condition would be aggravated in the case of a manufacturer whose output was of a varied nature.

Whether or not the expense of idle facilities constitutes a part of manufacturing cost or should be treated elsewhere in the accounts is a basis upon which difference of opinion may form. However, the writers are of the opinion that the expense of idle facilities is not entirely a proper part of manufacturing cost, and, in support of this contention, offer the following reasons:

1. **General:** While true costs are needed at all times, they are especially helpful during periods of depressions when business requires careful administration. Absorbing expense of idleness in manufacturing results in widely fluctuating costs, and consequently the management is without the aid of the cost records in determining comprehensive manufacturing and selling policies.

2. **Effect on Manufacturing Management:** To include the expense of idleness in costs would prevent the use of cost records for purposes of comparing present performance with those of periods in which idleness did not exist. For instance, the output per unit might be higher, but the increased cost might indicate that the output per unit was lower.

3. **Effect on Financial Management:** In cases where the product is shipped as soon as manufactured, no difference in the net profit is shown, whether the expense of idle facilities is absorbed in manufacturing costs or treated elsewhere in the accounts. On the other hand, if the product is not promptly shipped and the tendency is to increase inventories, it will be found that undue inflation of inventories and profits follow. In later periods, when the product commences to move, profits appear to be much less on account of the inflation in cost. This is due to the fact that the profit had actually been anticipated at the end of the previous year through the inclusion in inventories of idle facilities' burden.

4. **Effect on Sales Management:** When selling prices are based on cost, the inclusion of idle facilities' burden would force selling prices so high as to prevent the securing of new business when the establishment needs it most.

Sales policies may be outlined in a more definite manner if the expense of idle facilities were known as a separate factor. The mere transferring of idle facilities' expense from manufacturing cost does not abolish it, and as such it must be borne in mind when outlining sales policies and prices. Knowing the extent of the expense of idle facilities as a separate factor would enable the management to determine the following:

(a) The amount necessary to increase normal selling prices to provide more profit to be used as an offset to idle facilities' expense.

(b) When competitive or other conditions prevent increase in price the volume of sales necessary to increase volume of production consequently eliminating idle facilities' expense.

Whether or not the expense of abnormal idleness is to be absorbed into cost or charges elsewhere is a matter for the management to decide. In this discussion it has been the endeavor to show some of the points upon which this decision might be based. In any event, it is suggested that provision should be made for collecting the expense of such idleness as a separate element of costs.

For the most part normal idleness should be included in manufacturing cost, because it is felt that such idleness is controllable by management. Such idleness covers many items, but it is thought that the list mentioned under normal idleness is fairly complete. It is not reasonable to expect that there can be secured 100 per cent of possible operating time and, therefore, it constitutes a constant proper item of cost. Having determined to include it in cost, proper control may be maintained by collecting it as a separate account in the overhead. Where questions arise as to the amount of such expense that has been absorbed into cost, the treatment above prescribed will prevent any shifting of responsibility.

It is difficult in some cases to determine normal idleness chargeable to cost, as idleness due to excess facilities might have been caused by both manufacturing and financial policies. Excess facilities that are a protection to production in case of breakdown would be an instance of manufacturing policy. Excess facilities, such as land and buildings originally purchased with investment or expansion possibilities in mind, would be an instance of financial policy. It is suggested that a reasonable effort be made to distinguish between these two classifications of expense and appropriate reflections made in the accounts.

Accounting for Cost of Idleness

Having discussed the various arguments in favor of including in costs the normal expense of idle facilities and excluding from costs the abnormal expense of idle facilities, several methods of computing and applying the expense in the accounts will be reviewed.

The particular method of overhead distribution in operation at any establishment need not necessarily be discarded to install a basis for idle facilities' relief. However, burden distribution methods might have to be adjusted in order to accomplish the object desired; namely, that of having our costs represent the results of normal activities without the influence of abnormal factors of uncertain character and length.

It is not the purpose of this paper to enter into a technical discussion of cost accounting, but it is thought best to insert here a short discussion on the method of relief to manufacturing cost, the theory of which will hold, except as to detail, in most cases where idle facilities exist.

In view of the wide use of the "percentage of overhead to productive labor" basis of distributing overhead, we shall assume that the manufacturer uses this method. We shall assume, also, that his plant is divided into many departments, the facility in each department being approximately the same, and that the system in vogue provides for securing total expenses by departments. Referring to the example previously quoted, regarding two departments shut down and the other in full operation, it is obvious that the idleness in each department must be computed separately if the process or departmental costs are to be accurately relieved. This information could be secured from a report similar to the one annexed to this paper, and the ratio of abnormal idle hours to possible hours determined.

It would first seem that this ratio should now be applied to the total departmental portion of burden, which includes all fixed charges, and relief made for crediting work in process account, and charging some general account outside of manufacturing. Before doing this, however, it is necessary to consider those expenses other than fixed charges, such as salaries and wages of factory administration, accruals to such reserve accounts as reserve for repairs, reserve for inventories, and other accounts not directly related to volume of output. There is usually a point below which a manufacturer cannot reduce organization and expense, while sales and output may continue to decrease far below this point.

Before applying relief it is, therefore, suggested that a statement of overhead be prepared to be known as "overhead eligible for idle facility relief." This is done by simply reviewing each account in the manufacturing card of accounts to determine its eligibility as part of the idle facilities' relief and listing on a columnar analysis sheet the accounts vertically on the left-hand side and the departments horizontally across the top.

As overhead is finally applied to product on the percentage of overhead to productive labor in each department, it is, of course, necessary to transfer the overhead of the non-production departments to that of the production departments before this ratio can be secured. This is also necessary in preparing the statement of "overhead eligible for idle facility relief." Therefore, each production department will absorb that portion of the non-production departments' total overhead as their productive labor is in proportion to total productive labor.

We now have before us the total for each department of those expenses which accrue regardless of volume of output. It is now only necessary to departmentally apply the "ratio of abnormal hours to possible hours" to totals of eligible overhead to secure the expense of idle facilities not chargeable to manufacturing.

The amount of this relief would be credited to each productive department and the total charged to profit and loss surplus, or reserves provided for idle facilities or contingencies.

By this method the expense of normal idleness controllable by the manufacturing management is indirectly absorbed into costs. It is felt, however, that it is necessary to collect this expense in one account, the caption for which might be "manufacturing expense of idle facilities," for the purpose of establishing a means of bringing this expense forcibly to the attention of the management. This is accomplished by crediting the various overhead accounts making up "eligible overhead" and charging, per contra, the "manufacturing expense of idle facilities account."

This account would also include the cost of all waiting time of the workers, consisting of wages paid to men waiting for tools, repair or other causes heretofore enumerated. The total of this account would represent a part of the general overhead distributed to the cost of the product.

In those plants that maintain service departments, such as millwright, tool room, electrical, carpenter, etc., all that has been said of idle facilities applies here with equal force. These departments usually work on additions, improvements and repairs of property, which expense is charged to operating or capital, as the case may be.

These departments resemble outside concerns, charg-

ing for their work at cost, and it is obvious that it would not do to inflate fixed asset values with the expense of idleness incurring subsequent to increased depreciation, insurance and tax charges applying against these departments. The remedy is to relieve the service department overhead in the same manner outlined for productive manufacturing departments, thus eliminating the inflation in charges to fixed assets and the overhead accounts of the productive departments.

If the facilities in the service departments take the form of machines, the method already outlined can be readily employed. With movable facilities, if it is impractical to attempt to measure the idle facility hours, it would then be necessary to absorb such percentage of eligible overhead in costs as the actual man-hours worked bears to the possible or standard man-hours.

If it is to be noted in this discussion, we have used the percentage on productive labor method of overhead distribution and the relief for idle facilities based upon facility hours. It is advisable wherever possible to use facility hours as a measure of idleness. If it is possible to use facility hours as a basis in arriving at percentage of normal and abnormal idleness, it may be necessary to absorb such percentage of eligible overhead in costs as the current production bears to maximum production. This method, however, does not take into consideration the inefficiency of workers, which might have the effect of eliminating more expense than the used time would justify.

In establishments using the machine rate method of distributing overhead, when actual burden exceeds predetermined burden charged to costs, it might be assumed that the entire difference represented cost of idleness. In this we do not wholly concur, because in originally setting up the machine rate, certain items included therein must necessarily have been established, and this difference may represent inaccuracies in the forecast of these items. It is also for this reason that the writers do not advocate the use of the machine hour rate multiplied by the idle hours in computing the relief for idle facilities.

Another reason against this method is that apparently no distinction has been made between the fluctuating and non-fluctuating items in the rate. Using this rate without eliminating the items that fluctuate with production would result in excessive relief and would reduce costs artificially.

The writers have attempted in their suggestion to utilize the practical features embodied in the machine rate methods by using facility hours and eliminating fluctuating items of expense.

Having discussed the expense of idle facilities from a standpoint of normal and abnormal idleness, this paper would not seem complete unless the possible methods of reflection in the accounts were briefly enumerated, as follows:

1. Inclusion of normal and abnormal idleness in cost of manufacture.
2. Inclusion of normal idleness only in cost of manufacture, and disposing of abnormal idleness in one of the following manners:
   (a) Charging direct to current profit and loss statement.
   (b) Charging direct to surplus account,
   (c) Charging direct to reserve for idle facilities or contingencies.

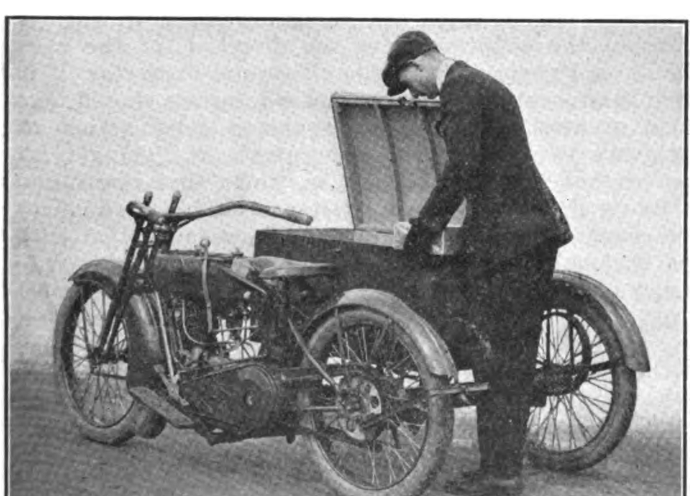
In concluding this paper the writers wish to express their earnest desire that they may have been of some assistance to the members of the association in solving some of the problems connected with idle facilities.

We feel that in these days of industrial depression our subject should be of paramount importance to the industrial executive or financial manager who is ever watchful and eager to ascertain actual conditions regarding the employment of his productive units and how their non-employment is reflected in the cost of his product.

Improved methods of dealing with industrial problems can come only from careful studies coupled with a knowledge of actual conditions. Progress in cost accounting, as in all other lines, must come by degrees and one step leads to the next. We trust that the above analysis of the problem of idle facilities may constitute a step toward the ultimate solution of all problems in connection with this subject.

A Commercial Model Motorcycle

THERE has been some feeling among motorcycle manufacturers recently that a definite attempt should be made to broaden the sales field of the motorcycle to more fully include commercial utilities. A manifestation of this feeling appears in the new one-cylinder model recently added to the Harley-Davidson line. This machine has been designed primarily to meet the requirements of commercial service. It is specially adapted to use for delivery purposes, for telephone company linemen and trouble "shooters" and similar classes of work.



Harley-Davidson model 21-CD with side car designed for commercial use

The construction and design are in general similar to that of the regular "74-in., magneto-equipped, V-twin" machine, except that the rear cylinder is removed in this commercial model. The bore is 3 7/16 in. and the stroke 4 in., giving piston displacement of 37 cu. in.

The machine is designed for an average speed of 25 to 30 m.p.h.

A SUNSHADE visor which comprises a light but rigid frame of U-section steel, electrically welded, covered with Du Pont Double Texture Rayntite fabric, padded to prevent wrinkling and sagging, has been brought out by the Troy Sunshade Co. The fixtures are so designed as to permit of adjustment of the visor to suit the driver's convenience. The visor is finished in brush-applied baked enamel with nickel-plated wing nuts.

Chinese Famine Is a Boost to Automotive Industry

Realization of the meaning of transportation to the welfare of the nation is brought home to Chinese. American Red Cross building 100 miles of roads. Americans hold leadership in trade with sleeping giant of the East.

By Don D. Patterson*

THERE was a day in China, many centuries ago when the imperial rule was at its zenith, that the nation had what was probably the world's model highway system—a system that penetrated into the farthest reaches of the land for official and military usage. But the national highway system followed closely the decadence of the Empire until to-day only cart roads and wheelbarrow paths indicate its course and these, for the most part, are in an impassable condition in so far as the motor car is concerned.

It is in the matter of roads that the greatest obstacle is found for the development of the automotive transportation in this Far Eastern republic. The desire for motors has been indicated by the Chinese over a period of ten or more years, but its growth has been seriously hampered due to confinement to the ports and larger cities of the interior, where passable highways are found. The total mileage of metal surfaced roads in China does not exceed 100 miles.

This condition would be discouraging to the western manufacturers of motors and motor equipment were it not for the fact that the past two years has brought forth the beginning of what will some day be a nationwide movement for better highways. The movement has been thus far sporadic in its development and the roads that have been built are short in length and in the majority of cases widely separated.

Various sources may be credited for the impetus that has brought this about. The first modern road of any importance in the nation was that built by the American Red Cross several years ago from Peking to Tungchow as a measure of aid for the sufferers from a disastrous flood in North China. Other road projects were started and as a result in the vicinity of the capital and Tientsin may be found the majority of the modern road mileage in the country. Shanghai has also been the seat of similar developments; a municipal road built by the authorities of the International Concession provides a drive near the outskirts of the city. A second road was constructed by the Chinese military authorities, using soldier labor, from Shanghai to Woosung, where the Yangtsze River joins the ocean, a distance of eight miles.

Projects Planned

More recent projects include the construction of a highway from Tientsin, the route having already been selected, and the development of roadways in Kwangtung Province, around Canton. Foochow, an ocean port between Shanghai and Canton, has constructed motor roads within its city limits and a private company is operating a bus line. Nantungchow, known as the model city of the Yangtsze Valley, which is practically owned and controlled by Chang Chien, former Minister of Agriculture, has a road system of thirty or more miles on which motor bus lines are operating. This system is being extended rapidly. Canton has also inaugurated a motor transportation system for passengers.

The famine which is now running riot in North China has also provided for the construction of roadways. The American Red Cross is building a highway of approximately 100 miles in length in the province of Shantung and other roads are being constructed to make use of the famine labor in other sections of the stricken territory. The famine in itself has been a grim object lesson of China's great need for motor transportation. The region in which the 45,000,000 people are affected is impenetrable except to the most primitive forms of cart and wheelbarrow transportation now used in the country. In many instances food is rotting at railheads with people starving 50 to 100 miles away due to lack of transportation. The relief agencies, with the exception of the Red Cross, have failed to recognize the advantage of motor transportation for the present, in their plans for the future, and are not using light trucks when it has been demonstrated that they are practical for the work in some regions. However, the recurrence of such a famine is highly improbable with the road system now under way.

Merchants Are Leaders

Other road ventures are being organized in various parts of the country under the direction of the merchants and gentry of various cities and districts. It is from these ventures that the motor interests should take their greatest hope. Any organized construction of highways by the Chinese Government at Peking is at the present out of the question, since that institution is living a hand-to-mouth existence so far as finances are concerned and has only a dilatory connection with the various provinces, depending largely upon the efficiency of a system of graft. The merchants are the most progressive element in the country and their interest in road building may be taken as a good omen. Much of this development is centering around Shanghai, where it has foreign encouragement.

It has been suggested by foreigners in China that the motor manufacturers, particularly those of the United States, would find a greater field in China if they were able to organize a financial group that would make loans under supervision to the Chinese Government for the construction of highways. This plan, however, is hard-

*Financial Editor *Millard's Review* and former editor of *The Oriental Motor*.

ly feasible at this time due to the formation of the International Consortium, one of whose purposes is to provide foreign money for the construction of railways and highways, and to the present unsettled and corrupt state of the so-called Republic of China. Each province is for the most part a feudal entity, giving allegiance to Peking so long as the funds necessary for the maintenance of a military autocracy in the district is forthcoming. There are two governments, that of Peking and of Canton, and with such a state of affairs a highway loan would probably be a failure.

Bankers Aroused

China's future existence depends largely upon her means of communications and now that the merchants and bankers are becoming alive to the possibilities of their nation it may be expected that they will interest themselves in providing these necessities. And when they do, China will be the most fruitful of all foreign markets for the automotive industry of the west. The Chinese will not be able to offer any domestic competition, for while cheap labor exists, it is unskilled and not easily adapted to complicated manufacturing such as is involved in the making of motor cars.

There is a phase of the road development that has not been touched and that is the possibility of foreign assistance in a moral way. The present motor car distributors have done nothing to encourage the building of roads and all developments have come from the individual initiative of the natives themselves.

The dealers seem satisfied with their sales in the treaty ports and with one exception have done little or no pioneering. One firm handling the most popular low-priced American car now has a representative in the country districts of Central and North China who is pushing through on almost impassable roads, working on the principle that motor cars will bring good roads, and is selling cars in isolated districts where they are being operated successfully.

Importance of Treaty Ports

The present automotive industry of China centers in the treaty ports of the country. Shanghai has the largest number of distributing and service plants, Hongkong and Tientsin following, and Hankow, Canton, Tsingtau bringing up the total. There are small hire services in other parts of the country and branch plants of Shanghai interests are opening up in Peking, which has been heretofore served from Tientsin.

The Shanghai distributing plants are largely American and British, with one or two French concerns in the field. The majority of the standard makes of America, Great Britain, France and Italy, of both motor cars and trucks, are represented as well as the leading tires and accessories of all the countries mentioned. For the most part, the Shanghai plants are on a par with those of the larger cities of the United States, including machine work and repairs, tire servicing, and body building. The latter has come to be a large part of the industry in China, due to the inability of many of the bodies imported to stand up under climatic conditions in China and more especially the desire upon the part of the Chinese buyers for distinctive and luxurious equipages. The Shanghai plants serve Central China territory, although some extend into North China. The Tientsin industry serves North China and Hongkong has the south. The development in the south is the most backward in the country, Canton only being a motor possibility.

The sale of motor cars in China is, like all business of an import nature in the country, largely affected by the fluctuation of exchange. During the year of 1919 China imported motor cars, trucks and cycles to the value of $6,242,368, and 59.6 per cent of the total came from the United States. For the year of 1920 this total will be materially reduced due to the falling of exchange from the beginning of the year. During the latter part of 1919 one Chinese dollar would buy $1.15 in American currency, while at the present time it would take $2.20 Chinese currency to buy one American dollar.

Prices Vary Constantly

The exchange rate between China and America is continually fluctuating and consequently each shipment of cars from the United States has its price, depending upon the rate of the day when the exchange was settled. As a result two similar models of the same make may have a price varying from $100 to $500, all due to exchange. There is no way that the dealer in China can set a fixed price for the year as is possible in the United States. This causes a rising and falling demand in the motor market, depending upon the relation of Chinese currency to the American dollar or to the currency of the country from which the car is imported. Nothing can be done to remedy this until a reformation is effected in the currency system of China, which will be some years in coming.

An attempt to stabilize the industry in Shanghai is being made by the organization of a dealers' association for general protection and the advancement of motors. This association will take up also the matter of roads and is launching a plan for the establishment of an annual motor show next fall. The show will be the first in the Far East, that is, in the section east of India.

Counting the Cars

The motor population of China is difficult to estimate due to a lack of registration in some sections of the country. Shanghai has the largest, with approximately 3,000 cars and 1,000 or more trucks and motorcycles. Tientsin has approximately 500 to 700 cars and Peking a like number. Canton has only a few and a hundred or so are scattered around through the various sections. Tsingtau has probably 100 and Hankow approximately 300. Hongkong, being British, cannot be included in any estimate of China proper. A number of cars are centered at Kalgan on the Gobi Desert of Mongolia, where, under government supervision, a motor line is operated between that point and Urga, the capital of the province, half way to the Russian border. A recent order will place fifty-seven Fiat trucks in this service within a short time. The Kalgan to Urga trip over the desert takes four days and the round trip costs $300, Chinese currency.

American makes predominate the motor field due to the close proximity of the country, the more favorable prices, and the activities of the manufacturers in the export field. England is paying little or no attention to China from an automotive standpoint and most makers will deliver only a half dozen or so cars during the year. France is giving all of the attention to the field she can and Italy is following her example. However, the American manufacturers have the advantage of being firmly established on the ground and of having factory representatives in the field approximately twice each year. A number of the larger motor manufacturers of the United States have direct representatives who are permanently established in the field to assist the distributors and to organize their services. As a result even the larger British firms handle a majority of American makes.

There is one disadvantage in the field at present and that is that most of the distributors in China represent

too many makes. There are two notable exceptions in Shanghai and these, having only a few American makes, have the lion's share of the business due to their ability to push these makes and to pioneer in the territory assigned.

Future of Trucks

Motor trucks are coming in for their part of the recognition and when the day comes that China has a semblance of a highway system, trucks are going to be more important in the country than railway trains. Trucks are already in daily operation in Manchuria, Mongolia, in Kiangsu Province, in the city of Foochow and elsewhere. The truck population of Shanghai is growing rapidly and the city is supporting one public truck transportation line with a fleet of approximately twenty-five. A majority of the larger Chinese manufacturing plants are using trucks, as are the Chinese and foreign department and other stores. As Shanghai is the most important shipping port of China, the trucks are playing a large part in the movement of cargo—a part that will increase rapidly.

Gay Turnouts

The Chinese have taken up the motor car rapidly and the wealthier classes are never without them. They fill the inherent craving for display and ostentation as well as being a utility. The limousine because of its luxuriousness is the most popular and the fittings of many have given them the nickname among the foreign population of "rolling boudoirs." This type is painted a brilliant red or yellow, or perhaps a blue, pink or purple. The fittings inside are of the same color, generally in brocaded Chinese silk, and the equipment consists of silk tasseled curtains on the windows and doors, draped back, and Chinese vanity cases on the rear of the back seat, containing a full line of cosmetics, a cigarette case, matches, a mirror and other luxuries. The younger generation have taken to vivid colored sport roadsters and all young or old are addicted to speed. The Chinese chauffeur has no nerves, no conscience and the pedestrian moves slowly with the habit of centuries in only dodging wheelbarrows, carts and rickshaws, resulting in a rather large toll of daily accidents in the cities where motor cars are most numerous. Traffic problems are Chinese puzzles, figuratively and literally.

There is a great future ahead of the automotive industry in China, but it is a prospect that will take years in the realization. At the present moment China is in the throes of a business depression that is more gloomy than that of the United States for the reason that she has no organized bank system to tide her through, no organized system of business communications and her markets are largely dependent upon foreign sources. The next year or so will be slim ones for foreign business in China and the automotive industry will suffer a trifle more even than the others concerned. Rising exchange will come only when exports begin to move—and there is at present a dead calm in the export market—and that movement will only result when demand revives in the United States, Great Britain and, to a lesser degree, Europe.

China should be cultivated by American motor manufacturers, encouraged to build roads and kept closely in hand. When the road development does come, China will offer one of—if not the greatest—largest export motor markets of the world. She has 400,000,000 in population and while that population is for the most part possessed of only a scant buying power, if there was only one in every 400 who could buy a motor car every three to five years it would tax the capacity of the manufacturers of the United States and other countries to fill the demand.

Hundred Passenger Plane Reported Wrecked

It is reported that the enormous Italian flying boat with six 400 hp. Liberty engines and with seating accommodations for 100 passengers—recently completed and described below—was wrecked during its first ascent on Lake Maggiore. *The Aeroplane* of London, whose editor made a trip to Cesto Calende, where the trial was to take place, prints several views of the wreckage. The Caproni Works will not admit the destruction of the machine, the official report being to the effect that the machine made a flight of a mile and on descending was damaged so that it was retired for slight repairs. The unofficial report was that pilot Sembrini took the machine off the water, got her up about 60 ft. and then gently put her nose down and continued so till she drove it under the water. Mr. Gray says, "considering that she had four Liberty engines on her forward planes and four more aft, with very small elevators and yards of space between the engine masses, it must have been very difficult to counteract her enormous longitudinal moment of inertia, and so the story has every semblance of truth." The wreckage which he photographed was said to be that of an ordinary triplane on floats which about the same time made a complete submersion, but it bears remarkable resemblance to the published photos of the eight-engined machine.

According to a report by U. S. Commercial Attache H. C. McLean at Rome, the huge flying boat was made up of three triplanes with the tails removed, placed one behind the other. Between the wings of the rear set of planes were placed the rudders, while the elevation of the machine was controlled by ailerons on all of the wings. The length of the ship was 75 ft. and the wingspread 108 ft. It was equipped with eight low compression Liberty engines of 375 hp. each, making the total available power 3000 hp. Its weight was about 16 tons and it was designed to carry a load of 10 tons, making the total weight 26 tons.

The cabin, which was entered through a door at the stern, was 7 ft. high, about 8 ft. wide and ran the entire length of the ship. A narrow aisle ran down the center, with comfortably upholstered seats on both sides. At the bow a small compartment was provided for the commanding officer, while a ladder led to the pilot's post, immediately behind and above, from which all operations were controlled. Provision was made for two pilots, one of whom was to be in reserve, and between the two seats was located an electrical switchboard for the transmission of orders. Two levers at the right permitted the pilot to control the engines without reference to the engineers in case of emergency.

The engines were mounted in two groups, four in the first set of planes and four in the last. In each case two engines were placed back to back directly in the center, with one on each side, the central engines being equipped with four-blade propellers, and those on the sides with two-bladed. Provision was made for one engineer for each set of engines. During its first trial the ship was to carry only sand ballast.

It was estimated that the total cost of the new airplane exceeded 4,000,000 lire.

The Spirit Behind the Dealer Contract

An automobile salesmanager recently discussed dealer relations in an informal way and said some interesting things. "To exercise control over dealers," he said, "it is primarily necessary to convince them you are trying to help them. It is the spirit behind the contract that counts."

By Norman G. Shidle

NOT long ago I had an interesting talk with the general sales manager of one of the largest automobile concerns in the country. The talk was specially interesting because of the universal increase in attention being given to marketing, dealer relations, etc., and because this sales manager has been conspicuously successful in carrying out his work.

Discussing the matter of marketing, he outlined some of the plans which he is using to help dealers in making sales and in decreasing sales resistance. A number of these plans depend very largely upon the co-operation afforded by the dealer and the attitude taken by the dealer toward the help extended. Some of them, in fact, seemed to call for a very strong control of the dealer organization by the manufacturing sales department.

When some of these plans had been outlined, the thought came to my mind that it might be very difficult in many cases to get the dealer to operate so closely under the supervision and control of the manufacturer; that the dealer would be likely to feel that his own way was the best and to resent too close supervision. So I asked this sales manager if he didn't have a good many troubles on this score. I said that it seemed to me as though the plans might work more successfully if he were operating factory branches instead of dealer; but that under present conditions such control appeared difficult.

"Well," this sales manager replied, "that is not necessarily as true in practice as you might think. It depends very largely upon the attitude and actions of the manufacturer as well as upon the sort of dealers that you have.

"The primary necessity is to convince the dealers that you are trying to help them; that you understand how closely bound up with their success is your success. This must be done in actions as well as in words. During the last few years, for instance, when all the dealers were asking for many more cars than could possibly be supplied to them, I made it an invariable rule to treat every dealer in exactly the same way.

"As you know, we have worked out a quota system on a scientific basis, so that our production can be proportioned to the various territories in a fair and accurate manner. On the basis of this quota system, we proportioned our cars during the entire period of peak demand. We gave the same treatment to the country dealer that is accorded to the city dealer, even though the latter had enormous demands at a certain time. Through it all, we kept the confidence of our dealers, because, even when they wanted extra cars most and couldn't get them, the big dealers felt in their heart that we were on the level. They knew that while they couldn't get more than their share, no one else could either. In other words, to put it frankly, every individual dealer knew we were square because we wouldn't cheat for him.

"That is just one example of how by actions dealer confidence can be built up. And I often think actions are of more importance than house organ messages in many cases.

"Take the matter of dealer contracts, for instance, about which there has been considerable stir lately. The bad practices of a few manufacturers and dealers cause a lot of disturbance. It is foolish to talk about the elimination of a cancellation clause from the contract. It costs us money to establish a dealer; we invest a certain amount in every new dealer we take on, and that investment must be protected. If we find we have an inefficient dealer it is not profitable either to him or to us that he should continue his connection with our organization.

"As far as suddenly cancelling a dealer's contract is concerned, the manufacturer has nothing to gain from cancelling the contract of any dealer who is doing satisfactory work. His success is our success. In fact the manufacturer cannot possibly be successful unless he has an efficient and effective dealer organization.

"That is the fundamental to which the whole thing boils down. A sound basis of mutual understanding and mutual desire for a square deal is far more important than any words in a legal contract. The perfect contract can never be written in black and white. It is the spirit behind the contract that counts."

Perhaps much of this sounds like theory. Probably some one will object that all these general ideas are all right, but that it is different when it comes to actual practice.

There are some things in this world which cannot quite be reduced to statistics or figures. An understanding of certain abstract factors is necessary to success in modern merchandising. The results obtained from such an understanding will be very practical, however, as can be noted in this case.

It will be admitted that there has been considerable dealer unrest during the last year. The dealer personnel of this manufacturer, however, for 1921 comprises 98 per cent of those associated with him during 1920, a remarkable record in view of the conditions. Moreover, this bunch of dealers has been selling more cars than the factory can produce for over two months.

These facts go a long way toward emphasizing the importance of the spirit behind the dealer contract.

THE Union Petroleum Co. is marketing a new cutting oil known as Wilkut. It is claimed to be a better coolant than lard oil. It requires no mixing or diluting, is sterile, does not corrode bronze or other bearings of machines or discolor work. The oil is transparent, enabling the workman to see his work at all times.

Production Manager's Relation to Fatigue Studies

New methods of observation for fatigue studies were used in recent British investigations. This article discusses the general application of these principles and indicates the function of the production manager in translating the results of such studies into practical operations.

By Harry Tipper

FROM time to time in these articles reference has been made to the question of fatigue and the relation between the fatigue established, the hours of labor, the physical requirements of the operation and the surroundings. In considering these items, reference has been made to the investigations conducted by the medical profession, the value of these investigations to industry and the limitations of them.

In Great Britain the long development of the industrial system from its early beginning, the crowded condition of the country and the character of the climate have combined to make the problem of fatigue of more importance from the physical standpoint. During the war medical committees were appointed to inquire into the health of munition workers, the conditions in the munition factories, and to make recommendations regarding changes in the character of the factory surroundings and hours. This work has been continued by the Medical Research Council, which is a department of the government. This council has issued an extended report upon the atmospheric conditions and their effect upon fatigue.

The principal points of interest in this report are the new methods adopted for observation and the extended investigations into wet and dry temperatures, cooling powers, air velocities and similar conditions entering into the atmospheric surroundings of the worker. Interim conclusions have been arrived at concerning the effect of these variations upon the fatigue.

The present report is confined to the boot and shoe factories, but the methods of making observations would be of interest in a great many other cases. The report shows the difficulty of separating one factor in the surroundings and noting its effect without the other factors entering into the conclusions. It also indicates the intimate relation existing between the surroundings, the character of the clothing worn by the worker, the condition of the worker's health at the time, and so forth.

The report lays emphasis on the government of the air in the work room, and a variation in the temperature naturally associated with such movements has elements of great importance in lessening the fatigue and increasing the co-operative powers of the worker.

In order to determine the conditions affecting the loss of heat the board used the kata-thermometer, which measures the cooling power of the air. The dry kata loses heat by radiation and convection; the wet kata by radiation, convection and evaporation. This makes it possible to secure some indication of the ability of the skin to exercise its cooling effect. The measurements are made in the immediate location of the worker. The comparisons are not exact because of the effect of the clothing and the work itself upon the loss of heat from the body.

Mainly, this report shows what a long way we have to go before we will be in a position to determine accurately the effect of the surroundings upon the physical conditions of the worker.

It is obvious that our knowledge is confined to very elementary conclusions of a general character concerning the temperature of the air, the moisture in the atmosphere and its movement. It is not surprising that the conditions in various manufacturing establishments should be so different when the best investigations of the medical man have been able to prove so little in respect of the required elements.

In this country the researches of the medical man into fatigue have secured little attention from the business man, so that even what is known at present about the effect of fatigue upon production is not fully considered in the working out of the factory organization. The importance of examination of fatigue has not been appreciated by the manufacturer in its effect upon production efficiency, and therefore the production cost.

Very little has been done in the examination of distinct occupational groups within the various industries and the effect of the particular work upon which they are engaged, except in those special cases where the character of the work has been obviously dangerous to the health. The reports which have been issued from time to time in this country and abroad are still somewhat general in their examinations, and not sufficiently exact to be of much benefit to the production manager in his attempt to determine the practical conditions of his organization.

There is lack of co-ordination between the researches of the medical man and the various engineers concerned with factory building and organization, so that many of the researches are academic in character and have not resulted in the development of practical measures designed to overcome the difficulty.

Heating engineers, ventilating engineers, building engineers and medical men interested in industry must co-ordinate their researches very much more closely if the discoveries in the one case are to effectuate practically in the other.

There is not much value to the production manager in the observations of the medical man, unless these can be translated into the practical construction and the equipment of the factory without an unbearable expense. The desirability of proper light, heat, ventilation and movement of air within the factory is admitted by all industrial engineers and production men.

The progress in factory building and lighting indicates the attention which has been paid to these matters, but the construction of a factory offering the best conditions possible, for the reduction of fatigue on account of the surroundings, depends upon the combined efforts of these various engineers and their knowledge of the medical researches. This demands a co-ordination of effort in research which has not been secured at present and which has minimized the effects.

The conclusions derived from the researches into the physical surroundings and their effect upon the physical condition must be accepted with reserve at the present time, because they are always complicated by the mental factors entering into the condition of fatigue. All that they can do in themselves is to establish the broad general necessities in regard to the physical conditions of the work and the surroundings in which the work is done.

The limitation of physical effort to a reasonable average requirement, the provision of proper floors where the work requires continuous standing or walking, provisions for changes in the position where the work is concentrated, proper arrangements for light, the elimination of fumes and smoke, continual replacement of the air and a proper amount of heat must be determined for an average individual under the average requirements in the factory.

These general matters can be determined so that the conditions of work minimize the fatigue to some extent. They do not alter the accumulation of fatigue on account of the character of the work itself, and the incentives which are developed by the work.

The processes of their practical working out in factory organization is a slow one and they can only be improved detail by detail, so that their effect upon the production efficiency is not very marked at any particular period. They are valuable because it is obvious that any improvement which can be made in factory organization in agreement with the known laws of health will eliminate some of the difficulties under which the workers labor, and to that extent prevent accumulated fatigue or loss of health from other causes.

Naturally the working out of organization improvement within the factory depends upon the advance in the engineers' capacity to provide practical methods of improvement. This question of physical fatigue as influenced by the surroundings and conditions of the work is one which must be solved by the engineer and the production executives.

The researches which are being made from the medical standpoint can be understood readily by the engineer who will give some study to the matter, and they will be of great value to him in their suggestion of present deficiencies and the possibilities of improving present conditions.

There should be a larger interchange of information along these lines and a larger discussion between those industrial engineers who are interested in examining human efficiency and those medical men who are interested in industrial health. Such interchange would benefit the practical situation by the general understanding of the conditions secured on both sides, the better direction of future research and the better examination of practicalities.

Individual the Most Important Factor

THE general outlines of the Studebaker co-operative plan are well known throughout the industry. The plan provides, among other things, for stock owning by employees, bonuses for continued service, pensions, vacations, checks, etc. The plan has been in operation for over a year and a half and is being conducted with considerable success.

A recent informal conversation with Dr. C. A. Lippincott, who has charge of the administration of the plan, however, brings to light certain factors in regard to industrial relations not discussed so frequently as those pertaining to group labor policies. Dr. Lippincott believes very thoroughly in the essential soundness of the Studebaker co-operative plans. They are economically and ethically sound and for that reason operate to the mutual advantage of both the corporation and the employees.

There are certain factors involved in the matter of industrial relations, however, not included in such plans. The relation of the individual to his job, for instance, is not accounted for by any group plan. The question of the mental effect of continued performance of the same simple operation day after day, the possibilities for promotion for the average worker through the experience gained on the job he is doing, the effect on the individual of the continued tendency toward specialization—all of these things constitute industrial problems which can be handled successfully only through the proper study of the individual.

Dr. Lippincott believes that the work his personnel department is doing in regard to the handling of individual complaints, the adjustment of minor working conditions, the changing of a man from one job to another when he becomes tired of the monotony, etc., is of equal if not greater importance to that of administering the co-operative plans.

He says that these problems relating to the individual are as yet solved only to a very limited extent. His department recognizes the presence of such problems, however, and is gradually attempting to work out a solution through careful study and intelligent analysis of the various factors involved.

This statement of the importance of a study of the individual is specially interesting as coming from Dr. Lippincott, since he is associated with the administration of highly successful group labor plans. In other words, it emphasizes the essential importance of the individual as the fundamental industrial unit, without minimizing the comparative value of the broader and more readily established mass methods of dealing with the labor situation.

THE new British motor taxation is yielding larger sums than was anticipated. During January and February the total receipts amounted to £7,092,400. The statistics indicate that owners of commercial road transport vehicles are contributing over 50 per cent. of the revenue from the new taxation.

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Tractor Industry's Big Task

"WE know that power farming is the surest method of reducing production costs. If the farmer and public as a whole do not know this fact it is our own fault."

This was the answer of Finley P. Mount, chairman of the Tractor and Thresher Department of the National Implement and Vehicle Association to the comment recently heard that low price of farm produce was slowing up tractor sales. The answer appears to be complete and it also appears to be a justification of the recently established Power Farming Bureau by this association. This bureau is to supply accurate information concerning power farming and is to cooperate with the farm press and with agricultural institutions and organizations to advance the power farming idea.

It is a big undertaking to re-educate a great public, like the farmers of this country, to a new process of operation. Just how large a task this is one can judge by noting how slowly manufacturing plants, mercantile establishments and other business institutions accept devices and machinery which clearly show an ability to increase profits. The advertising task before the tractor industry is a considerable job.

Recommended Practice in Hub Design

THE controversy between those who favor standardization and those who would leave everything to the judgment of individual engineers is as old as the effort to create standards. To-day most engineers occupy a middle ground; they favor standardization so long as it does not tend to throttle initiative on the part of the designer, but they oppose it when the tendency is to trespass upon ground which the engineer considers strictly his own.

It is, as a matter of fact, extremely difficult to draw the line between things which should and should not be standardized, while commercial and other considerations complicate the problem. It may be said in general that standards are necessary where interchangeability is required, or where units made by different groups of manufacturers must fit together, but this need not interfere with initiative or with originality in design. For example, several dimensions of the flywheel and its housing have been standard for some years and are quite generally used to the advantage of all concerned, but many non-standard flywheels and housings are used, and there is nothing to prevent any maker not so benefited from using other dimensions if he desires.

So long as all the parts for a given machine are made in the same plant they are readily made interchangeable, though even then certain standards must be established and maintained, but when parts for a given assembly are made in different plants, standardization becomes a necessity.

Interchangeability and mating between parts of like or similar character brought about by standardization has been one of the largest and most important elements which has made the modern low-priced American automobile possible. In England, where there is very little standardization and every manufacturer makes, to his own design, nearly all the parts of the car, the automobile is relatively high priced and its field of usefulness is correspondingly limited.

The enormous parts business which has developed in this country has been made possible by a willingness of manufacturers to co-operate in making parts that will fit together. This interchangeability has made possible large quantity manufacture and correspondingly reduced price to the benefit of all concerned. It has, perhaps, limited originality to a slight degree, but the benefits gained far outweigh the slight disadvantages, and the great volume of business which has resulted has widened rather than narrowed the field for the engineer, or perhaps we should say has provided far more work for engineers to do than would otherwise have resulted.

Axles and wheels are made, for the most part, by different groups of manufacturers, and it is not at

all surprising that these groups find it necessary to bring about standards which will enable their respective products to fit together without innumerable small changes which in themselves are of little consequence so far as the design is concerned, but which cause no end of trouble and needless expense in changes in tools, patterns, etc.

The remedy is, of course, the adoption of standards or recommended practice in hub design. Since the hub design depends, in turn, upon spindle and bearing sizes, certain selections in this regard are necessary and have been made. Since two types of bearings are available, two sets of standards or recommended practice are to be proposed at the coming semi-annual meeting of the Standards Committee of the Society of Automotive Engineers, one intended for the use of inch dimension roller bearings, and the other for metric size ball or roller bearings.

The subject has been given thorough consideration by those interested, and the proposals to be made involve chiefly or wholly connecting dimensions (not details of design) and are said to have the approval of all prominent makers of ball and roller bearings and wood and steel wheels, as well as of many axle and truck manufacturers. In arriving at the recommendations to be made in the report of the Truck Division of the S. A. E. Standards Committee, all arguments for and against the adoption of recommended practice have been heard and, except for those who oppose any standardization, are believed to be composed.

No one who opposes the use of this or any other recommended practice is obliged to use it, but if there are any valid objections to the recommendations offered, opportunity to express them will be afforded at the forthcoming meeting. Those who desire to see the recommendations accepted by the Standards Committee and the Society should not fail to attend the meeting, in order that the vote may be representative and not biased by a minority who do not favor the recommendations.

AUTOMOTIVE INDUSTRIES believes that hub standardization is desirable, but has gladly given much space to those who oppose it, as well as to its advocates. We are inclined to the belief that the report now agreed upon by the Truck Division is worthy of acceptance as recommended practice, and think the Society is to be commended for bringing together conflicting elements. Those who are vitally concerned, however, are the ones who will either use or be handicapped by the proposals, and both sides should be fully represented in the final vote.

"Scratching Gravel"

THERE was a business man in a town of about 100,000, who had a large corner office on the third floor of the largest office building in town. He had occupied that office for three years.

The other day an automobile salesman called on him in his office, told him about the car and sold him a car the next day. Although financially an excellent prospect, this man had not owned a car before. But this was the first time during the three years that an automobile salesman had ever called on him or approached him in regard to buying a car.

This business man was interested, so he asked the salesman how he happened to call on him. The salesman replied that until a month before he had been a salesman for office furniture. He had always called on executives in search of a market for his product. When he started to sell automobiles he naturally followed out the same plan as before.

The experience of this business man would indicate that the actual listing of prospects has not come "naturally" to enough automobile salesmen. This story is told by a well-known salesmanager, who cites it as an instance of what he believes to be the essential factor in bringing sales back to normal—"just naturally scratching gravel."

A Standard Sprocket Tooth Form

ONE of the most important pieces of standardization work now under way is that on roller chain sprockets. Heretofore most of the companies manufacturing roller chains have had their own form of sprocket tooth, and, while all used the standard pitches and widths, the sprockets of one concern were not strictly interchangeable with those of another. Moreover the old style of sprocket, in which the chain, when worn, bore only on a single tooth of the sprocket, was not very efficient, because with such contact the pressure on the roller and tooth was necessarily very high, and the wear, therefore, was rapid.

In the new form of sprocket tooth, already agreed upon by the chain manufacturers and which will undoubtedly be ratified shortly by the standardizing bodies, the pressure between chain and sprocket will be divided between a number of teeth whether the chain is new or old. When the chain is new, the rollers will bed at the bottom of the tooth spaces, whereas, when the chain is worn, contact will occur farther up the side of the teeth. The conditions of contact will, therefore, be substantially equally good whether the chain is new or old, an advantage which has long been confined to the silent type of chain.

Roads and Reputations

A PROMINENT highway engineer told a group of his fellow workers recently that their job was to build roads so that they would last. "Ten years from now," he said in effect, "the people won't care about how large your appropriation was with which to build these roads; they won't care about anything except the condition of the road. You can serve the people best by building roads that will stand up.

"It is upon that fact and that alone that your reputations will rest. The people will want a road; not a memory. Traffic will probably get heavier, but you must build the roads to meet the conditions. It would not be economically proper to expect traffic to limit itself by the roads." This is the point of view which means permanent progress for motor vehicle transportation.

Square Deal on Tax Aim of Industry

Equal Distribution to Be Urged in Plea

Directors of N. A. C. C. Complete Plans for Hearing Before Senate Committee

DETROIT, May 9—Directors of the National Automobile Chamber of Commerce at the May meeting in Detroit last week formulated plans for its fight before the Senate finance committee on May 16 on the proposed tax increase on automobiles and trucks. The efforts of the organization will be supplemented by those of allied interests, the National Automobile Dealers' Association already having asked for and been granted a hearing. The Motor and Accessory Manufacturers' Association and the Rubber Manufacturers' Association also will be represented at the hearings.

Directors of the National Automobile Chamber of Commerce took the position that the matter was one of such grave importance to the automotive industry as well as the country in general and that the industry is of such magnitude that the separate units should be given opportunity to present their claims individually and preferably on separate days rather than attempt to sum up all the issues in a short conference of a general committee. As a result the interests of the chamber will be represented by Chairman C. C. Hanch of the Tax Committee, George M. Graham, who will present the claims of the truck manufacturers; J. Walter Drake, of Hupp Motor Car Corp., and H. H. Rice, who succeeded R. H. Collins as president of Cadillac.

Hanch Outlines Appeal

"We are seeking only a square deal for one of the greatest American industries," said Chairman Hanch. "An equitable distribution of taxation is our plea, for the moment Congress puts the stamp of special taxation on an industry it brands that industry as illegitimate. It is our contention that automobiles and trucks, as President Harding so aptly put it, are essentials in the modern scheme of life, and we insist that taxation should be based on exactly the same reasoning as in the case of every other means of highway transportation."

The directors took exception to the plan of Secretary Mellon for a Federal license system in horsepower tax as an injustice to the industry which they contend is taxed to a greater degree than any other. Favoring a sales tax, preferably on retail sales, the directors will protest vigorously against any special or discriminatory tax and will urge the removal of the present excise tax. The program as outlined and made public three months ago will be urged upon the Senate committee.

Aside from the taxation problem, the directors spent much time in discussion of the location for the annual New York show with opinion divided as between Madison Square Garden and the Eighth Regiment Armory. The matter finally was passed over until the June meeting with the feeling prevalent that the armory probably would be favored on account of the immense floor space available unhampered by posts or supports.

A campaign of education with the idea of bringing full realization of the magnitude of the automotive industry and the fact that the motor vehicle is a necessity and indispensable, also was planned by the directors to cover the entire country. Facts and Figures of the Automobile Industry for 1921, the pamphlet published by the chamber, will be sent out to 45,000 bankers, chambers of commerce, industrial leaders and universities and

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Berliet Gets Ten Years to Pay Off Creditors

(By cable to AUTOMOTIVE INDUSTRIES)

PARIS, MAY 9.—By permission of the French courts, the Berliet Co. has been allowed to make an arrangement with creditors whereby its debts will be paid within a period of ten years together with normal interest. Under this plan the company will continue in business.

The Fiat factory has been reopened after being closed for more than a month. The men returned under the owners conditions.

CALL OFF TOOL CONVENTION

WORCESTER, May 7—The spring meeting of the National Machine Tool Builders' Association which had been arranged for May 19-20 at the Traymore in Atlantic City has been finally canceled because of the condition of the industry, according to Carl F. Dietz, vice-president and general sales manager of the Norton company and who is secretary of the big organization.

WILLYS LIGHT PRICE CUT

TOLEDO, May 9—The Willys light division of the Electric Auto-Lite Corp. announces a reduction of $100 in the price of the Willys light. The cut has been made to meet the sharp price liquidation in the farming industry. The company asserts that for the time being the light will be sold at a loss.

Anti-Dumping Action Unfair, Say French

Blame Glutting of European Market on Heavy Shipments from America

PARIS, May 1 (By Mail)—Motor Transport Corps First Reconstruction Park, at Verneuil, the biggest organization of its kind left behind by the American Army in France, has been sold after standing idle for twenty-nine months. This park was built in four months by the Motor Transport Corps, and at the time of the Armistice was running with 3500 soldiers, all of them skilled hands, while 1500 German prisoners were working on the construction of additional buildings. The total area was 355 acres, and the park was laid out for the complete overhaul and reconstruction of motor vehicles of all kinds.

Immense stocks of spare parts were kept at Verneuil, and although the American Army is supposed to have prepared complete inventories, the French authorities never knew how much material was contained in this camp. M. Doucet, who had purchased the park from the French Government at a cost of 55,000,000 francs, admitted in an interview with the correspondent of AUTOMOTIVE INDUSTRIES that he did not know how much material he had bought.

The only definite information obtainable at the offices of the company was that there were 9000 unopened boxes of Ford parts. A representative of the Ford company in France who had an opportunity of opening some of these boxes stated that most of the parts were ruined by being left out in the open. On this account his company refused to purchase.

Parts for Many Cars

The biggest stocks of parts, according to the officials of the purchasing company, are for the following cars and trucks: Cadillac, Cole, Dodge, Ford, F. W. D., Garford, G. M. C., Kelly, Mack, Nash Quad, National, Packard, Peerless, Pierce Arrow, Riker, U. S., White, Holt tractor and Harley-Davidson and Indian motorcycles. There are very few complete vehicles, for Verneuil existed only for reconstruction and supply. The park, however, had machine shops of such a complete nature that it would have been possible to build automobiles in them. All this machinery is now for sale, and the Austin buildings will also be disposed of.

The park contained 45,000 solid tires and about 60,000 penumatics when taken

(*Continued on page* 1034)

Lower Prices Stir Renewed Buying

New York Business Shows Sharp Ascent

Sales Rise High Over Previous Months in Marmon and Jordan Salesrooms

NEW YORK, May 7—Marmon and Jordan, which announced substantial price reductions a week ago have had brisk sales both wholesale and retail in the New York territory.

Inquiries of prospects visiting the salesrooms, and of others using the mails or telephone began almost as soon as the salesroom opened Monday morning, the price reduction ads having appeared in the Sunday newspapers. Throughout the week, sales of both cars have run high in comparison with recent months.

Marmon has received several applications for dealerships in the territory. Jordan, which was seeking expansion of wholesale business, has placed several additional dealers and has received numerous applications which are still under consideration, as a result of the lowered price.

Jordan had 40 people in the salesroom Tuesday evening, two or three of whom bought cars on the spot. Since then not a single day has been a "goose egg," as far as retail sales are concerned. In other lines, the week has been considerably ahead of several recent weeks in the retail sales despite the fact that it has rained almost every day. Practically all sales made have involved a trade, but the used car market is active and fairly good prices have been obtained.

There is a noticeable improvement in truck sales. One dealer sold 24 new trucks and six used trucks in April. Another sold within five of his April, 1920, record, and his sales for January, February, March and April were within 10 per cent of those of a year ago.

Dealers who have sold trucks since Jan. 1 have had to trade in most cases and state frankly that they have made more liberal allowances than those prevailing a year ago.

Accessory and tire business is good. One large house, whose sales for several years have quite closely paralleled those in the passenger car field had a first quarter's business which was 60 per cent of 1920. April sales were better than that.

GERDIS OBENBERGER TRUSTEE

MILWAUKEE, May 9—J. F. Gerdis, who was appointed receiver of the John Obenberger Forge Co., Milwaukee, upon involuntary bankruptcy proceedings, has now been elected trustee of the bankrupt estate under bond of $25,000.

COLLINS TAKES OVER OLD CADILLAC PLANT

DETROIT, May 11—R. H. Collins, who retired from the presidency of the Cadillac division of the General Motors Corp. to head the Collins Motor Car Co., a $10,000,000 Michigan corporation, has purchased the Cass Avenue plant occupied by Cadillac before that company moved to its new location. Negotiations for the purchase were closed yesterday.

Collins stated to-day it was too early to make any announcement regarding the type of car he expects to build beyond the fact that it will be a high grade automobile which is expected to be in production by Jan. 1. He will not begin work at his own plant until he finally severs his relations with Cadillac, July 1. He still is in full charge of the General Motors company and will continue until that date. He declined to state the price paid for the property.

Collins will be allied in his new venture with W. C. Durant, who is at the head of Durant Motors, Inc. An early announcement is expected from Durant regarding the location of the main plant for the production of his car.

Strike Threats Slow Sales in Kansas City

KANSAS CITY, May 9—The last week of April was a big one in retail sales of motor cars in Kansas City, some firms running their totals into figures large for any season. There had been a sharp upturn on volume in many lines in April, but motor cars as well as most other lines, suffered sharp depression the first week of May.

The announcement of price reductions of motor cars, was called a factor in the depression of sales. But there were many other factors, perhaps even more impelling. One of these was the existence of a delicate situation in several industries, with strikes threatened.

LOCK SEAM PATENT UPHELD

CHICAGO, May 9—Judge Killets in Federal District Court has handed down a decision sustaining patents 1,034,954 held by the Dallas Brass & Copper Co. on their lock seam tube forming machine in a suit against the Motor Products Corp. and the Diamond Mfg. Co. of Detroit. Tubing made by this machine is used principally in the radiators of automobiles.

Chevrolet Reduces Prices on "490" line

Will Now List Within $100 of Pre-War Level—Look for Sales Increase

NEW YORK, May 7—Speculation concerning the plans of the Chevrolet Motor Co. regarding prices was set at rest yesterday by announcement of an average reduction of 21 1/3 per cent for the "Four-ninety" models. The new price list follows:

Touring car, $645; a reduction of $175.
Roadster, $635; a reduction of $160.
Sedan, $1,195; a reduction of $180.
Coupe, $1,155; a reduction of $170.
Light delivery wagon, $645; a reduction of $175.

These prices bring the Chevrolet back to within $100 of those which prevailed in April, 1917, before the United States went into the war. In that year the touring car sold for $550. In 1918 the price was raised to $685 and it had stood at $795 for nearly two years.

The Chevrolet company announced March 21 that if 50,000 cars were sold between Jan. 1 and Aug. 1, a refund of $50 would be given to each purchaser. This refund will be paid at once to all purchasers since the announcement was made instead of waiting until Aug. 1.

The Chevrolet price cut was more drastic than had been expected and it came somewhat unexpectedly, following close upon reductions made on Marmons and Jordans. It is expected by the company that the demand at the lower price will largely increase production with a consequent lowering of overhead which will justify the decreases.

Oakland Second of G.M.C. to Announce Price Cut

PONTIAC, MICH., May 9—The second of the General Motors Corp. subsidiaries to announce a reduction in prices was the Oakland Motor Car Co., which put a new schedule into effect to-day. The cut is $250 on each model or 18 per cent on open cars and 12 1/10 on closed.

The touring car and roadster which were $1,395 now will sell for $1,145. The coupe and sedan which were $2,065 will sell for $1,815.

The cut in prices followed closely a visit to the plant by the chief executive of the General Motors Corp.

STEVENS-DURYEA NEAR NORMAL

SPRINGFIELD, MASS., May 7—Stevens-Duryea, Inc., has increased production 50 per cent and has taken back 150 men. It is announced that the plant will be running on a normal basis by the middle of the month.

Manufacturers Take Up Contract Points

Clauses to Strengthen Dealer Credit and Customer Relations Favored at Meeting

DETROIT, May 10—In an all-day session, characterized by harmony and an apparent desire to cooperate more closely, committees representing the National Automobile Chamber of Commerce and the National Automobile Dealers Association, wrestled here to-day with vital problems brought out by the dealers. At the end of the meeting adjournment was taken until next month pending reference of the suggestions and decisions to the parent organizations.

The meeting was presided over by W. C. Sills, general sales manager of the Chevrolet Motor Co., while H. B. Harper, Philadelphia Overland dealer, acted as secretary. Although morning and afternoon sessions of the conference were executive and a formal statement issued to-night gave no details of the meeting, reports filtering from the conference room indicated it was a field day for the dealers.

Six points brought up for discussion by dealers, according to unofficial information, were received with apparent favor by the manufacturers' representatives, their attitude indicating the committee recommendations would be highly satisfactory to the dealers. Requests of dealers and suggestions for disposition of points at issue were formulated at a meeting of the N. A. D. A. directors yesterday. At the same time the N. A. C. C. directors met and outlined the course of action.

While little information concerning the meeting was available and no intimation was given as to the attitude of either side, the situation was well stated by President Jesse A. Smith of the N. A. D. A., and General Manager Reeves for the N. A. C. C.

Both Sides Seek Solution

"The time is here to sell cars," they said, "and we all realize that success in the merchandising of our products must and can come only through close cooperation. The prosperity of the factory is dependent on that of the dealers, and the latter's success depends solely on his treatment of customers and prospects."

The discussion ended with both sides anxious to find the solution, but the situation proved too formidable for quick decision. "It is the country dealers who are up against the real problem in the used car business," said President Smith, after the meeting, "and when you consider they comprise a big percentage of dealers of the country, you get some idea of its importance. We in the cities where proper effort is made can keep our used car stocks in fairly good shape, but the man in the small town soon finds his credit t'ed up in his used cars."

Three of the subjects planned for discussion discounts, exclusive representation, and freight rates were eliminated, the dealers themselves being unable to agree on discounts. A formal statement given out by General Manager Reeves after the meeting follows:

"Representatives of the N. A. C. C. and the N. A. D. A. held an all-day session at the Detroit Athletic Club today and considered such items as yearly contracts, used cars, parts, stocks, advertising and service to the public. Contracts were considered from the viewpoint of clauses that would strengthen the dealer with his banker and his customer on the problem of used cars.

"It was agreed that a general investigation should be made into the used-car situation by the national organizations. Sectional advertising for the benefit of the dealers, a closer and more frequent survey of parts stocks and a broadening of service plans for all users of cars and trucks were deemed necessary for the dealers' success. To-day's suggestions with additional information to be obtained after consideration by manufacturers and dealers, will be the subject of another meeting of the committees to be held in Detroit next month."

W. E. Metzger to Handle Wills Sales in Detroit

DETROIT, May 9—W. E. Metzger, a pioneer automobile man, will take over the Detroit distribution of the Wills Sainte-Claire with a salesroom on the ground floor of the Ford Building. He expects to have a car on display in two weeks.

Mr. Metzger graduated from a bicycle agency and in 1899 handled the first electric automobile in Detroit. In 1890 he took over the Oldsmobile and helped organize the Cadillac Motor Car Co. In 1902 and 1908 he was with B. F. Everett and Walter E. Flanders, who organized a company which brought out the E M F car and later formed the Metzger Motor Car Co. In 1909 he built the Everett car and merged with Maxwell. In 1912 he was vice president of the Columbia Motor Co, and an officer and director of other companies.

TRACTOR DISPOSAL HITS HOLT

PEORIA, ILL., May 7—As a result of the turning over by the Government to state highway commissioners of a large number of 10-ton Holt caterpillar tractors, the Holt company has closed its factory temporarily to permit of readjustment of conditions. The factory force and a part of the office staff are affected.

A. E. A. CONVENTION JULY 4

CHICAGO, May 7—The date of the convention of the Automotive Equipment Association, at Mackinac Island, has been changed from the week beginning June 20 to the week beginning July 4. Hotel arrangements were responsible for the change.

White Motor Makes Change in Officers

Windsor T. White Retires as President and Is Succeeded by Walter C. White

CLEVELAND, May 9—The first shift in the personnel of officers of The White Co. since it was organized was announced at the close of the annual meeting of directors, which followed the stockholders' meeting. The change in officers marks the passing of control of the corporation from the hands of older men, who largely have been responsible for the upbuilding of the corporation. Their places will be taken by trained young men, who have come up from the ranks. The changes follow:

Windsor T. White, resigned as president of the company, and is succeeded by his brother, Walter C. White. W. T. White was elected chairman of the board of directors.

A. R. Warner, secretary, resigned, and is succeeded by T. R. Dahl, who has been assistant secretary. Warner asked to be relieved from active duty, but he was re-elected to the board of directors.

E. W. Hulet, who has had charge of production, presented his resignation, but he was asked to remain with the company in an advisory capacity and consented.

All three of the officials have been connected with The White Co. for seventeen years or more, and while the active management will hereafter rest upon the shoulders of more youthful men, the ones who have been on the job for so long will be available for advice and counsel. The new president has for some time been senior vice-president, and for years has been active in the management of the corporation.

Teagle Becomes Director

One of the notable additions to the Board of Directors was Walter C. Teagle, president of the Standard Oil Co. of New Jersey. Teagle was born here and he is still interested in many Cleveland business and financial institutions. William G. Mather, president of the Cleveland Cliffe Irons Co., one of the leading business men of Cleveland, also was elected a director. Other directors elected are: J. R. Nutt, president of the Union Commerce Bank; Warren S. Hayden, Otto Miller, Homer H. Johnson, Albert R. Warner, Windsor T. White, Walter C. White and Thomas H. White, all of Cleveland; E. R. Tinker of New York City, and Philemon Dickinson of Philadelphia.

The retiring president told the stockholders and the directors that in his opinion the low point in business, not only in the automobile industry, but in other lines, had been passed and that from now on business would continue on the up-grade. Evidence of this was manifested in the report of the company. The regular quarterly dividend of $1 a share was declared.

March of Industry Continues Steady

M. A. M. A. Analysis for April shows Unbroken Gains—July Slump Doubted

NEW YORK, May 9—A month's sustained and unbroken progress in the onward march of the automotive industry is reflected in the May analysis of conditions made public to-day by the Motor and Accessory Manufacturers Association.

"The gratifying betterment of fundamental factors noted in last month's survey is increasingly manifest in the first-hand reports and authoritative financial data consolidated in the summary for the month of April," comments M. L. Heminway, general manager of the association.

"Payments for the last month have been better than for the three months prior," says the report.

"More firms are paying their current accounts in full on due date, and an increasing number are paying a larger proportion of their notes as they fall due, quite a number paying in full.

"Releases on old orders show a decided improvement. Many of the car and truck manufacturers are placing orders for new materials. Virtually all the car manufacturers are now showing signs of life, and this applies to the manufacturers of trucks and tractors to a somewhat lesser degree.

"Quite a number of vehicle manufacturers are operating their plants at full time or nearly so.

"Labor conditions in the automotive industry seem to be causing comparatively little trouble. There is a marked increase in labor efficiency following the readjustment period."

These statements loom up conspicuously in the chart of automotive trends plotted with the greatest possible precision by the credit and financial executives of the principal manufacturers making parts, units, and accessories for the passenger car and truck builders. Close to 400 of these parts-purveyors are affiliated with the association.

Group Meetings Show Trends

Through monthly group meetings for the interchange of credit information and the pooling of experiences and viewpoints, these unit and equipment makers are able to diagnose conditions in an impartial and scientific manner. No attempt is made to cloak unpleasant facts. The parts makers must face the conditions as they are. Their verdict is therefore based on evidence, not on expectation.

During the last week in April five groups of the association met to discuss business and financial conditions generally and the credit entitlements of the makers of motor vehicles. One group met in New York, the others in Chicago, Detroit and Cleveland.

The information on business conditions brought out in the five groups showed little variation. Without exception every significant indication was constructive. Some members, to be sure, insisted that the present improvement in business is only a spurt which will be followed by a decided slump after July 1. This, however, was distinctly a minority report, in no way sustained by the preponderant weight of the evidence. The majority opinion seems to be that the improvement has been so gradual and consistent that it presages a continued increase of business along conservative lines.

Feeling Decidedly Better

"Altogether," says the report, in recapitulation, "there is a decidedly better feeling among our members. Collections are better and money required from banks seems to be somewhat easier. Many plants are resuming operations on a larger scale than heretofore, and the condition of extreme depression has certainly changed for the better."

Makers of automotive accessories and the smaller replacement parts report an unusually large volume of business from dealers and jobbers.

A first-hand up-to-the-minute report on automotive business conditions on the Pacific coast was telegraphed to the association's headquarters by Ezra W. Clark, advertising manager of the Clark Equipment Co., Buchanan, Mich., who is making a speaking tour across the continent, addressing local dealers' organizations and chambers of commerce. He is also placing on exhibition his oil paintings on "The Spirit of Transportation" by twelve of the leading artists of America who portrayed on canvas their "conceptions of the dynamic force of civilization—transportation."

"Business conditions on the Pacific coast show decided improvement," telegraphed Clark.

"New registrations are greater than last year, showing more sales. Dealers' associations strength in adversity has shown need of solidarity and co-operation. Organizations are putting on real sales pressure.

"San Francisco is now holding wonderful open road week. Present stocks of cars will be exhausted in two weeks.

"Many better known cars are now unable to make floor deliveries.

"Due to prohibition California has received splendid price for grape crop, many new vineyards being planted.

"Good demand for heavy trucks for highway construction and light trucks for agricultural use."

OVERLAND RISES 71 PER CENT

TOLEDO, May 9—The Willys-Overland Co. announces that, taking sales since the first week of March as a starting point, business has increased 71 per cent. The retail sales for the second week showed an increase throughout the country of 17 per cent over the first week, the third week an increase of 41 per cent, the fourth week a decrease of 25 per cent, the fifth week an increase of 60 per cent, and the sixth week an increase of 71 per cent.

Industry Reemployed 31,986 Men in April

Leathers, Textiles and Liquors Also Improve Positions—Steel Reports Declines

WASHINGTON, May 7—While the finance committee of the Senate is considering the imposition of additional taxes on the already overburdened automotive industry, the Department of Labor has made public a summary of employment conditions showing that manufacturers of motor vehicles and allied lines are virtually sustaining the entire industrial structure at a time when other lines of business are in deep depression.

The labor department report shows that there was an increase in unemployment in 28 out of 53 industrial centers east of the Mississippi in the month of April. Virtually the only places in which employment increased were centers of automotive activity. The chief gains were noted in Detroit, Chicago and Toledo. Detroit led all other cities in the percentage of increase with a gain of 25.9 per cent. The industry as a whole added 31,986 workers to its payrolls in the month, an increase of 22.3 per cent over March.

The only industries which improved their position in April were automobiles, leather, textiles and liquors. These four took on 42,630 workers, but approximately 75 per cent of this gain was in automobile and allied plants.

The report shows that in most places where the number of men out of work was reduced, automobile and allied lines relieved unemployment through gradual increases in their forces. While there was a sharp decline in the volume of iron and steel business, a good share of what was obtained came from the automotive industry.

DISCOUNT RATES CHANGED

WASHINGTON, May 7—Reports received by the Federal Reserve Board indicate a steady and sustained improvement in credit conditions. Large increases in reserves show that there has been a heavy liquidation of frozen credits and all the reserve banks are expected to announce a lowering of their rediscount rates in the near future. This action already has been taken by the banks in Boston, New York, Atlanta and Chicago. Boston cut its rate on commercial paper to 6 per cent, New York followed with a reduction from 7 per cent to 6½ per cent, Atlanta reduced the rate from 7 per cent to 6 per cent, and Chicago from 7 per cent to 6½ per cent.

HARVESTER PAYS BONUS

SPRINGFIELD, OHIO, May 7—More than 500 employees of the Springfield works of the International Harvester Co. have received extra compensation and stock certificates under the policy of the company announced last year.

Form Moline Engine as R. & V. Subsidiary

Company Will Be Expanded to $15,000,000 Annual Production—New Officers Named

EAST MOLINE, ILL., May 7—The Moline Engine Co. formal organization is being completed and in addition to its established business of producing poppet-valve engines, the company will manufacture Knight engines for the R. & V. Motor Co. The Root & Van Dervoort Engineering Co. will hold all capital stock of the engine concern and thus becomes merely a holding corporation for the R. & V. industries. The automobile manufacturing plant has already been separated and organized as the R. & V. Motor Co.

Expansion of the Moline Engine Co. is announced and annual production valued up to $15,000,000 is scheduled.

Directors of the three R. & V. unit organizations recently elected the following officers: President, H. A. Holder; vice-president, G. A. Shallberg; secretary-treasurer, S. G. Smith, and assistant secretary-treasurer, G. L. Walker. C. H. Van Dervoort was elected a vice-president of the motor company and will direct its sales. In addition to these officers the directors are O. J. Root, Rufus Walker, Jr., R. S. Hawes, J. W. Reinholdt, S. A. Mitchell and D. W. Gurnett.

With the announcement of the organization plans, formal confirmation was given of the sale of 74 acres and 15 manufacturing and administrative buildings of the concern to the Troy Laundry Machine Co. of Chicago, which, beginning Sept. 1 will move its plant to this city. This sale, it is announced, will not curtail activities of the R. & V. organizations but centralize their work.

Denial has been made to rumors that the Continental Motors Corp. is negotiating for purchase of the engine division of the organization.

FALLS MOTORS AT CAPACITY

MILWAUKEE, May 9—The Falls Motor Co., Sheboygan Falls, Wis., a large manufacturer of motors for passenger cars, trucks and tractors, is now operating its works at full capacity to fill its orders. Some departments are working overtime and the remainder on full time. In the last few months the company has completed the installation of a new forge shop, heat treating department and a new testing shop, as well as a complete first aid hospital.

SAMSON OFFICERS CHANGE

JANESVILLE, WIS., May 9—J. A. Craig, president of the Samson Tractor Co., division of General Motors, has announced three changes in departmental personnel. M. J. Gregory, foundry superintendent, is temporarily assigned to the Saginaw Products Co., Saginaw, Mich., but will return to Janesville when the new foundry unit of the Samson plant is completed in about two months. J. P. Little, assistant factory manager, is transferred to the Chevrolet works at Flint, Mich. D. W. Robertson, advertising manager, has been granted leave of absence for the summer months to enable him to rest and recuperate at Northern Wisconsin lakes. President Craig recently returned from a trip to the Pacific Coast for recreation. While in the West he spent some time at the Samson company's Pacific Coast works in Stockton, Cal. In addition to tractors, the Stockton plant is putting a new design of Samson disk plow into production.

Post and Whitney Form New Tractor Company

CLEVELAND, May 9—The Post Tractor Co. of this city and the Whitney Tractor Co. of Upper Sandusky, Ohio, have been consolidated under the name of the Post-Whitney Co. This company which is capitalized at $10,000,000, is headed by C. P. Casatt of this city. The other officers are: Vice-president, A. B. Whitney, Upper Sandusky; treasurer, C. B. Post, New London, Ohio; secretary, F. R. LePage, Cleveland. The officers, with Ralph Blue and A. H. Weiblem of Cleveland, constitute the board of directors.

The company will maintain the plant at Cleveland where the Post tractor will be manufactured and the Whitney plant in Upper Sandusky where the Whitney tractor is being built. An announcement is expected soon regarding the purchase of an engine plant in which engines and transmissions will be built. The Whitney tractor has been manufactured for several years and is of two-cylinder, four-wheel, two-plow size. The Post tractor has been in process of development for some time and is now being put into production. It has both a front and rear drive and is of three-plow size.

GASOLINE DOWN TO 23.4 CENTS

NEW YORK, May 7—The average price of gasoline in 30 large cities of the country is now 23.4 cents a gallon, wholesale, compared with 29.3 cents at the beginning of the year, a decline of 5.9 or 21 per cent. The sharpest declines have been in cities of the Mid-Continent district. The price in Dallas, Tex., has dropped from 31 cents to 19 cents since Jan. 1. The second largest decline was a drop of 11 cents in Tulsa, Okla. Houston, Tex., shows a drop of 10 cents a gallon and Kansas City 9.5 cents a gallon.

MOON GAINS 27 PER CENT

ST. LOUIS, May 7—The Moon Motor Car Co. announces that its domestic business is running 27 per cent ahead of domestic business for the same period last year. This period covers the first four months. Export business practically has ceased, but notwithstanding this fact, the total gross sales for January, February, March and April exceeded sales for the first four months of last year.

American Chain Buys Four Bumper Patents

Licenses Are Granted to Leading Makers to Avoid Confusion in Trade

BRIDGEPORT, CONN., May 9—The American Chain Co. has entered the bumper field and has acquired ownership or control of the Hoover and Fageol patents which cover bumpers of the spring steel type, as well as the Pancoast and Grotenhuis patents of the Biflex type, covering bumpers having between the ends of the bumper bar a widened impact portion in front of the radiator.

Licenses under all three groups of patents have been granted to the following companies: C. G. Spring Bumper Co., succeeding U. S. Auto Bumper Co. and Kalamazoo Spring & Axle Co., Chicago; L. P. Halladay Co., Streator, Ill., Biflex Products Co., Waukegan, Ill., New Era Spring & Specialty Co., Grand Rapids, Mich., and Gemco Mfg. Co., Milwaukee.

These companies are authorized to use the inventions covered by these patents in bumpers made and sold by them. The American Chain Co., while it is said to intend energetically to enforce its rights against infringers, has adopted a liberal policy of granting licenses generally to responsible manufacturers upon reasonable terms.

Had it been decided to exclude others from the use of the inventions in question the results to the industry might, in view of the importance of the patents involved, have been of a serious nature, creating much confusion in the bumper trade.

HARVESTER DEFERS PLANT

FORT WAYNE, IND., May 9—All further construction work on the big truck plant which is to be erected by the International Harvester Co. in this city has been postponed for the time being. An extension of time in which to start actual construction operations has been granted to the company by the Greater Fort Wayne Development Co., which holds the contract with the Harvester company and which was organized for the purpose of building homes in which to house the workers at the plant. The development company's office will be closed until such time as the Harvester company starts operations. Business conditions are the reason for this postponement of the work. It is believed that it may be a year before the work on the construction of the plant is resumed.

PETROLEUM ERECTS FIRST UNIT

ROCKFORD, ILL., May 7—The first unit of the Petroleum Motors Corp., which will make kerosene burning engines, will be started in a few days and the production schedule started in 60 days. An output of 10 to 12 engines a week is expected.

Bank Finds Prices Holding Up Buying

Republic Bank of Chicago Predicts Automobile Reductions as Business Declines

CHICAGO, May 9—The indisposition to buy in all commodity lines is still prompted by the lack of confidence in present price levels and by the desire to buy only at bottom prices, is the finding of the National Bank of the Republic of Chicago in its résumé of April business throughout the country. At the same time it declares that further reductions in the price of automobiles is dependent upon the continuance of the present buying movement of motor cars. Prices will be lowered further, it predicts, as soon as it is seen that a stimulant for sales is needed.

"The steady improvement in the automobile industry," it says, "reflects in no small degree the demand for cars by that section of the public designated as the 'fixed income class' and by that class whose wages still leave an appreciable margin of income over necessary expenses. While shipments of automobiles in March were still 58 per cent below the volume of the same month last year, many dealers expect sales in the second quarter to approximate 75 per cent of the same quarter of 1920, which was a record. While this goal may be attained it is believed that the pace cannot be continued throughout the year, as in times past, but that manufacturing as well as selling will revert temporarily to a seasonal basis.

"It is apparent that the manufacturers themselves distrust the permanence of the present improvement, as they are keeping output closely in conformity with incoming orders, and in many cases are deliberately adhering to a fixed schedule much under the volume of new business. This is done to avoid any possible surplus, should the demand fall off, as well as to keep the demand far enough in advance of output to obviate the necessity of further price reductions which might again unsettle the industry. At the same time the matter of price reductions is being kept in reserve as a possible sales stimulant should the present buying movement wane."

April Business Gains in Texas Territory

FORT WORTH, TEX., May 9—The automobile business in the Southwest has started on the up-grade again, according to dealers in all sections. April sales far exceed those of March and May is beginning as though it will surpass April. Comments by dealers follow:

J. B. Mikesell of Houston, whose agency extends over thirty-nine south Texas counties, declares that the dealer in standard cars is moving his automobiles rapidly and is prospering again.

Plenty of cars are being sold in Austin, says Ben M. Barker of the firm of Barker & Co. Business there, he says, is staging a come-back and the revival is taking like wild-fire.

George K. Marshall of Galveston, R. S. Carter of Galveston, William Morriss of Dallas and L. E. Askew of Dallas also announce a general sales gain in their respective sections and a bright outlook for the summer months.

The settling of the weather in the Southwest, which until now has been wet and cold, has stimulated business.

Higher Priced Trucks Lead in New Business

CHICAGO, May 8—Reports reaching the Motor Truck Mfrs. Assn. indicate that the truck industry is staging a come-back, though it may not be as noticeable as the return of the automobile. The majority of manufacturers report better business and show a more optimistic spirit than has been evidenced for many months. Conditions are somewhat spotty, but as a whole they are good considering what they have been for months past, and give every ground for the foundation of optimism.

While the preponderance of interest on the part of buyers centers in the higher priced, heavy duty trucks, there is movement in the others. Truck interest is more or less of a barometer for conditions as they prevail in general business lines and the fact that the higher priced trucks are the first to be called into service points to a resumption of activities in the larger businesses which, naturally, are the first to feel the effect of improved conditions. Users of the smaller trucks whose activities depend to a great extent on the business transacted by the larger owners will follow into the market in gradually increasing numbers.

One manufacturer of the higher priced trucks has stated that his business for the past month was better than at any time for more than a year.

SOUTH TO EXTEND ROAD-WORK

ATLANTA, May 6—Project agreements for the construction of highways in the South in the six States comprising this district with headquarters at Montgomery, Ala., totaling $34,831,213, have been executed, according to a report just issued. Georgia leads the district in the amount of money already obtained or to be obtained for highway work on project agreements already approved, with $5,563,128.24 from the Federal government. Georgia will spend $12,214,791.09 in projects that have already been approved. Of the total amount for the six States the Federal government contributes $16,259,710.98.

STIFFENS THEFT PENALTY

WASHINGTON, May 6—Senator Nelson of Minnesota has introduced a bill to make the moving of a stolen automobile from one state to another punishable by five years imprisonment and $5,000 fine.

California Business Waits Price Action

Present Owners Found Buying to Get Full Value on Used Cars —Shows Help Selling

SACRAMENTO, CAL., May 10—The automobile trade in northern California is recovering from the reaction which followed the first return of normal business conditions. After the first impulse on the part of buyers to secure cars, there followed a lull which made dealers somewhat apprehensive, but active advertising and a following up of sales prospects has brought about what appears to be a steady buying activity.

Many smaller cities of the district have announced automobile shows, and these have been reported as having a very healthy influence on the buying public. In nearly every instance dealers of these towns report the effort and expense attending these exhibits well worth while.

Heavy damage to fruit crops through frost, and injury to the grain crops through north winds made the sales companies fearful of a decided slump, but this has not put in an appearance. The situation appears not to be so much one of a lack of money as a belief that automobiles will suffer a further drop in price. The announcement of the Jordan cut, however, did not affect the market here noticeably and the demand for smaller cars appears particularly good.

Another proof of the waiting attitude of the buying public is the fact that the bulk of the sales are to owners of cars who are turning in their old automobiles. These recognize the value of their cars will go down with any possible cut in the price of new cars and that it makes little difference to them when they purchase, so far as a change in price is concerned. The used car market is fairly good notwithstanding the resultant flood.

PETERSON OPENS IN MEXICO

LOS ANGELES, May 6.—The Peterson Corp., which handles rebuilt cars exclusively, has extended its field to include Mexico. Its first branch in that country was recently opened at Guadalajara, the second city of the republic, and announces that additional branches will be opened at Mexico City, Puebla, San Luis Potosi, Monterey, Tampico and Merida, thus covering the most important cities of Mexico.

A. S. M. E. TO INSPECT PLANTS

CHICAGO, May 6—One of the industrial plants which will be inspected by the delegates to the spring meeting of the American Society of Mechanical Engineers which will be held here May 23 to 26, will be the McCormick and Deering factories of the International Harvester Co. The South Chicago works of the Illinois Steel Co. also will be inspected.

British Car Imports Show Gain in April

Parts Importations Fall Off Heavily But Tires Increase—Exports Active

LONDON, April 15 (By Mail)—A notable increase in the number of imported motor cars, commercial vehicles and chassis is a feature of the figures for March contained in the Board of Trade returns of imports and exports. The total is 1153 compared with 752 in February. The corresponding value has risen by $1,600,000 for March.

A drop is apparent in the value of imported parts, other than tires, the figure being $873,450 as against $2,335,560 in February. On the other hand there is a slight increase in the value of imported tires, the figure for March being $1,340,000, against $1,066,320 in February.

Little change characterized the volume of British export auto trade in March. The total export of cars and trucks was small, the March figure being 407, a drop of 5 on the February total of 412. The value of the export of cars and trucks shows an increase, being $1,825,500 compared with $1,765,220 for February. The value of exported parts increased to $668,350 compared with $552,090 in February. The value of exported tires rose from $837,365 in February to $1,222,000 in March.

Imported chassis in March had an average value of $1,450 as against $4,810 per British chassis exported.

The foregoing exchange rates are taken as at par, $5 to the £1.

BRITISH REGISTRATION HEAVY

LONDON, April 8 (By Mail)—According to a just issued return of the Ministry of Transport, Britain had registered on March 10 under the new motor taxation scheme, which came into effect on Jan. 1, 281,600 motorcycles, 202,000 cars, 102,500 taxi-cabs and passenger coaches (including autobuses and charabancs), and 208,400 road trucks of all kinds. *Trucks are paying* 51.3 *per cent of British motor taxation.* The estimated expenditure on British roads this years is $225,000,000, but the outlay in normal times is expected not to exceed 50 million dollars yearly.

BRITISH MOTORCYCLE CUT

LONDON, April 15 (By Mail)—The Triumph Cycle Co., Inc., Coventry, has revised the prices of its motorcycles and motorcycle sidecar combinations, the reduction ranging from $25 to $75.

MEXICO GETS FORD TRAINLOAD

LAREDO, TEX., May 7—A solid trainload of Ford automobiles passed through here this week consigned to Ford dealers in Mexico. The cars were crossed into Mexico at this point without delay and, notwithstanding the motive power shortage in that country, the train was sent South as soon as it reached the other side of the border. It is stated that this is the first of several similar shipments that are to be made soon. Many used cars are also being shipped to Mexico. Dealers in Laredo, San Antonio, Eagle Pass, El Paso and other towns on and near the border are flooded with orders for used cars from Mexico, it is said.

South American Feeling Unfriendly, Says Banker

YOUNGSTOWN, OHIO, May 9—W. A. Beecher, vice-president of the Mahoning National Bank and director of the Powell Pressed Steel Co., Youngstown, who has just returned from a trip through Brazil, Argentina, Uruguay, Chile and Peru with a party of bankers, states that the feeling of the people of South America is not altogether friendly toward the United States.

Organized propaganda, inspired by Germany, it is believed, is being directed against American business in South America, he states, and furthermore the business methods during the war, principally the failure to deliver goods according to contract are responsible for the unfriendliness on the part of business interests.

"Conditions in South America are somewhat depressed," says Beecher, "largly due to the depreciation of the English pound on which they base their currency. Large quantities of goods are tied up in the wharves and warehouses of South American ports, because they do not have the money to pay for them. In Buenos Aires alone 4000 automobiles are boxed up. The feeling against America is partly our fault and part of it is propaganda. When we began to fail to make delivery of goods along during the war due to our products going elsewhere and the effect was readily felt. Now the South Amercans are inclined to resent it."

WOULD CLOSE OUT AUSTIN

(By Cable to AUTOMOTIVE INDUSTRIES)

LONDON, May 7—Following the appointment of a receiver for the Austin Motor Co. a petition for the compulsory winding up of the company's affairs was presented by a creditor and ordered heard by the court. The law provides that persons interested must be represented for or against the petition and that until arguments are heard the company's assets and business must not be interfered with.

SMALL TIRES LEAD IN JAPAN

WASHINGTON, May 7—As 96 per cent of the total number of automobiles imported into Japan are of American make, three-inch tires are universally used. The ordinary clincher type, writes Trade Commissioner Abbott, is the most popular, and the sizes in common use are 30 x 3½, 32 x 3½, 32 x 4, 33 x 4, and 34 x 4½ in.

Light Cars Leading in British Markets

Many Makers Rushed to Meet Orders—Opinion Differs on Price Cuts

LONDON, April 27 (By Mail)—Some extraordinary contrasts are apparent in the demands for British cars. While one or two plants now have difficulty in keeping pace with orders, others are practically closed down. In Coventry, Humbers are a month behind, despite working at full pressure, Singers and Standards are also very busy and Rovers are trying hard to work up again to full production on their 8 hp. air-cooled runabout; Calthorpes in Birmingham are instituting a night shift and Wolseleys are fairly well occupied, though not operating full time in all departments.

On the other hand, Daimlers have all but closed down, and though a labor dispute is partly accountable, continued slackness is primarily responsible and has caused a lockout of the staff because the latter were not allowed by their union to work on a new basis of pay which the majority had found acceptable.

The liveliness in some quarters is not due in all cases to price reductions. Humbers, for instance, have not receded a cent, in fact one model with recent improvements has increased nearly $300. Singers and Calthorpes have made severe cuts, however, and seem to have benefited by a rush of orders on that account.

Dealers especially maintain that too much has been made of mere reduction in price and not enough of better value. The public, it would seem, takes it that a big cut means either that a car has been priced at an unreasonable level hitherto, or that it is not popular enough.

The plants which are doing best are those which are turning out good light cars, small four-seaters in particular, with a presentable finish and economical to run. That a comparatively high price is not a bar, providing the value is there, is exemplified by the demand for the improved and very slightly enlarged 10 hp. Humber. Of its type it is the most expensive, selling freely at £700 (say $3500) for the four-seater. It is not a matter of stocking up dealers, for the latter are in many cases giving supplementary contracts.

Guarantees Hold Up Cuts

The price guarantee system introduced early in the year has placed some firms in a quandary. While they are believing that a reduction now would induce more orders, they dare not make one owing to their commitments under the guarantee, which does not expire until July 1 at the earliest.

The whole position is very unequal. Some firms are doing well at old prices, some at lower prices; the remainder badly on either basis. The only semblance of uniformity is that nearly all those giving good value in light cars of repute are not complaining.

Congress Orders Army Truck Sale

Makes Obligatory Immediate Disposal

Provision for Transfer to Roads Departments Killed—Fixes Excess at 12,000

WASHINGTON, May 11—An amendment of the Army bill which passed the House yesterday makes it obligatory on the Secretary of War to sell immediately at public auction or private sale all surplus motor trucks and passenger automobiles now in the possession of the War Department. The provision in the present law authorizing the transfer of motor equipment to the Bureau of Public Roads was eliminated in the Army Appropriation bill.

The surplus is approximately 10,000 trucks and 2000 passenger cars.

Under the terms of the amendment, the Secretary of War has no choice but to sell all the motor vehicles on hand beyond those necessary for an army of 150,000 men. Auction sales of unserviceable automobiles and trucks have been held at camps by the Motor Transport Corps for the past two months. There will be another to-morrow at South Amboy, N. J., at which several hundred trucks and light delivery cars will be sold.

The introduction of this amendment by Representative Anthony of Kansas precipitated a debate as to the methods employed by the War Department in disposing of surplus motorized equipment. According to Representative MacGregor of New York, sponsor of the drastic requirement of sales, the number of army motor vehicles up to and including April 23, 1921, was 63,429, of which 50,321 were serviceable and 13,108 were unserviceable. Of this total, 53,423 were in closed storage, while 10,006 were in open storage.

With the proposed reductions in effect, the authorized retention of motor vehicles for the army of 150,000 men would be 4245 passenger vehicles, 19,652 trucks, 4218 trailers, 5058 motorcycles, 2048 ambulances and 1328 vehicles of special designs, making a total of 36,541 motor vehicles for the regular army.

Senate Gives Mellon Anti-Dumping Power

WASHINGTON, May 12—Senator Ball of Delaware informed AUTOMOTIVE INDUSTRIES to-day that the anti-dumping bill, which passed the Senate yesterday, authorizing the Secretary of the Treasury to levy customs duties in cases where an investigation disclosed unfair competition, would protect American dealers against reimportation of surplus war supplies sold abroad by the Federal government. The automotive industry had hoped that a clause would be inserted in the bill covering this subject specifically, as European speculators contemplate throwing enormous quantities of motor vehicles and equipment on the American market.

Because of drastic changes made in the Senate in the anti-dumping bill, it is expected a bitter fight will follow when it goes to conference in the House. This may result in a disagreement and throw the bill back for passage through both houses.

Formation in New York of an import organization which proposes to sell $3,000,000 worth of automobile equipment purchased from the Slough Trading Co. of England, is expected to stir automobile manufacturers and dealers to such an extent that they will attempt to convince Secretary of the Treasury Mellon that an inquiry into this competition is essential for protection of American industry. The finding of investigators would determine the amount of duty which Mellon could levy to equalize domesic prices and quotations.

If the Senate and House conferees fail to agree on the bill as it passed the Senate, opportunity would be given automotive organizations to express their views on the subject if they cared to avail themselves of the chance.

Mixter Is Invited to Head Pierce Arrow

NEW YORK, May 11—George W. Mixter, who has represented G. W. Goethals & Co., Inc., in the management of the Pierce-Arrow Motor Car Co. since 1919, has been invited by the directors of the Buffalo company to become the president of Pierce-Arrow, and it is understood that he will sever his connection with Goethals to accept.

Goethals & Co. were employed by the Pierce-Arrow company to assist in bringing the plant to a peace-time basis and also to aid in reviving its line of cars and trucks. This work has been accomplished and a new line of vehicles, both passenger and commercial, has been placed in production.

Mixter has been in active charge of the plant since that time and his management has been entirely successful.

MOORE PROMOTERS ON TRIAL

ST. LOUIS, May 11—Six promoters of the Moore Motor Vehicle Co. of Danville, Ill., went on trial in Federal Court here to-day on charges of using the mails to defraud. They are accused of having sold stock amounting to $1,500,000 without return to the purchasers.

Tire Companies Cut to New Price Level

Goodyear Reduction Ranges 12 to 15.8 Per Cent—Kelly Decrease Largest

NEW YORK, May 11—With the announcement of a price cut, ranging from 12 to 15.8 per cent on tires by the Goodyear Tire & Rubber Co., practically all of the larger Akron companies have revised their lists.

Firestone, as part of its price revision plan, will produce a new 30 x 3½ smooth tread tire, to sell at $13.95. The company declares this to be the lowest priced of any standard tire of that size on the market. Cord prices are cut 12 per cent; fabrics, 17 per cent, and tubes, 20 per cent.

Miller has cut cords 12½ per cent; fabrics, 17½ per cent, and tubes, 20 per cent. The new prices reduce the 30 x 3 fabric tire from $17.25 to $14, and the 30 x 3½ cord, from $32 to $24.

The 12 per cent cut by Goodyear is on cord tire prices. A 15 per cent cut is made on the general run of fabrics, with a 15.8 per cent reduction on some sizes of fabrics. Tube prices have been reduced 20 per cent.

United States Rubber Co. has reduced prices from 11 to 20 per cent; the minimum cut on cord tires and the maximum on plain tread tires and gray and red tubes. A 15 per cent reduction is made on Usco treads and a 17½ per cent cut on knobby and chain treads.

Kelly-Springfield Tire Co. makes a straight 20 per cent reduction on all pneumatic tires except Ford sizes, which are cut 22 per cent. Tubes are reduced 30 per cent.

Fisk Rubber Co. has reduced prices from 12½ to 20 per cent.

Lee Rubber & Tire Co. reduced 20 per cent in the price of cord and fabric tires and 15 per cent in puncture proof tires.

Keystone Tire & Rubber Co. has made a straight 20 per cent reduction.

Thermoid Rubber Co. has made a price cut on all Ford sizes of 28 per cent; on 4½-in. sizes, 23 per cent, and on all other sizes, 20 per cent.

Erie Tire President Guilty of Embezzlement

TOLEDO, May 10—Peter F. Wills, president of the Erie Tire & Rubber Co., was found guilty of embezzlement of $29,793 of his company's property by a jury in common pleas court at Sandusky last Friday night. The jury was out twelve hours. Sentence was withheld for a few days.

Square Deal on Tax Aim of Industry

Highway Committee Approves Principles of Townsend Bill—Push Advertising Plans

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colleges and a similar number of cards bearing the statement of President Harding, declaring the motor vehicle a necessity, will be sent out to dealers and garage men for prominent display where it will attract the attention of the general public.

The Highway Committee met Tuesday, when the principles of the Townsend bill were approved, and Roy D. Chapin, chairman of the committee, and George M. Graham were named to go to Washington and present the views of the chamber. More vigorous efforts in the educational campaign for better roadways were decided upon through the agency of schools and colleges and by personal and printed appeal to the general public.

The Truck Committee also met Tuesday and spent much time in consideration of the anti-dumping bill pending before Congress. It was said strong pressure would be brought to bear to insure Congressional action against the reimportation of trucks. The plan for co-operation with the railways to secure the short haul business for motor trucks was given much consideration and arrangements made for presentation of the truck manufacturers' plan to the Interstate Commerce Commission, with the feeling prevailing that the railways now are in a receptive mood and that definite agreement on a policy for division of this business would result.

Reeves Talks Advertising

With the idea of stimulating closer cooperation between the advertising managers of the automobile and truck companies and the National Automobile Chamber of Commerce a meeting of the advertising men was held Friday, presided over by Alfred Reeves, manager of the chamber. Reeves emphasized the point that service and advertising now are the vital factors in the merchandising of motor vehicle and declared the time had come when the advertising manager must be lifted out of the rut and given his proper place in the administrative effort looking to sales promotion. He pointed out some evils that exist and cautioned the ad men against repetition. In a critical time like this, said Reeves, every man must be unusually careful to see that every word that goes out as advertising copy carries a real message to the consumer.

H. R. Hyman, advertising manager of Cole Motor Car Co., read a paper on "New Forces in Automobile Advertising." Hyman took his fellows to task for some of the crude methods that have marked their efforts and laid stress on the value of illustrated advertising of the right sort. He deplored the tendency toward freak pictures and urged more thought and less anatomy in illustrations. Efforts to convince the public that the automobile is a necessity and to educate the owner to its proper use were urged by Hyman, who declared the industry was struggling with a buyers' market and if the product was to be merchandised properly it must be through advertising. The dealer, he said, is demanding co-operation of the factory in his effort to get to the consumer and urged that the advertising manager now has the big opportunity to show his real merit.

Dart Presents Paper

H. G. Dart, advertising manager of Paige Detroit Motor Car Co., read a comprehensive paper on "General Advertising Plans That We Have Found Helpful," in which he told of experiences in his own factory with especial reference to the mistakes and the benefits of the lessons learned. He pointed to many instances where beneficial results in sales promotion were traceable directly to efforts of the advertising department and urged more careful thought and study in the preparation of material that was designed to appeal to the prospective purchaser.

General discussion followed the reading of the papers in which many joined and in which the good and bad effects of various efforts were threshed out. Decision to affiliate with the National Automobile Chamber of Commerce as an advertising managers branch was reached and assurance was given Reeves of full co-operation of the ad men.

N.A.C.C. Committeemen to Confer in Washington

NEW YORK, May 10—The representatives of the National Automobile Chamber of Commerce who will appear before the Senate finance committee in opposition to increased Federal taxes will hold preliminary conferences at Washington Friday, Saturday and Sunday in preparation for the argument next Monday. The hearing will be given specifically on the question of excise taxes and the burden of the argument will be against discriminatory imposts.

The National Automobile Dealers' Association also has asked for a hearing on the excise section of the revenue law and this also may be granted Monday, but at a different hour. The course of the Motor and Accessory Manufacturers' Association and the Rubber Association of America in relation to appearances before the finance committee has not been definitely determined, but M. L. Heminway, general manager of the M. A. M. A. will appear with the N. A. C. C. committee unless his association is granted a separate hearing.

The N. A. C. C. decided that inasmuch as it was not the chief proponent of the sales tax, it would not make an appearance this week with the industries which are advocating that form of tax.

Anti-Dumping Action Unfair, Say French

Compelled to Take Thousands of Cars After Armistice—Would Turn Some Back

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over by the French Government. Most of the pneumatics were used by the French army or sold privately, but the solids remain, and are to be thrown on the market, after having stood in the open for more than two years.

It will be a difficult matter to dispose of more than a fraction of these spare parts in European countries, for the stocks are out of proportion to the number of vehicles in service here. The purchasers declare that it is their intention to sell in big lots, as far as possible, and to dispose of this material in America if purchasers can be found. It is thought that these supplies will interest American jobbers, manufacturers, and big truckers. A thoroughly commercial sales organization is being gotten together.

French opinion fails to understand why America should protest against the shipment of American army automobiles, trucks and parts to the United States. One leader of the French industry declared a few days ago:

"We were obliged to take 80,000 American automobiles after the Armistice. After the thousands we had purchased for our own army from the States, it was insisted that we continue to take delivery of automobiles months after the end of the war. The price of these stocks was fixed in dollars at a time when the dollar was only worth 8 francs, and we are now having to pay at the rate of 14 francs to the dollar.

"Despite all this the American automobile industry protests because a few thousands of her own vehicles are likely to be thrown on her market. America seems to look on the return of these vehicles as unfair competition, forgetting that in the first place she forced us to absorb immense stocks for which we had no need, thus flooding our market and contributing in a very large degree to the present glut. It is fortunate for us that there was no clause in the agreement against the return of this material to America, and personally I only hope that the whole of the remaining American automobile material will be shipped back to its country of origin."

PUSH STRAIGHT SIDE TIRES

NEW YORK, May 9—The executive committee of the foreign trade division of the Rubber Association of America has adopted a tentative program covering foreign advertising and publicity. The committee is giving its attention to the promotion of straight side tires abroad and protection against price declines on foreign sales. Reviving European competition has made necessary immediate action on the straight side tire problem.

Production in April Exceeds 1920 Total

Ford Output of 90,125 Leads Former Year by 40,000—Most Companies Gain

DETROIT, May 11—Automobile production in the Detroit district in April numbered 140,955 vehicles, compared with 119,213 in April, 1920, and 105,245 in March of this year. Ford production alone in April amounted to 90,125 cars and trucks, as compared with 51,066 for the same month last year.

Dodge also increased production last month and went several hundred over the record for April, 1920. Buick showed an increase of several hundred over March, although its April output was approximately 3000 behind that of April, 1920. Chevrolet, which was about 1000 behind April of last year, increased its output over March by about 2000.

Dort's April output was slightly in excess of March, but about 300 under April, 1920. Hudson and Essex both ran considerably behind the figures for a year ago. Hupp, on the other hand, with an output of approximately 2000 last month, showed an increase of about 700 cars over the same month last year and approximtely 600 more than in March.

The Lincoln Motor Co. built an average of 15 cars a day last month, and is operating on a schedule of 17 a day for May. The Olds Motor Works reached a production of about 2800 last month, which was about the same as in that month last year and an increase of 500 over March.

Packard built 625 "single sixes" last month, as against 670 in March, and 700 "twin sixes" in April, 1920. Paige slumped slightly in April in comparison with April, 1920, and also with March of this year.

Reo made a big spurt last month, producing 2750 cars and speed wagons, as compared with 2350 in March and a decrease of only about 300 as compared with April of last year. Studebaker, with an output in its Detroit and South Bend plants of 7825, went close to 3000 over March.

Body Shortage Slows Reo

April production schedules which were outlined in March failed to materialize in most instances. This was due to various causes. Reo, for example, was forced to curtail production because of inability to obtain bodies. Officials of the company said to-day that if an adequate supply of bodies could have been obtained production would have run close to capacity. An interesting fact in connection with the Reo business is that its foreign trade has fallen to approximately half its normal total. This company will make practically the same number of vehicles in May as in April, working short time but with a full force.

Oldsmobile shipments in the first quarter of this year were approximately 5000, as against 8500 for the same period last year. Olds is working full time with a force practically normal, building "fours" at Saginaw and some light "eights" at Lansing.

Olds production figures for the last five months, which are more or less characteristic of most companies, show the steady upward trend of business. In December, Olds built an average of 33 cars daily, in January 47, in February 40, in March 82 and in April 100. The rate for May thus far has been 104. The schedule for June is 119. These figures refer to the Saginaw plant. The company has had no truck production.

Lincoln Adds Distributers

The Lincoln company has increased the number of distributers from 15 to 50 in the last 60 days, and President Leland says the company is selling all the cars it can make, chiefly in New England and on the West coast.

The Denby Motor Truck Co. built 70 vehicles in April, which was about 35 per cent of capacity. General Motors turned out 650 at its Pontiac plant.

The business of parts manufacturers in the Detroit district showed an increase for April over March. Continental Motors is operating about 55 per cent of capacity, and the Timken-Detroit Axle Co. about 20 per cent.

The Motor Wheel Corp. reports a payroll larger than at any time since Jan. 1, having taken on 400 in the last 60 days. The Wilson Foundry & Machine Co. at Pontiac expects to be working at 50 per cent of capacity by the middle of May with a large increase in number of employees.

The O. J. Beaudette Co. of Pontiac now has 1085 men working in its body shop and is working night crews in its metal and tool departments. The Michigan Drop Forge Co. also has returned to a normal basis in the number of employees and is above normal in production. The factory is working 20 hours a day with two shifts.

SUPREME SUES ON STOCK

AKRON, OHIO, May 10—Suit to collect $200,000 alleged to be due on unpaid subscriptions for stock in the Supreme Cord Tire & Rubber Co. of Akron has been filed in the Summit County Common Pleas Court by Scott Kenfield, receiver of the company. B. L. Eaton of Greenville, Pa., is sued for $100,000 for stock which he is said to have subscribed for in April, 1920. Eaton was the company's former fiscal agent. The other defendants to Kenfield's action are all directors in the defunct company.

F. PHILIP DORN DIES

CLEVELAND, May 9—The death is announced of F. Philip Dorn, for twenty years secretary and general manager of the American Ball Bearing Co. His health began to fail several years ago and he retired from active business when his company was merged with the Standard Parts Co. A year ago he suffered serious injuries in an automobile accident and this hastened his d-ath.

Position of Willys Steadily Improves

Stockholders Told of Reduced Bank Loans—Sales Policy Conservative

TOLEDO, May 11—Reorganization of the internal affairs of the Willys-Overland Co. was made complete at the meeting of stockholders held here to-day when the executive committee was increased from five to seven members and the finance committee was eliminated. President John N. Willys addressed the stockholders and promised them that he would devote his entire time to the rehabilitation of the company until it gets back into the front rank.

"I shall work harder in the next twelve months than I ever did until I know that Willys-Overland is in its rightful position," Willys declared.

"This institution is my pet and I have just as much faith in it as I ever had. I shall not shirk my responsibility to the stockholders."

Willys told the stockholders that there will be no immediate reduction in the prices of the company's cars notwithstanding many rumors that Overland would join the companies making price cuts.

"We are watching the situation closely and are pursuing a conservative sales policy," Willys said.

"There is a market for the cars at the right value. The history of the automobile industry is not over yet. Companies that will survive conditions will be those that have the best management and which have eliminated loose methods. We have cut expenses to the bone. There are many bright spots in the future and we have reason to be hopeful.

"We have $6,700,000 in cash on hand. Agents throughout the nation report increasing inquiries for our cars. Last week showed the biggest increase in retail sales since last September. We are building the best organization we ever had at the Toledo plant and we will continue on a conservative sales policy.

Report to Show Profit

"We owe $20,000,000 less than we did a year ago. We have cut our inventories down to $38,000,000. Our annual report, which has been delayed for several days, will show a profit for the year."

The stockholders re-elected substantially all of the old directors; they are: J. N. Willys, W. P. Chrysler, C. B. Wilson, James E. Kepperley, J. R. Harbeck, E. R. Tinker, Elisha Walker, Edward F. Swift, Rathbun Fuller, C. B. Mertz, George R. Spencer and C. E. Killinger.

Willys praised the work of Charles B. Wilson, executive vice-president of the local plant, who, he declared, has succeeded in geting the plant down to an economical, efficient basis.

Maxwell Holding Company Formed

$40,000,000 West Virginia Corporation Also Will Take Over Chalmers

NEW YORK, May 11—The Maxwell Motor Corp., capitalized at $40,000,000, has been incorporated under the laws of West Virginia to take over the assets of the Maxwell Motor Co., Inc., and the Chalmers Motor Co. The company is authorized to manufacture and construct automobiles, motors, engines, etc., and to do all things incident to the business of building motor cars.

Formation of the new corporation is one of the final steps in the reorganization and consolidation of the Maxwell and the Chalmers interests. It had been supposed that the Chalmers name would be retained in the corporate title of the new company, but it apparently has been lost, although manufacture of the car will be continued. The physical assets of the Maxwell company in Detroit will be bid in to-morrow at a receiver's sale by the reorganization committee headed by Walter P. Chrysler. No other bids are expected. When the process of acquiring the assets of the two companies is completed they will be assigned to the West Virginia corporation.

The incorporators of the new company are clerks in the law offices of Albert Rathbone, the attorney who represents the reorganization committee. Directors and other officers will be elected as soon as the reorganization is complete and the board will include representatives of both the Maxwell and Chalmers companies.

The stock of the Maxwell Motor Corp. is divided into 200,000 shares which have a par value of $100 each, and 800,000 which have a total value of $20,000,000. The charter was the first large one issued in West Virginia since the enactment of the non par stock law. The company is the second largest ever granted a charter by the Secretary of the State of West Virginia.

Court Denies Appeal to Stop Maxwell Sale

DETROIT, May 11—United States District Judge Arthur J. Tuttle yesterday denied a petition of first preferred stockholders of the Maxwell Motor Co. in which the petitioners asked to intervene in the sale of the company, set for to-morrow.

The petitioners asked to intervene on the grounds that the proposed merger of the Maxwell and Chalmers Motor companies would take away their holdings and give them only a small share of the stock of the new company.

The court ruled that such a step would prevent reorganization of the company and thereby endanger the future of the concern.

Attorneys for the reorganization interests argued that the reorganization plan was fair, giving all classes of shareholders representation in the new company and making it possible to procure funds with which to liquidate the more than $15,000,000 indebtedness of the concern and to continue in business.

The petition of Holmes Jones of Wilmington, Del., asking a stay in the sale pending settlement of litigation in Delaware courts, was dismissed by Judge Tuttle on the grounds that it contained improper statements.

Attorneys for the first preferred stockholders obtained permission from Judge Tuttle to file a new petition for intervention at the time of the court's confirmation of next Thursday's sale.

According to certain holders of first preferred stock, under the reorganization plan stockholders surrender $17,603,964 of first preferred, according to book values, and get in exchange $2,561,013 of stock in the new company. Of second preferred, it was alleged, $2,172,337 will be exchanged for $987,441 in new stock. The common stock is reported as of no value, but the holders will get in return therefor $501,384 of new stock. Holders of Chalmers preferred will receive $1,029,600 in new stock for $4,519,722 old stock, and the holders of common stock, of no value, will get $557,543 of new stock.

Judge Tuttle held the concern must have new money in order to save that already invested. He said bankruptcy would ruin the company and declared to stop the sale would likely kill the whole undertaking. Appointment of a permanent receiver, he said, would be a detriment to shareholders in that it would interfere with sales, for no man would buy a car from a concern in receivership.

G. M. Export Names Officers

NEW YORK, May 12—At a deferred annual meeting of the stockholders of the General Motors Export Co., directors were elected as follows: Curtis C. Cooper, Paul Fitzpatrick, J. Amory Haskell, Norval A. Hawkins, Alfred P. Sloan, Jr., Peter S. Steenstrup and Alfred H. Swayne.

At the subsequent organization meeting of the directors, the following officers were elected: Haskell, president; Fitzpatrick, vice-president; Steenstrup, vice-president; Swayne, vice-president; Austin S. Murray, treasurer; Thomas S. Merrill, secretary, and George H. Bartholomew, assistant secretary.

Body Receiver Named

DETROIT, May 12—The Security Trust Co. has been named receiver for the Detroit Weatherproof Body Co., with a factory at Corunna, Mich., pending sale of the property. The action is a friendly suit, brought by the Michigan Steel & Metal Co. The body company has liabilities of approximately $650,000 and assets estimated at present market value to be worth $200,000. They consist chiefly of materials which actually cost about $700,000.

Stockholders Ratify Goodyear Financing

Almost Unanimous Sanction Given Program—Seiberling May Stay as President

AKRON, May 12—Stockholders of the Goodyear Tire & Rubber Co. ratified yesterday the $85,000,000 refinancing and reorganization program. More than 90 per cent of the common stock and more than 82 per cent of the preferred stock voted in favor of the execution of a first mortgage on the company's property to secure $30,000,000 in 20-year 8 per cent first mortgage gold bonds and $30,000,000 in 10-year first mortgage 8 per cent gold debentures.

Action of the stockholders completes the necessary steps preliminary to definite reorganization of the company. Plans of reorganization and the new official personnel will be announced at noon Saturday, to which time the meeting was adjourned. President F. A. Seiberling was given an ovation by stockholders and was unanimously elected chairman of the meeting. As he called the session to order the stockholders rose and cheered him.

No intimation has been given here by the interests which now control the company concerning the new management. It has been persistently reported, however, that G. M. Stadleman, one of the vice-presidents, would succeed Seiberling as president. On the other hand, the reception given Seiberling by the stockholders has led to belief in some quarters that he will be retained as president, although with greatly curtailed powers. The resignations are expected of C. W. Seiberling as vice-president and of P. W. Litchfield as vice-president and factory manager.

Timken Company Gets Truck Makers' Views

DETROIT, May 12—More than two score manufacturers of assembled trucks in which products of the Timken-Detroit Axle Co. are used, responded to an invitation from Fred Glover, general manager of the Timken company, to attend a meeting here yesterday for a discussion of the unit parts servicing problem. The conference was called by Glover to obtain the views of the truck makers on this subject. He informed them his company, while desirous of giving the best service possible to the public, was anxious to adopt whatever plan was most satisfactory to the manufacturers themselves.

Several of the manufacturers expressed their opinions on the subject, but no decision was reached. One proposal was that a dealer "pool" of all parts be established in the hope of insuring service, rather than direct distributing depots maintained by parts manufacturers.

Kansas City to Show Evil of Credit Ban

Automotive Organizations of Entire Federal District Back Liberality Appeal

KANSAS CITY, May 9—The visit of Governor Harding of the Federal Reserve Board to Kansas City May 21, arranged through the National Automobile Dealers' Association, will be the occasion for a conference with representatives of the automotive industry of the Tenth Federal Reserve District.

The most elaborate feature of the Harding visit will be a dinner Saturday evening, May 21, at the Hotel Muehlebach; but this will be chiefly the opportunity for the delivery of an address by Governor Harding to the industry. There are to be conferences during the day in which automotive distributors from many states will participate with Federal Reserve officials and Governor Harding.

Arrangements for the governor's coming are being made by E. E. Peake, secretary of the Kansas City Motor Car Dealers' Association. He will be met at the train Saturday morning by the directors of the association, who will take breakfast with him at the Hotel Muehlebach. The governor will then be taken for an outing in a ride over the boulevards.

For the business conference and the dinner, the Kansas City Association has tried to provide representation from every organized group of automotive distributors in the Tenth Federal Reserve District. The conference Saturday afternoon will be the opportunity for presenting to Governor Harding and J. Z. Miller, governor of the Kansas City Reserve Bank, the subject of rediscounts of automobile paper.

Many to Present Subject

To present this subject, besides the men from the Kansas City Association, will be one man from each of the automotive organizations of the district. These representatives will be selected from the committees of three from each organization, invited to Kansas City to meet Governor Harding at the evening event. Through this arrangement, the situation throughout all the states, and parts of states of the entire district will be laid before the federal bank officials, and the size of the industry in the West will be demonstrated, as well as the phases in which the previous attitude toward automobile paper has affected various interests.

At the dinner, besides the members of the local association, there will be present members of the Kansas City Tractor Club, bankers whose institutions constitute the Kansas City Clearing House Association, committees from each of the 30 civic bodies represented in the Club Presidents' Round Table, and the committees of three men each from the automotive organizations of Kansas, Nebraska, Colorado, Missouri, Arkansas, Oklahoma and Texas. In the last-named group will be committees from some sections that have not established organizations, the men invited being from the industry, however.

Acceptances have been received to most of the invitations transmitted to dealers in the territory. It is expected that attendance at the dinner will reach 600.

Governor Harding will spend at least one day, perhaps more, in Kansas and Oklahoma, prior to the Kansas City meetings. He will have opportunity to secure information from the districts visited, and will therefore reach Kansas City with a fresh knowledge of conditions. He is to address a bankers' meeting at Topeka Friday on the subject of motor car paper.

Governor Hyde of Missouri will be present at the dinner to deliver an address of welcome.

Hart-Parr Cuts $200 on Model "20" Tractor

CHARLES CITY, IOWA, May 9—The Hart-Parr Co. has reduced the price of its "twenty" tractor from $1,195 to $995, factory cash list. This places the "twenty" in actual competition with all makes of tractors in the 10-20 class. The factory is gradually increasing production of this model and shipments are moving forward steadily.

In addition to this price cut, the Hart-Parr Co. has improved and extended the scope of its sales financing plan, thereby helping the dealers still further to solve their financial problem.

A meeting of divisional sales representatives from all parts of the United States and Canada was held at the factory last week. It was the general opinion that the worst of the business depression is over and that bright sales spots are appearing where dealers doing systematic work actually are selling tractors. It is expected the next sixty days will see a rapid improvement in the tractor market.

The Hart-Parr factory has not been closed entirely but has been running on a limited production schedule because it was determined not to pile up an inventory but rather to manufacture only as fast as the field absorbs its product. The steel foundry was reopened last week.

FORT WAYNE CONDITIONS GOOD

FORT WAYNE, IND., May 9—Business among the local automotive concerns is very much on the up-grade. Dudlo Mfg. Co., makers of magnet wire used by Ford, has been re-employing men right along; General Electric Co. is picking up, and the manufacturers of lock devices for cars are also showing a distinct spurt in business. Among the retailers business is brisk. Several dealers state that business so far this year is as good or even better than it was up to the same time of last year. Business generally throughout this section has been pretty fair all spring.

METAL MARKETS

IT would seem as though the steel market, for the time being at least, is once more obstructed by anticipation of further price reductions. The general expectation is that the leading interest will not delay unduly long readjustment of its selling prices, once the 20 per cent cut in labor costs, which will go into effect shortly, has become operative. Moreover, buyers look for additional wage cuts by the "independents" and the latter may shave their prices even before the United States Steel Corporation does, provided actual orders can be booked as the result of such cuts. The blind alley which the market presents at this writing discloses in nearly every department remarkable pliancy of prices, a condition that is the natural forerunner of the lowering of quotations. Those who disseminated early in May news of heavy buying of sheets by one of the large builders of low-priced passenger cars have admitted freely that the actual tonnage placed was very light, and that what really did happen was that a number of sheet producers were asked to furnish their lowest quotations on a modest amount of deferred deliveries. This tonnage was pyramided by multiplying the quantity under discussion by the number of producers who were asked to quote. In fact, very little of the tonnage actually ordered by this interest represents new business, nearly all of it being on account of old contracts prices governing which have been amicably and equitably adjusted. A good deal of this sheet tonnage consists of material for frames that is sold on a plate basis. What orders were placed for the latter stock, which runs No. 12 gage and heavier, are presumed to have been taken at very close to 2c., Pittsburgh base. The bulk of this body stock, as well as of the light sheets which were ordered forward from northern Ohio mills, is for immediate requirements, and no fresh commitments for deliveries beyond the next four weeks are reported. Body builders, credited with having inquiries from the Cadillac Motor Co., are canvassing the market for quotations on suitable gages of sheets. Report has it that this company has placed a fair-sized order for cold-finished steel bars. Nowhere, however, is there any indication of buying for deliveries beyond June 30, and this stresses the belief of buyers that prices for third quarter deliveries will shortly move in their favor.

Pig Iron.—Cleveland pig iron interests report that the Ford Motor Co. is again placing orders with automotive foundries for castings conditional upon purchases of pig iron from the Ford furnace. The market for foundry and malleable remains slow with quotations generally on a basis of $24@$24.50, valley.

Steel.—Producers of cold-rolled strip steel are increasing their operations as the result of better inquiries from those who make automotive parts. Nominally the cold-rolled strip steel market is on a 5.50c. basis, while the hot-rolled is quoted at 2.75c. All of this buying, however, is for prompt shipment.

Tin.—The tin market presents the strange spectacle of having been lifted 20 per cent over its 1921 bottom without the least sign of a recovery in consuming demand, speculation having performed this feat unaided by consumers.

Lead.—It remains to be seen whether the advance that has elevated lead prices in the "outside" market to over 5c., New York, will be sustained. Basic conditions, however, are conceded to have improved.

FINANCIAL NOTES

Fisher Body Ohio Co. stockholders will receive one-fifth of a share of Fisher Body Corp. stock and $3 in cash under the exchange plan now declared operative. The Fisher Body Corp. guarantees the payment of the current quarterly dividend upon the preferred stock of the Ohio company down to and including the dividend payable on July 1, 1922. The company also agrees to pay on or before that date the accrued dividends for the year 1920. The dividend accruing April 1, 1921, is expected to be paid by the Ohio company.

H. H. Franklin Mfg. Co., in a balance sheet as of Dec. 31, shows total assets of $19,174,-902, in which is included property, $7,738,595; cash, $1,748,295, and inventory, $7,614,696. Liberty bonds total $684,630 and accounts and notes receivable $591,203. Liabilities show an increase in the preferred stock from $2,000,000 in 1919 to $3,324,800, and in common from $1,858,700 to $6,887,478. Accounts and notes payable total $7,233,180. Reserve for depreciation totals $1,049,014.

Parish & Bingham Corp. in a balance sheet as of Dec. 31 shows total assets of $5,696,770, an increase of $210,184 over Aug. 7, 1919. This includes cash of $281,419; inventories, $1,957,704, and accounts receivable of $375,844. The company's surplus of $2,332,363 is approximately $800,000 less than the surplus on the 1919 date. Real estate and buildings and machinery and equipment, however, has grown $1,200,000 since 1919.

Premier Motor Corp. in a balance sheet as of Dec. 31 shows assets and liabilities of $3,225,682. The assets include an inventory of $1,218,622; cash, $15,615; accounts receivable, $72,550; reserve on drafts, $207,-884; patents, good-will, etc., $443,719. The liabilities include deferred liabilities of $881,-227; accounts payable, $94,056; acceptances payable, $78,573; notes payable, $403,794, and dealers deposits of $20,166.

Pierce-Arrow Motor Car Co. for the first quarter of 1921 reports net operating loss after depreciation, charges and taxes of $489,502. In the first quarter of 1920 earnings amounted to $717,265, which, after payment of preferred dividends, amounted to $2.07 a share earned on common stock. The deficit this year is ascribed to poor truck business.

Michigan Drop Forge Co. shows total assets of $598,808.83 for 1920, with surplus of $86,136.32. Cash in hand and in bank was $39,925.07; accounts receivable, $53,175.10; notes receivable, $25,361.09. Inventories are given as $244,024.05; reserves, $87,085.09. Current liabilities were $72,989.11.

Timken-Detroit Axle Co. has declared the regular quarterly dividend of 1¾ per cent. on preferred stock June 1, to stock of record May 15. The company, however, has passed the dividend on common. The last bi-monthly dividend of 2 per cent on common was paid January 15.

Nash Motors Co. paid a dividend of $1.75 a share on the preferred stock on May 2. On the recommendation of President C. W. Nash the board of directors authorized some important extensions to the company's present plants.

Kelly-Springfield Tire Co. has issued $10,-000,000 in notes as part of its plans for financing, through a syndicate composed of H. P. Goldschmidt & Co., Lehman Bros., Halsey, Stuart & Co. and Goldman, Sachs & Co.

Willard Storage Battery Co. of Canada, Ltd., has been incorporated with a capital of $500,000 and head office in Toronto, Ont.

Titan Automatic Tool Co., Inc., Brooklyn, has filed schedules in bankruptcy with liabilities of $66,068 and assets of $61,139.

Willys to Float Bonds to Meet Bank Loans

TOLEDO, May 10 — Announcement was made here this week that the Willys-Overland Co. expects to take care of its bank loans, due Nov. 1 under the extension agreement, by means of a large bond issue to be offered to the public. If such a plan is carried into effect it probably will mean abandonment of the proposal made some time ago by the bankers interested for a consolidation in a new corporation of the Willys-Overland Co., the Willys Corp. and the other interests controlled by John N. Willys. Increased business recently has permitted substantial reductions in bank loans but they still run into many millions of dollars.

As a new means of increasing sales of Overland cars, each of the 7000 employees in the plant here has been made a salesman under a new plan by which he is paid $10 for each prospect reported which results in a sale before June 1.

Lockwood to Continue Accessory Production

KANSAS CITY, April 30—The purchasers at bankruptcy sale of the Lockwood Mfg. Co. have announced plans for operating the Lockwood automobile accessory factory as a unit in the business of the Baker-Lockwood Mfg. Co., Inc., Kansas City. The purchasers were W. C. Sommerville, president, and Walter L. Wilson, vice-president and treasurer, of the Baker-Lockwood Company. There is to be no change of name or official roster. The autmobile accessory factory will be operated as the Lockwood factory, with Wilson as general manager. Sommerville will manage the Baker factory. R. M. Secor, secretary of the Baker-Lockwood company, is made sales manager of the Lockwood factory business, Secor having had charge of the automobile accessory sales, with headquarters in New York until about a year ago, when the Lockwood interests withdrew from the Baker-Lockwood company, taking the autmobile accessory business with them.

INTERLOCKING TO PAY CLAIMS

AKRON, May 11—Officers of the Interlocking Cord Tire Co. have petitioned the court to absolve the receivership and dismiss Elihu Harpham as receiver. It is stated that an agreement has been reached with the creditors under which the company will pay 15 per cent on claims 30 days after the discharge of the receiver, 15 per cent in three months thereafter, 20 per cent six months thereafter, and the remainder within a year with promissory notes bearing 8 per cent interest. The statement is made that stockholders have raised sufficient money to cover the first payments to creditors.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, May 12—Secretary Mellon summed up present conditions by saying that the financial situation was improving and that the industrial situation was practically unchanged. The action of several of the Reserve Banks in the past week seemed to confirm his judgment of the financial situation. Following the reduction of its discount rate by the Boston Federal Reserve Bank several weeks ago, the New York Bank last week announced a reduction of its discount rate on commercial paper from 7 per cent to 6½ per cent. The 7 per cent rate had been in effect since June 1, 1920. Since that time the Atlanta Bank has reduced its rate from 7 per cent to 6 per cent, and the Chicago and Minneapolis Banks from 7 to 6½ per cent each. The Dallas Bank is now the only bank in the system which maintains a 7 per cent rate on commercial discounts.

The New York call money market eased last week after opening on Monday with a renewal rate of 7 per cent. The renewal rate for the remainder of the week was 6½ per cent. There was a freer supply and an easier undertone after the New York Bank had announced the cut in its discount rate. The range for the week was 6½ per cent to 7 per cent, as against 6 per cent to 7 per cent the week before. Time money also showed a slight easing. Sixty to ninety days' and four months' paper was quoted at 6¼ per cent to 6¾ per cent, and five and six months' paper at 6 per cent to 6½ per cent, as against 6½ to 7 per cent for all maturities up to six months in the previous week. The amount of business done was moderate, but trading was dull with a disposition to wait on further reductions in rates.

The stock market last week showed a decided upward trend, with a reaction, however, over the week-end. Many industrial stocks made new highs for the year, as did also a few railroads. The bond market was also buoyant, with many foreign government and municipal bonds and our own Victory 4¾s making new high records for the year. The same tendency was noticeable in the foreign exchange markets, where as many as ½ dozen European currencies made new high records for the year. The pound sterling at $3.98⅛ was at the highest since last June, and the French franc at 8.36½ was at its highest since last July. Exchange on Norway and several of the South American countries, on the other hand, made new lows for the year.

HOOD STARTS THREE SHIFTS

WATERTOWN, MASS., May 9—Evidence of marked improvement in the tire trade situation is shown by the increased activity of the Hood Rubber Co., manufacturers of Hood tires and tubes, which to-day began working three full shifts.

MEN OF THE INDUSTRY

Guy H. Peasley has been named sales manager of the Olds Motor Works, succeeding Charles A. Tucker, who resigned to devote his entire attention to the business of the Nebraska Oldsmobile Co., Omaha, of which company he is president and general manager. Peasley has been with Olds since 1911, when he started as a stenographer and bill clerk in the sales department. He worked his way up by successive steps, having been distribution manager for four and a half years, and during the past year assistant sales manager.

Homer K. York has been appointed assistant secretary and treasurer of the Indiana Truck Corp., Marion, Ind. Previously he had been supervisor of production and service for four years. Cecil B. Warner has been appointed western manager for the company, with headquarters at San Francisco. He was formerly connected with the Nelson and Gramm-Bernstein.

Homer J. Forsythe, manager of the construction division of the engineering department of the DuPont Co., has been transferred to the position of assistant general manager of the Hyatt Roller Bearing Co. of Newark, N. J., a subsidiary of the General Motors Corp. Forsythe had been with the engineering department of the DuPont company since August, 1906.

Ralph D. Webster has rejoined the selling forces of the Wire Wheel Corp. of America, and for the time being will make his headquarters in Detroit. Webster, a real veteran in the automotive industry, and a graduate of the older bicycle trade, was formerly sales manager of the controlling wire wheel organization.

John Jay Ide, who has been a frequent contributor to AUTOMOTIVE INDUSTRIES on aircraft subjects, has been appointed technical assistant in Europe of the National Advisory Committee for Aeronautics. His headquarters will be at the Paris office of the committee. He sailed May 3.

Edmond Rumpler, director general of Rumpler Auto & Airplane Works of Bavaria, accompanied by his purchasing director, Herman Aumer, is spending some time in Detroit visiting factories and conferring with business men with a view to the purchase of machinery for his plant.

Don Warren has been appointed vice-president and general sales manager of the Wolke Lead Batteries Co., Louisville. Elmer Brandell has been appointed advertising manager and W. G. Sauer has been appointed manager in charge of sales and sales promotion work.

P. J. Eubanks, who for the past two years has been serving as chief engineer and manager of the Aero Products Co. of Cleveland, has resigned to devote his entire time to the duties of chief engineer of the consulting engineering firm of Rush & Eubanks, that city.

E. J. Mueller, domestic sales manager of the Harley-Davidson Motor Co., is leaving that organization. He has no definite plans for the future, but intimates that he will continue in the motorcycle business, possibly in the retail sales field.

W. B. Blood, vice-president Campbell, Blood & Trump, has been made director of sales and advertising of the Ray Battery Co., Ypsilanti, Mich. Blood will retain his offices with the former concern in an advisory capacity.

C. L. Alexander has been appointed manager of sales promotion for the Elgin Motor Car Corp. He has been assistant sales manager since October, 1920, and formerly was connected with Lozier, Dodge and Maxwell-Chalmers.

H. G. Shirley, who has become well known to the automotive industry as a highway speaker, representing the Federal Highway Council, has been named as highway engineer for Baltimore County, Maryland.

O. N. McCool, who was formerly sales manager of the Commonwealth Motors Co. at Chicago, has joined forces with the Seneca Motor Car Co. at Fostoria, Ohio, as its Western representative.

O. M. Peters, formerly heavy line works manager of the Emerson-Brantingham Co., Rockford, Ill., has been appointed general works manager of the American Machinery Co., Kennett Square, Pa.

S. S. Jenkins has been appointed general sales manager of the Bijur Motor Appliance Co., Hoboken, N. J. He was formerly Detroit district sales manager for the company.

INDUSTRIAL NOTES

Toledo Automotive Products Co. has taken an exclusive license for the manufacture and sale of the Dorr Miller differential. Among the officials and stockholders are G. Huette and R. W. Randall, formerly of the Falls Motor Works; A. R. Class, president of the Toledo Steel Products Co.; C. E. Thompson and J. A. Krider, of the Cleveland Steel Products Co.; G. S. Salzman, of the H. J. Walker Co.; R. M. Bean, of the Durston Gear Corp.; D. A. Shaw, president of the Grant Motor Car Corp., and R. J. Goldie, of the Columbia Axle Co.

Milwaukee Circulating Pump Co., manufacturing circulating oil, water and other fluid pumps, and a subsidiary of the Milwaukee Shaper Co., has been acquired by a new corporation, the Cramer Mfg. Co. of Milwaukee, capitalized at $50,000. The present plant will be continued until such time as business warrants the erection of a new works. Officers of the Cramer company are: President, William L. F. Graf; vice-president and general manager, Robert Cramer; secretary and treasurer, William E. Graf.

Bridgeport Coach Lace Co. has established a factory branch at 1449 So. Michigan Avenue, Chicago, where a complete line of its products will be carried. T. N. Wakeman will be manager of the new branch. The company was formerly represented in Chicago territory by Blumenthal Bros.

Milwaukee Snow Conveyor Co., a new $25,000 corporation, has started production of a new type of rotary snow plow designed by A. F. Krueger, Milwaukee. It will be built for mounting with tractor and motor truck chassis, street and steam railway trucks, etc.

Mutual Truck Mfg. Co., Sullivan, Ind., has abandoned its intention of removing its plant to Peru, Ind. A. W. Petrie, inventor of mechanical features of the truck, has sold his interests for $50,000. It is thought he may start a factory at Peru independent of the Mutual company.

Gregory Tire & Rubber Co., Ltd., Vancouver, B. C., has started operations and will have a capacity of 500 tires and 1000 tubes a day when in full production. The company is incorporated for $1,500,000. Morton Gregory is president.

Cleveland Tractor Co. will operate temporarily on part time. The factory has been in full operation all winter. Business of the company is good and it is expected that dealers will liquidate their stocks in the near future.

Taft-Peirce Mfg. Co., manufacturer of machinery and tools and employer of 700, is shutting down May 9 for a week and will open again May 16 on full time. It has been operating on a four-day basis.

Independent Tire Co., Chicago, has changed its name to the Better Tire Co. No change has been made in the personnel or management, and the policy of the company will remain as heretofore.

Alvord Reamer & Tool Co. has opened a direct factory branch in Chicago under the management of C. B. Cole, formerly manager of the Union Twist Drill Co. at Chicago.

No-Leak-O Piston Ring Co., Baltimore, reports a sales increase for the first quarter of 1921 of 75 per cent over business in the 1920 quarter.

International Motor Co. has removed its New York offices to the new 22-story office building of the Cunard Line at 25 Broadway, which was opened this week.

To Merge Three Plants of Kelly-Springfield

NEW YORK, May 9—J. V. Mowe, general sales manager of the Kelly-Springfield Tire Co., who has returned from the formal opening of the company's new $11,000,000 plant at Cumberland, Md., announces that the twelve acres of manufacturing space now available in the new factory will make it possible to combine the Buffalo, Worcester and Akron factories in one plant, thereby producing cord and fabric casings, tubes and solid truck tires on a scale which the company never before has been able to approach. The immense new plant is said in some respects to be the finest in the world. Cumberland was selected because of its strategic location for the distribution of tires, the shipment of crude rubber from nearby ports, the proximity of the West Virginia coal fields and the favorable labor situation.

STEVENSON TO START PLANT

DETROIT, May 6—The Stevenson Gear Co., incorporated with a capital of $3,600,000, will begin work this month on a factory to cost $1,500,000 and to employ about 500 men. The company is headed by Richard T. Wingo, president and other officers are Frank C. Sibley, secretary, and G. W. J. Linton, treasurer. G. E. Stevenson, inventor of the product the company will manufacture, and E. B. Johns are members of the board of directors with the officers. The company will manufacture gears on special machines, the invention of Stevenson, and expects to be in production in the fall. The Stevenson Gear Co. of Indiana, the parent company, now has a $10,000,000 company in operation in that city.

Calendar

SHOWS

Sept. 28-Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8 — International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

May 17-19—Buffalo, Convention of Factory Service Managers, Auspices of Service Committee, N.A.C.C.

May 23-26 — Chicago, A.S.M.E. Spring Meeting, Congress Hotel.

May 24-28—West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

July 4-9 — Mackinac Island, Mich., Summer Meeting Automobile Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

RACES

May 31 — Indianapolis, International Sweepstakes.

June 3-5 — Reno, Nev., First Annual Nevada Highway Road Race.

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

S. A. E. MEETINGS

Dayton Section—May 17, H. L. Horning.

Cleveland Section—May 20.

Court Clears F. W. D. of Conspiracy Charge

MADISON, WIS., May 9—The Wisconsin Supreme Court has dismissed the complaint of R. P. Rohloff and other former stock holders in the F W D Auto Co., Clintonville, Wis., against directors and officers of the corporation, claiming conspiracy and fraud in keeping information of importance from them. The decision affects merely the right of a group to bring suit, and does not go into the merits of the action. It will mean that to recover it will be necessary for stockholders to sue individually.

The case involves hundreds of thousands of dollars to investors who sold their holdings just before large Government contracts were made. The plaintiffs were mostly original stockholders who helped form the F W D company in 1909. They claim the defendants induced them to dispose of their holdings in 1914 without informing them concerning actual and prospective contracts for thousands of F W D trucks for European belligerents. It is claimed that stock of a par value of $100, sold for that price in 1914, was actually worth $900 in 1917, 1918 and 1919.

Further action by the plaintiffs in accordance with the decision is promised immediately.

Factory to Direct Marmon in New York

NEW YORK, May 9—Under a new operating arrangement just worked out, the Marmon Automobile Co., of New York, distributor of the Marmon in the Metropolitan territory, will come under the direction of the officers of the Nordyke & Marmon Co. A. R. Heiskel, treasurer of the Nordyke & Marmon Co., has been elected president of the New York corporation, and S. S. Toback and Frank Carrie, vice-presidents. Toback, until he retired from the New York organization several months ago, to do some special work for the factory, was general sales manager. Carrie has been vice-president of the local company for some time.

The change in plan does not make the Marmon representation in New York a factory branch. The company remains a separate entity.

United Motors Tells New Service Plans

NEW YORK, May 10—Plans of United Motors Service, Inc., for the extension of replacement parts service direct to consumers through dealers and garagemen throughout the country were discussed at a three-day convention of New York territory distributors.

In introducing the plan Fred A. Oberheu, salesmanager, asked the distributors to assist in the extension of the service in their respective territories through selling small dealers and garagemen United Motors Service contracts. He pointed out that the prime object of the extension of the sales plan at this time was to make it possible for every motor car owner to get service and genuine replacement parts for any of the company's products through the establishment of selling and servicing connections in the smaller communities.

Oberheu also explained the national advertising campaign through trade publications, nationally circulated periodicals and newspapers, which is to support the extension plan with an educational program stressing the use of genuine parts, and enlarging on the fact that material and workmanship rather than dimensions are the factors to be considered in the satisfactory replacement of parts in these products.

The convention, which opened Monday, followed an interesting program of sales and service topics which were discussed by the following representatives of the company: F. A. Oberheu, salesmanager; D. M. Sweeney, superintendent of distribution; J. W. Parry, manager of the technical department, and R. L. Stevens, of the technical department.

Durant Coast Plant to Be Started at Once

OAKLAND, CAL., May 7—R. C. Durant, son of W. C. Durant, the former president of the General Motors Corp., has returned here and announced that the new Pacific Coast assembly plant of Durant Motors, Inc., will be located in this city and actual construction work is to be commenced within the next thirty days. The younger Durant is to head the Coast project just as he formerly headed the Pacific Coast Chevrolet organization.

The local plant is to be operated under the name of the Durant Motor Co. of California. The company is capitalized at $3,000,000, and of this amount young Durant has taken $2,000,000, while his associates and their friends have taken more than half of the remaining million. Among Durant's associates in the Coast unit of the Durant enterprise are C. M. Steves, A. and L. Warmington, H. T. McKnight, Capt. A. G. Waddell, J. E. Appleby, Capt. Eddie Rickenbacher, Chas. Dunham and a number of others.

Milwaukee Factories Show Early May Gains

MILWAUKEE, May 9—Gradual increase in the operating forces of the Milwaukee shops manufacturing motors, frames, parts and automotive equipment generally, which was the rule throughout April, has been slightly accentuated so far in May as the result of the broadening demands of passenger car and motor truck manufacturers. The makers of cars and trucks in this district likewise are effecting further increases in production, orders now being considerably ahead of current production. The situation is improving steadily, although slowly. Things are picking up in the tractor industry as well, but makers are still stocked with finished goods and a better demand has not yet been reflected into production requirements of an appreciable extent.

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Rumors and June 30—Our Industrial Brakes

What follows is a consideration of some interesting questions of today. A few of them are: Who is buying? Why does he hesitate? Is price cutting the remedy? How to check rumors? What can we do?

By Clyde Jennings

RUMORS are the worst feature of the business situation to-day. As a matter of fact, rumors always are the chief source of trouble in a nervous market or an unsettled manufacturing situation. In this case it happens to be a market that is rapidly gaining strength.

Just at this time rumors are especially troublesome to the automotive industry. It is a rumor that keeps John Smith from buying the car that he has been looking at through the plate glass window for the last three months. He has heard many things. Just a few of the things that he has heard are:

> **The price of this car is to be cut week after next. (The fact that he has heard this once a week since last December makes him more confident as to the truth.)**
>
> **The company that makes this car is going to bust within a few days and the car will be an orphan.**
>
> **The dealer that handles this car is going bust and likely the new dealer will not take care of the older purchases.**
>
> **There is going to be a new car on the market soon, almost like this one that will be sold for about half of the money.**
>
> **The automobile factories profiteered heavily during the war and only a few of them have made proper adjustments in their prices.**
>
> **Dealers are making all kinds of wild allowances for used cars and if he scouts around and gets hold of a pile of junk he can sell to the dealer at a good price.**

These rumors are just a few of the things that the prospect is hearing among the "know it alls" whom he meets. The prospect has not recovered from that greatest of all rumor periods, the war, and he is inclined to listen to almost any fantastic tale.

Then there is another circle of rumors that is equally vicious. This is in the stock market centers. The tapes all day long carry notes that this company is "going to cut prices" or "reduce dividends," or both. Also it is told that the manufacturing companies are ignoring service, that service is being used "as a hold up to maintain profits" and so it goes. This particular form of rumor would not have been as important a few years ago as it is now. But in recent months the motor shares, through recently formed banking connections, have become an important factor in the great bourses. A sample of how these rumors break into print is well illustrated by the short article that follows. It was printed at the head of the financial news in a reputable New York newspaper. The headline was "BLUES IN WALL STREET OVER THE MOTORS."

While there was deep gratification over Germany's acceptance of the Allied terms it was not reflected yesterday in the stock market, where the greatest pessimism as to the immediate future of our own industrial situation prevailed. The traders talked of nothing else but dividend cuts and impending cuts.

Most of the rumors of this sort concern various motor companies and the corporations selling them supplies. Unfortunately, the spring boom in the automobile trade has been short lived. Buying has slowed up and the industry is apparently face to face with a readjustment as drastic as that to which other lines of business have been subjected and has in most instances met with liberal reductions in prices.

This necessity now faces the manufacturers and purveyors of cars as well as those who provide the accessories. Reports that another General Motors subsidiary and its principal rival will cut prices 20 per cent next week circulated yesterday, and there were stories of impending dividend cuts all around.

Heavy selling of Chandler was due to the belief that the company will not be able to maintain the quarterly dividend of $2.50.

American Bosch Magneto, which supplies many of the cars and motor trucks with magnetos, broke to 50½ on the statement that the company has been running into poor business because most of the companies at the beginning of 1921 had an oversupply of these electric distributors. The company has been paying dividends on a $5 annual basis and the next dividend is to be acted on early in June. The course of the trade in the meantime will determine the action to be taken then.

The effect of these rumors cannot be otherwise than bad, and such publicity as this financial item is especially bad, because a lot of men who deal in Wall street merchandise place great faith in what they hear there. Still more men who have never had an actual interest in anything that is sold in Wall Street, read these articles almost with reverence. The effect of the rumors is as widespread as the American motor trade.

The cure of these evil effects is not plainly seen, but the natural place to expect the answer is in automobile publicity. The reader turns there and finds exactly nothing that has any bearing on the subject that is uppermost in his mind.

Suppose the puzzled prospect turns to the advertisements for cars to find the maker's answer to the many rumors he has heard. It is an even chance that he will find that advertisement to be a wordy effusion on the use of the car for some entirely luxury purpose. He is urged to buy because the car will be a nice plaything for the children, or because he can take a long overland trip, which he cannot afford. Perhaps the price is on the advertisement and perhaps it is not. A year ago all advertisements had prices attached, and the manufacturers were quite proud of those prices. Indeed, a number of them pointed with pride to the price as an evidence of the excellence of the car.

Apparently every automobile and truck manufacturer in the country had a distinct steel-ribbed sales policy early in 1920 and he was proud of his strict adherence to it.

Sad is the contrast to-day.

Last midsummer AUTOMOTIVE INDUSTRIES printed some articles on merchandising—price cutting included—and these are especially good reading to-day. They were not prophetic, they were simply common sense. Some things were said about guarantees that were made when the first price cutting was announced. Some of the guarantees that were then made were withdrawn as soon as possible, others were not. To-day there is not a manufacturer in the industry who put out a hastily made guarantee that does not regrét that he did so.

Far be it from any one man to decide whether price cutting is the answer to the present ills of the trade. If the profit on the car is too high, then price cutting is one answer. But the real answer, as to what extent price cutting should be indulged in, must come from the cost sheet in the factory—not from an outsider. But some things can be set down with certainty. All of these things have been said before and will be said again. We venture a few:

There can be no dispute that the psychological attitude of the people is that prices should be cut from the war time standard.

The manufacturer who was well stocked with materials at after war prices is due for a loss.

He is going to take that loss whether he wants to or not. If he does not take it through cuts in sales price, he will take it through sales resistance and idle plant facilities.

A greater loss than inventory markdown is the disruption of an organization. This applies to the factory as well as to the sales field.

Now it is entirely possible that some vehicles to-day are priced at a perfectly reasonable figure, current priced inventories considered. The writer does not believe that the public is either illogical or unfair. It may seem so at times, but in the end it is not. A frank discussion of prices and reasons therefore in an advertisement would appear to be quite the right thing for a car or truck that is properly priced. This advertisement should not be mere "bunk." You cannot fool all of the people all of the time.

Those statements that were put out a year ago about it being impossible to lower prices because labor was not cheaper were "bunk" and they had just as much effect as "bunk" can be expected to have upon an intelligent public.

An automobile manufacturer recently showed to AUTOMOTIVE INDUSTRIES his report that labor in his factory constituted 14 per cent of the cost of his car. And this is quite a complete factory—not a mere assembly plant. The public knows, when it looks at a car, that relatively labor wage is not the chief thing to be considered in fixing the price of that car and it is absurd to expect such "bunk" to prevail. The public also knows that employers are saying freely that labor is more efficient than before—so labor is cheaper. Also the public has heard and believes much about reduced wages and if any particular factory has not reduced its labor prices this factory must say so.

Not long ago AUTOMOTIVE INDUSTRIES reported that a certain car had not been reduced in price. The salesmanager of that car objected and showed wherein the actual value of this car had been greatly increased and that the price had not been raised. This, he said, was equal to a reduction. But at that time he had not stated these facts to the public. His letter would have made a very excellent advertisement and would have convinced any intelligent prospect that this car had been reduced in price fully $200, but the prospect did not hear of this letter. He continued hearing rumors, however.

A group of sales managers recently raised an interesting question in a conference where AUTOMOTIVE INDUSTRIES was represented. It was about like this:

Who are our present customers, where are they getting the money and why are we not getting orders from our dealers for shipments after June 30?

These sales managers were much in earnest. They admitted that they were really surprised at the orders

received at the factories until June 30 and were entirely dissatisfied with what seemed to be in prospect after that date. The representative of AUTOMOTIVE INDUSTRIES answered the question in sections, in the main as follows:

Your present customers are in the main the "white collared class" that suffered so heavily during the war. They are the people sometimes called "middle class," who are the anchor of the great public. It was these people who had the hardest time getting through the war period. Pride caused them to make every effort to maintain a social position, intelligence caused them to continue the education of their children, and patriotism stirred them to heavy purchases of Liberty bonds and other securities. Comparatively their financial condition suffered. Their incomes were not increased in keeping with either the owners of business or with wage earners." Cost of living hit them sharply and their "solid" investments, usually public utilities or safe industrials, did not share in war profits. These people were the last to right their finances after change in living and investment conditions.

These people are now getting their money through an adjustment of the salaries that lagged behind wages and by interest on investments. These are the people who did not sell Liberty Bonds and now their gilt-edged securities that suffered during the war are doing comparatively better than they did during the high profit season.

These are the people who buy cautiously, carefully and with a full ability to pay their obligations. They are the people who used the old car a year or two longer or who put off buying a car. They are the people who are hardest to fool, because they do not act on impulse or hunch. It is to this class of buyers that a reasonable statement of quality or utility appeals. They do not want cars for purely pleasure; they cannot afford expensive luxuries. They would like very much for the manufacturer to justify their investment, for the purchase of a car is a considerable investment to this prospect. He feels that he must justify himself; not only in the investment as a whole but in the investment of a particular car. He will buy the lowest price car that he is convinced is in keeping with his social position and is economical in operation, other things considered.

The lack of orders after June 30 is because the dealers, either consciously or unconsciously are victims of widespread reports of price cuts on July 1. The factory man must remember that usually the dealer and salesman becomes a friend of his prospect. The prospect lets the salesman know that he puts a certain amount of faith in him and he asks certain questions—regular man to man fashion. This salesman, if he is worth having, does not pledge himself to things he does not know. He has heard that his factory is going to cut prices July 1. Where and when he heard this is not a part of this discussion. He has heard it and the factory has not said that it is not true. The factory has not announced any policy. When this man to man question is asked, the salesman is in a very embarrassing position. Does he owe his allegiance to the customer or to the factory? If he is as honest as a salesman ought to be, he tells the truth—says he does not know. He does not encourage the prospect. Consequently the dealer who gathers his reports from his salesmen, does not know what the prospects are for after June 30. So the dealer does not order.

Before the dealer can properly estimate his prospects after June 30, he must have a concrete idea of what his own and other factories are going to do.

In other words, the automotive industry must get a sales policy. At present it has none—and worse than that, it is not even answering the criticisms.

It is not strange that under present uncertain questions every shower finds a great many factories a long ways from home without umbrellas. A good many spring frocks have been damaged by these showers. When prices are cut on a well known line, and other manufacturers are asked about it, they bemoan the cruel fate that brought the shower at that particular time.

THE automobile and rubber industries have come back in a very definite fashion when some false prophets thought they had taken the full count for the time being. So far they have disappointed those who forecast a mere spurt instead of a continuous performance. There are still few belated thinkers who have overstayed their time and who fail to realize that automobiles are neither a fad nor a mere luxury but an essential and inherent phase of modern life.
—Archer Wall Douglas, chairman of the Committee on Statistics and Standards in Monthly Review of Business Conditions in The Nation's Business.

Far be it from the writer to say what the policy should be. That requires a careful study of the surroundings in the factory, into the bankbook of the manufacturer, into his reports on vehicles in dealers' hands and into the class of prospects that he hopes to attract. But there is a suggestion that can be passed on. It is this:

The sales reports all indicate many showers this season.

It behooves every person with automobiles to sell to dress accordingly.

If he prefers fine clothes and an umbrella, let him make that choice.

If he prefers a raincoat, that is up to him.

Perhaps he may prefer his golf tweeds.

The point is, let him decide how he is going out to await the showers. No matter what he wears, there is going to be damage, but the chief thing is that whatever dress he adopts, he must expect showers and not run for shelter when they come.

The method in this case is the same as has always won within the factory. Let your public—in this case the prospects—in on your plan and discuss the main problem and its details with them frankly and honestly. Let your dealers know what this policy is to be.

As we talk to dealers, we wonder if the manufacturer realizes just how important the dealer is in his contact with the public. The dealer is the spokesman for the factory, and often the dealer is spokesman for all factories to a particular prospect. It is well that this dealer should be informed as to factory plans. Don't be afraid to tell him.

The loss is in front of you—at least that part you have not written off—so decide how you are going to meet it —quickly or slowly—and then proceed on that plan determinedly and consistently. Perhaps you remember what Grant said about his Vicksburg campaign. Also you remember that he won.

Purposes of the Foreign Trade Finance Corporation Definitely Stated

There has seemed to be an element of uncertainty in the objects and methods of this new banking institution. In order to dispel this uncertainty, AUTOMOTIVE INDUSTRIES asked certain questions which the officials of the corporation have answered as set forth in the following article.

By George E. Quisenberry*

WHAT specifically does the Foreign Trade Finance Corporation offer to the automotive industry and what are the plans of its organization?

This question is one of exceeding interest, as the officials of this proposed foreign financing institution are endeavoring to close the company's books within the next ninety days and to commence active operations by Sept. 1. For the last four months the corporation has carried on a quiet campaign of education, endeavoring to show to the business interests of this country the imperative need for such an organization formed under the Edge law to solve the credit problems of American exporters. During this quiet campaign, according to officials, a considerable part of the proposed capitalization has been subscribed. Believing that conditions have been bettered to such an extent that the capitalization may be completed shortly, the corporation is now entering upon an intensive effort to complete its stock sales.

The automotive industries thus far have been one of the most liberal supporters of the plan. Several members of the organization committees represent the automotive industry and they have been among its active workers. Consequently, in order that the proposed institution might be better explained, officials of the corporation have been asked to go into more detail concerning its contemplated activities.

Specifically, the corporation plans to finance foreign sales of American products, both raw and manufactured. The extent to which this financing will favor the automotive industry depends upon the extent of support the corporation obtains from that industry in the sale of its stock. In other words, the industry will benefit in proportion to the interest it takes in the Edge organization.

Apportioning Credit

Will the corporation extend foreign credits to the automotive industry if manufacturers and exporters get behind it?

Yes. Under the Edge law, the Foreign Trade Finance Corporation will issue debentures to an amount of ten times its capital stock and can finance foreign trade up to the limit of its debentures plus the total of its capital stock. Another way to say this is that the corporation will be able to finance trade to a value equal to eleven times its capitalization. Theoretically, if the Sennett Motor Company subscribed $50,000, the corporation could finance its foreign trade to a total of $550,000, by the use of the original $50,000 capital and by the sale to the investing public of $500,000 debenture bonds.

*Managing Editor *El Automovil Americano*.

The corporation, however, cannot pledge itself at this time to any definite and concrete financing, such as pledging to the Sennett company an extension of credit totaling $550,000. The corporation reserves the right to pass upon each proposal for credit; it desires to use its assets in a manner best to promote American export trade in all commodities and it necessarily cannot forecast the channels into which this credit will be sent. The Sennett Motor Company as a stockholder of the corporation would naturally have a favorable standing over a non-stockholder and, undoubtedly, would profit thereby.

How It Will Work

How will the corporation finance foreign sales?

In effect, by opening letters of credit for foreign buyers in New York. When the Sennett company receives an order from, say, Argentina for cars valued at $75,000 upon which the buyer asks a credit of six or nine months, the Sennett company officials will refer the order to the corporation offices. The branch office of the corporation at Buenos Aires will be asked by cable if the risk is a good one. If so, the corporation will extend such a credit to the Argentine buyer. The Sennett company will ship the goods and obtain payment at New York by presenting the customary documents, the transaction in every way being similar to the present procedure of collecting against a confirmed letter of credit at New York or other ports.

The Sennett company has no connection with the credit in any way. That is entirely between the Foreign Financing Corporation and the buyer in Buenos Aires. The Sennett company forgets any liability for the deal as soon as it has received the money upon its shipping documents.

The only exception in the foregoing would be in a case in which the corporation might, for one reason or another, ask the Sennett company to indorse the paper of the Argentine company. In this case the manufacturer would be a party to the collection of the funds just as he is now in a transaction involving a secondary indorsement.

How to Join

In what way should the automotive industry join the corporation?

By subscribing to stock as individual firms, associations or districts. The corporation considers roughly the United States in districts similar to those of the Federal Reserve Bank. It prefers to consider its financing obligations in terms of these districts rather than by terms of industrial groups or other such divisions. It is active in this because of the fact that there might be need for financing from, say, the cotton and agricultural areas of

New Orleans and not the automobile manufacturing territory surrounding Detroit or Cleveland. Naturally, the corporation would not wish to tie up a large amount of funds awaiting the need of the Detroit district and failing to extend the required relief to the New Orleans people.

What does the corporation expect to achieve in its financing work?

It expects to take a prominent part in restoring prosperity to American industry. It will achieve its object when foreign buyers of American equipment buy freely in our markets; its profit will be derived from those transactions which are negotiated on long-term credit.

What are the provisions for the subscriptions?

Twenty-five per cent of the stock must be paid on the call of the directors that business will commence. The Edge law further provides that 10 per cent of the remainder shall be paid each sixty days, but objection has been made to this provision and the act is now being amended in Congress so that these additional payments may be made upon the directors' call. The amendment has passed the Senate and is now before the House with apparently no opposition to it.

Terms of Credit

What specific credits can the corporation provide?

Any credits which have a *longer* time to run than ninety days. In order that the company might not compete with domestic banks the Edge Act provides that ninety-day credits are the minimum. There is no maximum and the credits may continue as long as the bank decides. Branches will be opened in the chief foreign centers to pass upon credits, to supervise collections and to perform other necessary functions.

Has the promotion committee in mind a definite proportion between the capital of a manufacturer and the stock it should subscribe to the corporation?

No definite amount has been worked out, but may be determined on the amount of credit that might be needed.

Motor Cars Equipped for Casinghead Gas Tests

WHEN the casinghead gasoline industry was in its infancy, less than ten years ago, contracts were entered into by most of the mid-continent oil producers for the sale of their casinghead gas, which is the gas produced from oil wells. Gasoline plants were built wherever there appeared to be enough volume to justify their construction. Some of these plants returned large profits to their owners, others proved to be good investments, while a few operated at a considerable loss and were dismantled.

Experience quickly revealed that much of the casinghead gas did not contain enough gasoline to justify plant operation. Quantities of gas could not be conveniently carried to laboratories to be tested. It was not practical to pipe it for that purpose.

Thus necessity brought about the development of the test car, a miniature gasoline plant built on an automobile, to test the casinghead gas at the wells for its gasoline content—the number of gallons of gasoline that can be obtained from each thousand cubic feet of gas.

The use of the test car saves thousands of dollars each year for the buyers of casinghead gas, and insures the sellers an equitable method of determining value in disposing of their product.

The test car also has its use in the daily operation of gasoline plants. By it the critical pressure (the pressure at which the greatest yield is obtained) is found without disturbing the manufacturing process. It is also useful in maintaining the efficiency of the plants and in separating the gases of varying qualities to obtain the maximum yields.

The two principal methods in use to determine the yield in gallons per thousand cubic feet of gas are by compression and absorption tests. There is also the chemical test for the gasoline series in casinghead gas, but this test is seldom used in the field.

The compression test is most frequently employed and is usually designated in the gas selling contract, as the method to be followed in the so-called settlement tests, to arrive at the price to be paid the seller per thousand cubic feet for the gas until the next test is made. These tests are usually made quarterly or semi-annually.

The ordinary single-stage gas testing equipment consists of a small scrubber tank to free the incoming gas from water and whatever oil it may contain, a meter, a single-stage compressor, cooling coil and tank and a reservoir, called the accumulator tank, for collecting the gasoline as it comes from the coils while still under 200 to 300 pounds pressure. There are also the necessary gages for measuring pressure. All this is mounted on an automobile chassis. The power for operation is sometimes obtained from the automobile engine by jacking up a rear wheel and connecting it to the pulley of the compressor by a belt over a belt band on the rear axle.

In the compression method gasoline is manufactured from casinghead gas in the gasoline plants by compressing the gas in two stages, first by low-pressure and then by high-pressure compressors. With the purpose in view to more closely approximate plant production, it was found necessary in Oklahoma operations to develop a more efficient car than previously used. Instead of the ordinary single-stage, high-pressure apparatus, a two-stage, vacuum pump equipped test car was built. In this case the power is furnished from the engine through an auxiliary shaft direct from the transmission, which eliminates jacking up the rear wheel for power when in operation.

In the principle of operation this car is not very different from the single-stage machine in general use. However, it more nearly parallels the gasoline plant. Its vacuum pump permits of connecting into the lines, carrying the gas under the vacuum without the closing of any gates and a consequential loss of gas to the plant for several hours, and without loss of time to the gas tester waiting for pressure to build on the particular lease to be tested. The two-stage compressor, with both low- and high-pressure cylinders, necessitates the use of two sets of coils and accumulators.

The change in machine, however, does not modify the procedure of testing. This is governed by the rules and regulations made by the United States Interior Department. The minimum number of cubic feet of gas run in a test is ten. In order to eliminate errors in field calculations, 26.42 cu. ft. of gas are used, as this amount, passing through the meter at four ounces of pressure, yields one gallon of gasoline per thousand cubic feet of gas for every one hundred cubic centimeters of gasoline recovered. This is measured with the gasoline at atmospheric pressure after the temperature is raised to sixty degrees Fahrenheit at a rate not to exceed one degree every two minutes.

Many Important Subjects to Be Considered at S. A. E. Standards Meeting

Truck Division to report on recommended practice for important dimensions of front axles for trucks, and on truck body mounting dimensions. Specifications for electric cable among other important recommendations.

THE reports of the Society of Automotive Engineers Standards Committee Divisions covering their work for the first four months of 1921 has been forwarded to members of the Society and will be discussed at the Standards Committee meeting, which will be held at West Baden Springs, Indiana, on May 24. Parts of the report approved at the committee meeting will be submitted at the semi-annual meeting of the Society in session on succeeding days. Copies of the reports can be obtained without charge from the Society of Automotive Engineers, 29 West Thirty-ninth Street, New York City.

The reports consist of complete but concise statements of the practices and constructions recommended, together with such illustrations as are necessary.

The meeting of the Standards Committee, which will be held at the West Baden Springs Hotel, will be open to non-members of the Society who wish to attend. Those technically qualified who wish to discuss any of the reports will have the opportunity to do so. Written discussions submitted to the Standards Committee will also be given full consideration. The reports include recommendations on motor truck hubs, motor truck body installation dimensions, clutch release thrust type ball bearings, roller chains, roller chain sprockets, insulated cable, flexible disk couplings, headlamp brackets, lamp nomenclature, ball studs, exhaust pipes, square shaft fittings, universal joint hubs, radiator drain cocks, stationary engine belt speeds, stationary farm engine ratings, flywheel housings and other automotive parts and materials.

Clutch Release Type Thrust Ball Bearings

The Ball and Roller Bearings Division submits the following table of sizes for clutch release type thrust ball bearings as proposed recommended practice:

CLUTCH RELEASE TYPE THRUST BALL BEARINGS

Number	Bore	Width	Ball Diameter
1	1⅜	⅝	5/16
2	1½	11/16	5/16
3	1⅝	11/16	5/16
4	1¾	¾	5/16
5	1⅞	¾	5/16
6	2	¾	5/16
7	2⅛	¾	5/16
8	2¼	13/16	⅜
9	2⅜	13/16	⅜
10	2½	13/16	⅜
11	2¾	13/16	⅜
12	3¼	⅞	⅜

All dimensions in inches.
These bores and widths are intended for use with bearings with or without assembling bands.

Roller Chain Standardization

The Chain Division recommends the adoption of a standard tooth form, the pressure angle for a 6-tooth wheel running from 15 to 5 deg. and the pressure angle on a wheel of infinite diameter running from 15 to 30 deg., making the actual working face of the tooth a surface concave to the roller, the radius of which is approximately 1.3 times the diameter of the roller. The complete report covers the exact form of the tooth and the details of the cutters.

The Chain Division recommends also a numbering system for roller chains.

Insulated Cable

The report of the Electrical Equipment Division on Insulated Cable was formulated by a subdivision consisting of cable and passenger car manufacturers after a series of meetings at which the subject was exhaustively discussed. The recommendations of the Division will, if adopted by the Society, supersede the present S. A. E. Standard for Insulated Cable, adopted in 1916, which it is thought is not in accordance with the best engineering practice of to-day.

The proposed specifications cover conductors, cotton separators, rubber insulation, varnished cambric tape, braids, armor, tinning test, physical tests, miscellaneous tests and oil tests for braids as applied to high and low tension cables, and cables used for starting and lighting systems. The recommendations include tables giving armor thickness and width, number and nominal size of wires in stranded cable, thickness of insulation, carrying capacity, outside dimensions, etc. The report contains also a proposed revision of electrical equipment nomenclature.

Report of the Engine Division

The Engine Division recommends certain changes in the thickness of certain sizes of cast iron carbureter flanges used in stationary engines. The division also recommends that the following dimensions be added to the disk clutch flywheel standards:

Crankshaft flange counterbore: minimum diameter, 1¾ in.; minimum depth, 1/16 in.

Flywheel web thickness of counterbore, ⅝ in.

Clutch counterbore in flywheel: diameter limits, 11.500 and 11.503 in.; depth, 3/16 in.; corner radius, 1/32 in.

Report on Rating of Storage Batteries for Farm Lighting

The Isolated Electric Lighting Plant Division has, because of dissatisfaction with the standard rating for storage batteries adopted two years ago, prepared the revised rating standard printed below and recommends that it supersede the present standard:

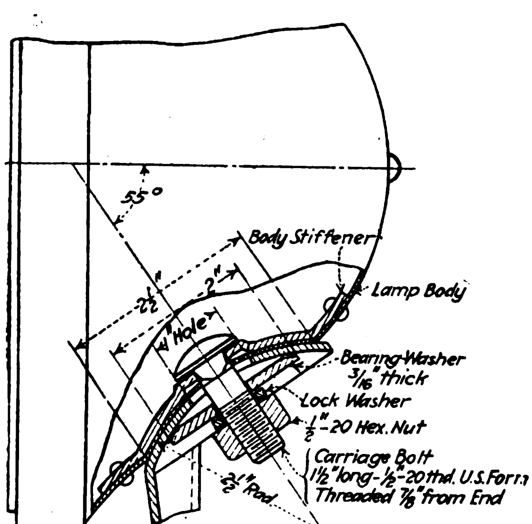
Storage batteries for farm light and power purposes shall be rated in terms of the number of hours discharge capacity at a constant rate corresponding to 300 watts, or fifteen 20-watt lamps.

In determining isolated electric light and power plant battery ratings, manufacturers shall consider:

1. The normal range of specific gravity which is recommended for the battery in service shall be used during the test.
2. The battery rating shall be established at an initial temperature of cells not to exceed 80 deg. Fahr.
3. The watts for rating lead batteries shall be based on a normal voltage of 2 volts per cell. The final voltage on continuous discharge shall not be less than 1.75 volts per cell.
4. The battery to be tested shall not be charged more than 120 per cent (in ampere-hours) of the last previous discharge.
5. The resulting test shall indicate the number of hours of service a lead-acid battery will give when discharged at a constant rate corresponding to 300 watts.
6. At 200 watts, 32 volts, the constant discharge rate shall be 6.25 amps.

Headlamp Brackets

The Headlamp Bracket Subdivision of the Lighting Division has, in cooperation with the lamp manufacturers, developed a universal fender type headlamp bracket which has been tested and found satisfactory in actual practice. This bracket has a spherical mounting surface for the lamp body, the radius of curvature of the surface being 2½ in. The lamp is held to the mounting surface by a single carriage bolt. The advantages of the proposed construction are twofold: the bracket permits universal adjustment of the lamp as well as interchangeability of lamps. The proposed bracket is shown in the cut herewith.



Proposed parabolic headlamp bracket.

Standard nomenclature for various types of lamps is also recommended in the report, while a revision of the present S. A. E. standard for lamp bases, sockets and connectors is proposed.

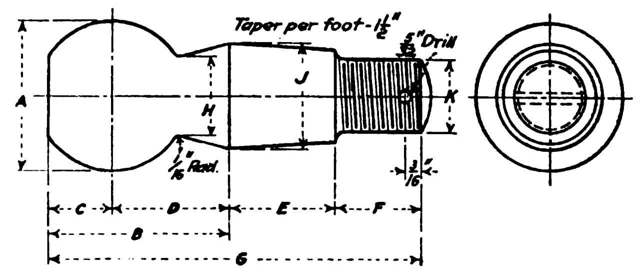
Miscellaneous Parts and Fittings

The Parts and Fittings Division recommends for adoption as S. A. E. recommended practice that

> The outside diameters of exhaust pipes extending from the engine to the muffler shall conform to the following inch sizes: 1, 1¼, 1½, 1¾, 2, 2¼, 2½, 2¾, 3, 3¼, 3½ and 4.

This recommendation was formulated in order to reduce the large number of exhaust pipe diameters used in present practice and make it unnecessary for the muffler and exhaust heater manufacturers to provide for an unnecessarily large number of sizes. Such a standard will be appreciated by the tubing mills and will facilitate deliveries and stocking. The recommendation is intended to apply to future production and is based on a survey of present practice which indicated that the 1⅝, 1¾, 2, 2¼, 2½, 2⅝ and 3-in. pipe sizes were most generally used.

The majority of steering gear connecting rods used are made with separate ball studs as this permits more satisfactory heat treatment. These studs are now made to many designs, differing but slightly in detail, but are much more expensive than standardized studs would be. The following table of proposed standard dimensions is therefore recommended:



No.	A	B	C	D	E	F	G	H	J	K
1	1	1⅜	7/16	15/16	13/16	13/16	3	⅝	0.766	⅝-18
2	1⅛	1½	½	1	13/16	13/16	3⅛	⅝	0.766	⅝-18
3	1¼	1 11/16	9/16	1⅛	1	13/16	3½	¾	0.875	⅝-18
4	1½	1⅞	⅝	1¼	1⅛	⅞	3⅞	11/16	1.000	¾-16
5	1¾	2⅛	¾	1⅜	1¼	1	4⅜	15/16	1.250	⅞-14

Proposed standard dimensions for ball studs.

It is recommended that the present S. A. E. standard for square shaft fittings be revised so that the shaft end and nut dimensions conform to the shaft end and nut dimensions of the present S. A. E. standard for taper fittings with plain and slotted nuts.

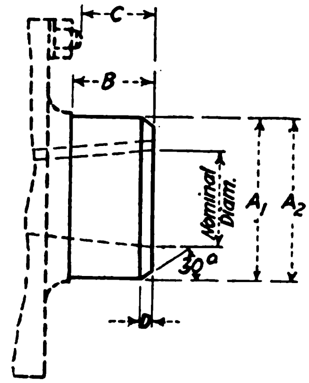
Universal Joint Hubs

In order to obtain better interchangeability between universal joints and transmissions, the Parts and Fittings Division recommends the adoption as S. A. E. Recommended Practice of the universal joint hub dimensions given in the accompanying table. The dimensions specified are of importance to the transmission manufacturers by eliminating many present variations in these parts, and to the transmission purchasers by making available transmissions having standardized shaft-ends.

The original recommendation of the Division, which was circularized among the universal-joint transmission, passenger car and motor truck manufacturers, specified dimensions for the outside diameters of the universal joint companion flange in order to permit the transmission designer to lay out the gearshift rods so that they would clear the companion flange. Criticisms received, however, indicate that the large number of different types and sizes of companion flanges would not permit specifying outside diameters without affecting individual design.

Stationary Engine Belt Speeds

The Stationary Engine Division recommends the adoption of the following belt speeds for stationary engines



<table>
<tr><th rowspan="3">Nominal Diam.</th><th colspan="4">Hub Diameter</th><th rowspan="3">Minimum Finished Length (B)</th><th rowspan="3">C[2]</th><th rowspan="3">D</th></tr>
<tr><th colspan="2">Lathe Finish (A_1)</th><th colspan="2">Ground Finish[1] (A_2)</th></tr>
<tr><th>Max.</th><th>Min.</th><th>Max.</th><th>Min.</th></tr>
<tr><td>3/4</td><td>1.280</td><td>1.270</td><td>1.253</td><td>1.250</td><td>5/8</td><td>9/16</td><td>1/32</td></tr>
<tr><td>7/8</td><td>1.530</td><td>1.520</td><td>1.503</td><td>1.500</td><td>3/4</td><td>5/8</td><td>3/64</td></tr>
<tr><td>1</td><td>1.780</td><td>1.770</td><td>1.753</td><td>1.750</td><td>3/4</td><td>3/4</td><td>1/16</td></tr>
<tr><td>1 1/8</td><td>2.030</td><td>2.020</td><td>2.003</td><td>2.000</td><td>7/8</td><td>3/4</td><td>1/16</td></tr>
<tr><td>1 1/4</td><td>2.155</td><td>2.145</td><td>2.128</td><td>2.125</td><td>7/8</td><td>3/4</td><td>1/16</td></tr>
<tr><td>1 3/8</td><td>2.280</td><td>2.270</td><td>2.253</td><td>2.250</td><td>1</td><td>3/4</td><td>3/32</td></tr>
<tr><td>1 1/2</td><td>2.530</td><td>2.520</td><td>2.503</td><td>2.500</td><td>1</td><td>3/4</td><td>3/32</td></tr>
<tr><td>1 3/4</td><td>3.030</td><td>3.020</td><td>3.003</td><td>3.000</td><td>1 1/4</td><td>15/16</td><td>1/8</td></tr>
<tr><td>2</td><td>3.280</td><td>3.270</td><td>3.253</td><td>3.250</td><td>1 1/2</td><td>1 1/16</td><td>1/8</td></tr>
</table>

All dimensions in inches.

[1]When specified the maximum eccentricity of the ground surface with respect to the hole shall be 0.002 in. (indicator reading 0.004 in.)

[2]The transmission design should provide clearance for the least distance from the end of the hub to the end of the flange bolt.

All fittings shall be S. A. E. Standard taper or spline fittings. The nominal diameter applies in either case.

Recommended universal-joint hub dimensions.

used for driving farm power equipment, such as ensilage cutters, milking machines and circular saws.

STATIONARY ENGINE BELT SPEEDS

Nominal Engine Rating, Hp.	Belt Speed, Ft. Per Min.	Nominal Engine Rating, Hp.	Belt Speed, Ft. Per Min.
1½	550	7	1340
1¾	600	8	1420
2	680	9	1500
2½	800	10	1575
3	900	12	1700
4	1030	14	1810
5	1150	15	1860
6	1250	16	1910

Stationary Engine Rating

The Stationary Engine Division recommends that the following horse-power formula be adopted as general information for publication in the S. A. E. Handbook as a means of securing uniform practice in rating stationary engines:

$$\text{Nominal Engine Horsepower} = \frac{0.7854\,D^2\,L\,R\,N}{13{,}000} \quad \text{where}$$

D equals the piston diameter in inches
L equals the stroke in inches
R equals the revolutions per minute of the crankshaft
N equals the number of cylinders.

The formula is based on a piston displacement of 13,000 cu. in. per min. per hp., as this is considered a very fair average factor for stationary and tractor engines burning either kerosene or gasoline. Various mechanical arrangements and refinements will, of course, influence the actual results on any one engine.

The results obtained using this formula are almost exactly 80 per cent of the brake horsepower under average good conditions and provide the desired 20 to 25 per cent of reserve power.

The Stationary Engine Division recommends as S. A. E. Recommended practice the adoption of the crankshaft and crankpin diameters given in the accompanying table.

CRANKSHAFT AND CRANKPIN DIAMETERS FOR STATIONARY ENGINES

Cylinder Bore	Crankshaft and Crankpin Diameter	Cylinder Bore	Crankshaft and Crankpin Diameter
3	1⅛	5½	2⅛
3¼	1¼	6	2¼
3½	1¼	6½	2⅜
3¾	1⅜	7	2½
4	1½	7½	2¾
4¼	1⅝	8	3
4½	1¾	8½	3¼
4¾	1⅞	9	3½
5	2	9½	3¾
...	...	10	4

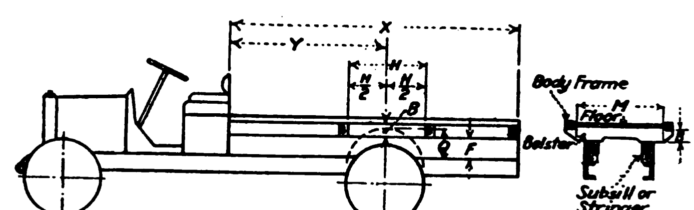
All dimensions in inches.

Other recommendations of the division include a set of dimensions for lubricator cups of various sizes and a table of water pot or hopper capacities for engines of various rated powers.

Motor Truck Bodies and Front Axle Hubs

The subject of motor truck body installation dimensions was first proposed to the Society about two years ago and assigned to the Truck Division. The original plan was to develop a standard which would include dimensions for the mounting of bodies on trucks and also frame widths, distance between spring centers, wheel treads and turning radii. A Subdivision was appointed which obtained considerable data on the practice at that time.

The original program has been reduced so that this proposal includes only dimensions for the stringers, bolsters, distance from the back of the seat to the center



F (Subsill) = (*Q* + Chain Clearance) — *B*

Nominal Capacity, Tons	Body Bolster (B)	Length Back of Seat to End of Frame (X)	Length Back of Seat to Center-Line of Rear Axle (Y)	H[1]	Dimension of Bolsters (M)
¾ to 1	5	108	60	32	36
1¼ to 1½	5	120	72	36	38
2 to 2½	5	132 156	81 98	36	38
3 to 4	5	144 192	90 114	36	42
5 to 6	5	144 192	90 114	36	42

[1] Dimension H permits a variation of plus or minus 2½ in. of the rear axle from the normal position.

Q is measured from the top of the chassis to the top of the tires when the springs are deflected to the "metal to metal" position.

Recommended dimensions for truck body installation.

of the rear axle, and the distance from the back of the seat to the rear end of the frame. The dimensions were quite generally approved as being suitable for the interchangeable mounting of truck bodies with the exception of special types such as large van bodies and special short dump bodies.

The proposal as now submitted by the Truck Division for adoption as S. A. E. recommended practice is shown in the accompanying drawing and table, and indicates the available space in which bodies may be mounted. The proposal also includes the nomenclature of the body mounting timbers, which at the present time are known by a variety of terms. It is believed that the proposal includes all the necessary dimensions for the installation of truck bodies by body manufacturers on trucks conforming closely to the dimensions given in the table, and that it will answer the requirements for such standardization which had been urged through the technical press for some time.

Readers of AUTOMOTIVE INDUSTRIES will recall that the report of the Truck Division on proposed hub standards submitted at the annual meeting of the Society last January, was referred back to the committee and later considered at a meeting held in Detroit on March 3. Other meetings of interested manufacturers were held later and the whole matter finally considered by the Truck Division meeting held recently in New York at which representatives of truck, axle, bearing and wheel makers were present. The whole proposal as presented to the Truck Division included two series of spindle sizes with their related parts in considerable detail. After thorough discussion of this proposal, it was deemed best to limit the proposed standard to only such dimensions as are essential for the interchangeability of bearings and wheels on the proposed series of spindles.

The Truck Division therefore recommends for adoption as S. A. E. recommended practice, the dimensions shown in the accompanying drawing and tables for installation of inch size roller bearings and metric ball and roller bearings.

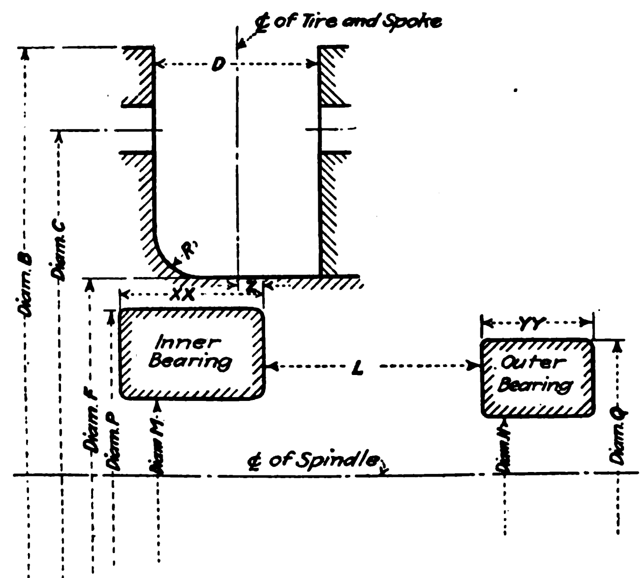


Diagram showing truck front axle hub dimensions referred to in accompanying tables.

TABLE I—DIMENSIONS FOR INCH SIZE TAPER ROLLER BEARING HUBS

Hub and Spindle Number	Letter	R5	R6	R7	R8	R9
Diameter of flange	B	9	9¾	10½	10¾	11¾
Flange fillet radius	R	½	½	¾	¾	¾
Diameter of bolt circle	C	7¼	8	8¾	9¼	10¼
Number of flange bolts		12	12	12	12	12
Diameter of flange bolts		½	½	½	⅝	⅝
Spoke thickness between flanges	D	1¾	2	2¼	2½	2¾
Hub diameter for wheel bore	F	4.125 4.128	4.625 4.628	5.125 5.129	5.563 5.567	5.938 5.943
Inner edge of inner bearing to centerline of spoke	Z	¼	0	7/16	7/16	11/16
Inner bearing shoulder to outer bearing shoulder	L	2 9/32	2 29/32	2⅝	3 15/32	3 15/32
Spindle diameter at inner bearing	K	1.7495 1.7485	1.9995 1.9985	2.1245 2.1235	2.4995 2.4985	2.5620 2.5610
Spindle diameter at outer bearing	N	1.187 1.186	1.4995 1.4985	1.7495 1.7485	1.9995 1.9985	1.9995 1.9985
Hub bore for inner bearing	P	3.482 3.481	3.981 3.979	4.372 4.370	4.731 4.729	5.184 5.182
Hub bore for outer bearing	Q	2.857 2.856	3.154 3.153	3.482 3.481	3.981 3.979	3.981 3.979
Overall length of inner bearing	XX	1.5000	1.5000	1.5000	1.7500	2.1250
Overall length of outer bearing only	YY	1.1875	1.1563	1.5000	1.5000	1.5000

TABLE II—DIMENSIONS FOR BALL BEARING OR METRIC ROLLER BEARING HUBS

Hub and Spindle Number	Letter	B5	B6	B7	B8	B9
Diameter of flange	B	9	9¾	10½	11¼	12¼
Flange fillet radius	R	½	½	¾	¾	¾
Diameter of bolt circle	C	7¼	8	8¾	9¼	10¼
Number of flange bolts		12	12	12	12	12
Diameter of flange bolts		½	½	½	⅝	⅝
Spoke thickness between flanges	D	1¾	2	2¼	2½	2¾
Hub diameter for wheel bore	F	4.625 4.628	5.000 5.003	5.563 5.567	5.938 5.943	6.375 6.380
Inner edge of inner bearing to centerline of spoke	Z	5/16	¼	⅞	13/16	⅞
Inner bearing shoulder to outer bearing shoulder	L	2 3/16	2⅝	2¼	2 31/32	2⅞
Length of ball bearing spacer	a	2 33/64	2 29/32	2 53/64	3 19/32	3 41/64
Spindle diameter at inner bearing	M	1.7703 1.7689	1.9671 1.9657	2.1640 2.1626	2.3608 2.3594	2.5577 2.5563
Spindle diameter at outer bearing	N	1.3766 1.3752	1.5734 1.5720	1.7703 1.7689	1.9671 1.9657	2.1640 2.1626
Hub bore for inner bearing	P	3.9362 3.9340	4.3299 4.3277	4.7236 4.7214	5.1173 5.1141	5.5110 5.5078
Hub bore for outer bearing	Q	3.1488 3.1466	3.5425 3.5403	3.9362 3.9340	4.3299 4.3277	4.7236 4.7214
Overall length of inner bearing	XX	1 9/16	1¾	1 15/16	2⅛	2 5/16
Overall length of outer roller bearing only[1]	YY	1⅜	1 7/16	1 9/16	1¾	1 15/16

[1] When the outer hub bearing is a ball bearing, the space required for it is $(L + YY) - a$.

With approval of this report by the Standards Committee, it is proposed to continue this work to include a series of similar hub dimensions for passenger car front axle hubs and also if feasible, for a complete line of rear axle hubs for passenger cars and motor trucks.

Chairmen for S. A. E. Summer Meeting Sessions

THE following men are expected to serve as chairmen at the various sessions of the Summer Meeting of the Society of Automotive Engineers, to be held at West Baden, Ind., May 24 to 28: Standards Committee Meeting, afternoon, May 24, B. B. Bachman; Business Session, evening, May 24, President David Beecroft; Aeronautic Session, morning, May 25, Howard E. Coffin; Transportation Session, morning, May 25, H. W. Alden; General Research Session, morning, May 26, H. M. Crane; Combustion Session, morning, May 27, Thomas Midgley, Jr.; Fuel Research Session, morning, May 28, O. C. Berry.

Judges' Report on the 1920 British Tractor Trials

Much delayed notation of decision of event held at Lincoln six months ago is disappointing in that it does not state definitely individual results.

MORE than six months after the event, the judges' report concerning the tractor trials held near Lincoln, England, last September has been issued by the Royal Agricultural Society. It is a disappointing form of report for those makers whose machines did well, for beyond descriptive references and tabulated specifications it does not refer individually to the competing machines—except to mention again the "awards" that were made in the various classes a week or so after the trials.

The actual performances of the competing tractors are set out in one of the tables, but these are merely grouped in the various classes, with minimum, maximum and the average of the five best given under the different headings. The portion of this table dealing with internal combustion engined tractors and self-contained plows is given herewith; from this it will be gathered that, taking the average of each class in cost of fuel and labor per acre, the four-furrow outfits did not show up well compared with those with two and three furrow plows, while there is not much to choose between the two last mentioned and the self-contained three-furrow units.

Explanatory of this table it may be said that where two lines of figures are bracketed in respect of fuel, the second line represents what is termed the cost or consumption per "equivalent" acre, the latter basis being arrived at by reducing the drawbar pull to a standard of 500 lb. per furrow. Actually the drawbar pull varied from 335 lb. to 565 lb. per share in the light land; in the heavy land the maximum was 1250 lb. per furrow. An acre of the latter in the second set of figures would therefore be calculated as 2½ "equivalent" acres.

In the working out of costs kerosene is taken at the price paid at Lincoln, viz., 46 cents per Imperial gallon and gasoline at 82 cents (at normal rate of exchange). Labor is taken at 36 cents per hour.

The judges in their summary refer with approval to the fact that out of thirty-eight competing machines, two only retired during the trials. They also say that the uniformity of excellence greatly increased the difficulties of judging and that it would have required extreme uniformity (which was lacking) in the general conditions to have warranted arranging the machines in order of merit under the various headings—work done, amount and cost of fuel consumed, drawbar pull, mechanical design, etc. And yet they say that they had no difficulty in selecting the prize winner in each class.

As an appendix to their report, the judges publish two estimates of plowing costs, one from a man who farms in the district in which the trials were held and who gives the cost of horse plowing, and another from a farmer who gives both tractor and horse plowing costs from his own experience. The former's figures enable a comparison to be made between the average of the competing tractors.

The Lincoln farmer referred to gives the average cost of plowing 6 in. deep in the trials district with horses in 1920 as follows:

Light land ....$5.60 per acre
Heavy land ....$10 to $11 per acre

The other farmer's estimated costs are:

Tractor Plowing Per Acre

Wear and tear of tractor	$2.50
Kerosene, 4 gal. at 46 cents	1.84
Lubricating oil	0.36
Labor—one man at $17.50 per week; weekly average, 15 acres; cost per acre	1.12
Plow, shares, etc	0.60
Cost per acre	$6.42

Horse Plowing Per Day

Three horses at $2 per day	$6.00
One man and one boy, per day	3.60
Plow, shares, etc., per day	0.48
Estimated daily work, five-sixths of an acre	10.08
Cost per acre	$12.10

Class	Land	No. of Furrows (All 6x10 in.)	No. of Attendants	Time in Hours Per Acre: Minimum	Time: Average of Five Lowest	Time: Maximum	Fuel in Imp. Gallons Per Acre: Minimum	Fuel: Average of Five Lowest	Fuel: Maximum	Wages, in Cents, Per Acre: Minimum	Wages: Average of Five Lowest	Wages: Maximum	Fuel Cost, in Cents, Per Acre: Minimum	Fuel Cost: Average of Five Lowest	Fuel Cost: Maximum	Total Cost, Labor and Fuel, in Cents, Per Acre: Minimum	Total Cost: Aver. of Whole Class
1 Tractors up to 24 hp.	Light	2	1	1.58	1.92	2.33	2.63 2.82	2.90 3.34	5.41 7.21	57.0	69.0	88.0	121.0 129.8	133.4 153.8	248.8 331.6	178	226
1	Heavy	2	1	1.75	1.96	2.61	3.42 2.31	3.84 2.95	5.51 3.83	63.0	70.6	94.0	157.2 106.2	176.8 136.0	253.4 176.2	220	262
							2.06	2.96	4.12				94.8	136.0	189.6		
2 Tractors up to 30 hp.	Light	3	1	1.09	1.21	1.99	2.96	3.63	6.51	39.2	43.6	71.6	136.2	167.0	299.4	134	200
2	Heavy	3	1	1.30	1.52	4.00	1.78	2.05	5.34	46.8	54.8	144.0	80.8	94.0	245.6	183	280
3 Tractors up to 30 hp.	Light	4	1	1.21	...	1.60	2.62	...	3.06	43.6	...	57.6	120.4	....	250.8	164	216
3	Heavy	4	1	2.01	...	...	7.12	...	...	72.4	...	...	327.6	....	....	400	400
7 Self-contained plows	Light	3	1	1.46	1.89	2.42	2.21	2.84	4.48	53.6	67.8	87.0	100.6	130.6	206.0	154	223
7	Heavy	3	1	1.30	2.08	3.22	2.27	3.78	6.21	46.8	74.8	116.0	104.4	173.8	285.6	151	316

NOTE.—The figures for minimum time and minimum fuel consumption per acre do not necessarily apply to the same tractor. The same is the case for the maxima.

Features of Mechanical Interrupters for Ignition Systems

Part I

An article pointing out the nature of the functions performed by an interrupter, in relation to other parts of the ignition system, and discussing the fundamental requirements of a well designed interrupter.

By Harry F. Geist

IT is very evident from the amount of attention that has been given to the development and design of the mechanical interrupter that it is a very important element of an ignition system.

It is the purpose of this article to point out the necessary functions that the interrupter has to perform in the operation of the ignition system and to discuss the fundamental considerations that must be borne in mind in the development of a good interrupter and of its connection with the rest of the ignition system.

In the design of such a mechanism as an interrupter, success must be based upon a sound principle and is attained by the proper proportioning of parts, by the proper selection and quality of materials and perhaps most important of all, by the workmanship represented in the quantity production of the mechanism. Because of the fact that the successful operation of the interrupter depends upon so many considerations, criticism of any of the designs shown would be out of place and is not intended. The service that any particular interrupter is giving will speak for itself better than any other form of analysis possibly could.

Evolution of High Tension Ignition Systems

The first electrical high tension ignition systems consisted of a vibrating induction coil that was energized intermittently by a battery of cells. In these induction coils the interrupter consisted of a magnetically operated trembler, constructed integral with the coil and operated by the magnetic action of the coil core, so that the timing of the system depended upon an extra mechanism known as a "timer" that was geared in timed relation to the engine. With such a system every time the timer would complete the circuit between the battery and the primary coil, a shower of sparks would be delivered to the spark plug at a frequency dependent upon the adjustment of the trembler and covering the complete period of closed circuit at the timer.

For multi-cylinder installations, the system required as many induction coils and timer contacts as there were cylinders, so that the timer served also as a distributer in the primary circuit of the system.

The first simplification of this system came in the form of a master vibrator which consisted of one trembler interrupter that was operated electro-magnetically by means separate from the coils and produced the sparks in turn in the particular coil with which the timer connected it.

At this same time the alternating current low tension magneto was coming into use. It was connected to a suitable step-up coil for energy transformation and was equipped with a mechanical interrupter in the primary circuit and a distributer for the high tension circuit. Both the interrupter and the distributer were constructed integral with the magneto, and were thus timed to the engine. The interrupter in such a system not only served its functions as a circuit breaker but took the place also of the timer. It is this same type of mechanical interrupter that to-day serves to break the primary circuit for spark production and to time the spark to the engine as well.

From this type of magneto and step-up coil system it was natural for the self-contained high tension magneto to follow, thus eliminating the separate step-up coil, but maintaining the same form of mechanical interrupter and high tension distributer.

The success obtained by the use of the mechanical interrupter and its single spark delivery, in the case of magneto systems, made its adoption the logical step in what is now the modern interrupter-distributor battery and coil type of ignition system. So that in the modern high tension ignition system, the mechanical interrupter serves both as circuit interrupter and as timer in both the magneto and the battery and coil systems.

The matter of its serving as a timer to the system is due to the fact that the interrupter is always geared in timed relation to the engine, and since its actuation is always affected by the rotation of the armature in the case of magnetos it is always in timed relation to the electrical firing range of the magneto.

In the case of so-called "variable ignition" the interrupter may be adjusted to actuate at any time desired on the firing range, while for "fixed ignition" the interrupter is always operated at the same piston position.

The principal functions performed by the mechanical interrupter are those affecting the electrical operation of the ignition system when the interrupter "makes" and "breaks" the primary circuit, but before attempting to study these functions, let us first consider a typical interrupter and its mechanical and electrical connections to a high tension magneto.

Interrupter Connections With Magneto

Fig. 1 shows a typical magneto interrupter and its connection with the rest of the machine. The breaker plate carries an insulated plate in which the insulated contact carrying screw is adjustably fitted.

Pivoted upon the breaker plate is also a lever arm

having two projecting ends. At one end of this arm the grounded contact is carried, and a spring, secured at one of its ends to the lever arm and at the other end to the breaker plate, tends normally to hold the two contacts together. These contacts are usually of a platinum-iridium alloy. At the other projecting lever end, a fibre bumper block is inserted for co-action with the cams, so that the rotation of the breaker plate produces an opening of the contacts every time the bumper block engages a cam.

The lever arm pivot fits into a fibre bushed bearing so that oil will not be necessary for lubrication. It is very important that the lever arm works easily on its pivot, without being loose, and it is especially important that it shall never stick. A retaining spring (not shown in Fig. 1 but shown in Fig. 9) is adapted to hold the lever arm in place upon the breaker plate. The lever arm spring is also backed up by buffer springs at each of its ends to relieve the strains that would otherwise cause fatigue.

The breaker plate is further equipped with a tapered concentric boss and key that fits into a female taper in the end of the armature shaft, and the entire mechanism is securely held in place by an insulated connecting screw that completes an electrical connection between the insulated breaker plate and the condenser plate, so that the connecting screw serves the double purpose of mechanically securing the interrupter to the armature

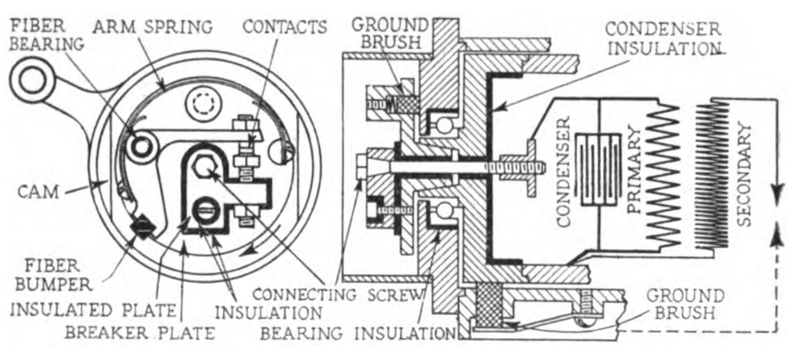


Fig. 1—Typical mechanical interrupter and its connections with magneto

and of electrically connecting the interrupter with the condenser.

A further electrical connection between the insulated primary winding terminal and the condenser plate ties the primary winding to the insulated breaker plate also.

The other side of the condenser and the other terminal of the primary winding are grounded to the armature core and thus are electrically connected to the breaker plate through the taper fit between the breaker plate and the armature shaft. From this arrangement it is very evident that when the interrupter contacts are together both the primary winding and the condenser are short circuited through the lever arm spring, the lever arm, the contacts and the connecting screw.

This short circuit allows the primary winding to generate and store energy with the rotation of the armature and keeps the condenser "empty" during the period of short circuit.

The cams which make possible the interruption of the circuit at the contact points, are mounted in a housing that is carried concentrically upon a flange projection of the armature bearing plate, and the housing is so adapted that it may be rocked on this dowel flange by means of a lever. With this adjustable breaker housing carrying the cams, it is evident that the time of circuit interruption can be changed to different armature positions and due to the fact that the armature is geared in timed relation to the engine, the resulting spark can be adjusted to occur at different piston positions.

For the "H" armature type magneto, represented in the figure there are two cams; one for the positive spark and the other for the negative spark, and they are so located that for the "advanced" engine firing position the circuit will be interrupted just following the magnetic break between the trailing armature core tip and the field pole shoe tip it is leaving, while for the "retarded" engine firing position the interruption can be adjusted to occur as much as 30 deg. of armature motion later. A stop pin usually limits the motion of the interrupter housing to the firing range of the magneto.

The interrupter housing is held in its place upon the armature bearing plate flange by a post and spring means clamping against a cover over the end of the interrupter housing.

As further features of interest, not essential to the interrupter, but to the high tension system as a whole, a grounding brush and spring makes a direct electrical connection between the magneto frame and the rotating armature so as to prevent the high tension spark current from passing through the bearings every time a spark is delivered by the secondary circuit. In addition to this precaution, the annular bearings sometimes have their races insulated from the bearing plates by the use of fiber.

A second grounding brush is mounted in the interrupter plate to engage with the armature bearing plate of the frame. This brush serves as an auxiliary to the above-mentioned grounding brush and serves especially for installations in which a switch is employed to short circuit the interrupter for cutting off the ignition.

Interruption of Primary Circuit

The most important electrical function performed by the interrupter is to break the primary short circuit at a time when the energy generated and stored in the primary winding is such that a high tension spark will be produced in the secondary circuit. In order to make this break of the electrical circuit as effective as possible, the separation that takes place between the contacts must be produced in a quick and decided manner, so that after the contacts have once separated, all the subsequent electrical action in the primary circuit will take place between the primary winding and the condenser.

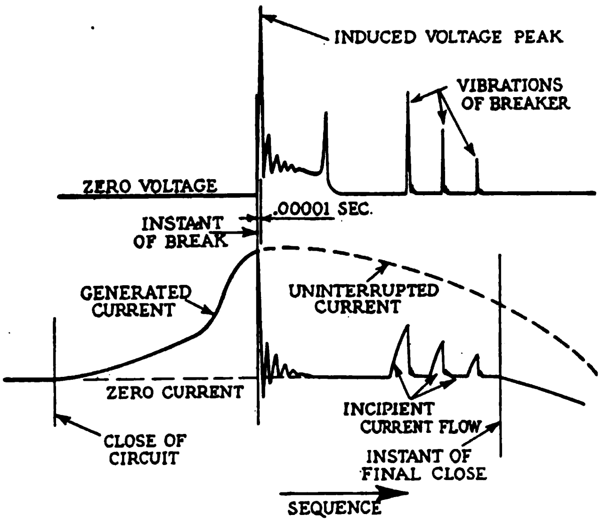
To accomplish this feat, the pivoted arm type of interrupter shown in Fig. 1 has been developed to a high degree of perfection, it being maintained that the rigidity of the arm assures that the contacts will positively and quickly separate when the fiber bumper engages with the cams.

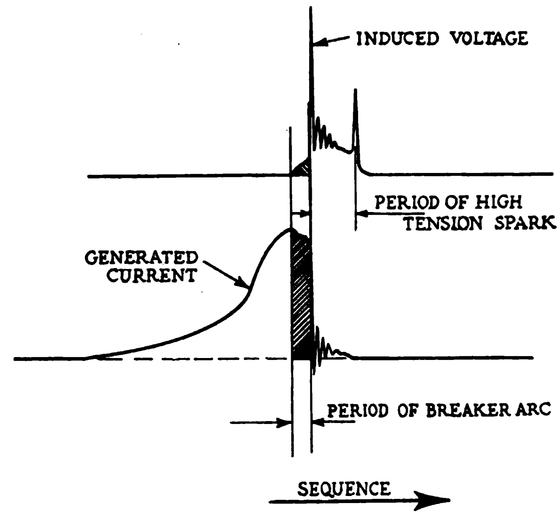
Fig. 2 is presented to show graphically the electrical phenomena of the energized primary circuit coincident to an interruption.

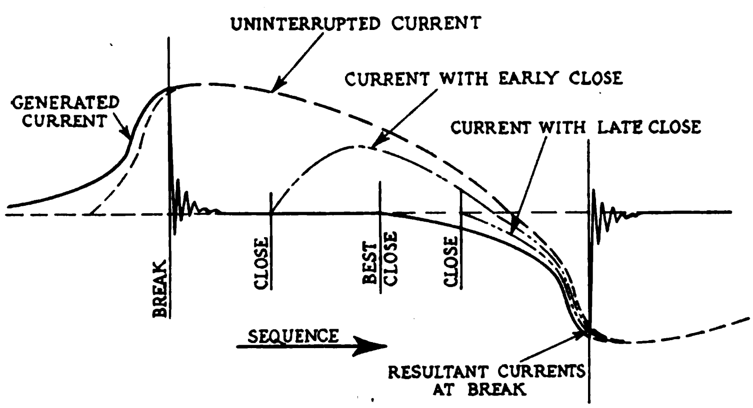
The lower curve, starting at the left, shows how the current is generated during a period of short circuit until it reaches about its maximum value at the instant of break. The upper curve shows that the voltage across the contacts during this period is zero.

If the interruption did not take place the current would flow as per the dotted line designated "uninterrupted current" and the voltage would, of course, remain zero.

But at the instant of break, two simultaneous results follow, first the current generation ceases and must drop toward zero, and second, the empty condenser which is







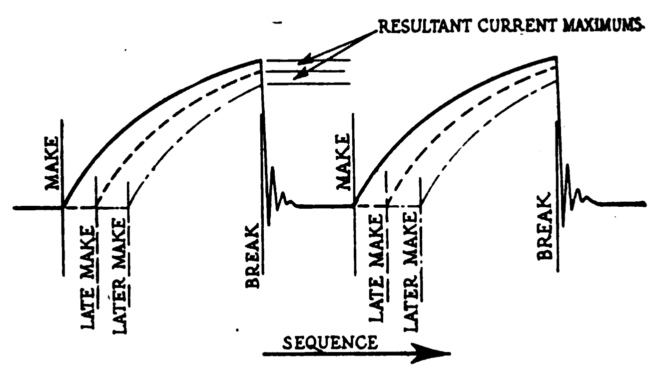


Fig. 2 (Upper)—Electrical phenomena accompanying break of primary circuit, including effect of vibrations
Fig. 4 (Lower)—Illustrating effect of time of make upon current values. (Magneto system)

Fig. 3 (Upper)—Phenomena typical of arcing at contacts
Fig. 5 (Lower)—Effect of interrupter closing on primary current. (Battery system)

suddenly thrown into the circuit across the primary winding will start to absorb a charge of energy from the primary winding.

The combination of these two results is that the current generation in the primary suddenly ceases and the primary energy tending to enter the condenser causes the primary winding current to drop toward zero precipitously, inducing a very high voltage per turn in both the primary and secondary windings. This induced voltage is shown in Fig. 2.

It is this voltage that initiates the spark at the secondary circuit spark plug and permits the secondary winding to discharge most of the energy in the form of a high tension spark.

The balance of the energy will oscillate electrically between the primary winding and the condenser until it is dissipated in primary circuit losses.

The effect desired in a quick break of the circuit is that the current shall drop toward zero and the voltage induced rise toward its maximum value as quickly and as directly as possible, so as to keep the period of time designated in Fig. 2 by ".00001 second" as small as possible.

While this period of time under perfect conditions is controlled by the balance of the electrical circuits and not by the interrupter, certain faulty conditions such as arcing at the contacts or a hesitating interruption of the circuit can affect this period of time very materially. These conditions will be discussed subsequently.

At the instant that the contacts first separate, the condenser will start to take on a charge of energy at a very high rate and the current flow into the condenser will therefore be very high, perhaps ten times or more the maximum winding current generated. The result is that this current will tend to take all the paths possible in getting to the condenser. These paths include the interrupter lever and its spring, which are intended to be its only path from the interrupter lever grounded contact to the breaker plate, and it is partly to prevent the rush of condenser charging current on the grounded side from flowing through the lever arm pivot and the cams, that the fiber bushing and the fiber bumper block are mounted in the interrupter. Fiber is also used at these places because of the excellent mechanical results obtained by a bearing between fiber and steel.

In some of the earliest types of magnetos, the practice was started of having a copper strip along with the interrupter arm spring to aid in taking care of this condenser charging current on the grounded side, but while this idea seemed to have considerable theoretical value, it was found by experience to be unnecessary.

Arcing at Interrupter Contacts

Following the interruption of the primary circuit, one of the most undesirable things that can happen is to have arcing at the interrupter contacts.

This arcing burns away the platinum contacts very rapidly when it is excessive, or it will also produce a coating such as an oxide on the contacts that will soon impair very much the operation of the system.

Some makers of magnetos advertise that a little arcing at the contacts is necessary to keep the contacts clean, but the writer believes the value of arcing in that direction rather questionable.

One of the principal functions of the condenser in a high tension ignition system is to prevent arcing by

handling all the energy that is not transferred to the secondary circuit, but even at best occasional arcing will occur. Continual arcing at the interrupter contacts is usually an indication of poorly balanced circuits or of a poor connection in the primary circuit.

Beside the evil effect of arcing upon the platinum contacts, this arcing when excessive also reduces the amount of energy that will be delivered to the high tension spark. This point is illustrated by Fig. 3.

Fig. 3 shows how the total period of sparking is divided between a period of breaker arc and a period of high tension spark, and shows that the high tension spark cannot begin to take place until after the primary circuit arc has ceased. Therefore if a large part of the energy available for a spark is spent in the breaker arc it must be very evident that the energy left for the high tension spark will be reduced that much. If you have ever watched a high tension magneto, on test, that would arc rather badly at times, you have perhaps noticed that the accompanying high tension spark was very poor. It is to explain this phenomena that Fig. 3 is presented. In Fig. 3 the shaded areas on the current and the induced voltage curves are components of the energy spent in the arc.

In addition to the evil effect of arcing upon the platinum contacts and the corresponding reduction of the high tension spark, arcing has still another detrimental effect upon the operation of the system. It seems that the amount of voltage that will be induced in the windings following the interruption of the primary circuit depends largely upon the amount of current flow in the primary winding just before break, that is the further the current has to drop toward zero following break the greater the induced voltage will be. During arcing, as shown by Fig. 3, there is a gradual fall of current so that when the condenser does get started, the resulting induced voltage peak will not be as great as it would had no arcing taken place.

When, as in some installations, the ignition system has all it can do under the best of conditions, it is very evident that arcing at the interrupter might cause the ignition to fail. The effect of arcing upon the voltage induced has a pronounced influence upon the slow speed performance of a magneto and in general it will be found that a magneto that arcs badly will not function at as slow a speed as it otherwise would.

Closing of Interrupter Contacts

While the breaking of the primary circuit is the important function performed by an interrupter, the circuit must close again to be ready for the next successive break, so that this closing or "making" of the short circuit is also important and has an important bearing upon the performance of the ignition system, whether magneto or battery system, especially at the higher speeds of operation.

To explain the importance of the phenomena of making the circuit, Fig. 4 is presented to illustrate what takes place in the case of magnetos.

In this figure the "uninterrupted" current and the "interrupted" current waves are superimposed in about their true relationship to each other.

The time of break of an interrupter is determined definitely by the position of the cams, but in most interrupters the time of "make" depends upon the relation of the reactionary forces of the lever arm to the arm spring force.

As the armature rotates and the interrupter lever arm is actuated by engagement with the cams, the arm receives a certain amount of throw and due to the inertia that the arm is bound to have the spring is unable to bring the contacts to a close immediately on passing the cam. This throw increases as the speed of the armature rotation increases and the result is that the "make" of the circuit may occur 45, to 90 or more degrees of armature rotation following "break."

During the period of "open circuit" following the interruption of the primary circuit and the high tension spark delivery, there is bound to be some residual magnetic flux cutting across the windings, with the armature rotation, that will generate an electromotive force in the windings.

If the "make" occurs very early after break, when this e.m.f. is of some moment, current will again flow in the primary winding. If the spark just delivered was of positive polarity current then this current will also be of positive polarity and due to the inductance of the winding it will tend to linger in the circuit beyond the armature position of no flux change; namely, the horizontal armature position, just as the "uninterrupted" current is shown to do in Fig. 4. The result is that when the armature passes the horizontal position and starts to generate current of negative polarity, a certain amount of energy will be required to neutralize the lingering positive current before the useful negative energy can be stored in the primary winding ready for the next spark. Or if the make occurs very late, that is very far beyond the horizontal armature position, the current generated for the next successive spark will be late in getting started. In the event of either a very early or a very late make therefore, the result is that the current for the next successive spark will not reach as high a maximum value as it would if the make occurred at about the horizontal armature position. It is to illustrate this point particularly, in connection with early and late making of the circuit and the general effect upon the resulting current maximum that Fig. 4 is presented. The resultant current maximum of course has a direct bearing upon the amount of energy that will be delivered to the high tension spark.

It is practically impossible to control the position at which the interrupter contacts will "make" in the usual type of interrupter for the different speeds that the magneto is subject to, but it so happens that at the slower speeds the amount of "extra" energy that will be generated drops off along with the tendency of the contacts to close earlier, so that if the interrupter is designed for satisfactory closing of the circuit at the higher speeds desired it will tend to regulate itself automatically very well for the slower speeds.

In the case of battery and coil systems, the time of make is also an important consideration. The phenomena are illustrated in Fig. 5, where it is shown that for any particular frequency of interruptions, as measured by the period of time between breaks, the time required for the contacts to close following break has a material influence upon the maximum value that the current will attain during the period of closed circuit for any particular coil.

It must be borne in mind that the rate of energization of a coil depends upon the electrical circuit characteristics and is always practically of a constant nature, while in a magneto the rate of energization tends to increase with increased armature speeds within certain limits.

In the case of the battery system, it must be evident that as the frequency of interruptions increases with engine speed, the period between breaks grows shorter and at the same time the tendency is for the make to occur later and later after break as the interrupter speed increases, with the result that the period of closed circuit gradually shortens at both ends and the high ten-

sion spark energy must decrease with increased engine speed. For these reasons the battery and coil ignition system delivers its best spark at slow speeds and gradually falls off as the engine speeds up.

Vibration or Bouncing of Interrupter Arm

Another important consideration in connection with mechanical interrupters is that of vibration or bouncing of the lever arm in closing.

The usual interrupter closes its contacts under the influence of a spring and since the arm has inertia during its motion there will be a tendency for the contacts to rebound or vibrate before coming to a final close. This bouncing will produce a series of incipient current flow impulses each time the contacts come together, and a series of induced voltage peaks each time they bounce apart. Additional strain upon the secondary insulation results from these induced voltage peaks and the vibrations delay the time of final closing of the circuit.

The electrical phenomena, including both the current flow impulses and the induced voltage peaks, coincident to vibration of the interrupter lever arm are shown in the curves of Fig. 2.

The results of the official tests conducted by the National Advisory Committee for Aeronautics to determine the "Heat Energy of Various Ignition Systems" as set forth in Report No. 56 show that in all magneto ignition systems the spark heat increases with magneto speed up to a certain speed. Beyond this speed, the energy begins to drop off gradually with further speed increase and in some cases a second rise in the curves takes place for still higher speed. While no explanation of the depression in the spark out-put speed curve was given, the writer ventures the belief that this depression in the curves was caused by the vibration of the interrupter arm and its effect upon the closing of the contacts.

These vibrations will have a certain period in any particular case dependent upon the relation of the numerous forces at play on the arm during the action of the interrupter, and it is not unlikely that the speed at which the maximum depression occurred in the case cited was such that it brought the arm in tune for maximum vibration. Increase in speed beyond this point would reduce the vibration again and permit the magneto to build up an increased amount of energy with it.

While the forces at play upon an interrupter arm are numerous and the reduction of vibration in any particular interrupter is purely a matter of experiment, it is highly essential to the reduction of vibration that the interrupter arm have a good bearing fit upon its pivot as a loose fitting arm will be free to vibrate badly.

Welding of Contacts by Condenser

It was pointed out in connection with the closing of the interrupter contacts that, during the period of open circuit following the break of the circuit and the high tension spark delivery, a residue flux cuts across the winding and generating an e.m.f. therein.

Since the primary winding is connected on open circuit directly across the condenser, it is evident that this e.m.f. will tend to charge the condenser.

From this it follows that if the contacts close either very early or very late while the condenser is so charged, this charge will be suddenly dissipated at the contact points at the instant they close. Short circuiting a charged condenser is always accompanied by intense heat at the points of contact and tends to have a welding effect upon them. The phenomena is accompanied by a shower of very small sparks that fly in every direction when the contacts come together. When these sparks are seen it is a sign that the interrupter is closing either too early or too late. So that beside the advantageous effect upon the maximum current produced by having the contacts close at a time of zero e.m.f. in the windings, this is also the time when no welding action at the contacts can occur.

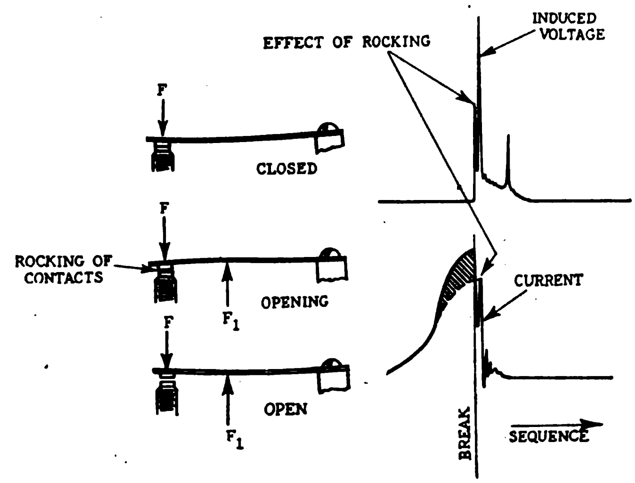


Fig. 6—Mechanical and electrical phenomena of simple spring type interrupter

In battery ignition systems there is no period of zero voltage during open circuit, hence the contacts are always subject to the necessity of discharging the condenser at every make. On the other hand the condenser capacity required for battery systems is much less than that required by magnetos so that the welding effect is not a grave concern.

Contact Material

It has been shown that the interrupter contacts are liable to be subject to such electrical phenomena as arcing, welding and the conducting of generated current, that they are subject to mechanical impact and the heating and oxidization that naturally results. In order to stand up in service under these conditions, the contacts have to be made of the very best material obtainable. A platinum-iridium alloy, containing from 15 to 20 per cent iridium, has been found to be the best material for ignition system contacts. This alloy oxidizes very slowly under average conditions and thus remains a very good conductor for the generated current. It is also hard enough to withstand the mechanical impacts it is subject to and to resist the arcing and welding actions in a very satisfactory manner. Because of the expense attached to these contacts attempts have been made to use tungsten, but while it has given satisfaction in special cases its general use has not been adopted. Tungsten seems to oxidize more rapidly than does the platinum-iridium.

In connection with interrupter contacts it might be well to mention at this time that it is highly important that oil or other foreign matter be kept from getting onto the contacts as it prevents the two contacts from making a good metallic "make" of the circuit.

It is because of this danger that interrupters are equipped with oilless bearings and no oil is ever admitted to interrupters except by means of a wick for oiling the cams for the interrupter fiber bumper arm. This oil should be used very sparingly.

Rocking of Contacts

From the very beginning of the use of mechanical interrupters for high tension ignition systems, efforts have been made to simplify it mechanically by eliminating the breaker arm. This is accomplished by mounting

the grounded platinum contact point directly upon the spring.

Fig. 6 is representative of the earliest types employing this construction, but in this particular embodiment of the idea which has now become almost obsolete, certain troubles arose that the writer has attempted to point out by means of the illustration, and it is, perhaps, due to these troubles that this particular form of interrupter has become practically obsolete.

The spring was connected directly to the breaker plate by a screw about as shown and due to a slight bend downward exerted a force throughout its entire length that can be represented as having a useful value F holding the two contacts together.

When the cam, or any medium through which it acts begins to exert a force F_1 tending to lift the spring and consequently its contact away from the insulated contact, the very first result obtained by F_1 is a tendency to relieve the spring tension from the point of its application to the point of application of F, hence that part of the spring tended to straighten out. The result was that instead of the contact being lifted quickly away from the insulated contact, it rocked from a flat surface contact to an outer edge contact before it finally lifted to a complete break.

This "rocking" or hesitating break is equivalent to a "break-make-break" action that seriously interferes with the efficiency of the energy transformation and transfer in the windings which should start at the very instant of first break.

The effect of this rocking is shown graphically by the current and induced voltage curves shown in the figure. The current at break tends first to take a very sudden drop toward zero for the induction of the high voltage necessary to initiate the spark, but being, as it is, followed almost immediately by a closing of the circuit again, the induced voltage is checked momentarily before the necessary spark voltage value is reached, causing it to drop toward zero again until the final break occurs. The current, of course, can never recover during the extra "rocking" made and so the induced voltage that does finally initiate the spark cannot be produced as effectively as it would have been had the first break been final and decisive.

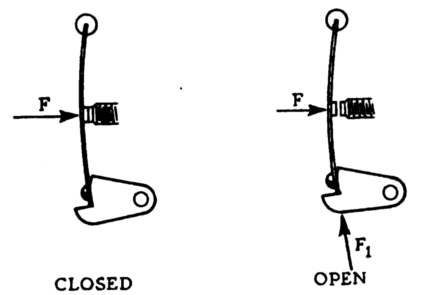


Fig. 7. Illustration of action giving parallel contact motion

The loss in effective primary current value is shown by the shaded area. Such a rocking break is bound to cause not only arcing at the contacts, but a welding action as well, hence the life of the contacts is bound to be short.

Certain modifications have been incorporated into this general type, shown in Fig. 6, that have overcome its troubles very well.

Parallel Contact Action

Fig. 7 is presented to show an interesting type of interrupter action that produces a very effective break. In this interrupter the contact is mounted on the center of the spring, one end of which is connected to the breaker plate with a slight freedom, while the other end connects to an actuating arm. A slight bow of the spring tends to hold the contacts engaged and they may be opened by a cam exerting a force F_1, as shown, that tends to further bow the spring against the force F.

A principal point of interest in connection with this action is that the force F_1 has to act through only about one-half the distance of contact separation resulting and a very quick separation of the contacts is obtained. Further it will be seen that the contacts open in an almost parallel relation to each other.

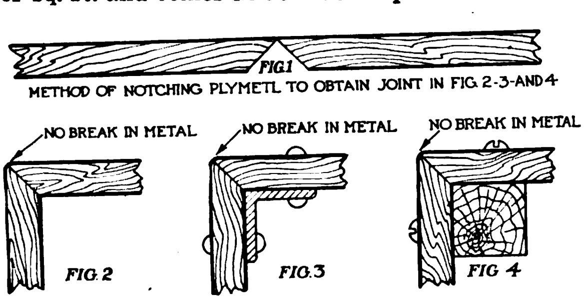
Parallel action of the contacts is a very desirable characteristic. It is not accompanied by a wearing of the contacts on one side as is liable to be the case in the lever arm type of breakers, so that when an adjustment of the contacts is made to take up wear, there is not the need for as much filing and dressing down of the contacts as is usually required. This is, of course, a very important item in the life of the contacts.

(To be continued)

Dashes and Body Panels of Metal Covered Veneer

A NEW material for automobile dashes and body panels is now being manufactured by cementing thin sheet metal faces to a relatively thick core of light-weight material. The sheet metal forms a smooth, impervious and durable surface. The core spaces the faces relatively far apart, making the material strong and stiff while still retaining lightness.

It is furnished from stock in panels 5/16 in. thick, with faces of black or galvanized sheet metal, No. 30 gage, and with planed wood veneer cores. It weighs about 1.8 lb. per sq. ft. and comes in 30 x 96 in. panels. It is claimed for the material that it is five times as stiff as a 5/16-in. solid wood panel and eight times as stiff as sheet steel of No. 19 gage, which has the same weight. The elastic limit in bending is 75 in.-lb. per inch of width or about five times the elastic limit of No. 19 gage steel. Impact, shearing strength and fatigue tests have also been made by the manufacturers with satisfactory results. The core subjected to tests was made of fir wood veneer, planed. The illustration herewith shows three methods of making a right-angled joint with this material which is known as Plymetl and is manufactured by the Haskelite Mfg. Co.



Three methods of making right angle joints with Plymetl, a veneer covered with light sheet metal

FOR students a motorist desiring to gain information concerning all branches of automobile construction and operation, probably no better method of handling the subject could be desired than that of questions and answers. This is the method used by Victor W. Page in his "Questions and Answers Relating to Modern Automobile Design, Construction and Repair," of which a revised and enlarged edition has recently been issued.

The nature and character of Mr. Page's work is familiar to automotive engineers, so that a detail discussion of the new edition need not be given here.

Development and Present Status of German Airships

The tables shown in this article include all the German airships built up to the present time, while the article describes the technical successes and failures of the various types. The performance of the R-34 is compared with that of the German L-59 which made a trip to East Africa.

THE Tables of German Airships on the following pages include all German airships built to date with the exception of a few built prior to 1910, which would be classified under the heading of miscellaneous types. These have been omitted because of their relative unimportance, since they could neither be classed as successful nor did they exert any important influence on the development of German airships.

The development of the non-rigid German airship can best be traced through the Parseval types. Their development covered the period of years from 1906, when the experimental PV Type was placed in service, to 1917 when the PL-27 was constructed.

The Parseval series were all built to the patents of Major von Parseval by the Luft-Fahrzeng-Gesellschaft (L.F.G.) at Berlin. That they were successful is attested by the fact that the company secured orders from Austria, England, Italy, Japan and Russia. The PL 22, 23 and 24 were laid down but never completed, probably because the rigid type was better adapted to purposes of war and the utility of the small non-rigid airship was eliminated with the advent of the large rigid types.

Starting with the PL-14, all Parseval airships had envelopes with the Parseval patent trajectory band system of car suspensions which was a very efficient system of non-rigid construction. The PL-25 had a small girder extending fore and aft from the center of the ship about 60 ft., and with the PL-27 really comprised a semi-rigid airship, although the Germans classify it as non-rigid. Under the envelope of this ship there is a fore and aft keel with a walkway which extends nearly the complete length of the ship. Beneath this, but forward, is the navigator's car and immediately behind it is the first power car. About half way along the keel are two side power eggs similar to those used in the latter types of Zeppelin airships, and at almost the extreme aft end of the keel is located another power car. The keel walkway carried the gasoline tanks and the water ballast bags as in semi-rigid or rigid airships.

The semi-rigid airships were of two types, that with the keel incorporated in the envelope as in the last Parseval airship (PL-27), and that with the keel slung several yards below the envelope, as in the Gross-Basenach or "M" type.

The most important semi-rigid airships constructed were the "M" or military types built for the Prussian Army by the Prussian Army Airship Works and were mainly the design of two men, Major Gross of the Prussian Army, and Herr Basenach. They were evidently not much of a success, for the later type of Parseval airship was given preference over the military types. In the early types of semi-rigid airships, those with the suspended keel, the gas tanks were carried in the cars, but in the later types with the keel incorporated in the bottom of the envelope, the gas tanks were placed in the rigid keel framework. This made it permissible to use lighter construction in the cars and utilize with slight modifications the existing keel framework, thereby effecting a saving in the structural weight of the airship.

The first rigid airship was constructed by David Schwartz in 1893 in Petrograd. It was composed of aluminum and was not sufficiently gas tight to be tested. However, in 1895 to 1897 he built in Berlin a new airship (47.5 m.) 155 ft. long (13.5 m.) 44.2 ft. in diameter, which had a total capacity of (3700 cu. m.) 130,500 cu. ft. The framework consisted of twelve rings and sixteen longitudinal aluminum girders and sheet aluminum was used for covering material. It was equipped with a Daimler engine developing 12 hp. at 480 r.p.m. The ship was inflated by using an interior bag, which, as soon as it was filled and the air had been totally displaced from the interior of the hull was torn up and pushed out through an aperture. This left the gas in direct contact with the aluminum envelope. The airship had three propellers, two on side brackets and the third between the gondola and the hull, and since it had no rudder, it was steered by this propeller arrangement. In its second flight on Nov. 3, 1897, the belting driving the propellers slipped off the pulleys and the helpless airship was dashed to the ground by a strong wind and wrecked.

The rigid airships were developed by two constructors, the Zeppelin Works and the Schütte-Lanz Company. Both types were composed of a rigid framework with a variable number of gas cells. In the Zeppelin type the rigid framework consists of longitudinal members running from stem to stern, and transverse members which run from longitudinal to longitudinal, around the ship, thus forming a ring. The material used for the construction is duralumin. In the first Schütte-Lanz airship the rigid framework was composed of diagonal members which ran spirally around the ship from stem to stern, and transverse rings as in the Zeppelin types. Too many difficulties in fabrication were encountered, however, and in the remainder of the Schütte-Lanz airships the girders run longitudinally and transversely as in the Zeppelin airships. The material used, however, in the Schütte-Lanz types was wood and all structural members were made of built-up wooden sections. When these ships were used by the navy it was found that the wood absorbed moisture and the airship became very heavy. In addition to this the glued joints opened up, but later through a new method of fabrication and chemical impregnation of the wood these difficulties were overcome. It is understood that at the time of the armistice

German Airships (Non-Rigid)

Miscellaneous Types

Airship Designation	Capacity, Cu. Ft.	Length, Feet	Diameter, Feet	Total Load, Pounds	Useful Load, Pounds	Useful Total, Per Cent	Engines, Number	Engines, Make	Engines, Total H.P.	Propellers: Number	Propellers: Material	Speed, M. P. H.	Number of Passengers and Crew	Placed in Service	History	REMARKS
Clouth	65,000	138	27.8	4,400	......	....	1	Adler	50	2-2 Bladed	Wooden	19.0	4	1909	Keel girder type	Endurance, 10 hours
Siemens Schuckert	475,000	394	44.3	32,300	......	....	4	Daimler	480	2-4 Bladed 4-2 Bladed	Steel	44.5	......	Jan. 23, '11	Rebuilt and dismantled	Passenger car in center Engine cars in front and rear
Suchard	353,000	246	55.7	24,200	......	....	2	N. A. G.	220	2-4 Bladed	Fabric	22.5	6	Early 1912	Motor boat car	Built for Trans-Atlantic Flight Expedition
Parseval Types																
PV	81,000	164	29.2	5,500	2,200	40.0	1	Daimler	85	1-4 Bladed	Fabric	27.0	6	May 26, '06	Built by Luft-Fahrzeug-Gesellschaft ("L. F. G.") Berlin. Built to the patents of Major von Parseval.	Experimental—enlarged to 99,000 cu. ft.
PL-1	120,000	197	30.8	7,600	2,350	37.5	1	Daimler	85	1-4 Bladed	Fabric	27.0	6 to 8	Sept. 21, '09		Rebuilt PV—purchased by Imperial Aero Club for excursions. Dismantled 1911
PL-2	141,000	197	34.1	9,600	3,500	36.5	1	Daimler	85	1-4 Bladed	Fabric	28.0	6	Aug. 13, '08		P-I of Prussian army. Destroyed by storm at Grünewald Sept. 16, 1908
PL-3	233,000	229	40.4	15,800	4,100	27.9	2	N. A. G.	220	1-4 Bladed	Fabric	32.0	12 to 16	Feb. 18, '09		P-II of Prussian army. Destroyed by storm May 16, 1911
PL-4	89,000	164	28.2	6,050	2,200	36.4	1	Austro Daimler	70	1-3 Bladed	Fabric	28.0	5	1909		Built in Austria for Austrian army
PL-5	51,000	131	26.3	3,460	1,320	38.1	1	Daimler	25	1-3 Bladed	Fabric	20.0	4	Dec. 8, '09		Sporting airship. Destroyed by fire June 16, 1911
PL-6	240,000	229	40.4	16,300	6,600	40.5	2	N. A. G.	220	2-4 Bladed	Fabric	33.5	12 to 16	Jan. 30, '10		Commercial airship "Stollwerck" later enlarged to 282,000 cu. ft.
PL-7	268,000	236	45.9	18,200	4,840	26.6	2	N. A. G.	220	2-4 Bladed	Fabric	36.5	12 to 16	Oct. 30, '10		Russian army airship
PL-8	290,000	253	50.9	19,700	6,160	31.3	2	Maybach	340	2-4 Bladed	Plate steel	41.8	....	Dec. 24, '12		Started 1910 but building interrupted. Replaced P-II of Prussian army
PL-9	60,000	131	26.3	4,080	2,420	59.4	1	N. A. G.	50	1-2 Bladed	Wooden	21.6	4	Oct. 10, '10		Sporting airship. Enlarged to 78,000 cu. ft. in 1912
PL-11	353,000	276	50.9	24,000	6,780	28.2	2	Körting	400	2-4 Bladed	Plate steel	40.2	7 to 12	Dec. 13, '11		P-III of Prussian army
PL-12	282,000	269	45.9	19,200	6,600	34.4	2	N. A. G.	220	2-4 Bladed	Plate steel	33.5	12 to 16	May 11, '12		Commercial airship "Charlotte." Used for excursions
PL-13	282,000	259	47.6	19,200	4,840	25.2	2	Maybach	300	2-4 Bladed	Plate steel	41.2	7	Apr. 3, '12		Built for Japanese army
PL-14	353,000	269	52.5	24,000	......	...	2	Maybach	360	2-4 Bladed	Plate steel	41.3	....	Feb. 27, '13		Built for Russian army
PL-16	353,000	308	50.9	24,000	7,480	31.2	2	Maybach	360	2-4 Bladed	Wooden	18.0	....	Aug., 1914		P-IV of Prussian army
PL-17	353,000	279	52.5	24,000	6,160	25.7	2	Maybach	340	2-4 Bladed	Plate steel	40.2	....	Sept. 13, '12		Built for Italian army
PL-18	311,000	275	49.2	21,200	6,160	29.0	2	Maybach	360	2-4 Bladed	Plate steel	40.2	....	Apr. 23, '13		Built for Great Britain. Assembled in England
PL-19	363,000	308	51.2	24,700	7,270	29.4	2	Maybach	360	2-4 Bladed	Wooden	47.8	....	Summer '14		Ordered by Great Britain. Used by German navy during World War. Overloaded, fell into sea. Destroyed by Russian warship
PL-21	353,000	302	49.2	24,000	......	....	2	Maybach	360	2-4 Bladed	Wooden	47.5	....	....		Built for Great Britain. Assembled in England
PL-25	470,000	369	53.8	32,000	13,200	41.2	2	Maybach	420	2-4 Bladed	Wooden	43.5	....	Jan. 1915		Had gun mount on top. Made over 300 voyages. Built for German navy
PL-26	1,060,000	512	62.7	72,000	About 35,200	48.9	4	Maybach	840	4-2 Bladed	Wooden	50.5	....	Oct. 26, '15		Built for German navy. Burned in shed Nov. 19, 1915 at Bittefeld
PL-27	1,100,000	518	64.3	74,700	39,600	53.0	4	Maybach	960	4-2 Bladed	Wooden	56.0	....	Mar. 8, '17		Built for German navy. Cars similar to rigid cars. Geared propellers
PL-22-23-24 Never Completed																

German Airships (Semi-Rigid)

Miscellaneous Types

Airship Designation	Capacity, Cu. Ft.	Length, Feet	Diameter, Feet	Total Load, Pounds	Useful Load, Pounds	Useful Total, Per Cent	Engines, Number	Engines, Make	Engines, Total H.P.	Propellers: Number	Propellers: Material	Speed, M. P. H.	Number of Passengers and Crew	Placed in Service	History	REMARKS
Ruthenberg I	42,000	131	21.3	2,860	......	....	1	Benz	24	1-4 Bladed	Plate steel	22.4	3	Sept. 1909	Keel girder type	Touring airship
Ruthenberg II	60,000	151	24.3	4,080	......	....	1	Fiat	75	1-4 Bladed	Plate steel	28.0	....	Early 1911		Excursion airship. Wrecked June 1, 1911 while landing
Veeh	247,000	249	43.0	16,800	......	....	2	Schneeweis	180	4-2 Bladed	Wooden	35.0	....	Oct. 1913	Keel girder type	Dismantled after forced landing. Cars built in keel
Erbslöh	102,000	174	32.8	6,950	......	....	1	Benz	125	1-2 Bladed	Wooden	30.0	5	Oct. 1909		Exploded on July 13, 1910 at high altitude. Erbslöh killed
Military Types																
MV	63,000	131	26.9	4,280	1,030	24.1	1	Gaggenau	24	2-3 Bladed	Metal	20.0	....	May 7, '07	Built by the Prussian Army Airship Works to the designs of Major Gross and Herr Basenach.	July 23, 1907 flew 7 hours; Aug. 28, 8 hours. Not satisfactory, rebuilt
M-I	176,000	215	36.4	12,000	3,000	25.0	2	Körting	150	2-3 Bladed	Metal	28.7	....	June 30, '08		Sept. 1908 flew 13 hours (282 KM.)
Replaced M-I	194,000	235	39.3	13,200	3,640	27.6	2	Körting	150	2-2 Bladed	Wooden	28.1	....	Feb. 26, '13		Cars suspended low
M-II	176,000	215	36.4	12,000	3,000	25.0	2	Körting	150	2-3 Bladed	Metal	28.7	....	Apr. 26, '09		Aug. 4, 1909 flew 16 hours (460 KM.)
Replaced M-II	198,000	237	39.7	13,500	3,740	27.7	2	Körting	150	2-3 Bladed	Metal	28.0	....	Aug. 12, '11		Cars suspended low
M-III	275,000	267	42.6	18,700	5,350	28.6	4	Körting	300	2-4 Bladed	Wooden	36.7	....	Dec. 31, '09		Destroyed by fire Oct. 10, 1911 in Tegel shed. Fastest airship 1909-10
Replaced M-III	318,000	274	42.6	21,600	6,160	28.5	4	Körting	300	2-2 Bladed	Wooden	42.2	....	Aug. 1912		Cars suspended low
M-IV	390,000	317	45.9	26,500	5,940	22.4	2	Körting	400	4-4 Bladed	Wooden	38.0	....	Mar. 11, '11		2 gondolas. Cars suspended low
Replaced M-IV	475,000	323	50.2	32,300	7,050	21.8	3	Maybach	480	2-4 Bladed 2-2 Bladed	Wooden	51.2	....	Aug. 11 '13		Cars built in keel. Gas tanks suspended in keel
Rebuilt replaced M-IV	687,000	396	52.8	46,700	15,400	33.0	3	Maybach	480	2-4 Bladed 2-2 Bladed	Wooden	50.3	....	Sept. 7, '14		Largest airship built to date. Rebuilt to increase useful load

the Schütte-Lanz Company was preparing to use duralumin instead of wood for the construction of their airships.

It should also be noted from the tables that, while using various types of engines in the early days, each series finally adopted Maybach engines. This is indeed a wonderful tribute to that engine. Its weight per horsepower is considerably heavier than most aviation engines, but the Germans seem to have neglected that characteristic and demanded primarily reliability which, after all, is the first requirement that should be considered in aviation engines. From the data available it appears that only two airships, the LZ-24 (L-3) and the LZ-59 (L-20) were lost due to engine failure.

Curves

The curves plotted show at a glance the complete development of the rigid airship.

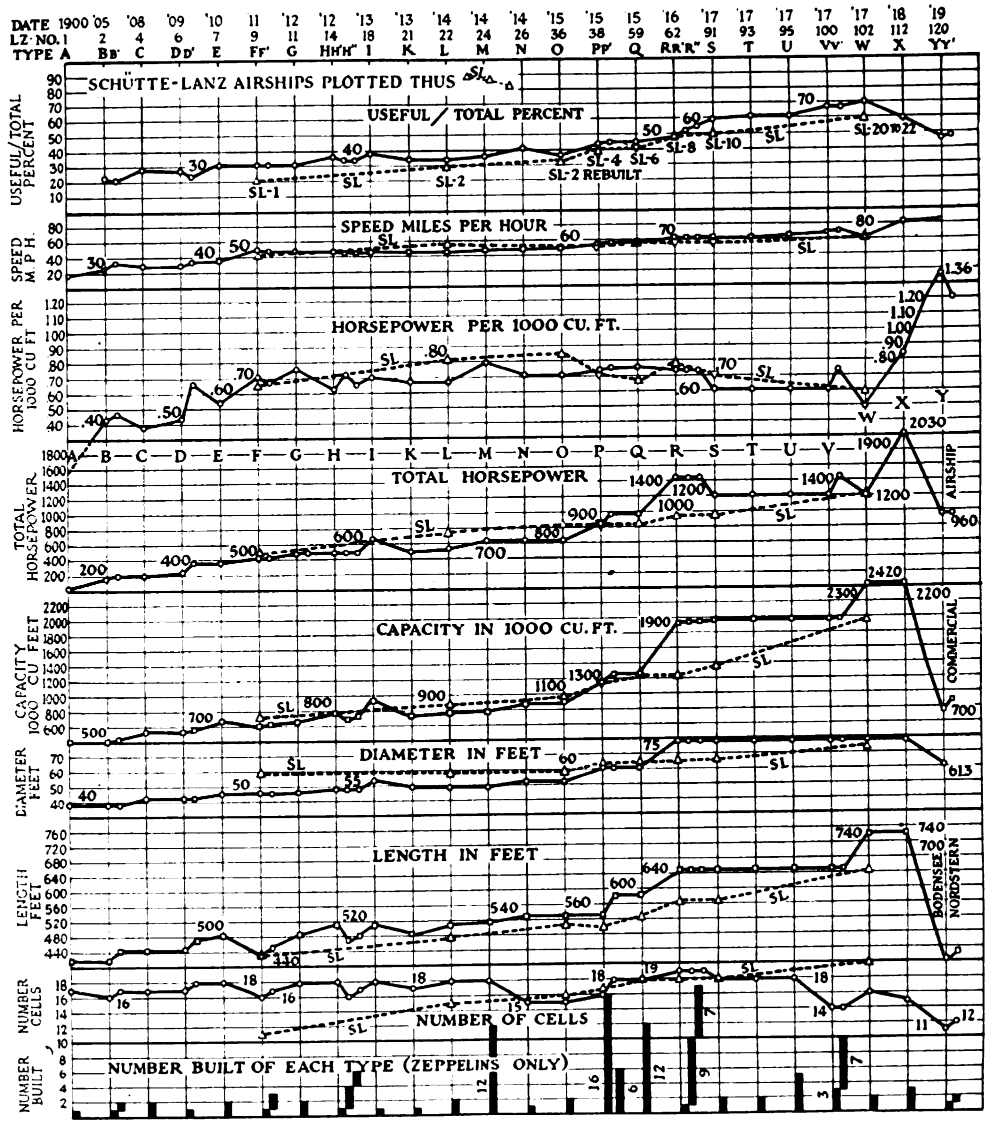
The points for the Schütte-Lanz curves are inclosed in triangles and the curves are light dotted lines. It is evident that the Schütte-Lanz airships followed the Zeppelin types and that the latter were the more important. For that reason the following comments will only refer to the Zeppelin types. (Points shown on curves as

squares and circles, curves are heavy full lines.)

At the extreme top we have the year in which the first airship of a particular type appeared, and next the LZ number of that ship. In the third heading are given the type letters arbitrarily assigned to the various classes of ships. Where several types have included in them airships which have different characteristics, these have been plotted separately on each curve (see H, H′, H″; P, P′; and R, R′, R″). For instance, the airships H, H′ and H″ are all of the same particular letter type, but since their characteristics varied and showed development within the type, it was necessary to plot them separately, as shown on each curve.

The first curve covers the percentage of useful load to total load and the figure shows an improvement from 20 per cent in 1900 to almost 70 per cent at the close of the war. In the second curve, the speed rose from 20 to 82.8 miles per hour. More than half of this increase was obtained in the period of 1914 to 1918.

The curve showing horsepower per 1000 cu. ft. (an arbitrary relation for purposes of comparison) indicates that the first Zeppelin was considerably underpowered, having only .07 hp. per 1000 cu. ft., wheras .7 hp. per 1000 cu. ft. appears to be an average figure. The influence of



Curves Showing Characteristics of German Airships (Zeppelin Types)

German Schütte-Lanz Airships (Rigid)

Building Number	Building Shed	Class	Owned by	Capacity Cu. Ft.	Number of Gas Cells	Length, Ft.	Diameter, Ft.	Total Load, Pounds	Useful Load, at 0°-760 Mm Pounds	Useful Total, Per Cent	Engines, No.	Engines, Make	Engines Hp.	Engines, Total H. P.	Speed, M. P. H.	Date First Flight	Placed Out of Service	Life, Months	REMARKS
SL-1	Rheinau	SL-1	Schütte Lanz	724,000	11	430	60.3	49,200	9,900	20.1	2	Mercedes	240	480	44.0	Oct. 17, '11	July 17, '13	21	Destroyed by storm at Eipel
SL-2	Rheinau	SL-2	Army	883,000	15	473	59.7	60,000	17,600	29.3	4	Maybach	180	720	55.0	Feb. 28, '14	....	....	....
SL-2 Rblt.	Rheinau	SL-2	Army	968,000	16	512	59.7	65,800	23,000	34.9	4	Maybach	210	840	....	....	Jan. 10, '16	22.5	Wrecked in storm at Luckenwalde
SL-3	Rheinau	SL-3	Navy	1,144,000	17	503	64.8	77,800	29,000	37.3	4	Maybach	210	840	52.5	Feb. 4, '15	May 1, '16	15	Wrecked in Baltic sea
SL-4	Sandhofen	SL-4	Navy	1,144,000	17	503	64.8	77,800	30,700	39.4	4	Maybach	210	840	53.0	Apr. 25, '15	Dec. 15, '15	8.3	Destroyed by storm in Seddin shed
SL-5	Darnstadt	SL-5	Army	1,144,000	17	503	64.8	77,800	31,400	40.4	4	Maybach	210	840	51.5	June '15	July 5, '15	1	Forced landing at Giessen. Torn loose in storm and wrecked
SL-6	Leipzig	SL-6	Navy	1,240,000	18	532	64.8	84,500	34,800	41.2	4	Maybach	210	840	57.5	Sept. 19, '15	Nov. 18, '15	2	Fell burning at Seddin (Stolp)
SL-7	Rheinau	SL-7	Army	1,240,000	18	532	64.8	84,500	34,200	40,5	4	Maybach	210	840	56.0	Sept. 3, '15	Mar. 6, '17	18	Dismantled in Jüterbog shed after curtailment of army airship operations
SL-8	Leipzig	SL-8	Navy	1,240,000	18	572	66.0	84,500	41,100	48.6	4	Maybach	240	960	57.5	Mar. 30, '16	Nov. 20, '17	19.7	Dismantled in Seddin shed
SL-9	Leipzig	SL-9	Navy	1,240,000	18	572	66.0	84,500	43,600	51,6	4	Maybach	240	960	57.5	May 24, '16	Mar. 30, '17	10.2	Fell burning in Baltic sea
SL-10	Rheinau	SL-10	Army	1,370,000	19	572	66.0	93,300	46,200	49.5	4	Maybach	240	960	56.0	May 17, '16	July 28, '16	2.3	Disappeared in Black sea
SL-11	Leipzig	SL-11	Army	1,370,000	19	572	66.0	93,300	About 46,200	49.5	4	Maybach	240	960	57.0	Aug. 2, '16	Sept. 3, '16	1	Shot down in attack on London
SL-12	Zeesen	SL-12	Navy	1,370,000	19	572	66.0	93,300	45,800	49.1	4	Maybach	240	960	53.5	Nov. 9, '16	Dec. 28, '16	1.7	Wrecked at Ahlhorn
SL-13	Leipzig	SL-13	Army	1,370,000	19	572	66.0	93,300	Over 44,000	Over 47.2	4	Maybach	240	960	About 56.0	Oct. 19, '16	Feb. 8, '17	3.7	Burned in Leipzig shed
SL-14	Rheinau	SL-14	Navy	1,370,000	19	572	66.0	93,300	About 45,100	About 48.4	4	Maybach	240	960	56.0	Aug. 23, '16	May 11, '17	8 5	Damaged in hard landing and dismantled at Wainoden
SL-15	Rheinau	SL-15	Army	1,370,000	19	572	66.0	93,300	45,100	48.4	4	Maybach	240	960	56.0	Nov. 9, '16	Summer '17	8	Dismantled in Sandhofen shed after curtailment of army airship operations
SL-16	Leipzig	E-9	Army	1,370,000	19	572	66.0	93,300	45,100	48.4	4	Maybach	240	960	56.0	Jan. 18, '17	Summer '17	7	Dismantled in shed at Cologne
SL-17	Zeesen	E-10	Army	1,370,000	19	572	66.0	93,300	45,100	48.4	4	Maybach	240	960	56.0	Mar. 22, '17	Summer '17	4	Dismantled in Allenstern shed
SL-18	Leipzig	E-11	Army	1,370,000	19	572	66.0	93,300	......	....	4	Maybach	240	960	....	....	Feb. 8, '17	....	Framework destroyed by fire in Leipzig shed while being built
SL-19	Leipzig	E-12	Army	1,370,000	19	572	66.0	93,300	......	....	4	Maybach	240	960	....	....	....	....	Building stopped due to damage to Leipzig shed by fire on Jan. 8, 1917
SL-20	Rheinau	SL-20	Navy	1,978,000	20	650	75.2	134,400	77,700	57.8	5	Maybach	240	1200	64.0	Sept. 10, '17	Jan. 5, '18	4	Burned in Ahlhorn shed
SL-21	Zeesen	F-2	Army	1,978,000	20	650	75.2	134,400	78,000	58.0	5	Maybach	240	1200	Not Obtained	Nov. 26, '17	Feb. '18	2.5	Dismantled in Zeesen shed
SL-22	Rheinau	SL-22	Navy	1,978,000	20	650	75.2	134,400	......	....	5	Maybach	240	1200	64.0	June 5, '18	June '20	24	Dismantled in Jüterbog shed

the horsepower per 1000 cu. ft. on the speed curve is shown by the parallel fluctuations of each curve. Comparing types S, T, U and V with type R, it is noted that the hp. per 1000 cu. ft. fell from .742 hp. to .610 hp. per 1000 cu. ft., whereas the speed remained practically constant or even advanced. (R = 62.2, S = 60.3, T = 60.3, U = 66.0, V = 67.0 miles per hour.) This would indicate a better aerodynamical form in these later ships. The next curve is for total horsepower and this curve parallels more or less the following one, capacity in thousands of cu. ft.

The diameter curve shows few changes, mainly because of the stress of wartime production, since a change in diameter probably meant the scrapping of a considerable amount of dies and tools. This supposition appears to be borne out by the fact that in the commercial airship Bodensee, which, of course, is smaller than those produced at the end of the war, the Zeppelin designers returned to a diameter of 61.3 ft., which had been used on the 34 airships of the P and Q types. The next curve is for length and shows, as does the diameter curve, a steady increase up to the close of the war.

The curve showing the number of cells illustrates perhaps best the method of the Zeppelin engineers in the development of their airships. The method obviously was to construct a given type of airship, and when all information had been gained from it, cut it in two, insert an extra gas cell, and experiment with the lengthened ship. The next step was a redesign, either keeping the same number of gas cells or reducing them, and at the same time increasing slightly the length of ship and the horsepower, and, less frequently, increasing the diameter. The new product then is used exactly like its predecessor, and gradually better constructional features are developed and incorporated. The last graph indicates clearly the numbers of each type built, those built before the war, the successful war types M, P, Q, R and V and the experimental war types, of which only a few were built.

Type Y is interesting because it is the commercial airship Bodensee and has incorporated in it the experience of twenty years of airship building. Commercial transportation was financially successful in Germany before the war, since four airships made 761 flights for a total of 1713 hours, traveling 95,848 miles, carrying 13,917 persons in the period from 1910 to 1912. The improvement in the Bodensee airship of 705,000 cu. ft. over type E, a ship of nearly the same size, is no-

German Zeppelin

Bldg. Number	Building Shed	History	Class	Owned by	Capacity cu. ft.	No. of cells	Lgth ft.	Dia. ft.	Total Load lbs.	Useful Load (0°-760mm) lbs.	Useful Total %	Power Cars No.	Engines No.
LZ-1*	Manzell	....	....	Zeppelin	400,000	17	420	38.2	27,200	....	....	2	2
LZ-2*	Manzell	....	....	Zeppelin	400,000	16	420	38.2	27,200	About 6,000	22.1	2	2
LZ-3	Manzell	....	....	Zeppelin	400,000	16	420	38.2	27,200	6,000	22.1	2	2
LZ-3	Manzell	Rebuilt	Z-I	Army	430,000	17	446	38.2	29,200	6,000	20.5	2	2
LZ-3	Manzell	Control surfaces rebuilt	Z-I	Army	430,000	17	446	38.2	29,200	6,000	20.5	2	2
LZ-4*	Manzell	....	....	Zeppelin	530,000	17	446	42.7	36,000	About 10,000	27.8	2	2
LZ-5	Manzell	....	Z-II	Army	530,000	17	446	42.7	36,000	10,000	27.8	2	2
LZ-6*	Friedrichshafen	....	....	Zeppelin	530,000	17	446	42.7	36,000	10,000	27.8	2	2
LZ-6	Friedrichshafen	Rebuilt	....	Delag	562,000	18	473	42.7	38,200	About 8,800	23.0	2	3
LZ-7*	Friedrichshafen	....	Deutschland	Delag	680,000	18	486	45.9	46,500	About 14,300	30.7	2	3
LZ-8	Friedrichshafen	Replaced LZ-7	Deutschland	Delag	680,000	18	486	45.9	46,500	14,300	30.7	2	3
LZ-9*	Friedrichshafen	....	Z-II	Army	592,000	16	433	45.9	40,200	....	....	2	3
LZ-9	Friedrichshafen	Rebuilt	Z-II	Army	628,000	17	459	45.9	42,700	About 13,200	30.9	2	3
LZ-10	Friedrichshafen	....	Schwaben	Delag	628,000	17	459	45.9	42,700	13,200	30.9	2	3
LZ-11*	Friedrichshafen	....	Viktorialuise	Delag	658,000	18	486	45.9	44,700	About 13,600	30.5	2	3
LZ-12	Friedrichshafen	....	Z-III	Army	628,000	17	459	45.9	42,700	13,200	30.9	2	3
LZ-13	Friedrichshafen	....	Hansa	Delag	658,000	18	486	45.9	44,700	13,600	30.5	2	3
LZ-14*	Friedrichshafen	....	L-I	Navy	790,000	18	518	48.7	53,700	18,900	35.2	2	3
LZ-15	Friedrichshafen	Replaced Z-I (LZ-3)	Z-I	Army	686,000	16	466	48.7	46,600	15,500	33.3	2	3
LZ-16	Friedrichshafen	....	Z-IV	Army	686,000	16	466	48.7	46,600	15,400	33.0	2	3
LZ-17	Friedrichshafen	....	Sachsen	Delag	686,000	16	459	48.7	46,600	About 15,400	33.0	2	3
LZ-17	Friedrichshafen	Length increased	Sachsen	Delag	735,000	17	486	48.7	50,000	About 16,500	33.0	2	3
LZ-18*	Friedrichshafen	....	L-2	Navy	950,000	18	518	54.4	64,500	24,200	37.5	3	4
LZ-19	Friedrichshafen	Replaced Z-I (LZ-15)	Z-I	Army	686,000	16	459	48.7	46,600	15,400	33.0	2	3
LZ-20	Friedrichshafen	....	Z-V	Army	686,000	16	459	48.7	46,600	15,400	33.0	2	3
LZ-20	Friedrichshafen	Length increased	Z-V	Army	735,000	17	486	48.7	50,000	16,300	32.6	2	3
LZ-21*	Friedrichshafen	....	Z-VI	Army	735,000	17	486	48.7	50,000	16,500	33.0	2	3
LZ-22*	Friedrichshafen	....	Z-VII	Army	780,000	18	512	48.7	53,000	17,600	33.2	2	3
LZ-23	Friedrichshafen	....	Z-VIII	Army	780,000	18	512	48.7	53,000	17,600	33.2	2	3
LZ-24*	Friedrichshafen	....	L-3	Navy	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-25	Friedrichshafen	....	Z-IX	Army	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-26*	Frankfurt am Main	....	Z-XII	Army	880,000	15	529	52.4	60,000	24,200	40.3	2	3
LZ-27	Friedrichshafen	....	L-4	Navy	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-28	Friedrichshafen	....	L-5	Navy	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-29	Friedrichshafen	....	Z-X	Army	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-30	Potsdam	....	Z-XI	Army	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-31	Friedrichshafen	....	L-6	Navy	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-32	Friedrichshafen	....	L-7	Navy	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-33	Friedrichshafen	....	L-8	Navy	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-34	Potsdam	....	LZ-34	Army	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-35	Friedrichshafen	....	LZ-35	Army	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-36*	Friedrichshafen	....	L-9	Navy	880,000	15	530	52.4	60,000	22,000	36.7	2	3
LZ-37	Potsdam	....	LZ-37	Army	792,000	18	518	48.7	53,800	19,100	35.5	2	3
LZ-38*	Friedrichshafen	....	LZ-38	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-39	Friedrichshafen	....	LZ-39	Army	880,000	15	530	52.4	60,000	About 22,000	36.7	2	3
LZ-40	Friedrichshafen	....	L-10	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-41	Loewenthal	....	L-11	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-42	Potsdam	....	LZ-72	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-43	Friedrichshafen	....	L-12	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-44	Loewenthal	....	LZ-74	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-45	Friedrichshafen	....	L-13	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-46	Loewenthal	....	L-14	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-47	Friedrichshafen	....	LZ-77	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-48	Loewenthal	....	L-15	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4

*First airship of its type. Delag-Deutsche Luftschiffahrt Aktien Gesellschaft, Frankfort a. M.

Airships (Rigid)

Engines Type	Engines H.P.	Total H.P.	Propellers No. & Material	Spd mph	Date First Flight	Placed Out of Service	Life Mths	Type Development	REMARKS
Daimler	14.7	29.4	4LZ Aluminum blade	18.0	July 2, 1900	Early 1901	7±	A	Dismantled in shed
Daimler	85	170	4LZ Aluminum blade	24.5	Nov. 30, '05	Jan. 17, 1906	2	B	Destroyed by storm at Kiesslegg (Allgäu) after forced landing
Daimler	85	170	4LZ aluminum blade	24.5	Oct. 9, '06	....	84	B	Became obsolete, dismantled in Metz shed
Daimler	100	200	4LZ aluminum blade	27.3	....	....		B	
Daimler	100	200	4LZ aluminum blade	33.5	....	Autumn 1913		B	
Daimler	100	200	4LZ aluminum blade	28.0	June 20, '08	Aug. 5, '08	2—	C	Forced landing at Echterdingen. Later burned up
Daimler	100	200	4LZ aluminum blade	28.0	May 26, '09	Apr. 25, '10	11	C	Forced landing at Weilburg. Carried away and wrecked by storm
Daimler	115	230	4LZ aluminum blade	29.0	Aug. 25, '09	....	13—	D	Destroyed by fire in Badenoos shed
2 Daimler 1Mayb'ch	2-115 1-140	370	4LZ aluminum blade	34.5	....	Sept. 14, '10		D	
Daimler	120	360	4LZ aluminum blade	35.7	June 19, '10	June 28, '10	0.3	E	Wrecked at Wellendorf (Teutoburgerwald)
Daimler	120	360	4LZ aluminum blade	35.7	Mar. 30, '11	May 16, '11	1.5	E	Destroyed while bringing out of Düsseldorf shed
Maybach	140	420	4LZ aluminum blade	48.5	Oct. 2, '11	....	34	F	Became obsolete, dismantled in Gotha shed
Maybach	140	420	4LZ aluminum blade	47.0	....	Aug. 1, '14		F	
Maybach	140	420	4LZ aluminum blade	47.0	June 26, '11	June 28, '12	12	F	Destroyed by fire at Düsseldorf
Maybach	140	420	4LZ aluminum blade	47.0	Feb. 14, '12	Autumn 1915	32	G	Destroyed while being put in Liegnitz shed
Maybach	140	420	4LZ aluminum blade	47.0	Apr. 25, '12	Summer 1914	27	F	Became obsolete, dismantled in Metz shed
Maybach	165	495	4LZ aluminum blade	47.0	Ju'y 30, '12	Summer 1916	48	G	Became obsolete, dismantled in Johannisthal shed
Maybach	165	495	4LZ aluminum blade	47.4	Oct. 7, '12	Sept. 9, '13	11	H	Wrecked at Heligoland (Crew 21, endurance 31 hrs.)
Maybach	165	495	4LZ aluminum blade	45.8	Jan. 16, '13	Mar. 19, '13	2	H	Destroyed by storm at Karlsruhe after forced landing
Maybach	165	495	4LZ aluminum blade	46.7	Mar. 14, '13	Autumn 1916	43	H	Became obsolete, dismantled in Jüterbog shed
Maybach	165	495	4LZ aluminum blade	47.0	May 3, '13	....	41	H	Became obsolete, dismantled in Düren shed. (4 side bracket propellers.)
Maybach	165	495	4LZ aluminum blade	44.7	....	Autumn 1916		H	
Maybach	165	660	4LZ aluminum blade	47.0	Sept. 9, '13	Oct. 17, '13	1	I	Caught fire during flight. Totally destroyed at Johannisthal. (Crew 17, passengers 11, all killed)
Maybach	165	495	4LZ aluminum blade	4o.6	June 6, '13	June 13, '14	12	H	Wrecked at Diedenhofen after forced landing
Maybach	165	495	4LZ aluminum blade	45.8	July 8, '13	....	13.5	H	Hit oy gun fire and wrecked at Lipoviec (Mylawa)
Maybach	165	495	4LZ aluminum blado	44.7	....	Aug. 27, '14	....	H	
Maybach	165	495	4LZ aluminum blade	45.4	Nov. 10, '13	Aug. 6, '14	9	K	Hit by gun fire over Lüttich, wrecked at Cöln
Maybach	175	525	4LZ aluminum blade	45.8	Jan. 8, '14	Aug. 23, '14	7.5	L	Hit by gun fire on special flight. Wrecked at St. Quirin
Maybach	175	525	4LZ aluminum blade	45.2	Feb. 21, '14	Aug. 23, '14	6	L	Hit by gun fire on special flight. Wrecked at Badonvillers
Maybach	210	630	4LZ aluminum blaoe	48.0	May 11, '14	Feb. 17, '15	9	M	Engines failed, wrecked during storm a. Fanö coast (Monop'ane rudder)
Maybach	210	630	4LZ aluminum blade	47.8	July 29, '14	Oct. 8, '14	2	M	Destroyed by English aviators in Düsseldorf shed
Maybach	210	630	3LZ aluminum later 3 Lorenzen wood	49.6	Dec. 14, '14	Aug. 8, '17	32	N	Dismantled in Jüterbog shed after abandonment of use of airships by army. (Spur gear drive).
Maybach	210	630	4LZ aluminum	48.0	Aug. 28, '13	Feb. 17, '15	17.5	M	Driven by storm to Denmark, wrecked at Borsmose
Maybach	210	630	4LZ aluminum	48.0	Sept. 22, '13	Aug. 6, '15	23	M	Hit by gun fire, wrecked at Mitau
Maybach	210	630	4LZ aluminum	49.2	Oct. 13, '14	May 21, '15	7	M	Hit by gun fire in attack on Paris, wrecked at St. Quentin
Maybach	210	630	4LZ aluminum	49.2	Nov. 11, '14	May 20, '15	6	M	Wrecked and burned while bringing out of Posen shed
Maybach	210	630	4LZ aluminum	49.2	Nov. 3, '14	Sept. 19, '16	22.5	M	Burned in Fuhlsbüttel shed
Maybach	210	630	4LZ aluminum	49.2	Nov. 20, '14	May 4, '16	17.5	M	Shot down at Horns Reef while on special flight.
Maybach	210	630	4LZ aluminum	49.2	Dec. 17, '14	Mar. 5, '15	2.7	M	Hit by gun fire and wrecked at Tirlemont
Maybach	210	630	4LZ aluminum	49.2	Jan. 6 '15	May 21, '15	4.5	M	Hit by gunfire in attack on Kovno, forced landing in East Prussia and burned.
Maybach	210	630	4LZ aluminum	49.2	Jan. 11, '15	Apr. 13, '15	3	M	Hit by gun fire in attack on Poperinghe, wrecked at Thielt
Maybach	210	630	3 Lorenzen wood	49.2	Mar. 8, '15	Sept. 16, '16	18.2	O	Burned in Fuhlsbüttel shed
Maybach	210	630	4LZ aluminum	49.2	Feb. 28, '15	June 7, '15	3.3	M	Hit by aviators after attack on Calais
Maybach	210	840	4 Lorenzen	56.0	Apr. 3, '15	June 7, '15	2	P	Destroyed by British aviators in Brüssel-Evere shed
Maybach	210	630	3 Lorenzen wood	48.0	Apr. 24, '15	Dec. 18, '15	8	O	Hit by gun fire in attack on Rowno, wrecked at Luck
Maybach	210	840	4 Lorenzen	about 56.0	May 13, '15	Sept. 3, '15	4.3	P	Hit by lightning at Cuxhaven and fell in flames. (2 car, 2 side bracket propellers)
Maybach	210	840	4 Lorenzen	56.0	June 7, '15	Apr., 1917	22	P	Became obsolete, dismantled in Hage shed
Maybach	210	840	4 Lorenzen	56.0	June 15, '15	Feb. 16, '17	20	P	Dismantled in Jüterbog shed following abandonment of army airship operations
Maybach	210	840	4 Lorenzen	56.0	June 21, '15	Aug. 10, '15	1.6	P	Hit by gunfire in attack on England, reached Ostend and burned
Maybach	210	840	4 Lorenzen	56.0	July 8, '15	Oct. 8, '15	3	P	Wrecked by striking mountain in Belgium. (2 car, 2 side brackets props.)
Maybach	210	840	4 Lorenzen	56.0	July 23, '15	Apr., '17	21	P	Became obsolete, dismantled in Hage shed
Maybach	210	840	4 Lorenzen	56.0	Aug. 9, '15	July, '19	47	P	Destroyed in Nordholz shed
Maybach	3-210 1-240	870	4 Lorensen	56.0	Aug. 24, '15	Feb. 21, '16	6	P	Shot down at Révigny
Maybach	240	960	4 Lorenzen	56.0	Sept. 9, '15	Apr. 1, '16	7	P	Forced landing and sunk at mouth of Thames after attack on England

ticeable. Whereas Type E has a useful to total load percentage of 30.7, the Bodensee has 45.6, this all the more remarkable when the power plant increase of 600 hp. (from 360 to 960 hp.) is considered. This increase in horsepower represents a considerable increase in fixed weight which, of course, lessens the useful load for airships of the same capacity. As might be expected, the speed increases from 35.7 to 82.8 miles per hour. This increase is not entirely due to increase in power, but is due in a great part to the streamline form of the hull, and, from an aerodynamical standpoint, it probably is the best airship that has ever been built.

Of the first 22 (LZ-1 to 22 included) airships constructed, ten were used by Zeppelin or commercial companies, ten were taken over by the army, while only two were assigned to the navy. The army and navy divided equally the next 52 airships (LZ-23 to 74 inclusive) and of the remaining 40 airships, the navy secured 36 (excluding six for the navy on which building was discontinued), whereas the army only had four assigned. (The army received 12 Schütte-Lanz airships against the navy's 8.)

The Allies, from the table above, are credited with the destruction of a total of 40 rigid airships, of which 16 were shot down, 17 were hit by gun fire and subsequently wrecked, and 7 were destroyed by aviators in their sheds.

It may also be concluded from the table that forced landings are serious affairs for large rigid airships and generally result in wrecks. A total of 31 rigid airships were wrecked either through forced or bad landings. Further, 28 rigid airships caught fire either in their sheds, after being wrecked or in flight. It therefore appears reasonable that the use of helium instead of hydrogen would reduce the risk to personnel considerably as well as that of loss to a commercial company.

In regard to Item 2 of the "Conclusions" Table, all army airships (LZ—No. 26, 42, 57, 58, 63, 67, 68, 71, 73, 77 and 81) in use January, 1917, were ordered to be dismantled owing to the fact that it was decided to abandon airship operations conducted by the army. Two reasons can be assigned to this decision. First, the navy had personnel available for airship work, since the fleet was more or less confined. Second, naval officers were probably better trained to operate ships of the air, particularly in their navigational ability. The decision to abandon army airship operations probably was made in January, 1917, since the last army airship was

put in service Jan. 31, 1917, and the army airships were dismantled in the period from June to September, 1917. (One in February, 1917.)

Historical

The LZ-104, Naval L-59 airship, made a non-stop flight from Jamboli, Bulgaria, to German East Africa and back. The flight started Nov. 21, 1917, at 8 a. m. and there was a crew of 22 men on board, carrying besides gasoline, about 20 tons of medicines, bandages and special munitions, which were to be delivered to the German defenders of East Africa. Khartoum was reached when a wireless order was received ordering the airship to return because East Africa had been occupied by British forces. On Nov. 25, at 8 a. m., after a 96-hour flight, they landed at Jamboli, with, it is claimed, enough fuel, etc., for an additional 64 to 80 hours' run.

The R-34 crossed the Atlantic in July, 1919, taking 108 hours to make about 3600 miles or 5760 km. The Germans claim that the L-59 traveled on its East Africa trip about 1000 to 1500 km. further than the R-34, made it in less time, did not have the benefit of a meteorological service, had the additional difficulty of crossing the equator, which meant loss of gas due to valving, and that all in all the L-59 made a much more creditable showing. They further state that although the capacity of the L-59 was 450,000 cu. ft. greater than the R-34, the dead weight of this ship was 23,000 lb. less than the R-34.

The R-34 is more or less a copy of the LZ-76 (L-33), which was brought down at Brentwood, England, in September, 1916. When the LZ-96 (L-49) was brought down in France in October, 1917, it was examined with care and many of the later technical developments of this airship were incorporated in the R-34. It is, therefore, reasonable to give some credence to the above, for the English were undoubtedly unable in their first attempt to produce an airship holding a useful to total load percentage of 50.0, which the Germans claimed for the L-33.

As a matter of interest, it is estimated that the LZ-113 (Navy L-71) airship with a high speed of 82 miles per hour, and full useful load aboard could make a non-stop flight of about 11,160 miles, or approximately three times the distance from New York to Hamburg.

At the time of the signing of the Armistice the Zeppelin company had projected a monster airship (L-100) of 3,810,000 cu. ft. capacity, 780 ft. long, 96.4 ft. diameter, 10 engines 260 hp. each, which would have a high speed in

German Zeppelin Air

Bldg. Number	Building Shed	History	Class	Owned by	Capacity cu. ft.	No. of cells	Lgth ft.	Dia. ft.	Total Load lbs.	Useful Load (0°-760mm) lbs.	Useful Total %	Power Cars No.	Engines No.
LZ-49	Potsdam	....	LZ-79	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-50	Friedrichshafen	....	L-16	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-51	Loewenthal	....	LZ-81	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-51	Loewenthal	Lengthened LZ-51	LZ-81	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-52	Loewenthal	....	L-18	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-53	Friedrichsoafen	....	L-17	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-54	Friedrichshafen	....	L-19	Navy	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-55	Potsdam	....	LZ-85	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-56	Potsdam	....	LZ-86	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-56	Potsdam	Lengthened LZ-56	LZ-86	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-57	Loewenthal	....	LZ-87	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-57	Loewenthal	Lengthened LZ-57	LZ-87	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-58	Potsdam	....	LZ-88	Army	1,228,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-58	Potsdam	Lengthened LZ-58	LZ-88	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-59*	Friedrichshafen	....	L-20	Navy	1,262,000	18	586	61.3	85,800	38,500	44.9	4	4
LZ-60	Potsdam	....	LZ-90	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-60	Potsdam	Lengthened LZ-60	LZ-90	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-61	Loewenthal	....	L-21	Navy	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-62*	Friedrichshafen	....	L-30	Navy	1,940,000	19	649	78.4	132,000	63,200	47.9	4	6
LZ-63	Potsdam	....	LZ-93	Army	1,128,000	16	536	61.3	76,800	33,000	43.0	2	4
LZ-63	Potsdam	Lengthened LZ-63	LZ-93	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-64	Loewenthal	....	L-22	Navy	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-65	Friedrichshafen	....	LZ-95	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-66	Potsdam	....	L-23	Navy	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-67	Loewenthal	....	LZ-97	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-68	Loewenthal	....	LZ-98	Army	1,262,000	18	536	61.3	85,800	38,500	44.9	2	4
LZ-69	Potsdam	....	L-24	Navy	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-70	Loewenthal	....	L-26	Navy	1,262,000	18	Building discontinued in order to						
LZ-71	Potsdam	....	LZ-101	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-72	Loewenthal	....	L-31	Navy	1,940,000	19	649	78.4	132,000	66,000	50.0	4	6
LZ-73	Potsdam	....	LZ-103	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-74	Friedrichshafen	....	L-32	Navy	1,940,000	19	649	78.4	132,000	66,000	50.0	4	6
LZ-75	Staaken	....	L-37	Navy	1,940,000	19	649	78.4	132,000	66,000	50.0	4	6
LZ-76	Friedrichshafen	....	L-33	Navy	1,940,000	19	649	78.4	132,000	66,000	50.0	4	6
LZ-77	Potsdam	....	LZ-107	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-78	Loewenthal	....	L-34	Navy	1,940,000	19	649	78.4	132,000	68,200	51.6	4	6
LZ-79	Staaken	....	L-41	Navy	1,940,000	19	649	78.4	132,000	68,200	51.6	4	6
LZ-80	Friedrichshafen	....	L-35	Navy	1,940,000	19	649	78.4	132,000	68,200	51.6	4	6
LZ-81	Potsdam	....	LZ-111	Army	1,262,000	18	586	61.3	85,800	38,500	44.9	2	4
LZ-82	Friedrichsharen	....	L-36	Navy	1,940,000	19	649	78.4	132,000	70,400	53.3	4	6
LZ-83	Staaken	....	LZ-113	Army	1,940,000	19	649	78.4	132,000	70,400 to 71,500	53.3	4	6
LZ-84	Loewenthal	....	L-38	Navy	1,940,000	19	649	78.4	132,009	71,500	54.2	4	6
LZ-85	Staaken	....	L-45	Navy	1,940,000	19	649	78.4	132,000	71,500	54.2	4	6
LZ-86	Friedrichshafen	....	L-39	Navy	1,940,000	19	649	78.4	132,000	71,500	54.2	4	6
LZ-87	Staaken	....	L-47	Navy	1,940,000	19	649	78.4	132,000	71,500	54.2	4	6
LZ-88	Friedrichshafen	....	L-40	Navy	1,940,000	19	649	78.4	132,000	71,500	54.2	4	6
LZ-89	Staaken	....	L-50	Navy	1,940,000	19	649	78.4	132,000	71,500	54.2	4	6
LZ-90	Loewenthal	....	LZ-120	Army	1,940,000	19	649	78.4	132,000	71,500	54.2	4	6
LZ-91*	Friedrichshafen	....	L-42	Navy	1,960,000	18	645	78.4	133,000	79,200	59.5	4	5
LZ-92	Friedrichshafen	....	L-43	Navy	1,960,000	18	645	78.4	133,000	79,200	59.5	4	5
LZ-93*	Loewenthal	....	L-44	Navy	1,970,000	18	645	78.4	134,000	82,500	61.5	4	5
LZ-94	Friedrichshafen	....	L-46	Navy	1,970,000	18	645	78.4	134,000	82,500	61.5	4	5
LZ-95*	Friedrichshafen	....	L-48	Navy	1,970,000	18	645	78.4	134,000	85,800	61.5	4	5
LZ-96	Loewenthal	....	L-49	Navy	1,970,000	18	645	78.4	134,000	85,800	61.5	4	5
LZ-97	Friedrichshafen	....	L-51	Navy	1,970,000	18	645	78.4	134,000	85,800	61.5	4	5
LZ-98	Staaken	....	L-52	Navy	1,970,000	18	645	78.4	134,000	85,800	61.5	4	5
LZ-99	Staaken	....	L-54	Navy	1,970,000	18	645	78.4	134,000	85,800	61.5	4	5
LZ-100*	Friedrichshafen	....	L-53	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-101	Loewenthal	....	L-55	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5

*First airship of its type.

ships (Rigid)—Continued

Engines Type	Engines H.P.	Total H.P.	Propellers No. & Material	Spd mph	Date First Flight	Placed Out of Service	Life Mths	Type Development	REMARKS
Maybach	210	840	4 Lorenzen	56.0	Aug. 2, '15	Jan. 30, '16	6	P	Hit by gun fire in attack on Paris, forced landing and wrecked at Ath
Maybach	240	960	4 Lorenzen	56.0	Sep . 23, '15	Oct. 19, '17	25	P	Destroyed after bad landing at Nordhols
Maybach	240	960	4 Lorenzen	56.0	Oct. 7, '15	....		P	Hit by gun fire in attack on Bucharest, forced lanaing at Trnovd and wrecked
Maybach	240	960	4 Lorenzen	about 56.0	....	Sep . 27, '16	11.7	P	
Maybach	240	960	4 Lorenzen	56.0	Nov. 3, '15	Nov. 17, '15	0.5	P	Destroyed by fire in Tondern shed
Maybach	240	960	4 Lorenzen	56.0	Oct. 20, '15	Dec. 28, '16	14.3	P	Destroyed by fire in Tondern shed
Maybach	240	960	4 Lorenzen	56.0	Nov. 27, '15	Feb. 2, '16	2.1	P	Fell into North Sea
Maybach	210	840	4 Lorenzen	56.0	Sept. 12, '15	May 5, '16	7.8	P	Hit by gunfire in attack on Saloniki (Greece). Forced landing at Wardar and wrecked
Maybach	210	840	4 Lorenzen	56.0	Oct. 10, '15	....		P	Wrecked after bad landing at Temesvar
Maybach	210	840	4 Lorenzen	56.0	....	Sept. 4, '16	10.8	P	
Maybach	240	960	4 Lorenzen	56.0	Dec. 6, '15	....	20	P	Dismantled in Jüterbog shed after curtailment of army airship operations
Maybach	240	960	4 Lorenzen	56.0	....	July 28, '17		P	
Maybach	210	840	4 Lorenzen	56.0	Nov. 14, '15	....		P	Taken over by navy as experimental airship L-Z5, became obsolete, dismantled in Potsdam shed
Maybach	240	960	4 Lorenzen	56.0	....	Sept. 15, '17	23	P	
Maybach	240	960	4 Lorenzen	56.0	Dec. 21, '15	May 3, '16	5.4	Q	Encountered engine trouble after attack on England, wrecked at Stavanger
Maybach	240	960	4 Lorenzen	56.0	Jan. 1, '16	....	11.2	P	Broke loose during storm at Wittmund and disappeared at sea (unmanned)
Maybach	240	960	4 Lorenzen	56.0	....	Dec. 7, '16		P	
Maybach	240	960	4 Lorenzen	56.0	Jan. 10, '16	Dec. 28, '16	10.5	Q	Shot down at Lowestoft on English coast
Maybach	240	1440	6 Lorenzen	62.2	May 28, '16	Summer '20	50	P	Dismantled in Seerappen shed. (Crew 22) (first ship fitted with side cars)
Maybach	210	840	4 Lorenzen	56.0	Feb. 23, '16	....	17	P	Dismantled in Trier shed after curtailment of army airship operations
Maybach	240	960	4 Lorenzen	56.0	....	Summer '17		P	
Maybach	240	960	4 Lorenzen	56.0	Mar. 3, '16	May 14, '17	14.3	Q	Shot down by torpedo boats at Terschelling
Maybach	240	960	4 Lorenzen	56.0	Jan. 31, '16	Feb. 22, '16	0.7	Q	Hit by gunfire while flying over Champagne front and wrecked at Namur
Maybach	240	960	4 Lorenzen	56.0	Apr. 8, '16	Aug. 22, '17	16.5	Q	Shot down by torpedo boats at Horn's reef
Maybach	240	960	4 Lorenzen	56.0	Apr. 4, '16	July 5, '17	15	Q	Dismantled in Jüterbog shed after curtailment of army airship operations
Maybach	240	960	4 Lorenzen	56.0	Apr. 28, '16	Aug. '17	16	Q	Dismantled in Schneidemühl shed after curtailment of army airship operations
Maybach	240	960	4 Lorenzen	56.0	May 20, '16	Dec. 28, '16	7.2	Q	Burned in Tondern shed
provide shed space for building of 1,940,000 cu. ft. airship (LZ-72)									
Maybach	240	960	4 Lorenzen	56.0	June 29, '16	Sept. '17	14.5	Q	Dismantled in Jüterbog shed after curtailment of army airship operations
Maybach	240	1440	6 Lorenzen	60.3	Aug. 12, '16	Oct. 2, '16	1.7	R	Shot down in attack on London
Maybach	240	960	4 Lorenzen	56.0	Aug. 8, '16	Aug. '17	12	Q	Dismantled in Königsberg shed after curtailment of army airship operations
Maybach	240	1440	6 Lorenzen	60.3	Aug. 4, '16	Sept. 24, '16	1.7	R	Shot down in attack on London
Maybach	240	1440	6 Lorenzen	60.3	Nov 9, '16	Summer '20	44	R	Taken apart in Seddin shed. To be re-erected in Japan
Maybach	240	1440	6 Lorenzen	60.3	Aug. 30, '16	Sept. 24, '16	0.8	R	Hit by gunfire, forced landing at Brentwood England, and there dismantled. (4 car, 2 side bracket propellers)
Maybach	240	960	4 Lorenzen	56.0	Oct. 16, '16	July '17	9	Q	Dismantled in Darmstadt shed after curtailment of army airship operat'ns
Maybach	240	1440	6 Lorenzen	60.3	Sept. 22, '16	Nov. 28, '16	2.2	R	Shot down by English aviators at Scarborough on English coast. (4 car, 2 side bracket propellers)
Maybach	240	1440	6 Lorenzen	60.3	Jan. 15, '17	July '19	30	R	Destroyed in Nordhols shed. (4 car propellers)
Maybach	240	1440	6 Lorenzen	60.3	Oct. 12, '16	Summer '18	21	R	Became obsolete, dismantled in Jüterbog shed
Maybach	240	960	4 Lorenzen	56.0	Dec. 20, '16	Aug. 10, '17	7.7	Q	Dismantled in Dresden shed after curtailment of army airship operations
Maybach	240	1440	6 Lorenzen	60.3	Nov. 1, '16	Feb. 7, '17	3.2	R	Wrecked in fog at Rethem (Aller)
Maybach	240	1440	6 Lorenzen	62.5	Feb. 22, '17	Oct. 8, '20	43.5	R	Flew from Seddin to Maubeuge and turned over to France
Maybach	240	1440	6 Lorenzen	62.5	Nov. 22, '16	Dec. 29, '16	1.2	R	Wrecked at Seemuppen (Russia)
Maybach	240	1440	6 Lorenzen	62.5	Apr. 2, '17	Oct. 20, '17	6.5	R	Wrecked after attack on England in Saone Valley
Maybach	240	1440	6 Lorenzen	62.5	Dec. 11, '16	Mar. 17, '17	3.2	R	Shot down at Compiègne
Maybach	240	1440	6 Lorenzen	62.5	May 1, '17	Jan. 5, '18	8	R	Destroyed by explosion and fire in Ahlhorn shed
Maybach	240	1440	6 Lorenzen	62.5	Jan. 3, '17	June 17, '17	5.5	R	Wrecked at Neuenwalde (Geestemünde)
Maybach	240	1440	6 Lorenzen	62.5	June 9, '17	Oct. 20, '17	4.3	R	Landed at Montigny Le Roi after attack on England. Finally wrecked in Switzerland
Maybach	240	1440	6 Lorenzen	62.5	Jan. 31, '17	....	.....	R	Journeyed from Königsberg to Rome and turned over to Italy
Maybach	240	1200	5 Lorenzen	60.3	Feb. 21, '17	July '19	29	S	Destroyed in Nordhols shed (4 car propellers)
Maybach	240	1200	5 Lorenzen	60.3	Mar. 6, '17	June 14, '17	3.2	S	Shot down by English fleet over North sea. (4 car, 2 side bracket propellers)
Maybach	240	1200	3 Lorenzen 1 Jaray-LZ	60.3	Apr. 1, '17	Oct. 20, '17	6.7	T	Driven off course in attack on England and shot down in France (2 engines on single propeller)
Maybach	240	1200	3 Lorenzen 1 Jaray-LZ	60.3	Apr. 24, '17	Jan. 5, '18	8.3	T	Destroyed by explosion and fire in Ahlhorn shed. (4 car propellers)
Maybach	240	1200	4 Jaray-LZ	about 66.0	May 22, '17	June 17, '17	0.8	U	Shot down at Ipswich. (4 car proplrs.)
Maybach	240	1200	4 Jaray-LZ	66.0	June 13, '17	Oct. 20, '17	4.2	U	Driven off course after attack on England, wrecked at Bourbonne Les Bains, France
Maybach	240	1200	4 Jaray-LZ	66.0	July 6, '17	Jan. 5, '18	6	U	Burned in Ahlhorn shed. (4 car props.)
Maybach	240	1200	4 Jaray-LZ	66.0	July 4, '17	Aug. '19	25	U	Destroyed in Wittmund shed (4 car propellers)
Maybach	240	1200	4 Jaray-LZ	66.0	Aug. 13, '17	July 19, '18	11.2	U	Destroyed by English aviators in Tondern shed
Maybach	240	1200	4 Jaray-LZ	67.0	Aug. 18, '17	Aug. 11, '18	12	V	Shot down at Terschelling (4 car props.)
Maybach	240	1200	4 Jaray-LZ	67.0	Sept. 1, '17	Oct. 20, '17	1.7	V	Hit by gunfire in attack on England, wrecked at Tiefenort (Werra)

excess of 82.8 m.p.h. and a useful load in excess of 180,000 lb. with a total load of 259,000 lb. These weights give a useful to total load percentage in excess of 69.5. It had a maximum altitude of 26,900 ft., which compares with 6600 ft. for the LZ-24 (L-3) and 21,600 ft. for the LZ-113 (L-71).

Recent Aeronautic Features in Foreign Countries

SOME interesting comment has been given recently in regard to certain recent features of aeronautic development in European countries.

The London Daily Mail of April 14, 1921, contains the following, prepared by Harry Harper, technical secretary of the Civil Aerial Transport Committee:

"A vista so wonderful that our whole conception of the place of aircraft in the scheme of transport may have to be altered. Such is the promise of the new 'pulsating' wing of the Austrian scientist, Professor Raimund Nimfuhr. . . .

"The theory on which Professor Nimfuhr has been working is that we should concentrate attention on the propulsive methods of birds and insects. Aeroplanes with fixed wings and an engine driving a propeller can, according to this line of research, be shown vastly inferior in relative performance to either a bird or an insect.

"If one could take a bird like an albatross and increase it in size till it was as big as a medium-sized present-day biplane, it would, it is claimed, exert not more than the equivalent of about 10 hp. in propulsion, whereas the biplane would require about 200 hp. A giant gnat, big as an aeroplane, it is averred, would fly with infinitely less exertion of power than is required for any of our existing machines.

"The Nimfuhr principle is to imitate mechanically, so far as it is possible to do so, the methods of Nature, in the wings of birds and insects. The Nimfuhr 'pulsating wing' relies upon an extraordinarily rapid vibrating or stroke action upon the cushion of compressed air which in flight is formed beneath a sustaining plane.

"The actual Nimfuhr wing, as constructed, for a full-sized machine, will, it is understood, be hollow, with a flexible membrane on the underside. By pneumatic mechanism this membrane is set pulsating or vibrating with such rapidity that waves of atmospheric pressure are generated, which shall, it is intended, not only

sustain but also propel the machine. Air screws will, in fact, be eliminated."

Writing in the London Observer, April 17, 1921, Major C. C. Turner, R.A.F., states in part:

"Dr. Nimfuhr's 'solution' of the problem of soaring flight by means of a pulsating wing has yet to be proved scientifically sound; and, if that, mechanically expressible.

"At the moment the principal and most promising flight mechanism outside the aeroplane appears to be the helicopter, and especially some combination of helicopter and aeroplane. Some difficulties at one time supposed to be insuperable are no longer considered even formidable; and so convincing are the claims of helicopterists that both the British and the French governments have given financial aid for experiments. In England Mr. Louis Brennan of monorail fame, has been experimenting for years in the full confidence of the Government.

"It used to be supposed that even if vertical ascents proved feasible, the question of lateral motion by the same machine still had to be settled This difficulty appears to have been overcome by the simple operation of slightly inclining the screws, so that instead of rotating on a vertical axis their thrust is a few degrees from the direct downward. High speed in a horizontal direction is then attained."

German Zeppelin Air

Bldg. Number	Building Shed	History	Class	Owned by	Capacity cu. ft.	No. of cells	Lgth ft.	Dia. ft.	Total Load lbs.	Useful Load (0°–760mm) lbs.	Useful Total %	Power Cars No.	Engines No.
LZ-102*	Friedrichshafen	....	L-57	Navy	2,420,000	16	743	78.4	164,500	114,400	69.6	4	5
LZ-103	Staaken	....	L-56	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-104	Staaken	Made trip to East Africa and return	L-59	Navy	2,420,000	16	743	78.4	164,500	114,400	69.6	4	5
LZ-105	Friedrichshafen	....	L-58	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-106	Friedrichshafen	....	L-61	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-107	Loewenthal	....	L-62	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-108	Staaken	....	L-60	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-109	Staaken	....	L-64	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-110	Frieorichshafen	....	L-63	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-111	Loewenthal	....	L-65	Navy	1,975,000	14	645	78.4	134,300	88,000	65.6	4	5
LZ-112*	Friedrichshafen	....	L-70	Navy	2,400,000	15	743	78.4	163,000	Over 88,000	over 59.4	6	7
LZ-113	Friedrichshafen	....	L-71	Navy	2,400,000	15	743	78.4	163,000	over 88,000	over 59.4	6	7
LZ-114	Loewenthal	....	L-72	Navy	2,400,000	15	743	78.4	163,000	over 88,000	over 59.4	6	7
†													
LZ-120*	Friedrichshafen	....	Bodensee	Delag	705,000	11	396	61.3	48,000	22,000	45.8	1 pass'gr 3 pow'r	4
LZ-120	Friedrichshafen	Length increased	Bodensee	Delag	796,000	12	425	61.3	54,100	25,300	46.8	"	4
LZ-121	Friedrichshaten	....	Nordstern	Delag	796,000	12	425	61.3	54,100	25,300	46.8	"	4

*First airship of its type. †LZ-115 to LZ-119 not built.

Below is given a summary of the ultimate disposal of all rigid airships built by Germany.

Disposition	Zeppelin	Schütte-Lanz	Totals
1. Dismantled—Obsolete	11	5	16
2. Dismantled—Army Airship Operations Abandoned	11	2	13
3. Shot Down in War	15 (a)	1	16
4. Hit by Gun Fire and Wrecked	17 (b)	0	17
5. Wrecked, Storm, Forced Landing, etc.	12	3	15
6. Wrecked, Bad Landings, etc.	11	5	16
7. Destroyed in Shed by Fire	14 (c)	3	17
8. Destroyed While Handling on Ground	4	0	4
9. Destroyed by Fire in Flight	4 (d)	2	6
10. Turned over to Allies	7 (e)	0	7
11. Wrecked Deliberately Since Armistice	7 (f)	0	7
12. Building Discontinued	6	1	7
13. Now in Commission	2 (g)	0	2
Totals	121	22	143

(a) One shot down by aviators.
(b) Two burned after wreck.
(c) Seven destroyed due to aviator's bombs.
(d) Two fell burning, cause unknown; one hit by lightning.
(e) Two each for England, France, Italy; one for Japan.
(f) All wrecked in sheds deliberately to evade Peace Treaty conditions.
(g) Bodensee and Nordstern, LZ-No. 120, 121. Allied Commission claims these as replacement for (f).

The summary below divides the rigid airships into groups according to owners.

	Zeppelin	Schütte-Lanz	Totals
Civilian	12	1	13
Army	40	12	52
Navy	63	8	71
Building Discontinued	6 (a)	1 (b)	7
Totals	121	22	143

(a) Naval airships.
(b) Army airships.

ships (Rigid)—Continued

Engines Type	Engines H. P.	Total H. P.	Propellers No. & Material	Spd mph	Date First Flight	Placed Out of Service	Life Mths	Type Development	REMARKS
Maybach	240	1200	4 Jaray-LZ	62.5	Sept. 26, '17	Oct. 7, '17	0.3	W	Burned in front of Jüterbog shed. (4 car propellers)
Maybach	240	1200	4 Jaray-LZ	67.0	Sept. 24, '17	Aug. '19	23	V	Destroyed in Wittmund shed. (4 car propellers)
Maybach	240	1200	4 Jaray-LZ	62.5	Oct. 10, '17	Apr. 7, '18	6	W	Fell burning over straits of Otranto. Cause unknown. (4 car propellers)
Maybach	290	1450	4 Jaray-LZ	about 71.5	Oct. 29, '17	Jan. 5, '18	2.2	V	Destroyed by explosion in Ahlhorn shed
Maybach	290	1450	4 Jaray-LZ	71.5	Dec. 12, '17	Aug. 29, '20	32.5	V	Flew from Wittmund to Rome and turned over to Italy. (4 car props.)
Maybach	290	1450	4 Jaray-LZ	71.5	Jan. 19, '18	May 10, '18	3.8	V	Fell while flying over Heligoland. (4 car propellers)
Maybach	290	1450	4 Jaray-LZ	71.5	Dec. 18, '17	July 19, '18	7	V	Destroyed by English aviators in Tondern shed. (4 car propellers)
Maybach	290	1450	4 Jaray-LZ	71.5	Mar. 11, '18	July 22, '20	28.4	V	Flew from Ahlhorn to Pulham and turned over to England. (4 car props.)
Maybach	290	1450	4 Jaray-LZ	71.5	Mar. 4, '18	July, '19	16	V	Destroyed in Nordhols shed. (4 car propellers)
Maybach	290	1450	4 Jaray-LZ	71.5	April 17, '18	Ju'y, '19	15	V	Destroyed in Nordhols shed. (4 car propellers)
Maybach	290	2030	6 Jaray-LZ	about 80.5	July 1, '18	Aug. 5, '18	1	X	Shot down at Boston. Streamline fins. (6 car propellers, direct drive)
Maybach	290	2030	6 Jaray-LZ	80.5	July 29, '18	July 1, '20	23	X	Flew from Ahlhorn to Pulham and turned over to England. Streamline fins. (6 car propellers)
Maybach	290	2030	6 Jaray-LZ	80.5	July 9, '20	....	.....	X	Flew from Loewenthal to Maubeuge and turned over to France. Streamline fins. (6 car propellers)
Maybach	240	960	3 Jaray-LZ	82.8	Aug. 20, '19	....	45.8	Y	Not put in service after length was increased because of allied commission's restrictions
Maybach	240	960	3 Jaray-LZ	....	....	....	.....	.....	Crew 15, passengers 20 to 25. (3 car propellers)
Maybach	240	960	3 Jaray-LZ	....	....	....	.....	.....	Not put in service because of allied commission's restrictions

All the machinery is carried in the latter. There is a passenger deck with space for staterooms, dining-rooms and so forth, for passengers and crew. The envelope and the chassis are built in sections so that the airship can be enlarged. The airship is to be fitted with what is called the three-chamber system, using hydrogen, nitrogen and air. This is the device that provides protection against explosion, ignition and lightning. It is reported to reduce the loss of lifting gas (hydrogen) due to diffusion to 1 per cent as compared with other systems.

"The airship is to be fitted with a new propeller system which should make it possible to use all the dynamic forces of the vessel for forward, upward, backward and downward drive. Not the least important result, it is hoped to obtain from this equipment, is that of reliable landing without assistance from the ground.

"The hydrogen in the envelope is separated on all sides from the atmospheric air by a wall of nitrogen; these are the means used to eliminate the danger of fire. Should the outer envelope catch fire the flame, it is claimed, will be extinguished by the nitrogen

The Holland correspondent of the London Times reported March 30:

"Mr. A. Boerner, a Dutch airman, has invented a new type of airship, for which it is claimed that it needs no ballast and is not subject to loss of gas. More important than either of these is the claim that in the Boerner airship the danger of explosion is eliminated.

"Briefly, the design of the airship is as follows: The balloon proper consists of a large number of individual gas cells attached to a bridge chassis made of duralumin.

escaping as soon as a hole is burned in the envelope.

"The Boerner airship is about 950 ft. long and is to be propelled by 32 gasoline engines, to each of which an air screw is attached. The total horsepower developed will be 6400. On half its power the airship is to fly at a speed of 72 miles an hour. By the Boerner system the air screws may, together or in groups, be adjusted so as to propel the airship in any direction. The suggested number of passengers that the airship will be able to carry is 300."

Development of Aircraft Tires and Wheels

McCOOK FIELD Air Service Engineering Division activities in the rubber materials used in aircraft construction have been mainly centered around the development of the straight side tires and wheels. A satisfactory program of wheel and tire sizes has been drawn up after considerable experimental work, and it is hoped that tire and wheel replacements will be of the straight side type, rather than of the present clincher type.

Experimental work on the development of straight side tires and wheels has extended over a period of about two years. The chief reason for an attempt to develop the straight side tire has been that the unsatisfactory performance of the clincher type was most marked in the case of the DeHaviland airplanes, which use the 750x125-millimeter tires.

At best, the clincher tire has never been satisfactory, even in the case of automobiles, except in the smallest sizes. Underinflation was the chief contributing cause, as the majority of the trouble experienced was due to rim cutting. A secondary contributing cause was the type of wheel used, which is essentially an unbalanced structure.

The first service test on the straight side tires was made with the 44 x 10-inch tire, used on the Glenn L. Martin airplane, of the type which has only two wheels. To date the performance of these tires and the service, which extended over a period of about six months, has been very satisfactory.

Another size which has been subjected to service conditions is the 36 x 8-inch tire, which was developed with a view to replacing the 900 x 200-millimeter size. An essential difference between this size and the 44 x 10-inch size is that the wheel for the 36 x 8-inch tire has a one-piece rim, having a channel in the center to permit of the application of the casing. In general, it resembles a type of rim used on the Fokker D-7, which was equipped with a straight side tire. The wheel for the 44 x 10-inch tire has a truck-type rim. This includes the removable side ring to permit of ease of application or removal of the casing.

In every case of straight side tires the wheel used has a hub which is centered in the wheel, as opposed to the Palmer type of off-set hub. Other sized tires are being manufactured for service test, and it should not be long before complete information is available regarding the suitability and serviceability of this type, as compared to the original clincher type. It is believed that the difficulties experienced with the clincher type tires, especially when used on the Palmer type wheel, will be completely overcome in the straight side tires.

Automotive Demands Give Strong Impetus to Drop Forging Development

"The automotive industry was one of the first to appreciate the advantages of drop forgings," said an executive recently. The extent to which technical drop forging practice has been influenced by automotive demands is a phase of relations between the two industries discussed.

THE automotive industry has not only achieved very rapid growth itself during the last decade, but has been the cause of very marked technical and commercial development in certain contributory industries. One of these which has profited largely from its contact with the automotive field is the drop-forging industry.

The drop forge industry in the United States has had two major booms during its long existence. Drop forgings have always been used extensively in connection with firearms and ordnance, while they have been utilized also to some extent in railroad work and more recently in shipbuilding. The first real boom, however, was caused by contact with the bicycle industry, which attracted so much attention about twenty-five years ago. Next the automobile industry started its great rise.

Technical Development

To this latter contact can be traced a large percentage of the recent technical growth of the drop forging industry. The development of new methods has been very rapid during recent years and has been inspired chiefly by the demands of the automotive industry. The development of crankshaft manufacture may be cited as an instance of this development. Automobile and truck makers have been demanding an increasing accuracy in the manufacture of this part. As a result the drop forgers, through extensive experimentation and intensive research, have succeeded in meeting that demand. The same thing is true to a large extent of almost every drop forged part used on cars and trucks.

As the demands grew, many progressive drop forge concerns began to try to anticipate future demands, that they might be ready to meet requests as soon as they were made. Consequently, it has been possible for drop forgers on occasion to present to the automotive industry new methods for making better and more accurate forgings from time to time.

Drop forgings, of course, compete directly with malleable and steel castings in selling to the automotive industry. For this reason the drop forgers have made considerable effort in individual cases to study the possibilities for an increased use of forgings on cars and trucks; to devise new forging methods to meet automotive needs, with the idea of attempting to replace castings in certain instances.

Up to the present time, however, the demands upon the drop forgers have been so great that they have been kept busy to a large extent keeping pace with the demands made upon them, to the detriment of this experimental and research work. One prominent drop forge executive says, for instance, that:

"The general opinion seems to be that during the last few years the development along this line has not been carried on because of the high production requirements in the regular line, but since the dropping off in production has come about there is a very great effort being made along this line."

Such research is directly in line with the most urgent needs of automotive manufacturers at the present time. Reduction of production costs is necessary and material assistance can be rendered by a contributory industry such as this by research and experimental work.

Drop Forging Characteristics

Taken in a general way, the drop forging has always possessed certain characteristics which made it specially adaptable for automobile and truck construction. Some of these qualities, familiar to engineers, may be listed as follows:

1. Comparatively great uniformity of quality: not subject to certain defects, such as blow-holes
2. Suited to quantity production methods
3. Tensile strength and percentage of elongation in given length practically always high enough to meet requirements, even though highest grade steels or alloys are not used
4. Uniformity as to thickness, etc.
5. Possibility of producing forging to very close tolerances, thus necessitating a comparatively small amount of machining. The ordinary drop forging can be produced to a tolerance of 1/32 in., but many forgings are now being produced to smaller tolerances

One of the chief drop forging developments for which the automobile industry is largely responsible is in connection with the handling of high efficiency steel and new alloy combinations. As a result of efforts along these lines drop-forging operations are possible to-day that were considered utterly impossible fifteen years ago.

Limitations of Practice

Although remarkable strides have been made in drop-forging practice to meet the requirements of automotive engineers, there are limits to what can be accomplished. Discussion at the convention of the American Drop Forge Association during recent years indicates that engineers and designers sometimes make their design entirely from an engineering viewpoint without considering the limitations of drop-forging practice, even though they expect to use drop-forgings in construction.

One drop-forging manufacturer expressed it this way: "Drop-forgers should be called in for consultation and advice when new designs are being worked out. Or at least preliminary drawings or sketches should be sent to prospective sources of supply to get constructive suggestions and to avoid the revising of completed designs and details. Many drop forgers are more than willing to render their services to their regular customers, if not to the trade at large, and in many instances the saving has been enormous."

There is obviously an excellent field for co-operation along this line, since it is readily conceivable that considerable expense may be saved the manufacturer if, in making a design, he takes into consideration the limitations of drop-forging practice.

Co-operative Possibilities

In connection with the possibilities for profitable co-operation between the designer and the drop-forger the following statement recently made by a member of the drop-forge industry is of interest.

"There is no question but that the average automobile engineer and designer should be very well acquainted with the difficulties encountered in making drop forgings, in order to design forgings to the best advantage. There are a very large number of forgings made the production of which cause a great amount of trouble, and which can be produced only at a very high cost.

"This trouble and extra cost is made necessary through ignorance of the designing engineer of the fundamental principles of drop forgings. If the designing engineer had known the way in which forgings of a similar design were made, the design of the parts in question could have been simplified so as to render the forging easy to make, and at the same time capable of serving its purpose just as effectively.

"The general trend among automotive engineers, however, is to work more closely with the drop-forge industry in the designing of important parts, so that such difficulties can be eliminated and the best part for the least cost be produced."

While most of the progressive drop forge concerns are ready to render such co-operative service, the car designer and engineer has not always been satisfied with the kind of help extended. One prominent engineer, for example, complained recently that his experience had been that the drop forgers in making suggestions for simplification for manufacture did not take sufficiently into account the desire of the designer for individuality and other similar factors.

It must be admitted, moreover, that the drop forgers have not attempted very extensively, except in a few individual cases, to bring directly before the automotive engineer the various features and possibilities of their practice. An investigation of the situation indicates that very little sound publicity work has been done along these lines by drop forgers in general. It would seem that a definite attempt to reach directly the automotive engineers with information of this kind would increase the possibilities of mutually helpful co-operation.

Drop Forging Process

The details of drop forging practice cannot be adequately described, of course, in a brief article, but certain essential features can be outlined which will be of general interest. The process of drop forging is more complex than is sometimes understood; it consists of far more than merely heating metal and hammering it between dies. As one authority says, "The production of high grade forgings is, in reality, a co-ordination of many functions carried through with a nice regard for their effect upon one another."

The first factor of importance is that of chemical analysis and heat treatment. The chemical properties of any given lot of steel are a fixed quantity, but the physical properties can be changed by the application of the proper heat treatment. The amount of change possible by heat treatment, of course, is limited to a certain extent by the chemical analysis of the particular lot.

In the actual forging process several sets of dies are used. One set is used for forging, one set for trimming, and other sets for punching and bending. A properly constructed and sufficiently strong die is the chief essential of successful drop-forging. The value of a die from the point of view of the forging buyer should be judged rather in accordance with the quantity and quality of the forgings produced from it than with the actual initial cost of the die itself. One of the prominent forging concerns says that "the best dies cost anywhere from three to five times what poorer grades cost, but they are always cheapest in the end. A die made from good steel, carefully hardened and finished to a high polish, will make more forgings than a cheap die and will make them better."

The making of dies is a difficult job requiring the highest skill in workmanship. The various steps in constructing a die may be listed in general as follows:

1. The die block is planed smooth on the impression side, and the opposite side is cut a key, which holds the block in place on the ram or in the sow block of the hammer
2. The impression side is thinly copper plated and the outline of the forging is etched through the plating
3. The rough impressions are cut out on a mill or lathe
4. The die is finished by expert hand tooling

When the finished impression has been sunk in the die, a sample cast of Babbit metal is obtained, by means of which the general outlines of the piece can be checked up and suggestions made for changes before the die is finally finished to accurate dimensions.

The next step is to select stock of the shape which can be handled and forged most economically. Billets, round and square bars, or flats, are ordinarily used. There is a distinct danger of choosing too small a bar in an effort to reduce the amount of waste. The size of the stock should be large enough to permit the metal to be worked clear through and not merely on the surface.

There are four different operations on the piece while actually under the hammer:

1. Edger
2. Break down
3. Finishing pass
4. Cut off

A certain amount of excess stock, known as the flash, must always be removed from the forging after it comes from the hammer. This is the trimming operation. Trimming is followed by cleaning, after which the heat treatment takes place, provided this is to be done at the forge shop.

Difficulties

Certain definite difficulties present themselves in drop-forging practice. Every forging is not perfect, of course, even though the best manufacturing methods be adopted. A large proportion of defective forgings can be traced to defective dies. Some defects, such as laps, are superficial and do not affect the quality of the forging, but others are more serious. Among the chief possible defects are checks, laps, excess stock, scale pits, round corners, burrs, pipes and seams.

In a high grade shop, of course, forgings with such defects never get outside the forge shop. They are of interest to the customer chiefly since his design and demands sometimes affect one way or the other the possibility of producing a high percentage of perfect forgings.

Work of Drop Forge Association

The American Drop Forge Association comprises about 68 per cent of all the drop forge concerns in the

country and probably about 90 per cent of the total tonnage produced each year. This association has interested itself in the quality of the work done by its members, although the results of this interest are not recorded in definite statistics.

The Drop Forge Association has from time to time studied and compiled various tables of standard tolerances of drop forge practice, both with regard to dimensional limits and the weight limits of various types of forgings. The association uses the S. A. E. standard specification for forgings and attempts to see that all the forgings produced by its members are held well within those limits.

While definite figures are not available, a careful estimate states that fully 90 per cent of the output of the drop-forging industry has been absorbed by automotive manufacturers during the last five years.

The Drop Forge Association has not, as a body, undertaken anything in the way of research work up to the present time. The statement is authorized from a responsible source, however, that work of this kind, similar to that being done by the American Malleable Castings Association, is likely to be taken up and carried forward in the very near future.

One reason that records are not available to show the increased quality of the physical characteristics of forgings over a period of years is that a large percentage of the forgings produced by members of the Association are supplied to automotive manufacturers with no final heat treatment. Several individual members of the Association, however, have built up very strong laboratory and research forces and have carried work of this kind to a very high state of development. These standards are really considered by the rest of the industry as the standards for automotive work.

The recently formed American Drop Forge Institute is an association of the executives of the various drop forge companies designed to further the general interests of the drop forging industry along broad and constructive co-operative lines.

The Association has dealt entirely with practical shop problems, but the Institute will concern itself with the broader aspects of the industry, such as the relation of the drop-forging industry to outsiders with whom it comes in contact, uniform cost methods, the possibilities of constructive research, and so forth. It will have nothing to do with prices in any manner whatsoever, either directly or indirectly.

The Institute has been formed so recently that only these broad outlines of its purpose can be given at this time. Whether both the Institute and the Association will continue permanently or whether the Association will be merged into the Institute will be decided by the future.

The accompanying list includes the parts of a four-cylinder car which are made from drop forgings. This list is reprinted from AUTOMOTIVE INDUSTRIES of Jan. 20.

While additions might be made, the list is the most comprehensive that has yet been published and is included here for that reason.

Automotive Parts Made by Drop Forging

ENGINE

Crankshaft
Crankshaft counterweights
Crankshaft drive gear
Connecting rods
Camshaft
Camshaft drive gear
Rocker arms
Rocker arm brackets
Valves and stems
Valve lifter plungers
Valve lifter guide yokes
Magneto drive gear
Magneto idler gear
Generator drive gear
Generator strap tee, upper
Generator strap tee, lower
Pump shaft gear
Distributor drive shaft gear
Starting crank
Starter pedal
Starter pedal pad
Starter shaft lever
Starter operating shaft rod
Starter motor drive gear
Water pump drive gear
Oil pump adjusting shaft
Carbureter pipe flange
Throttle control lever
Spark control lever
Accelerator pedal
Fan supporting arm
Front motor support
Rear motor support

TRANSMISSION

First speed and reversing gear
Direct drive and second speed gear
Countershaft
Countershaft gear
Countershaft first speed gear
Countershaft second speed gear
Reversing pinion
Gear shift lever
Gear shifter shaft
Shifter rod
Shifter rod end
First speed and reversing gear and shifter fork
Direct drive and second speed gear shifter fork
Clutch pedal
Clutch pedal pad
Clutch pedal stop
Clutch throwout yoke
Clutch shifter lever
Clutch shifter shaft
Clutch spring sleeve
Clutch hub
Clutch drum
Drive shaft universal joint
Drive shaft universal joint flange
Drive shaft universal joint sleeve
Drive shaft universal joint sleeve yoke

RUNNING GEAR

Front axle
Steering knuckle, right
Steering knuckle, left
Steering spindles
Pitman arm
Steering arm
Steering yoke
Steering gear worm sector
Steering gear worm
Steering rod
Front spring shackles
Front spring plates
Front spring clip spacers
Rear spring brackets
Hand brake lever
Hand brake lever latch
Hand brake lever latch end
Hand brake tube rocker arm
Hand brake cross shaft levers
Hand brake cross shaft rocker arms
Hand brake cam levers
Hand brake levers
Hand brake lever clevis
Foot brake pedal
Foot brake pedal pad
Foot brake cross shaft rocker arms
Foot brake cross shaft levers
Foot brake operating lever
Foot brake band adjusting clevis
Foot brake band links
Brake equalizer draw bar
Brake equalizer draw bar clevis
Brake control turnbuckles
Brake pull rod clevis
Front brake band lever clevis
Torque arm
Torque arm pillar
Differential gear
Differential pinion
Differential pinion spider
Differential driving gear
Differential driving pinion
Rear axle nuts
Rear spring shackles
Rear Spring plates

ACCESSORIES

Windshield side arms
Tire carrier arms
Toe bolts
License tag clamps
Top support adjusting brackets
Top support wing bolts
Gasoline tank strap draw bolts (front)
Gasoline tank strap draw bolts (rear)
Valve tappet wrench
Valve tappet adjusting screw wrench
Valve lifting tool
Water pump stuffing nut wrench
Exhaust manifold packing nut and differential bearing adjusting nut wrench
Crankcase main bearing bolt and flywheel oil plug wrench
Spark control and oil reservoir drain plug wrench
Rear axle pinion shaft bearing gage

Exports of Automobiles and Tires for March, 1921

COUNTRIES	Commercial				Passenger				Parts	Tires			
	Complete Cars		Chassis		Complete Cars		Chassis			Casings	Inner	Solid	All Other
Europe													
Austria													
Azores and Madeira Is.													
Belgium					5	$ 7,299			$ 18,370		$ 150		$ 108
Czechoslovakia					1	440				$ 1,425			
Denmark			12	$ 23,850	3	8,197			7,872	7,223			935
Finland					2	1,135			932	490	125		
France	1	$ 2,900	1	519	20	34,979	1	$ 367	33,784	440			
Germany							1	354	1,048				
Greece			4	1,798	6	6,320			4,303	1,012	268		
Iceland and Faroe Is.					3	3,250			1,463	1,045	61		
Italy					2	842	3	4,235	831	2,393	155		
Malta, Gozo and Cyprus Is.									338	1,858			
Netherlands					10	10,228			11,026	8,060	2,104	$ 916	2,300
Norway	2	1,000			3	3,400			17,077	24,572	1,935	3,249	
Poland and Danzig					17	22,995			2,527	2,725			5,500
Portugal									599				
Roumania			1	450	40	45,739			4,962	495	54		
Russia in Europe	1	2,000							72				
Spain	3	3,600			23	40,375			96,562	175	27	1,475	120
Sweden	6	16,151			66	78,112			28,500	54,974	5,037		
Switzerland					95	143,520			2,686	1,788	279		
Turkey in Europe									981	6,236	1,736		
England	10	29,142	3	8,532	48	59,843	3	8,700	356,197	77,757	6,594	4,580	8
Scotland									732	40			
Ireland									85				
Yugoslavia, Albania					3	1,263						493	
North and South America													
Bermuda													530
British Honduras									308	231	31		
Canada	86	114,647	91	103,979	398	597,052	21	38,417	1,494,810	77,487	39,181	6,103	3,540
Costa Rica	3	6,935			2	2,360			565	432	15		210
Guatemala			1	450	4	6,095			2,472	1,949	159		
Honduras					1	1,130			1,895	922	84		
Nicaragua							1	1,300	775	1,014	157		
Panama					22	19,692			15,313	6,530	1,009	589	6,330
Salvador									1,648	1,378	255		50
Mexico	122	126,832	4	11,117	394	298,288	1	840	118,256	64,465	7,687	2,209	4,123
Newfoundland and Labrador					1	2,000			2,067	313	24	74	
Barbados					8	4,916			8,841	4,355	524		209
Jamaica	1	2,435	3	1,348	6	2,524	1	804	15,069	688	352	555	8
Trinidad and Tobago			3	6,938	12	8,973			6,592	2,928	99	1,675	317
Other British West Indies			2	450	6	4,991			1,352	2,891	273		61
Cuba	8	13,062	5	10,589	233	142,658	2	4,496	147,014	71,897	9,379	27,251	9,091
Virgin Islands of United States	1	2,794			4	2,146	1	367	8,955	1,700	184		8
Dutch West Indies			3	2,302	1	363			986	291	70		
French West Indies									4,251	272			
Haiti					2	1,766			1,058	1,153	20		
Dominican Republic			1	3,000	12	16,094			4,100	5,808	799		133
Argentina					5	18,500	5	8,152	185,306	89,911	10,869	2,253	
Bolivia									1,099				
Brazil					43	70,856			25,242	10,352	57	236	840
Chile			1	4,050					9,666	3,533	842	400	102
Colombia	6	14,359			3	5,349			10,945	2,920	315		5
Ecuador	2	15,163			1	1,000			846	497	62		
British Guiana	1	4,000							6,476	922	168	104	
Dutch Guiana									408	511			
French Guiana									10	75	43		
Peru					6	23,987			20,440	4,360	1,737	1,157	100
Uruguay					6	22,885			28,949	4,637			1,850
Venezuela					20	19,939			33,477	9,385	815	950	
Asia and Far East													
Aden									659	81	20		
China	6	3,118	1	2,300	8	27,211	15	6,439	7,319	6,955	105		
Kwantung, leased territory									5,053				
Chosen										1,918	560		
British India	4	7,589	7	10,104	49	30,095			65,705	32,256	112	4,019	5
Straits Settlements	1	2,581			1	1,200			8,683	1,346	86	809	
Other British East Indies					6	6,000			2,820	185			
Dutch East Indies					18	54,366	1	560	18,103	52,967	270	800	
French Indo China									105				
Hongkong					11	12,550			3,122	1,704	193		
Japan	25	51,537	76	42,575	118	129,470	6	18,163	37,373	10,114	98	2,226	
Persia									5,707	97	126		
Siam					2	3,000			749	171			
Turkey in Asia	6	27,250	1	545	28	15,638	1	1,200	13,880	242	171		
Australia	1	5,963	70	138,525	14	20,956	102	120,686	60,118	2,578	107	323	839
New Zealand	11	26,962			28	39,108			31,955	32,974	555	1,538	
Other British Oceania					1	763			116	1,149	726		1,150
French Oceania									1,081	955	49	171	260
Other Oceania									510		75		
Philippine Islands	1	2,350			11	23,574			29,898	20,306	1,375	13,601	1,940
Africa													
Belgian Kongo									7				
British West Africa					2	1,160	2	1,230	2,474	2,562	883		
British South Africa	5	6,210			12	18,063			32,384	10,434			
British East Africa					1	835	2	1,426	3,937	788			
Canary Islands	2	4,729							5,623	1,164	74		
Egypt			1	1,500	2	2,952			5,596	1,989	398		300
French Africa									1,144	144		1,568	
Kamerun, Etc.									2,166				
Liberia										16	145		
Morocco									1,315				
Portuguese Africa					1	2,200			150				
Total	315	$493,309	291	$374,921	1,850	$2,130,642	169	$217,736	$3,097,890	$749,610	$99,363	$79,324	$40,972

The FORUM

Concerning Argentine Trade

Editor, AUTOMOTIVE INDUSTRIES:

You, of course, realize that as you are just entering upon your spring season we are entering upon the fall and our winter season will not be over until the end of September. Consequently, our best months for selling automobiles are now about over and the new season does not begin with us until September or October.

The season just now closing has not been, generally speaking, a satisfactory one to the automobile trade. The unsettled and unfavorable conditions which have been existing in Europe, Great Britain and the United States for the past several months have reflected themselves very seriously in this market, and business in most lines has been almost paralyzed. Taking our automobile season as from Sept. 1 to April 1, I do not believe that during the season just closed there were more than 33 1/3 per cent of the quantity of cars disposed of the previous season sold. During the past three or four months such demand as has existed has been confined to a very few well-known cars which have become well established here and are being handled in a proper manner. From such information as I have been able to gather through our own organization and from outside sources, I am sure that we have been selling more cars than has anyone else, with the exception of Ford. The sale of the Ford has also fallen off a very great deal. Our business this year has probably reached more or less half of what it was a year ago, but it is to be borne in mind that a year ago we were not able to get sufficient cars from the factory to fill our requirements, and I do not know to what volume the business might have run had we been able to keep in stock.

You have no doubt seen press cablegrams concerning the number of cars and trucks in the Buenos Aires Custom House, most of which reports, I think, were exaggerated, and I believe you may, therefore, be interested in knowing the facts. The Association of Automobile Importers in Buenos Aires sent some of their own employees to the Custom House to take count of all the cars and trucks deposited there and they give the total as 2003. This count was taken on March 25. This is not a large stock for normal times, but under present conditions it is excessive and will undoubtedly take a great many months to liquidate. We, fortunately, were foresighted enough last September to alter our orders to bring them more in line with the anticipated demands, and, as the General Motors Export Co., understanding perfectly the existing conditions here, co-operated with us in a very whole-hearted manner and relieved us of the possibility of having an excessive amount of cars shipped to us, our position, therefore, at the present time is very comfortable in this respect. This is, unfortunately, not true of several of the other automobile agents here, some of whom are carrying a very heavy burden, and a few houses have been forced to liquidate their automobile business and in some instances left a few cars on the hands of shippers.

The Association of Automobile Importers also furnishes me with the following figures concerning the importation of automobiles and trucks during the months of January, February and March of this year:

From the United States, imported during these three months, 296 passenger cars and three trucks; from Great Britain and Europe, during same period, 66 passenger cars and 28 trucks.

You asked me how I am estimating the 1921-1922 season for the automobile business in the Argentine. I am afraid that I cannot make satisfactory reply to this question. I think it is too early yet for anyone to even guess with any degree of accuracy, and I have not attempted as yet to make any plans for next season. In July or August we should be able to form some idea, but even then one will not be able to prophesy with accuracy. We cannot tell a great deal about the prospects of next year's crops before August, and a great deal depends upon the movement of the hides, wool and cereals which are now available for export and in which there has been practically no movement for many months. Until these products move freely for export I see no possibility of any material improvement in either financial or trade conditions here, and it is impossible to say when this hoped-for movement in exports will begin. I am very much afraid that this calendar year is going to be one of liquidations very largely, with a possibility of some material improvement in conditions during the last quarter.

I wish to thank you very much for writing me, and I shall be very glad to hear from you personally at any time that you have the time and the disposition to write.

WILLARD T. CLARK,
Henry W. Peabody & Co.

Buenos Aires, April 8, 1921.

Volumetric Efficiency vs. Fuel Economy

Editor, AUTOMOTIVE INDUSTRIES:

Referring to your editorial in AUTOMOTIVE INDUSTRIES, "Is Volumetric Efficiency of Prime Importance?" issue of April 28. The last two paragraphs clearly define the effects and differences due to proper application of heat to the charge compared with the lack of sufficient heat. It is surprising that the oft-repeated argument against the application of heat on account of its tendency to reduce volumetric efficiency still continues to be put forward.

There is no question but that this is a complete fallacy, not only by reason of the fact that only 10 per cent of the time is the average passenger car engine called upon to exercise its full output, but also that this possible lack of volume, due to pre-heating of the charge, is greatly offset by the more rapid and better combustion that results from its proper preparation.

As a matter of information, it should also be pointed out that the heat taken up by the charge at full loads is greatly reduced. With wide-open throttle, the maximum temperature of the mixture occurs at the lowest speed, being rapidly reduced as the speed increases. At part loads the volume of the mixture passing through the

manifold is so small, comparatively, that the heat taken up increases, despite the fact that the external temperature of the manifold may not be as great as at wide-open throttle.

The popular conception of the heat of the charge is gained as a result of the observation of manifold temperatures, neglecting the question of heat units which can be absorbed by the mixture, which depend on volume and velocity.

We demonstrated, several years ago, with two motors identical in size and construction, with the exception of manifolding, that it was possible to obtain more torque at any speed and a greater maximum horsepower with the heat than without it, while, of course, the fuel economy was infinitely superior with the heated manifold.

There are many owners of cars, who, during the colder months of the year, use them for business purposes, probably for very short distances, and it is under these conditions that the proper heating of the charge is appreciated. Without it the engine does not run sufficiently long to function at all properly and requires constant manipulation of the choker, with its attendant ill results. A. A. BULL, Chief Engineer,
Northway Motor & Mfg. Co., Div. Gen. Motors Corp.

The Efficiency of Weak Mixtures

Editor, AUTOMOTIVE INDUSTRIES:

The whole automotive world must feel deeply indebted to the Asiatic Petroleum Co. for providing the necessary finance to enable Messrs. H. R. Ricardo, H. T. Tizard and D. R. Pye to conduct the extremely accurate and valuable research which has now been proceeding for more than two years in England.

Among the mass of information already given to us there is one phase which, to me at least, is of the first interest by reason of its having occupied my firm devotion for many years. This is the pronounced attitude of the findings in favor of the adoption of weak mixtures, if this can be done commercially.

Quoting from the reports: "The conclusion to be drawn is that the indicated thermal efficiency of the best engines is not likely to be improved upon substantially by any development of design other than that of the employment of weaker mixtures than can now be used . . . our results show that great improvement is to be expected."

The report appears to advocate at least a 20 per cent weaker mixture than that which is theoretically correct, and states that, with a very weak mixture, ignition is only possible by the stratified charge or similar arrangement. The reason for this is that "a homogeneous mixture of fuel vapor and air cannot be exploded if the concentration of the fuel vapor is appreciably less than 80 per cent of that required for complete combustion of the air."

Discussing the question of dissociation of CO_2 with a 20 per cent weak mixture, the report states that "at the lower temperature at the end of the expansion stroke the dissociation is negligible. The work done by the expansion in such a case is practically the same as if no dissociation occurred; in fact, the only effect of dissociation is to lower the maximum temperatures and pressures without materially altering the efficiency." Mr. Ricardo shows how, with a compression ratio of 5 to 1, he reaches a critical maximum with one fuel, so that if the compression is raised and the mixture strength remains the same, detonation occurs unless a slower burning mixture is used. He prefers to do this by either retarding the timing of the ignition or by *enriching* the mixture on test, although he says that the same results could be reached by reducing the mixture strength, but states the fact that the range on the weak side is very limited, "so narrow, indeed, that to attempt to escape detonation by working entirely on the weak side would be completely out of the question in any practical multi-cylindered engine, on *account of irregularities in distribution.*"

The italics drawing attention to the last phrase are my own. The report makes out a strong case in favor of the line I have followed. I have conclusively proved that the weak mixture can be used commercially and that it does reduce detonation. In 1912-13 I built several cars and had tests made by the Brooklands Racing Club on speed. One touring car of about 3000 lb. weight consistently did 26 miles to the gallon of fuel when adjusted for racing and hill climbing, and was certified doing 77.02 miles per hour on the track with the same setting.

The only way that such mixtures can be used commercially in an ordinary engine is by overcoming the distribution problem, and this is what I set out to do. I need scarcely point out the importance of every cylinder performing the same amount of work as its neighbor and in a similar manner. This is more important than engine balance from a mechanical point of view, but a fact often overlooked. I attacked the problem by eliminating the disturbing elements from the vapor stream and allowing only a comparatively dry homogeneous vapor to pass into the manifold. This is done by a system of separation and application of local heat.

The temperature of the manifold is of considerable moment, and this was ably dealt with by Mr. Frank A. Howard in his paper before the S. A. E. last winter. He, however, bases most of his deductions on the supposition that the engine runs with an absolute manifold pressure of 0.5 atmosphere. This, of course, would be an advantage from the vapor pressure point of view. My system operates equally well at approximately atmospheric pressure, tests being invariably made at low engine speeds and full throttle opening, a difficult condition for carburetion.

Recent examinations, made by an independent chemist, of exhaust gases from a large four-cylinder engine running on a mixture strength of between 16.8 to 1 at 500 r.p.m., full load, and 16.2 to 1 by weight at 1000 r.p.m., on full load and half load, showed that the combustion was complete in each instance. Mixture strengths of 17.4 to 1 are satisfactorily used, and these weak mixtures will give rapid acceleration; in fact, as compared with the usual commercial set of carburetor and manifold, the Brewer system generally shows an increase in the rate of acceleration up to 33 per cent with a decrease in the fuel consumed for equal work of at least 20 per cent and sometimes as high as 40 per cent.

Examinations of glass manifolds invariably show that there is sufficient liquid on their sides to suffice for as much as 50 cylinder charges. How can one expect to have equal distribution when such a state of affairs exists? ROBERT W. A. BREWER.

Correction

On page 910 of AUTOMOTIVE INDUSTRIES of April 28 there was printed a letter from C. T. Myers on the subject of Hub Standardization, in which a sentence read in part:

"The Scotch have a gloomy way of regarding the efficacy of remedies that are not mixed in their own pharmacy."

Mr. Myers intended that this part of the sentence should read:

"The doughty Scotch at times have a gloomy way of regarding remedies that are not mixed in their own pharmacy."

The Meaning of the British Coal Strike

Prolongation of the British coal miners' strike may reduce to starvation a large proportion of the population. The momentum of an idea, such as British Labor has, may cause people to rush forward even to the point of destroying the very aspirations for which they are struggling.

By Harry Tipper

THE coal strike in Great Britain continues to drag along with no immediate prospect of relief and with an indication that the other unions are prepared to protect the miners at least to the extent of preventing coal coming into the country if their union orders can do it.

The efforts of the government and the leaders of other unions have failed to bring the mine owners and the workers together, and so far the pressure of public opinion has been unable to effect any basis for further discussion. The stagnation of industry brought about by this strike is very severe, and it will have its effect upon the prosperity of all workers for a considerable time after the strike may be settled.

Great Britain is primarily an industrial country. Its population is more largely industrial than any other country except perhaps Belgium. By far the majority of the workers are occupied in some form of industrial endeavor and as a consequence of this the majority of the working population are members of unions, industrially. Politically, there is a very strong body of socialism paralleling the strong industrial unionism. Despite the fact that the present stagnation of industry will bring a large part of the population to the verge of suffering, if not to actual semi-starvation, the business of forcing the political industrial problems to conclusions is going on and the working population are pursuing these actions, even though they may destroy their prospect of future prosperity for a number of years.

We are very much inclined to forget that the momentum of an idea strongly fixed in the minds of a number of people will rush forward, even though its movement destroys the very aspirations which are back of the adherence to the idea itself. For this reason, the tendency and growth of a new creed in business or politics is very important; more important than the logic of its definition or the justice of its idea.

In the long swing, all such movements tend to equalize themselves and secure a larger measure of justice for the general group, but the long swing in human affairs may involve several centuries. In the meantime, the pressure of strongly organized groups fighting for definite ideas to be put into practice, disturbs the fabric of industry seriously. This disturbance may destroy the efficiency of the industrial accomplishment to a large degree and reduce a percentage of the population to starvation or destroy them. The present coal strike in Great Britain is critical for that reason. It may not be possible to confine the strike to the dispute between the miners and the government as the stagnation of industry grows and the suffering increases.

A good many years ago there was a prolonged struggle between the foundry men and steel workers and the owners, which affected all the steel and metal trades industries in Great Britain. That strike lasted about nine months. The strike was called after repeated attempts at negotiation and as the result of a complete split on one or two of the matters involved.

During the first two or three months of the strike, the affected workers were quite orderly and no attempt was made to interfere in the operations of some of the companies who employed non-union men. As the time went on and the strike funds diminished, strikers began to suffer in considerable numbers. In some of the towns depending upon the steel industries, the condition of the population was very serious. Sporadic outbreaks occurred, and when the strike was finally settled, a good many riots and other difficulties had disturbed the peaceful character of the dispute.

During the same period a considerable amount of the business went over to Germany, Sweden and other countries and a good deal of capital was transferred to the building of steel plants, foundries and so forth, in those countries. For a number of years the effect of that strike was felt in the position of the British metal trades industries in competition for export markets.

Any large development of suffering from the present stagnation in Great Britain is likely to have its effect in increasing the unrest of the population very materially. The last report indicated that the number of unemployed had reached several million, and each week without a reasonable supply of fuel the number increases.

Distribution will be difficult, even the distribution of foodstuffs will become sufficiently difficult to require severe rationing if the struggle is prolonged. In that case, the bitterness must increase and the population become more and more inclined to take severe measures to relieve themselves of the hopeless situation. It is more and more apparent that the political questions in Great Britain are subsidiary in importance to the industrial questions, and the future position of the country depends very largely upon the settlement of some of these important basic industrial problems.

The Whitley Councils have been of advantage in the settlement of smaller disputes, in the relief from local grievances, and in the interpretation of rules concerning the conduct of the particular industry. All methods of adjustment have failed industrially to meet the situation when the national aims of the trade unions have been at stake and the political aims of the labor party have been concerned.

Developments in Great Britain will have a considerable bearing upon this country; the relation is

too intimate to permit us to be without interest in the matter; especially since upon the stability of the industrial fabric in Great Britain depends the stability of the European Industrial World.

If this strike can be settled by the weakening of the miners or by the reconsideration of the owners, and with reasonable promptness, the settlement and its character will indicate the tendency of labor opinion in regard to its own program and the methods taken to secure it.

If the strike is protracted and the country maintains its orderly condition, it will become evident that the labor party is concerned with pushing some of its political ideas to immediate adoption and that its power is greater than we suspected.

In any event, the coal strike indicates the critical state of political affairs in Great Britain and the character of its settlement will have an important bearing upon the future policy of the country. It is one of those visible disagreements which accumulate out of years of slow definition, and as such, is likely to indicate the character of future developments more definitely than previous discussions have done.

We were somewhat disturbed in this country when we had a few days with the miners out of the mines, not very long ago. There has been a complete stoppage of coal production in Great Britain for several weeks now.

The stocks are almost exhausted and the unions have put an embargo upon importation. The next few weeks should be critical and important.

Statistics, Necessary and Unnecessary

THE usefulness of statistics and compilations would seem to be the only basis upon which to test the advisability of getting them together. The average business man would regard as a lunatic an automobile executive, for instance, who paid money to an employee for collecting data as regards the number of women with blue eyes in the cities of less than 10,000 population. Yet there are many statistics compiled and many charts kept up to date in various business institutions that have little more actual, practical value to the management than the figures in the example to the automobile producer. As B. C. Moise, secretary of the National Tube Co., put it recently: "Necessary figures are indispensable; unnecessary figures are a pure waste, not only of money, but of what is more important, time and effort."

Along with this statement, Moise made some other very pertinent remarks in an address on "Cost Accounting" before the recently organized Industrial Cost Association. The part of his talk which touched specially on this subject of unnecessary figures is of special interest:

"*Costs should be as simple as it is possible to make them consistent with giving all the necessary results.* Necessary figures are indispensable; unnecessary figures are a pure waste, not only of money but of what is more important, time and effort. Unnecessary figures tend to confuse the man who uses the costs instead of helping him. I have known some cost men who seem to consider that the object of the cost system was to make figures and not to get results, and as a result they piled up meaningless masses of exhibits which nobody wanted and which nobody could use.

"It should be a principle of every cost department to make only costs which are clearly necessary for the conduct of the business for selling, operating or competitive reasons, and to make no other exhibits which are not asked for as necessary by either the selling or the operating organization. Also, care must be taken to weed out costs or exhibits which have lost their value due to the lapse of time, or which were only meant to serve a certain purpose. I think every large cost department which makes up exhibits in considerable detail should have a committee appointed whose business it would be to go over every single cost sheet, report and exhibit made, at least once every three months, with a view to eliminating those found no longer necessary or those which were not used. A detailed classification on a cost sheet, or a detailed exhibit, may seem admirable to a cost department and may have been urgently requested by an operating official, and yet after the first two or three reports be unused.

"There is no object except expense and confusion in making reports which are not used. It is often the case that an operating official will cling to reports and detailed exhibits that he never looks at. In some companies, not only are the reports gone over quarterly, but where the accounting official at the mill has reason to believe that the report is not used, it is quietly dropped, and many times, in such cases, the operating official never even notices its lack. It evident that such reports are only a cause of expense and confusion. I cannot too strongly insist upon the desirability of a periodic review by every company of all reports of every nature, with a view to the elimination of those which have served their purpose, are obsolete, or which are not used to an extent to justify the expense of preparation.

"It seems to be the fashion for the legislative bodies of the National Government and the several States, and also, I am sorry to say, for many well-meaning but misguided eleemosynary societies, to consider that all human ills can be cured by the excessive multiplication of laws and the excessive multiplication of detailed figures. The extent to which miscellaneous information of all sorts is demanded and collected by National and State Bureaus is truly enormous and alarming. As a rule, and I speak from long experience, these reports have very little value of any sort. The data is asked for by people who often do not understand the subject, who have had no training and who are actuated by well-meaning but misguided enthusiasm. That is the charitable view. The other view is that all these unnecessary reports require additional clerks and these additional clerks are not necessarily skilled and trained men, although their salaries add to the taxes which you and I and every corporation pays."

Trades Disputes in Great Britain

THERE were 1715 labor disputes in Great Britain during 1920, an increase of about 300 over the preceding year. The number of persons involved, however, was smaller during 1920 than during 1919. The total number involved in the 1920 troubles was 2,019,000 as against 2,586,000 in 1919.

In 1919 there were 34,903,000 working days lost because of these disputes, but in 1920 the total reached only 27,011,000. A study of the detailed figures as reported by the British Labor Gazette shows the coal miners to be responsible for the most important of these disputes. Nearly a million and a half men were involved in mining disputes; that is, over half the total number involved in all the troubles.

The engineering and shipbuilding trades which caused the loss of 10,000,000 working days in 1919 was responsible for only 2,500,000 lost days during the last year. The miners lost 17,424,000, however, bringing the total up within striking distance of the previous year.

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Growing Popularity of the Line Drive

IN these days of hesitancy among potential tractor purchasers it behooves manufacturers to diligently study all possible means of making their machines more serviceable to the farmer. One feature that unquestionably makes a strong appeal to the average farmer is the line drive. It is not so much the sales phrase that it "handles exactly like a horse," but rather the saving in labor in certain farm operations. The harvest season is always a very busy time on the farm, and if a man is required to ride on the binder in addition to the man operating the tractor, it is a great handicap for the tractor. Although farm labor conditions have been somewhat relieved, the farmer is still under the influence of conditions that obtained during the past couple of years when efficient help was exceedingly rare and expensive and the other kind extremely unsatisfactory.

For operating a manure spreader, for hauling farm wagons and various other operations the line drive is exceedingly handy. The length of time the tractor is used for such operations may not be very long as compared with the plowing period, but the point is that the extra help required for these occasional operations is not available on the smaller farms.

That farmers think highly of the line drive idea has been demonstrated time and again at shows by the crowds at stands on which such tractors were exhibited. Line drive attachments have also been developed for the Fordson tractor and evidently met with considerable sale.

At first the line drive principle did not take well with the leading tractor makers, who evidently considered it a mere selling feature intended to convince the timid prospect of the ease of tractor operation. Its practical advantages are gradually coming to be recognized even by the more conservative makers, however, and the number of line drive models offered is perceptibly increasing.

New Applications of the Principle Leverage

IT seems that Archimedes, who discovered the law of the lever, thoroughly understood the principles of modern advertising copy writing. If he had enunciated his law in the now familiar text book form—"the moment of the load is equal to the moment of the force"—he would have created hardly a ripple of interest. So he thought up a way of putting more punch into its statement and put it thusly: "Give me a fulcrum point for a lever and I will move the earth."

This forceful enunciation of the simple law has lost none of its impressiveness even to-day, after more than two thousand years, and, enthused by the wonderful possibilities thus indicated, inventive minds are constantly at work in an endeavor to apply the great force of the lever to the solution of some of our every day problems—sometimes with rather startling results. A Montana inventor, for instance, has created a leverage system which he has applied to a well-known make of automobile engine, increasing the horsepower of that engine (we are assured) nearly 100 per cent. The crank throw is said to be different from the piston stroke. In an advertisement of the company promoting the invention, appearing in a Montana newspaper, a number of residents of the neighborhood vouch for the increase in horsepower. It would not be difficult to concede that a leverage system might increase the torque, and the thought occurs that possibly the men who attested the brake horsepower tests do not understand the difference between torque and horsepower or between force and power.

Archimedes' famous statement regarding the possibilities of the lever is quoted also by a Denver concern which has made what is claimed to be a new application of leverage in tractor construction. Instead of hitching the plow to the tractor frame, it hitches same to a crossbar fitted with rollers at its ends which travel on circular tracks secured to the driving wheels and concentric therewith. This is said to transfer the fulcrum point of the drivers from the axle to the

point of ground contact, and thus to prevent all slipping of the wheels. The fulcrum point of a rolling wheel is a rather novel conception. It is quite plain, however, that when a tractor exerts a drawbar pull there must be a reaction to this pull, and this occurs between the wheel rims (and their lugs) and the ground. If the load to which the tractor is hitched is excessive and there is sufficient engine power and a sufficiently large gear reduction, the drivers will slip, no matter how the load is hitched.

The lever will serve very well for multiplying forces, but in the same measure as the force is increased the speed of the motion is decreased and the power (or rate of doing work), therefore, remains the same. By a slightly more complicated mechanism we can even multiply horsepower, but in the same measure as the horsepower is multiplied the time of application is reduced. All attempts to use the principle of leverage for multiplying the power of engines must necessarily end against the stone wall of the law of energy conservation.

The S. A. E. and Research

THE announced intention of the Society of Automotive Engineers to enter actively the research field has been made the occasion of many letters addressed to AUTOMOTIVE INDUSTRIES and pertaining to proposed activities along this line. While some of these correspondents foresee some dangers and difficulties that must be guarded against if the new activity is to succeed, we have yet to hear anything but commendation for the basic undertaking.

It is quite generally agreed that it is necessary to the success of the project to make haste slowly, lest the plan be discredited by ill-considered action or mistakes in policy. Time in planning will not be lost, of course, if this time is used in establishing a sound foundation. One correspondent points out the need for laying out a complete program before conducting any actual research as a means of avoiding the possibility of becoming involved in a mass of details and losing sight of the most important items. It is obviously desirable to start first the items of greatest importance, later elaborating on details in logical sequence.

Another correspondent mentions the fact that few industrial organizations have the funds required for what may be termed fundamental research, but greatly need much fundamental data, now lacking, in order to start specific developments on a sound basis. Such data can, he says, be best developed through research in university and government laboratories, which will gladly undertake the work when it is once agreed what is required. The S. A. E., it appears, can and should be the directing and co-ordinating body, and serve as a clearing house for collection and dissemination of data from all available sources. When data in hand requires checking and when gaps in the available information need to be bridged, the S. A. E. should assign the problem to one or more laboratories, follow it through, and publish the resulting data in convenient reference form.

The belief is quite general that research involving fuel and its efficient utilization is of primary importance, and there are, of course, many angles to this problem which seem of pressing importance. Some consider that development must take place along lines that will make the automotive engine independent of specialized and high-priced fuel. Study of fuel injection is suggested. Means for controlling temperature inside the cylinder, study of the laws of heat transfer, behavior of various fuels, study of means for producing cheaper alcohol, and many related matters are mentioned as being of importance. One engineer suggests the need for dividing fuel research activities into two parts: those which relate to future designs and those applicable to equipment now in use or in process of manufacture, since much of this equipment will continue in operation for many years to come. It is evident that study of means for improving fuel economy, especially at part load, is needed and should constitute an item of first importance.

The fuel problem so far overshadows other matters of importance that little space is devoted in the letters received to the need for consideration of what may be termed mechanical research, but some draw attention to the need for improving mechanical efficiency, especially in the engine, and for lowering resistance to motion of the car (drawbar pull), while others cite the need for study of factors tending to increase the life of parts and lower cost of operation. In this connection weight reduction and elimination of nonessential equipment are mentioned.

Several correspondents point out the importance of keeping clear of patent considerations in all activities undertaken by those who have the research program in hand. Similar caution in this regard has been observed in connection with S. A. E. standardization work, but it will, it seems, require even greater attention in reference to research work.

There seems, on the whole, to be little question of the hearty support and ultimate success of the proposed activity, if the foundation is well laid and the work prosecuted in a thoroughgoing and persistent manner.

Complicated Practice; Simple Principles

SOME men who call themselves "practical" are inclined to scoff at those whom they choose to call "theorists." There are so many "practical" men and so many difficulties in industry that it sometimes leads one to wonder whether or not the high proportion of both is not more than a coincidence.

All sound practice is based on theory, and clear, logical thinking in an abstract way is necessary to the development of intelligent practice. Prof. Einstein has said a lot of things that only a few can understand, but he recently made a statement that has a clear meaning and a direct application to the problems of industry. He said:

"Complicated events flow from a few simple principles, and the more we know the fewer and simpler are the principles." But simple principles must not be confused with superficial catch-words or formulas as is sometimes the case.

Bad Weather Leads in Sales Check

Price Uncertainty Is Another Factor

Prompt Action Needed for Stabilization—Wall Street Hysterical Again

By James C. Dalton

NEW YORK, May 16—Temperamental Wall Street is worried again about the automotive industry and is selling motor stocks short. This is its reaction to price cuts, a slight decline in retail sales for April and lower dividend rates. This attitude in the "street" is nothing new and in it there is no new significance.

There is real significance, however, in the remarkable "come-back" of the industry at a time when the entire country is crying depression. Automobiles were one of the first commodities to bear the full brunt of the buyers' strike and they were one of the first to feel the pulse of renewed demand. This recovery in the middle of a prolonged period of deflation proves that the industry is on a stable foundation. Its future is vastly more assured than that of the railroads whose securities once were the chief source of revenue for widows and orphans.

Business in the United States never has been called upon to meet problems exactly like those which it has been compelled to face for the last year, but there never has been a period of depression from which the country has not emerged on an even keel. There have been ups and downs for every line of industry and there will be now.

It was not to be expected that when sales of automobiles began again after the serious slump of last fall and winter they would forge ahead steadily, month by month, with each thirty-day period better than the one preceding. That condition never has prevailed in normal times and it never will. Certainly it could not be expected under the abnormal conditions which prevail now.

Business Largely Seasonal

The automobile business, in its very nature, has been largely seasonal. This applies to commercial vehicles as much as to passenger cars. Until good roads become universal and until snow removal becomes a science this always will be true.

Passenger car sales in all except southern states always increase to a peak in early summer, and there always is a drop in the sales curve about July 1 when the first summer demand has been satisfied. After that sales forge ahead in a satisfying way and business is good in late summer and early autumn, reaching its ebb about the first of the year when winter has taken its first firm grip. From this ebb the rise begins gradually and spring sees a sharp upshoot in the curve.

The spring demand began this year abnormally early. The winter was remarkably open and the weather for the first quarter was more spring-like than it has been since then. It was only natural, therefore, that sales of cars started from six to eight weeks sooner than they would under the usual weather conditions. Such being the case, it would be remarkable if they did not fall off a little earlier.

Sales at retail were somewhat smaller in April than they were in March. That was due in large measure to the cold, raw weather which prevailed in nearly all sections of the country. It might be pointed out, however, that sales of winter overcoats, which usually start in late October, did not get under way last year until nearly Christmas. The topsy-turvy weather was the reason for that, just as it has been the chief reason for whatever slump there has been in automobile sales for the last month.

Proceeding With Caution

After its sad lesson with huge inventories purchased at high prices, the automotive industry is proceeding with the utmost caution. It is buying on a hand-to-mouth basis. This applies to all branches of the industry. Orders are placed only for goods which are actually needed and prompt deliveries are demanded. Sometimes, the parts makers contend, the demands in this direction are unreasonable. They are again beset by stock chasers.

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AUTOMOBILE SALES INDEX TO BUSINESS

NEW YORK, May 14—The following statement in reference to automobile conditions as contained in the monthly review of business conditions issued by the Northwestern National Bank, the largest in the Northwest, indicates the change in sentiment toward the automotive industry on the part of bankers:

"Automobile sales now are looked upon by many as one important index to business conditions. Although the industry is not so basic in character as some that by the rise or fall of their activity affect conditions generally, it has become so great in recent years that its availability for general guidance is more generally recognized."

Sales Slump Hits Lines Not Reduced

Buying Gains in Cars Repriced Offset by Check in Other Makes

NEW YORK, May 16—With the exception of Studebaker, practically all lines of cars handled in New York have been unfavorably affected by the price reductions on Marmon and Jordan more than two weeks ago, and on Oakland and Chevrolet announced last week. The four cars which reduced have been selling strong, Marmon particularly having made a big gain this week over sales during the first week of the lower priced period.. Oakland and Chevrolet sales started with a rush, naturally most noticeable in the latter line, Monday morning following the appearance of the reduced price announcement in the Saturday and Sunday newspapers.

Marmon sales have been so heavy that the accumulated stock of cars has been cleaned out except for three enclosed models. The distributor is even forced to do without the four passenger and seven passenger demonstrators. Orders for factory shipments during May have been largely increased. Marmon distribution outside the city is handled by five dealers, all of whom this week had the largest single week's sales since they took the Marmon representations.

Oakland sales have been multiplied several times in both the New York and wholesale territories. Chevrolet sales are strong throughout the territory and orders are pouring into the factory at Tarrytown. In the New York salesroom the sales force has been practically swamped with demands for attention from salesroom shoppers.

Studebaker Six Weeks Ahead

Studebaker sales, which have increased steadily since the first of the year, have now reached a point where orders are being taken subject to six and eight weeks' delay in delivery. Recent price reductions in other lines apparently have not affected Studebaker in this territory up to date.

Generally speaking, however, passenger car sales have suffered acutely from recent price reduction announcements. In some lines sales have been virtually halted by an attitude on the part of the public which indicates that lower prices are confidently expected. Several of the lines which have been selling strongly for the past month or two have been affected by competitive reductions, sales on some of these popular classes drop-

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Bankers Name New Goodyear Head

E. G. Wilmer Succeeds to Seiberling Place

Stadelman and Litchfield Continue as Vice-Presidents—Directors Reorganize

NEW YORK, May 16—Edward G. Wilmer of Milwaukee, vice-president of the Steel & Tube Co. of America, will succeed F. A. Seiberling as president of the Goodyear Tire & Rubber Co. under the reorganization plan which became effective when bankers formally took control of the corporation. He is a close friend of Clarence Dillon of the banking house of Dillon, Read & Co. of New York which headed the syndicate of bankers which has successfully put through the refinancing plan under which $85,000,000 in new securities will be offered. Wilmer, who is only 38 years old, has been identified with the mining, steel and chemical industries. He will move from Milwaukee to Akron and it is said he will have a free hand in the management of Goodyear.

The only Goodyear officers prominent under the Seiberling régime who will remain are George M. Stadelman and P. W. Litchfield, both of whom retain their positions as vice-presidents. Vice-president C. W. Seiberling retires with his brother.

The ousting of F. A. Seiberling from the head of the great tire company which he built up is one of the most dramatic and tragic incidents which has followed the period of depression into which the country was plunged nearly a year ago. The financial difficulties which resulted in his downfall were the result of the enormous inventory accumulated at high prices and the very large number of contracts made for future deliveries of crude rubber and long staple cotton.

Organized With $12,000 Capital

Seiberling, who is now recognized as one of the leading figures in the rubber industry in the world, began 23 years ago with $12,000 borrowed capital with which he founded the Goodyear company. From this small beginning the company grew until it became the second largest rubber company in the world with more than 50,000 employees, 100 acres of floor space in its Akron factories, a rubber plantation in Sumatra, tire factories in Canada and California, a 56-acre cotton plantation in Arizona and fabric plants at Goodyear, Conn., and Los Angeles. The company attained a peak production of more than 50,000 automobile, motor truck and motorcycle tires a day. It gave the motoring world

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Seiberling Says He Will Take One Month's Rest and Then He'll Go to Work—at Something

AKRON, May 16—"I am going to clear up my personal affairs next week and then go away for a month's rest. When I come back I shall go to work—at something."

This statement was made to-day by Frank A. Seiberling, who retires as president and director of the Goodyear Tire & Rubber Co., which he founded.

"My brother, C. W. Seiberling, and myself, sever all our relations with Goodyear and control of the business passes into the hands of the bankers as provided in the reorganization plan," he said. "Both of us continue our interest as the company's largest stockholders. For 22 years we have labored together and what has been achieved the world knows. The nation-wide slump in business last fall brought our business to the verge of disaster. Since that hour I have had but one purpose—to save this business from a receivership and this community from the results of such a calamity. That was accomplished yesterday and the new management inherits a business soundly financed.

"My successor, E. G. Wilmer, of Milwaukee, is a young man of fine legal training and broad experience in operating business, and with the return of the world to normal business there is no reason why Goodyear cannot move forward to a higher plane than it has yet achieved. The bankers in control made me an exceedingly generous offer to continue with the business, which, after careful consideration, I felt justified in declining.

"What I am going to do next I do not know. Since I left school 44 years ago I have labored hard, enjoying my work all the way along, through all its difficulties, up to within the period of the last six months. In truth, I have been tired during that period. The burden is now all off my shoulders, except for a few days I have had no vacation in over two years. I am going away for a month's rest and when I come back I shall go to work—at something."

Goodyear Files Show Business Struggles Fought by Seiberling to Win Success

AKRON, May 16—It is interesting to go back through the files of the Goodyear history from the time in 1898 when F. A. Seiberling started the company with a capital of $12,500, of which only $3,500 was cash—and that borrowed—and to follow the progress of the concern through years and months of troublesome times, up until the present when Goodyear at its peak a few months back had over 50,000 employees throughout the world.

First Directors Unfriendly

The Goodyear company, housed in ramshackle buildings in East Akron, where now stands the Goodyear plant valued at nearly $60,000,000, was forced to expand. But expansion meant re-financing and Seiberling presented to his directors plans for the securing of $150,000 of additional capital. His directors, many of them unfriendly to his personal interests, guaranteed the re-financing upon condition that the Seiberling brothers pledge the majority of their stock, and endorse the notes as evidence of good faith. Willing to make the personal sacrifice for the sake of their concern, the brothers announced the plan as acceptable, until they discovered hidden in the phraseology of the terms, clauses which would have transferred control from the two, robbed them of authority, and practically ousted them from the company.

The directors brought presusre to bear and issued the ultimatum that unless the two brothers surrendered unconditionally, all arteries of financial aid would be completely shut off.

One director who had advanced $10,000 to meet the company's payroll, demanded instant reimbursement. Goodyear records show that President Seiberling unflinchingly, although he did not know where the money would come from, calmly replied, "I will get your money for you by 5 o'clock."

Appearing before directors of an Akron bank which was none too friendly to him, and yet the only financial institution he could call upon for aid, Seiberling's outspoken frankness was attended by success. By 5 o'clock the turbulent director's $10,000 was in his hands, his stock was purchased by interests more friendly to the Seiberling brothers, ample credit was secured to endorse the company's paper, and the crisis was averted.

Averted Crisis in 1903

Again in the panic of 1903, Goodyear lived through another serious financial crisis. Approximately $800,000 of the company's paper, most of it in notes, was

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Senate Clears Way to Aircraft Dumping

Penrose Takes Position There Is No Air Industry Here Requiring Protection

WASHINGTON, May 16—Efforts of Senator New of Indiana to protect American aircraft manufacturers from foreign competition by a specific amendment to the anti-dumping bill failed Wednesday because Republican leaders insisted that the proposition was utterly indefensible. The New amendment was designed to block the sale here of surplus airplanes by the Aircraft Disposal Co., organized in Great Britain.

In opposing the proposition on the floor of the Senate, Senator Penrose of Pennsylvania, chairman of the Senate Finance Committee, insisted that it was an attempt "to tax the Government of the United States several hundred million dollars for fostering an alleged American industry which is non-existent." Senator New challenged the assertion of the Pennsylvania senator with the statement that 20 concerns are now making aircraft or aircraft parts in this country with great opportunities for expansion because of the commercial demand for airplanes.

Senator New pointed out that 100 airplanes were imported to this country after the armistice for sale here, but were not put on the market because of the effective campaign by American manufacturers. These aircraft producers appealed to the United States Court, and the court held that the British planes were based upon an American patent and did infringe upon that patent. He insisted that these planes are now in bonded warehouses at eastern ports ready to be put on the market here at any figure that their American owners can get for them.

The Senate was advised by Senator New that 30 concerns were making airplanes and about 20 others making aeronautical motors at the time of the armistice, representing a capital investment of $100,000,000 and employing 200,000 operatives. He declared that there was now perhaps a total of 2500 operatives within the industry hoping to remain in the field if not pushed out by foreign competitors.

He declared that manufacturers will not be warranted nor able to attempt to revive the domestic market until they receive ample protection.

See Plane Dumping Move in Handley Page Visit

NEW YORK, May 16—The Aero Club of America and its affiliated organizations in the principal cities of the United States have called the attention of President Harding and the Secretaries of War and Navy to the arrival in this country of Frederick Handley Page, head of the British syndicate organized to dispose of surplus aircraft. It is his purpose to sell a large part of this equipment in the United States.

Successful litigation by Amerian owners of patents used in British machines has interfered thus far with the sales. It is expected, however, a new effort to get business will be made coincident with the defeat of an amendment to the anti-dumping bill offered by Senator New. This amendment would have provided that the appraisal value of aircraft imported into this country should be based on the cost of production rather than on the 1 per cent of the original cost which the British interests paid for the war material. This amendment was defeated by Senator Penrose who asserted there was no American aircraft industry worth mentioning and that the United States should go to England for its airplanes if it could get them more cheaply there.

Slough Trading to Sell Trucks in South America

LONDON, May 2 (By Mail)—Plans of the Slough Trading Co., Ltd., for exporting to the United States a large number of the American made motor vehicles bought from the British Government have suffered a serious setback because of the opposition from American truck makers. Many of the trucks which had been stored at the Slough depot were requisitioned by the Government in connection with the threat of a strike by the "Triple Alliance," but as the strike did not take place they were not used. All the vehicles have been reconditioned and the company expects to ship a considerable number to South America, especially the Argentine.

The company has an enormous quantity of spare parts and the prices can be judged from the fact that new Packard cylinder blocks were quoted at $125. Lucas lighting generators, the normal price of which is $100, are marked at $20 in lots of 10.

The general use of the straight side tire makes them look like the British standard, but the fact is more of a tribute to successful American competition than to any recognition of the superiority of this type of tire. There has been a big drop in tire prices but there is little trade because so few vehicles are being built.

Strike Ties Up Daimler

The Daimler works at Coventry are almost at a standstill because of a wage dispute with the 1700 workers. The company's employees had been working on a premium bonus system and not on direct rates for piece work until it was proposed recently to introduce a new line of work with the object of increasing sales and providing more employment. This is believed to refer to a lighter and cheaper Daimler car.

The union objected to this plan, claiming that the standard time rates were affected by the proposed revision. It was contended the proposal would re-

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Experts to Teach Parts Units Service

Factories Launch Campaign to Improve Conditions — Will Tour Principal Cities

DETROIT, May 16 — Demonstration lectures to service managers, mechanics and others concerned in the repair and servicing of automobiles and trucks will be given in various cities, beginning tomorrow with a lecture at the Cadillac service station here under the auspices of the Detroit Automobile Dealers' Association. The lectures have been arranged through the efforts of Harry G. Moock, manager of the N. A. D. A., and officials of Continental Motors Corp., Timken-Detroit Axle Co., and Borg & Beck. An expert from each of these companies will lecture on proper servicing of those parts and will give demonstrations in repair work.

Experts employed by other manufacturers of standard units will be added as rapidly as is possible and it is hoped to extend the work to cover every large distributing center in the country. In each case the local dealers' association will have charge of arrangements for the lectures, bearing the necessary expense and attending to the work of bringing out a full attendance of those sought to be reached.

Two nights will be devoted to each city and the itinerary of the lectures following the Detroit meeting will be Cincinnati, May 19 and 20; Indianapolis, May 23-24; St. Louis, May 31-June 1; Kansas City, June 3-4; Omaha, June 6-7; Chicago, June 9-10-11, and Milwaukee, June 13-14. A change in the schedule to include Minneapolis is probable. There will be no sales or advertising propaganda used in connection with lectures.

Draymen's Association Asks Service Stations

LOS ANGELES, May 17—The Southern California division of the Draymen's Association has adopted resolutions requesting manufacturers of complete unit parts to establish parts stations at which genuine parts can be purchased at fair and uniform prices for the units now being manufactured as well as those which are considered obsolete. This method, the resolution asserts, is the only practical way in which motor truck users can get the service to which they are entitled.

The assertion is made that past experience demonstrates that distributors and agents either cannot or will not carry a complete stock of parts. Another difficulty, it is stated is that manufacturers are constantly changing their representatives as well as their models and that as a consequence members of the association constantly are finding themselves with broken down equipment because no one carries the parts needed.

Du Pont Finances G. M. C. Purchase

Will Sell $35,000,000 in Gold Bonds to Close Transaction with Durant

NEW YORK, May 16—The stock transaction in which E. I. duPont de Nemours & Co. purchased control of the General Motors Corp. from William C. Durant, formerly its president, in the liquidating market of November, 1920, is to be financed permanently by an issue of $35,000,000 7½ per cent 10 year gold bonds.

J. P. Morgan & Co. have purchased the issue from E. I. duPont Nemours & Co. and will offer it today through a nation-wide syndicate at 100 and interest to yield 7½ per cent. The bonds, dated May 1, 1921, are redeemable at the option of the company, in whole or in part, on 60 days' notice, at 110 and interest, at any time prior to May 1, 1922. Thereafter the redemption price decreases 1 per cent yearly.

The formal announcement of the banking house said:

"The proceeds of the bonds will be used partly to supply funds for permanently financing the cost of the common stock of the General Motors Corp. purchased last year and for other corporate purposes."

Approximately $25,000,000 will be required to finance the stock transaction permanently. The additional $10,000,000 is for corporate purposes.

This General Motors stock now held by the duPont Securities Co. amounts to approximately 4,000,000 shares in all. A total of 2,504,273 shares was acquired by purchase from William C. Durant in November for $23,790,600 in cash and 40,000 shares of the duPont Securities Co. Subsequently, the duPont Securities Co. gave Durant 230,000 shares of General Motors common stock for his 40,000 shares of duPont Securities Co.

To Wind Up Holding Company

It was said yesterday by the bankers that the affairs of the DuPont Securities Co., formed temporarily to hold control of General Motors, would be wound up. Its assets will be taken over by the DuPont American Industries, Inc., whose capital stock is owned entirely by E. I. duPont de Nemours & Co. Into this concern's treasury will go $7,000,000 of General Motors stock; $20,0000,000 of the preferred stock of the duPont Securities Co. and all of its common stock, under a trustee arrangement. The DuPont American Industries, Inc., in turn, will issue $25,000,000 of its bonds to the parent powder company.

It was made plain by the bankers that the General Motors Corp. was not identified with the current financing in any way, and that its mention came only because a sale of this particular stock needed financing. It was made plain by the bankers, too, that the control of General Motors was vested in E. I. duPont de Nemours & Co. and that the stock would not again come on the market. The Street has heard rumors that the purchase of the stock at forced sale was a temporary expedient and that some of it might be resold in the open market to reimburse the purchasers. These reports are set at rest by announcement of the permanent financing.

G.M.C. Stockholders Increase to 58,000

NEW YORK, May 13—Stockholders of the General Motors Corp. now number more than 58,000. This is an increase of approximately 30,000 in the number of common shareholders, which is regarded as significant in view of business conditions in general and the automotive industry in particular during the past eight months. This number does not include the holdings of individuals standing in the names of brokers and bankers.

The tabulation shows that investors own 18,860,881 shares of General Motors common, an increase of 4,694,257 in a year. The number of common stockholders at the beginning of May, 1920, was 7193, and it is now 37,991. The increase in the number of holders of preferred and debenture stock has been much less marked, growing from 18,943 to 20,833 in the year. An indication of the extent to which the floating supply of General Motors common is being absorbed by investors is seen in the fact that among stockholders owning from one share up to 200 shares there has been an increase of 130,000 shares in the last three months.

G. M. C. TO RENT OFFICE SPACE

DETROIT, May 14—The executive committee of General Motors Corp., has approved the rental of the second and third floors in the east half of the building, to outside firms or corporations. This gives approxmiately 50,000 sq. ft. of floor space which the announcement says can be made ready for occupancy by July 1. For a time it was the intention to devote the entire building to General Motors interests and many applicants for office space were turned down. Since the change in management however several changes in the policies of the company have been announced and the proposal to rent office space is the latest. Persons who had applied for space are being notified that they can be accommodated.

CHEVROLET PRODUCTION RISES

FLINT, MICH., May 14—The local plant of the Chevrolet Motor Co. began increasing its force at a rate which is expected to add 1500 men within the next two weeks with all departments operating on full time. General Manager C. F. Barth said the increased operations were due to greatly increased sales demand following announcement of the recent price reduction.

Lay High Insurance to Moral Hazards

N. A. C. C. Committee Would Eliminate Loose Methods in Accepting Risks

NEW YORK, May 17—The insurance committee of the National Automobile Chamber of Commerce, of which W. E. Metzger is chairman, has sent to its members a bulletin declaring that in its opinion the present high rates are due to the loose methods in accepting risks and that insurance companies "should scrutinize the moral hazard." The bulletin says:

"The cost of insurance to car and truck users has mounted steadily. In the belief that this is very largely due to loose methods on the part of insurance companies in accepting risks regardless of moral hazard we have taken the position, in public statements on this question, that underwriters should scrutinize the moral hazard, and that in the meantime mutual insurance companies which cover the public at much less cost are to be encouraged.

"Accidents are not prevented by liability insurance, which, on the other hand, tends to promote recklessness. The amount of fire and theft coverage allowed on cars and trucks, particularly after the first year of their use, frequently exceeds actual value; this minimizes care and encourages their being destroyed and reported as stolen by unscrupulous owners. These costs are spread over the policies of the great majority of responsible owners.

"The new plan of grouping cars according to construction features determines comparative rates but can have little effect on total fire losses, since a very small proportion occur from integral causes. It does not go to the main point of reducing total costs to the public, which is of direct interest to manufacturers.

"According to figures given out by 131 insurance companies, the fire and theft premiums received by them in 1920 amounted to $74,472,250. The losses paid amounted to $42,935,748.

While manufacturers are carefully studying the schedule of hazards of the underwriters' laboratories, in which are listed features of construction considered by underwriters to have a bearing on risk, we are presenting the point of view that while this may be helpful, it offers little hope of any great reduction in the average insurance premium per car."

Makers Consider Company

NEW YORK, May 16—The *Eastern Underwriter*, an influential insurance newspaper, says: "It is reported that automobile manufacturers are discussing the advisability of forming an insurance company or companies because of the high automobile rates, which are re-acting in car production. Some people are not buying cars because they cannot afford the insurance."

Weather and Prices Lead to Sales Check

Nobody Caught Napping Through Business Slackening—Price Situation Expected at This Time

(*Continued from page* 1076)

Production schedules for automobile factories are based largely on the business done the previous month. Under the conditions which prevail at present, if the sales for April fell below the mark expected, the schedule for May will be cut. Factories now are making only enough cars to meet actual demands.

The fundamental soundness of the industry has not been affected, however. The industry daily finds itself more solid than it has been for months and much of this solidity is due to the fact that nearly every condition that arose within the last year had been foreseen and the leaders of the industry are still far in advance of the present situation.

A falling off in sales at this time has been expected. Nobody has been caught napping. In fact, AUTOMOTIVE INDUSTRIES, which has chronicled in advance most of the moves and trends of the past year, has had in its office for some time a report from the national sales field, indicating that the encouraging upward swing of sales in the spring would not continue unbroken.

It has been known for months that a price situation was inevitable about this time. When prices broke last fall the industry adopted a stabilizing policy of making immediately any changes that were to be made. Numerous prices were adjusted and those that were not changed were guaranteed until about this time. That stabilization helped materially during the winter months. Now the next step in the readjustment has been reached and what is needed is stabilization as quickly as possible. Those who are going to adjust should do their adjusting early and help set the stage for a continuation of selling. Until the adjustment is made sales will be more difficult, for the public will not buy on a continuously falling market. Those who are not going to cut should say so and the rest should change their prices and have it over with.

Buyers Waiting Stability

Reports from the entire country say that buyers are ready to hold off until prices seem stable and there is a feeling that there will be good business in the last half of the summer and during the fall if the stabilization can be effected quickly. Sales of the entire industry will be affected if the companies adjust, one by one, for the rest of the summer.

Price must be taken into consideration in the present situation. Cars which show value for the money are having good sales and have had. Some cars may be comparatively over-priced and it is not a perhaps remote possibility that the 1921-22-23 profits of some companies for the term of years might be greater if adjustment to conditions were placed first and full profits second for the remainder of the present year. A healthful readjustment to a basis that would require little change for months to come would be beneficial. Keen students believe the peak of sales in the industry has not been reached and that the next few years will be the greatest ever seen in motor vehicle sales.

Stabilization of prices on all products is also essential. The agricultural areas are affected by the relation between farm product prices and the prices of other commodities and in many general items, such as are sold in department stores, even the proprietors of the stores are having trouble forcing their own prices down. Incidents have been found of department managers who mark goods even higher than the store owners desire in order to make the particular department show up well in the total store profits, in which the department manager, of course, participates. It is not possible to know how extensive such cases are, but they are regarded as an evidence of the lingering desire of the man who tasted war profits not to loosen his hold on the joys of the hey-day period. A recent conference in Washington of the National Conference of Business Paper Editors developed considerable information of this character.

Some Banks Antagonistic

In some sections, particularly the southwest, the old score between the automobile industries and the banks remains to be wiped out. It does exist. A bad impression still prevails and much good is expected to come from an address which Governor W. P. G. Harding of the Federal Reserve Board is to make in Kansas City May 21.

Reports gathered from the national field show instances of dealers who are getting more business than might be expected because of more intensive sales work. One dealer is holding his volume to normal but is using three times the usual number of salesmen to do it. Another dealer is taking cars in the rough and producing what is practically special models in color, and he makes the point that no matter what happens the dealer who works will still get some business.

Most interesting in considering the future is the statement by one student of affairs that when the world gets back to working and buying we shall have a new crop of buyers.

Reparation Terms Important

A potent factor in the return of better business is the recent acceptance by Germany of the reparations terms. It is the most important move toward world prosperity since Nov. 11, 1918, and the handling of the subject in the daily press has not been at all in accordance with what the acceptance means to the workers in American factories. England, as she has done for hundreds of years, undoubtedly will extricate herself from her present trouble with no disastrous consequences. Russia will always be a sore spot until her people return to productivity.

Dallas Car Registry Tallies with 1920

Figures for April Both Years Is 573—Other Texas Cities Report Activity

DALLAS, TEX., May 16—That the automobile business has about returned to normal in Dallas is clearly indicated by the number of new cars registered, according to dealers. During the month of April, 1920, a total of 573 new automobiles were sold and registered in Dallas County, and by a coincidence, 573 cars were sold and registered in Dallas County in April, 1921. The majority of the cars sold are priced from $1,200 to $2,500.

Dealers in Fort Worth and Wichita Falls declare business during April better than for the same period last year. From other north Texas cities and towns like Greenville, Sherman, Paris, Denison, Corsicana, Gainesville, Denton and Terrell, dealers report business improving. Accessory and repair men in these places make similar reports. The truck business appeared to suffer a slump during the past month. This is believed to be due to the heavy truck tax law which becomes effective in July.

Sales Slump Hits Lines Not Reduced

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ping off from 25 to 50 per cent during the past week.

Salesmen report a much wider use than formerly of the "prices have got to come down" argument by prospects who seem to be sold on the cars offered them but absolutely refuse to sign contracts. Several dealers in lines guaranteed to mid-summer have found the guarantee of little avail in the face of present conditions, prospects in a good many cases declaring that they will "wait a couple of months and see what happens." Distributors of cars which have been subject to recent price reductions are "making hay while the sun shines."

Chicago Finds Tendency to Wait Lower Prices

CHICAGO, May 17—While sales are being made in this territory there is evidence of a holding back on the part of many prospects due to the recent cut in the prices of some automobiles and the resultant questions that they raise in their own minds of how extensive this price reduction will be—if it will not, within the course of a few weeks, reach most of the lines. The same feeling of hesitancy that appeared last September when the price reductions started is again noticeable.

This feeling is true particularly among those prospects who would buy cars in the classes where a guarantee of price has been made.

Goodyear Files Show Route to Success

(*Continued from page* 1077)

in the hands of bankers scattered throughout the country. To cap the climax the company's chief endorser was himself plunged into financial difficulties and made plans to leave the country. President Seiberling and his brother, securing a list of notes and waivers of endorsement, started in opposite directions to seek extension of all loans.

While returning from New York, Seiberling evolved the strategic plan of selling the business, or at least of securing a contract for sale, for to have negotiated a sale within the limited time necessary in order to meet the notes was impossible, as one-third of the $800,000 was due within three weeks. He returned to Akron with a contract calling for the sale of the Goodyear business to a rival concern upon terms which would pay stockholders a substantial amount on their holdings, as his weapons with which to stave off impending ruin.

To add to his tribulations came the sudden death of his father. But undaunted he went before the directors with his contract. Pinning their faith in his ability, although deploring the thought of selling the business, the directors instantly approved any step he might deem necessary to meet the exigencies of the occasion. But the directors did not know that selling the business was the least of Seiberling's thoughts until he told them he would use it merely as a defensive weapon to stay the hand of impatient creditors.

"With this document," he said before that memorable meeting seventeen years ago, "I shall gain added confidence, secure extension of all loans, and even get those same creditors to loan us more money."

The two brothers then started out. There were 155 creditors scattered throughout the country, to be seen personally. And after weeks of traveling, the brothers returned, with faces wreathed in smiles, for the creditors, impressed by their frankness and past record of achievement, gave them the added confidence sought and provided the additional financing required.

Grew to 80 Unit Plant

From that time Goodyear grew rapidly. The Akron plant of eighty buildings comprising one hundred acres of floor space, had over 31,000 employees and a capacity of 35,000 tires daily. Goodyear had 74 branches scattered throughout the world.

Sales were $69,000 in 1910, jumped to $169,000,000 in 1919, and exceeded $200,000,000 last year. Every year since 1903, the officials, with substantial uniformity, were able to state in annual reports that "the past year's business has been the largest and most successful in volume and profits of any year in the history of the company."

For the first six months of the fiscal year beginning Nov. 1, 1919, Goodyear business was running 59 per cent greater than for the same period of the year before, with the demand for product far beyond the company's ability to supply. This entailed financial requirements beyond normal and the company offered to stockholders two shares of preferred and one of common stock at par, selling thereby $27,794,700.

Then came financial deflation, the tightening up of credit and slowing down of the automotive industry, with resultant lull in tire sales. Retrenchment became necessary and additional financing became imperative, this latter being accomplished by providing in new money and extension of bank paper $28,800,000 maturing February 15, 1921. The process of readjustment and deflation affecting all lines of industry proved especially severe to the rubber industry, raw materials, including both rubber and fabric having in a few months dropped in value over 50 per cent. This meant a loss to the company on contractual obligations of $19,000,000, in addition to the deficit of $15,647,653.56.

November was the low ebb of Goodyear operations. Business then began to pick up and sales increased encouragingly.

The company's annual statement listed the value of the Akron plant at $57,913,143.46 and the Sumatra rubber plantation at $5,003,257. Investments in and accounts due from domestic subsidiary companies wholly owned were $13,352,158 with $21,179,529 listed as due from subsidiaries not wholly owned, and $4,393,217 due from foreign selling subsidiary corporations.

The annual statement also showed that an account of $3,568,445 due the company from President Seiberling had been closed by Seiberling depositing as security 75,000 shares of $7,500,000 par value in the Akron, Canton and Youngstown Railway Co., and 250 shares in the East Akron Land Co., the Goodyear Co. thereby taking over one-half ownership in the railway and taking over the Goodyear athletic field of thirty acres, owned by the East Akron Land Co.

Dunham Heads Division on Axles and Wheels

NEW YORK, May 17—The Council of the Society of Automotive Engineers has appointed an Axle and Wheel Division to consider the question of standardization. G. W. Dunham of the Savage Arms Corp. is chairman of the division, and the other members are: C. C. Carlton, vice-chairman, Motor Wheel Corp.; T. V. Buckwalter, Timken Roller Bearing Co.; R. J. Burrows, Clark Equipment Co.; J. Coapman, Russel Motor Axle Co.; C. S. Dahlquist, Standard Parts Co., Eaton Axle Div.; F. W. Gurney, Gurney Ball Bearing Co.; Geo. L. Lavery, West Steel Casting Co.; A. M. Laycock, Sheldon Axle & Spring Co.; C. T. Myers, consulting engineer; A. L. Putnam, Detroit Pressed Steel Co.; J. G. Swain, Firestone Steel Products Co.; G. J. Thomas, Duplex Truck Co.; H. Vanderbeek, Timken Detroit Axle Co.

E. G. Wilmer Succeeds to Seiberling Place

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the pneumatic tire for commercial vehicles.

The interests which now control the company have elected the following directors: J. P. Cotton of Franklni, McAdoo & Cotton, New York; P. W. Litchfield, Akron, Grayson, M. P. Murphy, New York; J. R. Nutt, president of the Union Trust Co. of Cleveland; Robert C. Schaffner of A. B. Becker & Co., Chicago; A. A. Schlesinger, president of the Steel & Tube Co. of America, Milwaukee; G. M. Stadelman, Akron; Ralph Van Vechten, vice-president of the Continental & Commercial Bank of Chicago, and Edward G. Wilmer of Milwaukee.

The directors elected H. H. Springford as treasurer and Charles A. Stillman as secretary.

The reorganization of the board was the next to the last step in the rehabilitation of the financial affairs of the company, which has been attempted by the bankers. The first was in the offering of an issue of $30,000,000 of 8 per cent bonds. This last, to be taken within a few weeks, will be the offering of an issue of $27,500,000 of 10-year debentures, most of which, it is expected, will be subscribed by present stockholders.

Bankers for the company said that the raw materials now on hand had been written down to current market prices, that the factory at Akron now was turning out 19,000 tires per day, and that the outlook for the corporation under the new management was very promising.

Seiberling was in New York but did not attend the meeting. Officials of the corporation said that any comment about the removal of the former president from the board and from his position would have to come from him.

New Incorporation Filed

COLUMBUS, May 16—The reorganized Goodyear Tire & Rubber Co. of Akron has filed articles of incorporation with the Ohio secretary of state.

The articles provide for $140,010,000 of preferred capital stock and 1,500,000 shares of non-par common stock. In all, there are 2,910,000 shares of both classes of stock. The fee paid to the state was $290,010, the largest ever received by Ohio from a corporation for this purpose.

The reorganization scheme also provides for $30,000,000 8 per cent, 20-year first mortgage bonds, and $30,000,000 8 per cent 10-year debentures. The preferred stock is divided into three classes —$40,000,000 8 per cent prior preferred; $100,000,000 7 per cent ordinary preferred, and $10,000 6 per cent management preferred.

Mathews Cuts Light Price

SANDUSKY, OHIO, May 16—Mathews Engineering Co. has reduced the price of its farm lighting plant $150, the new price to be effective at once.

Austin Gets Funds from Private Source

Will Put Business on Satisfactory Basis If Creditors Approve—To Reduce Plant

By Cable to AUTOMOTIVE INDUSTRIES

LONDON, May 16—The Austin Motor Co. has arranged a private loan, subject to approval of its creditors, to put the business on a satisfactory basis. As a consequence the stock of the company is expected to react favorably. There is every likelihood of the proposal being accepted.

Argument in the High court for the compulsory winding up of the company's affairs has been postponed until May 31. Creditors whose claims are considerably in excess of $1,000,000 opposed the petition and asked for an adjournment.

Production at the Austin plant has not been suspended and there is no probability that it will be. It is likely, however, that the size of the plant will be reduced to something like the possibilities of the business.

Sir Arthur Whinney has been appointed receiver of the Austin company. During the war he acted as advisory to the Admiralty on costs of production and later as assistant accountant general to the navy. The receivership will be continued as long as necessary to reorganize the company's finances.

There is no disposition on the part of the industry in Great Britain to condole with Sir Herbert Austin on the state of affairs of his company. To the contrary he is being congratulated on the fact that financial control has passed temporarily into other hands. He is an experienced engineer and it is the firm belief that his company eventually will be placed on a solid basis.

At a private meeting of creditors Friday, Whinney reviewed the situation. He said the company had come to the end of its resources, that it was being sued, that it had no money to carry on and that the sheriff was in possession because of claims aggregating $200,000 filed by 26 creditors.

1920 Profits Over Million

The turn-over in 1919 was $12,500,000 and the profit was $1,290,000. The profits in 1920 were more than $1,000,000. The falling off in business in recent months was accounted for by the slump in trade. The present position of the company, Whinney said, was good as regards the reputation of its cars and the demand is greater than can be met under existing conditions. The output for the week ending May 14 was 77 cars. The value of the output for the first five months of this year was $3,935,000.

After considerable discussion by the representatives of creditors and on motion of the representative of the Dunlop Rubber Co., acting for creditors whose claims aggregate $2,000,000, the meeting was adjourned and a committee of six was appointed to confer further with Whinney.

The principal creditors disclosed were Van Dervells, for starting and lighting sets, $442,500; Fellows Magneto Co., $150,000; North British Lumber Co., $235,000; Dunlop Rubber Co., for tires, $169,500; Ransome & Marles, for ball bearings, $146,500; Birmingham Aluminum Castings Co. and Midland Motor Cylinder Co., $149,300.

A similar petition for the winding up of the affairs of the Harper Bean Co. is opposed by creditors having claims aggregating $2,750,000 and arguments in this case have been postponed for six weeks. This company also is in limited production and while prices of its stock are low they are firm.

The Dunlop Rubber Co. has registered a mortgage to secure $30,000,000 in 8 per cent first mortgage debenture stock payable at 105. The stock is secured by the company's property.

Stinnes Pushes Work at Fiat Tyrol Plant

WASHINGTON, May 13—Negotiations between the Fiat Co. and a German group headed by Hugo Stinnes with regard to the shares of the Alpinen-Montan Gesellschaft, control of which was acquired some time ago by the former, are explained in a communication received by the Bureau of Foreign and Domestic Commerce from Commercial Attache H. C. MacLean of Rome. According to a press dispatch from Vienna, it is stated, the Italian and German groups will exercise a joint control over the company on the following conditions:

"The Fiat will turn over 200,000 shares at a price of 1000 marks each to the German syndicate, which includes the Rhein Elbe Union, the Deutsch Luxembourg, the Gelsenkirchen, the Siemens-Schuckert and the Rochumer Verein, representing a combined capital of over 1,000,000,000 marks. On the other hand, the Fiat will retain 50,000 shares which it has held since 1919. It is said that Hugo Stinnes and Vogler, the general manager of the Deutsch Luxembourg, will become members of the board of directors of the Alpinen Co., and that four German engineers have already left for the Tyrol where the six blast furnaces of the company, only one of which is now active, will be put in operation."

RENAULT BUILDS NEW TRACTOR

PARIS, May 3 (*By Mail*)—Renault, who has specialized on a creeper type of farm tractor since the war, has just put on the market a new four-wheel type machine. The tractor has the same engine as the old type, with four 3.54 x 6.30 in. block-cast cylinders and same thermo-syphon cooling arrangement with radiator placed back of the engine. Transmission to the rear driving wheels is through a cone clutch, three-speed gearbox, and by live axle with planetary reducing gears in the wheel hubs. This type of final reduction has been employed on Renault 7-ton trucks.

South African Show Brings Trade Boom

Dealers Stage Exhibits in Salesrooms After Difference with Agricultural Promoters

JOHANNESBURG, SOUTH AFRICA, March 28 (By Mail)—The annual Johannesburg automobile exposition was held this year in the showrooms of the dealers themselves instead of in the automobile section at the Agricultural Show in Milner Park. All preparations had been made to take part in the fair as usual until it was found that the executives of the Agricultural Society took the position that it was their privilege to let space to certain dealers without reference to the body of motor traders of the city. The dealers thereupon decided to hold their exhibition in their own buildings and the only cars represented at Milner Park were the Nash and the Allen.

The buildings devoted to automobiles were thronged by visitors show week. For a considerable time it has been the contention of many dealers that the advertising value of the show at Milner Park did not repay them for the expenditure involved, and it almost seems that this contention is correct. It is certainly true, however, that numbers of country visitors have lost the opportunity of seeing the different models and in this way the country advertising has not been so widely spread.

The new Wolseley models—10 hp. roadster, 15 hp. touring, 10 hp. coupe and 20 hp. touring—have evoked a great deal of praise, and the exhibit made by the agents, Walker & Co., deserves every credit. The Willys-Knight models on view at the showrooms of Consolidated Motors have been a source of much admiration. The sedan has especially come in for approbation.

The "Silver Queen" (a Buick model in silver) has been the talk of the city. The engine is finished in aluminum and the body in silver. It certainly is a showy piece of work and has been the means of attracting numbers of buyers.

Cars Gain in Popularity

The trade has been experiencing a week of good business, and after the displays are things of the past they hope that the boom in cars will continue. There is ample scope in South Africa for automobiles and the population is coming to a fuller realization of the utility of the internal combustion engine as time goes on.

Only ten years ago the number of cars in this country was very small, but to-day, per head of population, the figurers have increased enormously and out of proportion to expectations. Trucks sales ought to be brisk during the winter months, as the demonstrations at Milner Park have brought home to the farming community the value of fast, efficient transportation. Tractors are being favored and sales are encouraging.

Off to New Start, Maxwell Reduces

Price Cut First Step by Chrysler After Court Confirms Sale —New Officers Named

DETROIT, May 18—The Maxwell-Chalmers reorganization committee, headed by Walter P. Chrysler, came into control of the property of the two companies to-day through confirmation of the sale of the Maxwell plants last week under Federal Court decree.

The first act of the committee after the decision of Judge Tuttle confirming the sale was the announcement of a price cut of $150 on Maxwell cars. This is the second reduction in a year, taking prices back to the 1917 standard. The touring car and roadster now sell for $845, the coupe for $1,445 and the sedan for $1,545. Chalmers prices will remain unchanged for the present.

A. E. Barker, general sales manager, said no announcement would be made of the personnel of the new organization until after the organization meeting of the Maxwell Motor Co., recently incorporated in West Virginia. President W. Ledyard Mitchell remains as receiver of the Maxwell company pending his final discharge.

In confirming the sale and dismissing petitions of R. R. Rogers and H. H. Webb on behalf of themselves and other first preferred stockholders, Judge Tuttle gave the attorneys two options. One of them was to place in control of the court 180,000 shares of class B stock not yet allotted for allocation to the intervenors if it was found they were entitled to a greater share than the reorganization plan gives them. The other option was for the committee to enter its appearance, which would constitute a practical assumption of liability for the protection of protesting stockholders. The attorneys elected to accept the latter plan and entered an appearance for the committee. Judge Tuttle then confirmed the sale. Lawyers for the petitioners intimated that an appeal would be taken but the attorneys representing the reorganization committee regard the confirmation as final.

Executive Offices Busy

Under the plan the new company will have $15,000,000 in new capital, and preparations already are under way at the plant to increase production. The executive offices at the Chalmers plant which have been practically deserted for some time teemed with activity this morning, and representatives of material men swarmed the office seeking new business.

Several changes in the personnel of the Maxwell-Chalmers organization already have been announced. H. C. Reichel, who has been in charge of factory service for Chalmers, has been made service manager for both Maxwell and Chalmers. A. E. Richmond, for several years in charge of Maxwell service at the factory, has been appointed supervisor of the San Francisco district for Maxwell-Chalmers. R. E. Thompson, former chief inspector for Maxwell-Chalmers, has been made special sales supervisor for both companies, with temporary headquarters at Detroit. Theodore Koerner has been named superintendent of inspection, having general charge of inspection in all Maxwell-Chalmers plants, and Leonard Vandersall, who for the last seven years has been connected with the company, has been made South African special representative for the export department. Mr. Vandersall sailed for his new territory May 12.

Dort Drops Prices as Costs Decrease

DETROIT, May 17—The Dort Motor Car Co. announces a price reduction ranging from $100 to $180 effective today. Touring and roadster models are reduced from $1,215 to $1,115, coupe from $1,865 to $1,685, and sedan from $1,995 to $1,835.

"These reductions are on the new model introduced in January," said J. D. Mansfield, general sales manager, "as the new Dort is not a pre-war car and we are not trying to establish pre-war prices for there is not a pre-war standard from which to judge these new models. The reduction is due solely to the fact that we have reached a production basis that enables us to operate on a lower overhead per car built."

Hupp Prices Reduced $200 to $325 a Car

NEW YORK, May 16—Effective today prices on Hupmobile cars are reduced $200 to $325, the smaller cut being made on open models and the larger on enclosed. Under the new scale of prices the roadster and five-passenger cars are reduced from $1685 to $1485; the coupe from $2725 to $2400, and the sedan from $2800 to $2485.

STERLING PRICES REDUCED

NEW YORK, May 16—Prices on Sterling tires and tubes have been reduecd 15 and 20 per cent, the minimum cut being made on Ford size fabric tires, and the 20 per cent reduction being made on all other fabric and cord tires, and on gray and red tubes.

FUEL PRICES HELP BUSINESS

NEW YORK, May 16—The leadership of the oil companies in reducing prices is being hailed in motor circles as a basic move in reconstruction which will permit lower costs of doing business. With 60 per cent of the total gasoline consumed used for business purposes, it is pointed out that fuel prices have a direct bearing on the cost of doing business. With refineries closing down for lack of business it is regarded as a certainty that lower prices will continue to reign indefinitely in the gasoline field.

VerLinden to Join Durant Enterprise

Will Resign Presidency of Olds Units of General Motors—Noted as Executive

DETROIT, May 18—The General Motors Corp. announced to-day that Edward Ver Linden has been relieved of his duties as general manager of the Olds Motor Works and that A. B. C. Hardy has been appointed acting general manager. Hardy is one of the veterans of the General Motors organization and has held many positions of responsibility.

DETROIT, May 18—Edward VerLinden soon will retire from the presidency of the Olds Motor Works at Lansing to join forces with W. C. Durant, it has been learned here. His resignation has not been filed and no date has been fixed for his departure from the General Motors organization.

Details of VerLinden's future plans are not obtainable but he will head a motor plant which will be established in Lansing to build engines for the Durant four-cylinder car. The Durant car, at the beginning, will be largely an assembled product and it is probable Continental motors will be used until the production of engines begins at the Lansing plant.

VerLinden resigned as superintendent of the Buick Motor Co. nine years ago to become works manager for Olds. Two years later he was made general manager and a short time later was promoted to the presidency. When he joined the Olds organization the output was 2000 cars a year and the plant is now producing about 40,000 cars a year. The factory has been rebuilt and re-equipped under VerLinden's management and more than $12,000,000 has been expended in bringing it up to its present efficiency. The factory is equipped to build two new models and now has on hand orders sufficient to permit operations on a basis nearly normal for some time to come.

Under the management of VerLinden, the Olds company frequently has led all other units of the General Motors organization and the Oldsmobile rivals Buick and Cadillac in popularity.

R. H. Collins has definitely severed his connection with the Cadillac Motor Car Co. and is devoting his attention to the formation of the Collins Motor Car Co. H. H. Rice has assumed complete direction of Cadillac affairs.

UNITED CUTS BODIES AGAIN

CLEVELAND, May 16—United Automotive Body Co. has made a reduction of 25 per cent in prices on its products, the reduction being the second of its kind within four months.

Exchange Hurts Car Sales Abroad

Need for Stability Is Shown by Hoover

French and British Makers Combat American Competition —Other Markets Poor

WASHINGTON, May 19—Evidence of Secretary of Commerce Hoover's intention to develop foreign markets for American automotive products is given in an official report compiled to-day from questionnaires sent to commercial attaches in European countries, concerning the general economic conditions with special reference to automobiles. The first of a series of reports indicates that the exchange problem is one of the greatest difficulties confronting American automotive exports. American agents abroad reported that foreign manufacturers have not increased production to any great extent because the present economic, financial and industrial depression had affected demand.

The first section of the report issued to-day dealt with automobile markets in France, Italy, England, Belgium, Austria and Czecho-Slovakia. While large American exporting firms have an intimate knowledge of the French market, the official report of Commercial Attache W. C. Huntington is of importance. He stated that the price will be of greater importance in the future and as a consequence French manufacturers are adopting standardization. Domestic manufacturers offer a very formidable competition but American automobiles have become very popular since they were put in general use after the army sold the surplus stocks to the French Government. The size of the average French farm prohibits large sales of tractors.

American Light Trucks Sell

The commercial attache at London reports that the best seller on the English market is a medium sized car of 12 to 18 hp. R.A.C. rating, and fully equipped. There has been a brisk demand for American trucks of 1 to 1½-ton capacity. British manufacturers are doing their best to offset this competition by producing a truck of this kind. They are also beginning to use the pneumatic tires. Because of the exchange situation, the terms usually sought are cash. There is comparatively little demand for tractors and the competition from British manufacturers is very keen.

The exchange is very unfavorable for American cars and the products of local factories in Belgium. Twenty-five per cent of the cars now operated in Belgium are of domestic origin. The Belgian manufacturers are reported for the most part secure financially, although the capital of their factories is low. The Belgian cars are firmly built to withstand the excessive vibration caused by the cobble stones on the highways, so that they are better fitted for local usage than the imported car. Owing to the present rates of exchange any advantage in price which the American car selling between $900 and $2,000 might possess over the native product has vanished. The Department of Commerce was advised that a recession of the dollar exchange to ten francs would undoubtedly allow American producers to undersell the domestic manufacturers. It is reported that a Fiat chassis can be bought for 18,500 francs. A 10-horsepower Renault complete with solid wheels sells in Belgium for 2200 francs.

Belgium Short on Cash

Belgian manufacturers have fallen down in their efforts to perfect their sales organization. It is customary to furnish dealers with chassis or complete cars on a commission basis, and these vehicles are paid for when sold. The average automobile dealer in Belgium has not a large amount of capital, and therefore must be financed to some extent by the factory or the distributor. If the distributor has subagents, he usually takes 25 per cent of the price and allows the subagent 10 or 15 per cent. Credit sales are made on the basis of 3 and 6 months' notes, but the natural preference is for cash. Tractors are used on the large farms in this country with good results but owing to the small size of the majority of Belgian farms, the market of the tractor will always be limited.

A number of important factors govern the sale of American automotive products in Italy. The radical increase in import duties on motor vehicles has a tendency to prohibit the development of this market. The internal taxes are so heavy that it is practically impossible

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AUTOMOTIVE PRODUCTS $2,000,000,000 IN 1919

WASHINGTON, May 14—Official preliminary production statistics compiled by the Census Bureau show that 312 factories in 1919 produced automobiles worth $1,181,659,000, or more than double the figure shown by the 1914 census when 300 producers manufactured products worth $503,330,137.

Products worth $567,655,200 were turned out in 1919 by 1879 manufacturers of bodies and parts. The total value of automotive products in 1919, therefore, was nearly $2,000,000,000.

Cleveland to Skip August Depression

Usual Slack Period to Be Overcome by Late Demand, Says Grant Official

CLEVELAND, May 16—The automobile industry, which has been doing more than any other production medium to restore normal conditions in this city, is now to have help from other lines.

The Cleveland Trust Co., after a careful survey, reports that genuine improvement in all lines of business has set in during the month. The reasons for it are lower interest rates here and abroad, better conditions in the Federal Reserve and State and national banks, decreased unemployment, greater activity in all important lines such as automobiles, rubber, textiles, shoes and leather; increased car loadings and greater railroad earnings, stock market advances and greater participation by the public, far-reaching wage agreements in important industries, increased building construction, brighter prospects for reparations agreement, and the rise in value of money of European countries. The last two reasons are considered especially important to all lines of industry, particularly the automobile producer, for they are considered a forerunner to an expansion of foreign trade.

George W. Hubbs, of the Grant Motor Car Co., whose company has moved forward steadily since the first of the year in production and net earnings, predicted that what some term as the annual slack period in August will not be experienced this year. He says that the general business revival, as seen by the Cleveland Trust Co., coming at this time of the year, is certain to continue right through the summer.

"Production of automobiles has been low for many months," said Hubbs. "That fact, coupled with the steady improvement in all lines of business, is certain to keep the automobile factories going through the summer months."

Credit Stringency Passed

The Cleveland Trust Co. says that so far as the Cleveland district is concerned the credit stringency has passed. Automobile producers, as well as leaders in other lines of business in this city, have organized for a movement that has been developed to increase foreign trade here.

Walter C. White, president of The White Co., and C. W. Mears, who handles the advertising for the Winton Motor Co., are members of an executive committee that has been formed to push the sale of stock in the Foreign Trade Financing Corp.

Industry Asks "Stigma Tax" Repeal

Excise Tax Unfair, Senators Are Told

Strong Arguments Presented to Finance Committee by Graham and Hanch

WASHINGTON, May 16—Congress has received the tax program of the automotive industry which was offered for its guidance in internal revenue revision. Spokesmen for the industry impressed upon the Senate Finance Committee to-day the utility of motor vehicles and the urgent need for relief from the oppressive and discriminatory burdens of taxation. While members of the Committee criticized and questioned many of the suggestions for fiscal legislation they indicated that they had a new vision of the magnitude and importance of the automotive industry and its relation to the political and economic structure of the country.

Distinguishing the present mode of taxation, as it applies to the automotive industry as "stigma taxes," had its effect for it revealed to the Senators the inequities under which the automotive industry struggled back to new levels of industrial activity. There were unmistakable evidences of the hostility of Senators to the proposal that the excise tax should be abolished. Their opposition was apparently founded on the supposition that such abolition would pass the burden of highway maintenance upon all classes without distinction as to the users of these arteries of commerce.

Representatives of the industry impressed the Committee with the fact that the highways were now in general use and not confined to motor vehicles, although automobiles bore the entire expenses of maintenance, and in some cases cost and construction.

Shows Suppressing Effects

George M. Graham, vice-president of the Pierce-Arrow Motor Car Company, and a member of the Taxation Committee of the National Automobile Chamber of Commerce, limited his presentation to the specific effects of the present tax system upon the automobile industry. He appeared also for the Motor and Accessory Manufacturers Association. Criticizing these levies as "stigma" taxes served its purpose for it constantly brought to the mind of his auditors the fact that the industry was singled out for heavy and iniquitous assessment. He illustrated the effect of such taxation by comparing them to such regulatory taxes as are levied on liquors, narcotics, dirks and dangerous weapons, the purpose of which was to regulate or even suppress, rather than encourage, the use of such products.

CAR TAX SENSELESS, SAYS NEW YORK TIMES

NEW YORK, May 14—In an editorial discussing the "shocking" methods employed by the Government to obtain its revenues, the New York *Times* takes issue with the tax proposals of Secretary of the Treasury Mellon. In this connection it says:

"He would increase stamp taxes and, strangely enough, proposes a license tax on the use of automobiles. The automobile is no longer a vehicle of pleasure. It is a common conveyance, necessary to the business man, the professional man and the farmer. Such a tax would be as senseless as one levied upon a farmer's horse and wagon or upon his oxen and cart."

Graham made an effort to disabuse the minds of the Senators as to the term "non-essential" and its application to the industry. He said that at the time it was originated preference in the matter of materials, transportation and labor was given to industries most essential to war activities, but that time had passed.

"We cannot feel that the motor car and the motor truck can be fittingly rated in any classification whose value to the public is questioned," Graham said. "During the discussion of the two previous revenue bills, the opinion was openly expressed that if the increased taxation on passenger cars should curtail their use it would be an excellent thing. Many gentlemen may have felt this with great sincerity during the war period; that they continue to think so now I should seriously doubt.

No Standing if Luxuries

"If the passenger car and motor truck are luxuries we must expect to be rated among the most heavily taxed industries. We have no standing here. But if they are luxuries, then the President of the United States is wrong, for he has placed the stamp of essentiality on cars and trucks. In his first message to Congress he made the very definite statement, 'The motor car has become an indispensable instrument in our political, social and industrial life.'"

It was his contention that a tax on motor vehicles was definitely a tax on transportation. His statement that the railroads have a monopoly after rights of way are constructed was challenged by Chairman Penrose. Graham made it clear that there were no Federal taxes on other units of transportation and

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Ford to Continue 4000 a Day Output

Report of Shut Down July 1 Denied—Company Straining to Meet Orders

DETROIT, May 18—In denial of reports that the Ford Motor Co. would shut down July 1, officials to-day said the company was far behind in orders and straining every energy to stimulate production to meet demand. As a result the company now is building more than 4000 cars and trucks daily and has been for more than a week. The record for production reached Oct. 20 last year still stands but the plant has been increasing its output almost daily for the last two weeks.

On May 3 the cars and trucks built numbered 3860 and the following day production reached 3992. Two days later the plant ran over the four thousand mark with 4032 cars and trucks and on May 9 turned out 4072. The following day it built 4083. The number for the record day last October was 4688.

The tractor plant also is running at full speed and the ten thousandth tractor was turned out May 3.

This work is being done with a force of about 40,000 men as compared with approximately 60,000 a year ago. The company now is paying a bonus each pay day instead of at the end of the year. It averages about $3 a week per man.

Slough Trading to Sell Trucks in South America

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duce the established time by something like 50 per cent, contrary to a clause in the national agreement.

Opposition to the anti-dumping legislation proposed by the Government is becoming more active and threatens to jeopardize the Coalition ministry because of the defection of the free traders. One of the features of the proposed legislation which is causing the greatest opposition is the plan to protect British industry at the expense of countries like France and Italy, which have a low rate of exchange.

Now that the price fall is in full swing there will be still greater difficulty in keeping out American products. The buying public is becoming more insistent on knowing why it is possible for American manufacturers to beat the British maker in his own market while contributing 33 per cent to the British Government for the privilege of doing business in that country.

Slough Trucks Here for Sale in U. S.

Truck Company of America Lands 2000—To Sell at Half List Price

NEW YORK, May 19—The Truck Co. of America has been organized by L. Mansbach of the Fidelity Motor Supply Co., I. Edward Roskam of the Roskam-Scott Co., and A. B. Messing of New York, and Morris Froelich of Chicago, to deal in American made motor trucks which will be reimported from England. It is understood the new company has purchased approximately 3000 of these trucks from the Slough Trading Co., Ltd., of London which bought them from the British government. Two thousand of the trucks are now in this country.

The trucks, it is stated, will be sold at approximately 50 per cent of the list price. Among the makes included in the purchase are Pierce, Mack, Packard, White, Riker, Locomobile, Liberty, Peerless, F. W. D., Nash and E. M. C. In addition to the trucks the company proposes to import a large quantity of parts for replacement purposes and also accessories of American make.

The company proposes to offer dealer franchises throughout the country and to advertise extensively.

Roskam has been the New York representative of the Slough Trading Co. since it began reimportation of these trucks into the United States. The first large shipment was sent to the Pacific coast but the demand for them was not heavy. It is now believed that with general business conditions approaching a more normal basis there will be an increased demand for these trucks.

The company has leased a building with 45,000 sq. ft. of floor space on the ground floor in 56th Street between 10th and 11th Avenues as well as a warehouse with 35,000 feet of space and a three story office building in West 63rd Street.

It is stated that the company will have an export department with representatives in various foreign countries to offer foreign buyers trucks in large quantities. An especial effort will be made in this country to develop business with road builders.

NASH BUILDS 2½ TON TRUCK

KENOSHA, WIS., May 14—The Nash Motors Co. has brought out a 2½ ton truck which is especially adapted to highway construction work. Its general specifications are much the same as the present 2-ton model, 3018, except that the springing has been made heavier, the wheelbase shorter and some other minor changes have been made to allow for the heavier loads. The price, f.o.b. factory will be the same as the 3018, $2550. The wheelbase is 121 in. and the space back of the driver's seat about 97 in., this of course depending on the style of body used. Pneumatic tires may be fitted.

OVERLAND ANNOUNCES "SMASHING" PRICE CUT

TOLEDO, May 19—A "smashing price reduction" will be announced by the Willys-Overland Co. in display advertising in the leading newspapers of the country Sunday morning. No information is available as to the range of reduction and a decision on the subject was not reached until yesterday.

C. R. I. & P. Files Protest of Bus Use of Highway

SPRINGFIELD, May 14—The Chicago, Rock Island & Pacific Railway Co. has filed a protest with the State public utilities commisssion objecting to the use of Illinois' hard roads by motor bus companies as an "appropriation of public improvement to private interest." The protest is directed against the Peoria White Star Bus Co. and the Ivy Way Bus line which the railway complains will force it to curtail its service.

The railway company declares that it already provides sufficient service in operating four trains each day

"The Chicago, Rock Island & Pacific Railway Co.; as a large taxpayer," the complaint says, "protest against the use of the improved hard roads of the State, recently built at a great cost, by common carriers for hire by automobile and autotomobile truck, and states the use of said highways by such common carriers amounts to a substantial appropriation of a public improvement by private interests, and for private purposes to the great annoyance and detriment of the public in general.

"The railway company further says the use of said highways by such carriers, who are accustomed to employ large, heavy and cumbersome vehicles, will result in the speedy disrepair, deterioration and destruction of said highways, and without any compensation from the private enterprises so using and abusing them."

EIGHT INDUSTRIES SHOW GAINS

WASHINGTON, May 18—Increased employment in eight major industries is shown in Labor Department figures for April. The largest increase was 25.2 per cent in the automotive industry. The others which showed increases were woolens, hosiery and underwear, men's clothing, silks, cigars, cotton finishing and boots and shoes.

PAIGE TO MAINTAIN PRICE

DETROIT, May 17—Paige Motor Car Co. has sent a notice to its dealers that there would be no price reduction now and none in the near future. President Jewett said he did not believe in guaranteeing prices but there was nothing in the cost of manufacture to justify any price reduction in so far as his company was concerned.

Automotive Activity Grows in Milwaukee

Passenger Car Engine Makers at Capacity — Truck Engine Makers Report Gains

MILWAUKEE, May 16—It has been especially gratifying to commercial, industrial and civic organizations of Milwaukee to be informed by governmental sources that one of the reasons that Milwaukee is one of the few large cities of the country showing an increase in number of men employed is the steady expansion of production in the automotive industries. This increase is being accentuated day by day by the reemployment of men who were laid off months ago, as well as the extension of working schedules of men who were retained at reduced hours.

Engine manufacturers specializing in passenger car power units are now operating at capacity, with several reporting overtime schedules in some departments. Makers of heavy duty engines for trucks and tractors are doing better, especially the former. Employment in service and repair shops continues to increase, due to the necessities of a situation in which used cars taken in trade are more numerous than ever before and buyers of renewed cars insist that the mechanical condition must be first class.

The merchandising of passenger cars continues to proceed very satisfactorily in Milwaukee and vicinity. Business is losing the spotty character of recent months. Sales are made with more freedom and cover the entire range of price classifications rather than the cheapest or the higher-priced vehicles, as before. It is noted, however, that the announcements made during the first two weeks of May by numerous manufacturers concerning price reductions has had an influence upon a good many prospective buyers who were considered the livest kind of prospects but suddenly resisted further sales effort on the plea that they intend to await developments in respect to future prices.

This has caused many dealers to offer on their own responsibility or by arrangement with maker and distributor to protect buyers to July 1 or even Aug. 1. Used car sales have been stimulated by special sales conducted by numerous big dealers.

FIRE DAMAGES STUTZ PLANT

INDIANAPOLIS, May 14—Production at the plant of the Stutz Motor Car Co. here will be seriously crippled for six weeks because of a fire in the warehouse of the plant late yesterday. The damage has been estimated at $100,000. He said it would be more than a week before the stock could be removed from the warehouse and the damage correctly estimated. The fire started in some cotton trimmings on the third floor of the four story building and serious water damage was sustained.

Exchange Rates Hurt Car Sales Abroad

Taxes Discourage Sales in Italy—Austrian Factories to Build 800 Cars in Year

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to sell to any class but the rich. The policy of the Government had been to discourage the use of motor cars. A heavy graduated tax was imposed not long ago, running from 2850 lira on low-powered cars to 1500 lira on cars rated at over 50 horsepower. There are not many medium or low-priced American cars imported and the Fiat company is reported producing 60 cars per day with an anticipated production of 200 cars per day when their new factory is completed. The Italian industry has always been dependent to a large extent upon export business. The Italian farmer has not been educated to a point where he can readily be persuaded to purchase tractors.

The economic conditions in Austria discouraged the purchase of motor cars. It is doubtful whether more than 800 cars will be produced during the current year in Austrian factories which have a capacity of from 20,000 to 25,000 cars a year. The depreciation of the Austrian currency is so great that it practically removes the element of foreign competition, inasmuch as the cost of foreign cars is too high for purchase by Austrians. American foreign agents state that if large amounts of foreign capital should be invested in Austria in the production of motor cars, the same circumstances would react to the disadvantage of the local manufacturers, as a comparatively small investment in sound currency would create a large capital in Austrian currency. Austrians are not willing to abandon their draft horses.

American cars have gained popularity in Czecho-Slovakia, particularly of late when the adverse exchange has made the low-priced cars the best sellers. There has been a demand for four and five-ton trucks. Shipments of American goods have been made via Hamburg because of the convenience of river transportation down the Elbe to Prague.

To Confer on Exports

NEW YORK, May 17—At the request of Herbert Hoover, a committee headed by J. Walter Drake has been appointed by President Clifton of the National Automobile Chamber of Commerce to confer with the Department of Commerce. The other members of the committee are: Arthur Waterfall, vice-president, Dodge Brothers; E. A. Williams, Jr., president, Garford Motor Truck Co.; Alfred H. Swayne, vice-president, General Motors Corp., and Percy Owen, president, Liberty Motor Car Co.

FRANCE HOLDS USED CAR FAIR

NEW YORK, May 16—Details have been received here of the used automobile fair which will be held at Limoges, France, May 23 and 24. The fair is being organized by the Automobile Club of France and none but used machines will be admitted to the grounds. On the first day, sales will be conducted by private negotiations but on the second day there will be an auction for owners who wish to dispose of their cars in this way. Limoges has been chosen by the fair not only because it is centrally located but also in order that the cars which will be for sale will be in good condition because they will have to travel there under their own power.

Motor Vehicles Gain in 1920 Transportation

NEW YORK, May 16—Statistics compiled by the National Automobile Chamber of Commerce show that automobile passenger travel neared the five billion mark in 1920. Fully 4,932,000,000 persons were carried by motor cars during this period, as compared with the 1,234,222,889 revenue passengers of the railroads.

Motor trucks hauled 1,200,000,000 tons of freight, or nearly half the amount carried by rail lines, which totalled 2,504,000,000 tons.

The growth of the automobile business has not been competitive with the railroads, however. Much of it is directly tributary, as in bringing both passengers and freight from farm to train, and in suburban service to cities. Another large field for highways transport when not directly tributary to railroad is the travel from point to point over short haul distances where there is no other means of communication.

The motor car passenger figures increased 400,000,000 during 1920 due to the gain in motor vehicle registration. At the same time the railroads showed a gain of 60,000,000 revenue passengers.

REMY TO WELCOME S. A. E.

ANDERSON, IND., May 16—Remy Electric Co. will hold open house at its factory on May 22 and 23, the dates of the summer meeting of the Society of Automotive Engineers, at West Baden. In sending out invitations to the engineers to visit the factory, the company points out that it is mid-way between both Detroit and Chicago and the meeting place and that "good old Hoosier meals" will be served those stopping over. Automotive manufacturers in all parts of Indiana are planning to extend hospitality to the visiting delegates.

TO REFUND BEARINGS TAX

NEW YORK, May 17—The Motor and Accessory Manufacturers Association has been informed by the Commissioner of Internal Revenue that manufacturers of bearings and bushings who have paid taxes on them as automobile parts or accessories when they had not been manufactured to specification or solely for use in motor vehicles are entitled to refunds on taxes paid since Feb. 25, 1919. These refunds will aggregate many thousands of dollars.

METAL MARKETS

EVEN amid the from day-to-day buying which constitutes the only form of activity in the steel market just now, purchasing agents feel the ground sliding from under the prices that a few weeks ago were proclaimed in certain quarters as "stabilized." In fact, conditions are parallel to those that prevailed previous to the last reduction in the leading interest's price schedule. The steel mills that succeed in obtaining what orders for small tonnages are available characterize their shading of prices as special concessions on desirable business. Their unsuccessful competitors call it price cutting. Far from being extraordinarily pleased with their purchases, the buyers of these odd tonnages almost invariably regret that they could not postpone placing their orders, feeling that had they been able to do so they could have saved money. Meanwhile active preparations against the coming of lower prices are being made by producers. One of the largest "independents" in the Youngstown district has taken the lead in abolishing the eight-hour day as a basis for wage computation, and hereafter straight time on an hourly basis will be paid. Other "independents" are following suit. On the basis of the last bi-monthly wage settlement between the Amalgamated Association of Iron, Steel and Tin Workers and the Association of Independent Sheet and Tin Plate Manufacturers, the conversion charge for No. 28 gage black sheets has been reduced to $17.11, which compares with $24 when sheets were on a 5.80c. card. Numerous operating economies are being instituted and result in steadily diminishing production costs. Unless the leading interest anticipates the evolution of a lower market by another cut in prices, the industry faces another period of slowly sagging values, and the uncertainty that attends such a condition is alike unsatisfactory to the purchasing agent and to the producer. Representative business will not be placed until the situation has clarified further, and what odd lot buying will be made necessary by immediate requirements will be a matter of individual negotiation in which "publicational" quotations will form a basis for concessions.

Pig Iron.—Were it not for accumulations of resale iron still pressing on the market its liquidated character in point of production and prices would be highly impressive. The melt in Middle West foundries is slowly increasing, due to foundry crafts being in a more reasonable frame of mind. With Foundry No. 2 selling at $23.30, valley, automotive foundries would be disposed to contract for a reasonable time ahead, were it not for the hand-to-mouth buying of automotive castings by passenger car and truck builders.

Steel.—The $39 price for sheet bars has apparently once more gone by the board, and non-integrated sheet mills could probably shade this figure fully $2 on representative orders. Youngstown automobile sheet makers are once more disgruntled over the paucity of orders. Cold rolled strip steel continues to be inquired for in modest quantities by the automotive industries, but concessions are asked in price. Bolts and nuts are in better demand, with the Ford Motor Co. figuring as purchaser in the Chicago market. Heavy forgings are also more actively sought by automotive builders.

Aluminum.—The market still waits for activity on more definite news from Washington regarding the outlook for a higher tariff.

FINANCIAL NOTES

International Motor Truck Co. reports net profits for the quarter ended March 31, 1 of $4,396. Present incoming business justifies an expectation of deliveries for the present quarter at the rate of 6000 trucks per annum. Net profits for the first half should show preferred dividends fully earned. The company has net working capital in excess of $19,000,000 and a cash balance of more than $3,000,000. The company has reduced inventories since Jan. 1 about $1,500,000.

Parish & Bingham Corp. reports sales for the first four months of 1921 as representing 41.14 per cent of sales for the corresponding period in 1920. The plant has been operating daily since Jan. 15 and maintained an average of 24.53 per cent of men employed. Releases scheduled for May are considerably in excess of $600,000 and additional releases are being received daily.

Stewart-Warner Speedometer Corp. reports net earnings for the first quarter ended March 31 of $50,527. Payment of a dividend of $1 a share, or $395,000, made it necessary to draw on surplus for nearly all of that amount, reducing the surplus to $6,697,86 compared with $8,092,865 on Dec. 31 last.

Marion Tire & Rubber Co. will increase its capital from $750,000 to $1,250,000, the additional capital to be used in broadening the activities of the company. C. J. Davis of Cleveland has been elected president and general manager of the company.

Elgin Motor Car Corp. for the year ended Dec. 31, 1920, shows that total sales were $7,383,606, as compared with $6,479,100 in 1919. Net profits for the year 1920 amounted to $195,908, a considerable increase over earnings of the previous year.

INDUSTRIAL NOTES

Minneapolis Steel & Machinery Co. has moved its New York offices from the Tribune Building to the Woolworth Building. The main export offices of the company will in the future be located at the factory in Minneapolis. C. W. Hadden, manager of foreign sales, will make his headquarters at Minneapolis. J. A. Teach will continue in New York as contracting engineer and designer for the domestic and export trade.

Essenkay Products Co., Chicago, has leased from the Chicago Consolidated Brewing & Malting Co. a two-story building for ten years at a term rental of $85,000. The property will be remodeled at a cost of $150,000 and used for general offices, salesroom and factory.

Hilbert Mfg. Co., Hilbert, Wis., and Mullins Mfg. Co., Brillion, Wis., both makers of farm equipment, have been consolidated as the W. M. Mullins Mfg. Co., with $200,000 capital. The Mullins company will remove its plant equipment to Hilbert, which plant will be enlarged.

Lansing Bus Co., Lansing, Mich., has been organized to distribute special bodies for all makes of truck chassis, the bodies to be placed with truck makers for mounting on chassis at buyers' orders. Fred L. Waite will be manager of the new company.

REES TO BUILD FREIGHT CAR

COLUMBUS, May 14—The Rees Motor Co., with headquarters in the Commerce Building, has been re-incorporated with an authorized capital of $300,000 and will soon locate a factory for the manufacture of the Rees automobile, a two litre high-grade car weighing 1850 lb. J. H. Rees, the originator of the car, has spent six years experimenting and solving the problem of producing a light car.

One of the features is the system of spring suspension. A specially designed carburetor is also featured. Rees is president and general manager; J. L. Stanton, vice-president; S. W. Moiselle, secretary and M. R. Slayback, treasurer.

Develop Steam Car to Sell at $1000

INDIANAPOLIS, May 13—A 5-passenger steam car to sell at $1,000 is being developed by George A. Coats, head of the Coats Machine Co. of this city. The power system is the invention of a Norwegian engineer who came to this country during the war to investigate the development of internal combustion engines here. The car will have a 110 in. wheelbase and will be equipped with electric lighting and an electric fuel heating outfit for starting.

The boiler of the new car is of the combined fire tube and water tube type and goes under the hood. An advance over previous practice in light boiler construction is said to consist in the top and bottom welding of the boiler tubes. There are really two engines arranged in a single unit and mounted directly on the rear axle, each engine driving one of the axle shafts, so that no differential gear is required. The housing of each half of the axle carries three fixed cylinders, set 120 deg. apart. These cylinders are of the single acting, poppet valve type. They have a bore of 2¾ in. and a stroke of 3 in.

The three connecting rods of each engine connect to a crank pin integral with the drive shaft of each wheel, thus dispensing with all gearing. With a car speed of 40 m.p.h. the engine turns at 500 r.p.m. Kerosene is used as fuel and 1 gal. is said to be sufficient for from 20 to 40 miles, the exhaust is condensed and one filling of the water tank gives a mileage of 300 to 500. It is planned to manufacture a light truck for delivery work on the same chassis.

KNOX TIRE OFFICERS INDICTED

MT. VERNON, OHIO, May 16—Five officers of the Knox Tire & Rubber Co. have been indicted on charges of violating the blue sky law. The men indicted are R. E. Frantz, president; S. D. Spencer, secretary; V. V. Hendershott, E. Scott Cannell and C. B. Carpenter, members of the board of directors.

COLLINS BUYS ONE BUILDING

DETROIT, May 16—R. H. Collins has purchased only the main building of the old Cadillac factory here and not the entire plant as announced last week. The various other buildings are retained by the General Motors Corp.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America*

NEW YORK, May 19—The local call money market showed a firmer tendency last week after opening at 6½ per cent on Monday. The following day and until Friday, when a 6½ per cent renewal rate was again quoted, the ruling rate had been 7 per cent. The firm tone was probably due to the anticipation of the shifting of funds at the opening of the present week incident to government operations and to the payment of subscriptions due on the $230,000,000 Northern Pacific-Great Northern issue.

On Monday of this week interest was due on the second 4 per cent Liberty Bonds and the second 4¼s, and there was due $232,124,000 of Certificates of Indebtedness. At the same time, the Treasury Department was to bring forth a $200,000,000 5½ per cent issue. Following the easy tone in the early part of the week, rates for sixty and ninety days' and four months' paper stiffened to 6½ to 6¾ per cent. Five and six months' paper was unchanged at 6 to 6½ per cent. There was moderate trading in the time money market, with few important transactions.

The mid-week statement of the Federal Reserve System showed another increase in gold reserves and a further reduction in Federal Reserve note circulation. These two factors were mainly responsible for the improvement shown in the reserve position of the System. The ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 55.3 per cent to 55.9 per cent—the highest ratio since August, 1918.

The April figures for our foreign trade show a continuation of the decline which has been characteristic of recent months. Exports for the month were valued at about $340,000,000, as against $386,800,000 in March, 1921, and $684,700,000 in April, 1920. Imports at $255,000,000 mark an increase of approximately $3,000,000 over the March figures, but a decrease of $240,700,000 from the figures of the corresponding month a year ago. Exports were the smallest for any month since January, 1916, and the excess of exports amounted to only $85,000,000. Exports of gold for the month totaled only $400,000, while gold imports amounted to $92,000,000. The inflow of gold has continued at about the same rate during the first two weeks of May.

The Dallas Federal Reserve Bank has just announced a reduction of its discount rate from 7 per cent to 6½ per cent. This means that six of the Federal Reserve banks now have a 6 per cent rate on commercial discounts, and four have a 6½ per cent rate. A significant ruling of the Federal Reserve Board is that made at the close of last week regarding the eligibility of six months' bankers' acceptances in import and export transactions. Under a new regulation, this type of paper becomes eligible for open market purchase by Federal Reserve banks.

MEN OF THE INDUSTRY

A. H. Bartsch, general sales manager of the American Bosch Magneto Corp., has returned from a two months' trip of 10,000 miles, during which he visited service stations and distributors in the South, Southwest and on the Pacific Coast. He reports that nearly everywhere greater effort is required to get business, but that service stations are conducting intelligent and aggressive sales campaigns. Most Bosch service stations now are handling the new shaft drive Bosch magneto attachment for Ford cars and Fordson tractors.

E. A. Blake has been appointed service engineer of the Transport Truck Co., Mt. Pleasant, Mich. Before joining Transport he was assistant superintendent of the Republic Truck Sales Corp.'s engine division at Alma, Mich. He has also been in the engine department of Curtiss Aeroplane Co., Inc., and before that was with Maxwell and Standard.

Fred G. Whipple, division sales manager for the Service Motor Truck Co., Wabash, Ind., has been appointed sales manager in California, Arizona and Nevada. Walter Dix, formerly of the Packard Motor Car Co., has been appointed to succeed Whipple in Maryland and Virginia and parts of Delaware and North Carolina.

Louis E. Clarke, who for several years has been connected with the manufacturing department of the Hoyt Metal Co., both in the East and the Middle West, has been appointed sales manager of the babbitt-lined bronze bushings and die casting departments, with offices in the Boatmen's Bank Building, St. Louis.

Frederick P. Nehrbas has become associated with George A. Weidely as works manager of the Weidely Motors Co., Indianapolis. Nehrbas has been connected with the industry since 1900, having been with E. R. Thomas Motor Car Co., Alco, Lyons-Atlas Co., and latterly with Premier.

Frank E. Wodell, assistant sales manager of the General Motors Export Co., has been given a leave of absence of six months to rest after eleven years of activity with General Motors, the last eight with the export company. Wodell will spend his leave on camping trips in the Rockies.

E. J. Shassberger has been named advertising manager for the Olds Motor Works, succeeding Thomas O'Brien, who has been promoted to assistant sales manager. Shassberger has been with Olds about four years in the sales department and was assistant to O'Brien.

O. C. Berry has joined the staff of the Wheeler-Schebler Carburetor Co., Indianapolis, as chief engineer. He was formerly professor of automotive engineering at Purdue University and research engineer for the Hupp Motor Car Corp.

Paul E. Ryan has been appointed sales manager of the Templar Motors Corp., Cleveland, succeeding Harry Anderson. Ryan was formerly with the Aluminum Castings Co., Perfection Spring Co. and the National Acme Co.

Jay Dewey, general sales manager of the Lexington Motor Co., will spend the balance of the year on the Pacific Coast directing sales activities in that section.

J. A. Callahan, vice-president in charge of production of Martin-Parry Corp., Indianapolis, has been elected vice-president and general manager of the company.

H. H. Crawford will be special representative for the Gier Tuarc steel disk wheel in the territory of Michigan, Illinois, Indiana, Wisconsin and Ohio.

Warren D. Oakes, president of the Oakes Co., Indianapolis, will sail for Europe June 1, to establish agencies in Belgium, Scotland, England and France.

C. E. Pumphrey has resigned as sales manager of the McGraw Tire & Rubber Co. and has been succeeded by W. H. Hurley, assistant sales manager.

Charles E. Speaks has been appointed European manager for the Firestone Tire & Rubber Co., with headquarters in London.

Norman DeWind, originator of the motor road roller, has severed his connection with the Austin Mfg. Co., Chicago.

Ford Dealers Combine for Used Car Disposal

CINCINNATI, May 23—Automobile men over the country are showing much interest in a plan that is being tried out by the Ford dealers in the Cincinnati territory, who have organized the Ford Dealers Corp. with a capital stock of $75,000 to handle the sales of used Ford cars in this territory.

The stock is divided equally among the 14 authorized Ford dealers in the three counties—Hamilton County, Ohio and Kenton and Campbell countries, Ky., just across the river from Cincinnati.

The purpose of the corporation is to handle used Ford cars which are offered in exchange for new cars, and, hereafter, when a man with an old model wishes to trade it in on a new car, he will be referred by the dealer to the corporation, where a cash sum will be offered him for the machine. The corporation will, in turn, dispose of the machine through the usual second-hand methods. This will permit dealers to eliminate the troublesome features of handling and financing second-hand cars.

C. H. Peterman is president of the corporation; J. A. Wissell, vice-president, and H. J. Berning, secretary and treasurer.

A.A.A. Visits Harding, Approves Townsend Bill

WASHINGTON, May 17—Representatives of the American Automobile Association in convention here this week called upon President Harding to-day, and pointed out the need for better highways and expressed hearty approval of the proposed Townsend bill, which is now before the Senate. Later the delegates attended hearings of the Senate Committee on Post Office and Post Roads, which is gathering opinions as to the effectiveness of the Townsend bill in correcting abuses now existing in highway administration.

The delegates discussed automobile thievery, policing for the National highways, opposed the discriminatory taxes on automobiles, and discussed the gasoline price situation.

Senator Townsend and other legislators addressed the conference at a dinner given Monday at Hotel Washington.

Western Radiator Formed to Combine 2 Companies

CHICAGO, May 18—The Western Radiator Corp. has been organized to take over the Hooven Radiator Co. and the B. & W. Mfg. Co., both of this city. The purchase of these two companies gives the Western Radiator Corp. one of the most complete lines of radiators. Production will continue in the fine Western Avenue plant to which the B. & W. equipment is being moved. Additional equipment has been provided for increased production of numerous types of radiators. The factory has a capacity of fully 2000 radiators a day.

New Jersey to Campaign for Fair Legislation

NEWARK, May 16—The New Jersey Automotive Trade Association, at its annual meeting in the Robert Treat Hotel here this afternoon, decided to carry its fight for better highways direct to the people and make it a dominant issue in the election of State legislators next fall.

The dealers are aroused by a condition which practically amounts to the stoppage of all highway development in 1922. The last Legislature, after increasing automobile fees and providing for a larger program of highway development than was asked for by the automotive interests through the State Highway Commission, failed to provide a proposed bond issue which would make highway improvement possible.

After hearing a report of George Paddock, one of the State Highway Commissioners, showing the deplorable condition of the highway program the association was unanimous in a resolution pledging itself to use every effort possible to acquaint the people of the State with the situation so that there may be no further delay than already occasioned. It was further resolved that the fight be carried into every county and that the citizens be asked to send to the Legislature only men favorably disposed toward good highways and who are familiar with highway problems.

CARPENTER ATLAS PRESIDENT

LANSING, MICH., May 14—Samuel H. Carpenter, former secretary of the Atlas Drop Forge Co., has been made president and general manager and will be succeeded as secretary by J. P. Hopkins, who also will retain the position of vice-president. Earl W. Goodnow was elected to the board and will become assistant secretary.

The changes were announced at a meeting of the board of directors Tuesday at which the favorable financial condition of the company was drawn to the attention of the stockholders.

Calendar

SHOWS

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

May 28, 1921 — Czecho-Slovak International Automobile Exposition of Cars, Trucks, Tractors, Motorcycles and Equipment. Prague.

May 28-June 8 — International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

May 23-26 — Chicago, A.S.M.E. Spring Meeting, Congress Hotel.

May 24-28—West Baden, Ind., Summer Meeting Society of Automotive Engineers, West Baden Springs Hotel.

July 4-9 — Mackinac Island, Mich., Summer Meeting Automobile Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

RACES

May 30 — Indianapolis, International Sweepstakes.

June 3-5 — Reno, Nev., First Annual Nevada Highway Road Race.

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

INDUSTRY ASKS SENATE TO REPEAL "STIGMA TAX"

(*Continued from page* 1085)

that the industry should be relieved of the sales tax on cars, trucks and repair parts.

Replying to a statement of Senator Simmons of South Carolina, ranking Democratic member of the committee, that the Government did not build the road beds for the rail carriers as it did for the automotive industry, Graham pointed out that nobody ever heard of steamships digging their own channels or building their own harbors, but that the Government paid for it. This illustration was considered very apt. He said that the industry pays enough for the maintenance of all vehicles. Graham placed the automobile industry in favor of a sales tax, provided it is extended to all industries and as such would be equitable. Objection was made as to confining it to the automotive industry because it would be highly discriminatory.

Hanch Outlines Appeal

C. C. Hanch, chairman of the National Automobile Chamber of Commerce Taxation Committee, opened the argument for the industry. He outlined the recommendations of the organization, emphasizing the need for economy in Governmental expenditures. His suggestion that Federal expenditures be held to $2,000,000,000 annually was well received. Senator Penrose, chairman of the committee, inquired of Senator Smoot, ranking Republican member of the Senate Appropriations Committee, whether this was possible under existing conditions. Senator Smoot answered that they could not possibly reduce expenditures to $2,000,000,000 and take care of the proposed soldiers' bonus. Mr. Hanch found many sympathizers on the committee when he suggested that "it is time for at least a brief naval and military vacation."

The committee questioned Mr. Hanch closely as to the effect of the excess-profits tax. His assertion that there was a vast preponderance of public opinion for the repeal was questioned by Senator McCumber, who contended that the farmers did not want it repealed. Responding to a question of Senator Simmons, Hanch insisted that the excess-profit tax was a consumption tax in the last analysis.

Senator Penrose wanted to know of the discriminatory effect of such tax, as had been alleged by the automotive industry. Hanch said it discriminated against conservatively financed institutions and favored extravagantly managed concerns, put a limit on initiative and was extremely uncertain of return. He furthermore insisted that it was unfair in principle, as was true of the excise tax.

Hanch emphasized the need for lessening the tax burden on industry, particularly during the reconstruction period. He expressed the opinion that no additional burdens would be required before 1923, provided the Government was prudently conducted and a tight rein kept on expenditures. He indorsed the sales tax only in the event that additional revenue is needed and is placed on all industry.

Hearings to Continue

Hearings on the Internal Revenue revision will be continued for several weeks in order that the committee may ascertain the views of the country on this problem which vitally affects all.

The House Committee on Ways and Means undoubtedly will take up this matter after the tariff measure is reported, probably by May 26.

"A very strong impression was made upon the members of the committee," said Alfred Reeves, general manager of the National Automobile Chamber of Commerce, after the hearing to-day. "We were delighted with the reception accorded us. The committee was a hundred per cent more friendly than ever before, and seemed keenly alive to the problems confronting the industry. Much interest was shown on the part of the committee by its questions as to our attitude on current tax problems, and we were able to give convincing replies. Quoting President Harding carried much weight."

Presenting the industry's views on highway legislation before the Senate Post office committee, Graham said:

"National development and the need for economy demand the formation of a highway policy under a Federal Commission.

"The economic barrier now confronting us is the lack of adequate highways. There is urgent need to build these highways as quickly as possible.

"Highways should be planned with consideration of their relationship to railway and waterway communication. The highway question concerns agriculture, commerce, the military and the social needs of the nation.

"Highway policy, therefore," Graham continued, "should be unified under a Federal Highway Commission directly responsible to the chief executive, as is now the policy in State road administration.

"Economy will be served by such a measure as roads will be built with regard to all the needs of the nation. It will be possible to pay higher salaries than can now be done under the bureau system. Millions of dollars are to be expended on roads, and it is the highest economy to secure the ablest brains in the country for this administration."

CORRECTION

DETROIT, May 16—In the story on production in the Detroit district printed in AUTOMOTIVE INDUSTRIES last week the statement was made that "an interesting fact in connection with the Reo business is that its foreign trade has fallen to approximately half its normal total." This reference should have been to farmer trade instead of export business.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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S. A. E. SUMMER MEETING

Education Dominant Thought at S.A.E. Summer Meeting

President Beecroft points way to attainment of results. Discusses foreign trade. Intensive research by S. A. E. not to conflict with competitive research. Hot weather greets convention visitors on arrival.

WEST BADEN, IND., May 24.

THE Society of Automotive Engineers is holding the hottest meeting in its history. Although accurate temperature figures are not available, each of the six hundred persons registered are ready to testify that this is a real summer resort and that summer has arrived in full force. Most of the visitors, however, had some taste of the hot weather before leaving home and so no one is inclined to blame this section of Indiana for the exceedingly warm reception which has been accorded. Everybody is having a good time in spite of the high temperatures.

The attendance is surprisingly good; much better than was anticipated early in the season. Six hundred arrivals have already been registered, while reservations have reached 650. Many arrivals are yet unregistered, so that the total attendance will probably be about 700. The attendance last year was 757, which was the largest for a summer meeting in the history of the society.

Both sessions held to-day were well attended. A surprisingly large number sat through the rather extended meeting of the standards committee in spite of the heat. The hall was also well filled to-night when President Beecroft delivered his address. His remarks centered about the subject of educational work and were listened to with close attention. He discussed especially the relation of the engineer to foreign trade and defined the various kinds of research work in general, together with the function of the research work to be carried on by the Society. President Beecroft's address was as follows:

It is a welcome opportunity to have the privilege and the honor to address you as your president because of what our society has accomplished in its brief history of 16 years, and also because of the character of the times through which we are passing, and the problems lying ahead with which we must cope. We have passed milestones on the automotive highway, but the future is not so clearly defined as we had hoped a few years ago it would have been, and within 12 months we have been brought face to face almost brutally with situations that have been anticipated by few, if any, in our industry. Our greatest concern is with the immediate future.

Within the last 12 months we have seen waves of industrial depression follow one another in long successive undulations, beginning at the Atlantic and ending at the Pacific. We have not only watched these waves traverse the breadth of our land but have seen them pursue their undulatory course across the Amer-

icas to our south, across Australia, Africa, Asia and devastated Europe, until we could not locate a single center on the earth's surface that seemed immune from the depression that we are still in the midst of.

We are not yet through liquidation, and are barely on the threshold of the adjustment period that lies ahead. These are days when courage is needed; when the fibre of which men are made is under the supreme test and when integrity and self-reliance are essential attributes of success.

This situation has suggested the subject of these remarks, namely, education, a more general consideration of fundamentals, a greater probing of one's self, and the development of greater self-reliance. In no field of human endeavor are these qualities more essential than in engineering, and this is specially true in a department of engineering such as transportation, with which we are connected and which is so inter-woven with all of the other industries of the world.

In transportation we must play our rôle and it must be a just and equitable one. We must give to the railroads what they can best do; we must give to the motor truck that which it can transport more economically than other means; to the commercial airplane should go that which can be best transported by it. There must be no inefficient wasting of the work by any form of transportation attempting to take onto itself that which can be more economically done by another medium of transportation. Corporational selfishness may exhibit itself and for a short time win, but in the end the economical will triumph, and in transportation, the straight line, as representing the greatest efficiency, will win. Heretofore the different kinds of transportation were warring more or less among themselves, vainly trying for the victor's share of the spoils. But a change of attitude has been exhibiting itself recently and now railroads are admitting the right of the motor truck in certain divisions of the transportation world, and are ready to leave those fields to it. Let the law be, render unto Cæsar that which is Cæsar's and to God that which is God's.

If the engineer is to maintain the status of his profession and pursue the ideal of seeking after the truth, then the pursuit of education must be an ever present and primary consideration. He must breathe the spirit expressed in the words of Ulysses: "To follow knowledge like a sinking star beyond the utmost bound of human thought . . . to sail beyond the sunset, and the baths of western stars until I die . . . to strive, to seek, to find, and not to yield."

For the first time in our industry since we shed our swaddling garments we are measuring ourselves with the other automotive manufacturing nations of the world. Before the war we were not an exporting nation, as our factory expansion which gave us the production we have to-day was developed during the early years of the war.

Previous to 1914 our foreign trade was a diversion; to-day it is a necessity. We find ourselves with factories of greatly expanded capacity, greater capacity than our domestic demands can absorb, and we are faced with the alternative of remaining in and increasing our position in the markets of the world or reducing output and depriving ourselves of the lower production costs we attained by virtue of volume production. For six years we have been in the markets of the world in a more or less representative way, but, lest we forget, may it be recalled that the world markets sought our wares and the world's buyers knocked on our doors; our task was easy—we opened the doors, took the remittances and delivered the merchandise.

Easy come, easy go, is an old proverb, yet still applicable and we might also further fortify ourselves by borrowing from divine writ words that can be applied to our foreign trade situation—namely, "Wherefore let him who thinketh he standeth take heed lest he fall."

Perhaps to some engineers foreign trade may seem far afield, but only last week the president of one of our greatest railroad systems in his testimony before the Interstate Commerce Commission attributed the present decline in railroad traffic to the falling off of our foreign trade, falling off $657,000,000 in three months of 1920 as compared with 1919. Not only has foreign trade affected our railroad systems but it is affecting all industries, and whatever factors affect the industries with which he is connected should properly be a matter of concern to the engineer.

Foreign trade, while directly a merchandising activity, has a very direct connection with engineering and its future will be to no small extent dependent on the knowledge the engineer has of the conditions and the characters of the people in the countries in which his product must perform. Some four years ago, when our expert sales departments ruled that a magneto was not necessary equipment because of our developed battery ignition systems, it was soon learned that conditions in many lands demanded the magneto, and, despite rulings, those companies that disregarded rulings and fitted the magneto were well repaid for their consideration. Others, who for a time resisted, were soon converted to the necessity of the magneto. In the end it was an engineering question, and, while from a merchandising viewpoint the dropping of the magneto seemed desirable in that it facilitated the production, yet in long-distance view, which should be the engineering view, it proved necessary. It is because of many situations of this character that engineering must be more intimately associated with such factory activities as merchandising and maintenance as well as with design and production.

The factory engineer becomes immediately a direct party to foreign trade. When sales in certain lands are decelerated, due to gasoline selling at $1 per gallon, or in another country where the horsepower tax is $5 per year per horsepower, we get a close-up realization of how interwoven engineering is with merchandising and how only the engineer thoroughly familiar with the fields in which his product goes can serve his company best. The engineer has not sufficiently weighed the factors involved in domestic trade, not to mention foreign trade.

It was not necessary until a year ago, as we had no world competition, but to-day, with European nations entering the field and with some of them actively in it for a year, it is necessary, if we are to retain our position, to give early consideration to these and other related questions.

To draw a parallel from our domestic field, two of our large farm tractor manufacturers have within the last thirty days concluded that the high cost of fuel in comparison with animal power has been one of the deterrents to the sale of farm tractors this year. If this becomes a considerable factor at home, where fuel is cheap and the machine is marketed at low cost, as compared with prices at which it must be sold in foreign fields, how much more a consideration does it become with $1 per gallon fuel and machine prices nearly doubled, due to freight, insurance, customs and shipping charges?

Only one year ago we found serious engineering de-

fects in certain cars in our own country, due to physical characteristics on our own Pacific Coast, and yet the engineer was ignorant of the facts and, still worse, obstinate in his conviction that he was right. It was finally the sales end that converted the engineer, whereas it is the duty of the engineer to be a guide to the sales and correct them where necessary. The engineering mind must give consideration to those factors that directly affect his company.

As engineers, be constantly remindful of the fact that your task is far from completion, and, while in the last thirty years, scarcely a generation, we have seen a measure of progress scarcely comprehended to-day, yet the goal lies far beyond the distant hills. Education is the greatest need of the hour in present-day engineering, and in this we may gain hope and inspiration in pursuing education along its devious paths from Lessing, the German philosopher, who in his "Education of the Human Race," speaking on the broad subject of evolution and the devious paths it pursues, which in places can scarcely be followed, says:

"Go thine inscrutable way, Eternal Providence, only let me not despair in Thee because of this inscrutableness. Let me not despair in Thee even if Thy steps appear to be going back. Is it not true that the shortest line is always straight?"

Education should only begin when college doors close behind us. The man does not truly live whoever concludes that his education is completed. "Education gives to man nothing he might educe for himself. It gives him that which he might educe for himself only easier and quicker. This in the same way that revelation gives nothing to the human species which the human reason left to itself might not attain, only it has given and still gives the importance of these things earlier."

The extension of knowledge and securing it quicker and easier is one of the functions of our society that your council has given consideration to since the first of the year and which was under consideration last year. Under the term research as related to our society, the dominant thought is securing of certain knowledge earlier and with less expenditure of effort and with greater conservation of the talent available for such work.

Your council has seen fit, after deliberate and mature consideration, to actively push the creation of a research committee that will take its place in the society activities along with standardization work. It is impossible to see what development lies ahead and what expenditures this department may make for the next few years, but in magnitude the research organization should exceed that of standardization and the growth of the department is only dependent on the enthusiastic support that is given by the membership.

Let us briefly analyze what research is, as contemplated, and what it would mean to our society and the members:

First, there has been no thought of creating a special research laboratory for the S. A. E. in which to carry on experiments necessary in any research, but rather that existing laboratories in the industry and outside of it be utilized for such work. The finances of the society would not permit of creating a special laboratory, and the feasibility of such would be gravely questioned at this time. There are in Government bureaus, such as the Bureau of Standards and the Bureau of Mines, and in our college laboratories and in our industrial laboratories ample equipment for all necessary research, and it would be wasteful to neglect the intelligent use of these facilities.

Second, there has been no thought in the research program as considered to encroach on what might be described as the secret developments of any corporation. There is nothing communistic or that flavors of engineering socialism in the contemplated program. The research program contemplates nothing more than has been considered as beneficial co-operation in associations of manufacturers. We have for years, even for centuries, considered these industrial associations, formerly known as guides for the efficient promotion of trade, not only desirable but essential. We are to-day accomplishing through them results not considered within the vale of possibility a few years ago.

There is nothing in the research planned that usurps the programs of the engineer to-day. There is no thought of extracting the scientific discoveries of one company and distributing them broadcast to the remainder of the industry. Rather research, as planned, is to do the things that thus far have been left undone. It is to obtain certain knowledge not only easier but quicker and to be more certain of its accuracy.

The term research will admit of certain analysis and, for our present convenience, we may consider it under three heads or classes:

1. First there is what might be designated explorational research, conducted in different fields, which is a purely scientific research largely conducted by individual scientists with the thought of extending the boundaries of human knowledge. This research is akin to an explorer starting on a mission of discovery in an unknown field, a case in point being that of the Scandinavian astronomist who has led a life of study in his observation stations within the Arctic Circle, where for twenty years he has studied the Aurora Borealis and as a result has established certain scientific relationships previously unknown to science and by virtue of which new scientific areas, so to speak, have been brought into the field for intensive study by the scientific and engineering world. With us this research program has little to do. It has not been considered as one of our major activities. It must be left to the physicist, the chemist, the mathematician and the general scientist.

2. Secondly, and related to explorational research, is what might be designated intensive research in the fields brought within the ken of engineering by explorational work. This intensive research field is the one that our program has to do with and in which our interest is greatest. It is in this field of intensive research where economy in effort is most needed and where the measure of work for an end accomplished is greatest. This intensive research is a job that involves co-operation and organization, and the talent used can rarely be used in explorational research.

An example of the research activity in this field might be work relating to fatigue in metals. Such work would involve an almost endless number of experiments and tests extending over long periods of time and over a wide range of materials and under varying conditions. Some of our universities have been conducting searches of this character in which tests have been carried on for over a year and are still far from completion.

These experiments in themselves do not give the answer to fatigue, but the findings must be interpreted, and from these interpretations deductions made so that it may be possible to predict the fatigue resistance of

metals. Intensive researches of this and similar character have and are in progress, and are supported by large industrial corporations who have their own research laboratories and who recognize the magnitude of the work and the urgent necessity of it by their liberal support.

3. The third kind of research is industrial or development research, which for convenience may be designated competitive research among manufacturers in the same field of industry, and is a research which our program takes no part in. Competitive or development research has largely to do with developing a design of a part or completed unit or entire vehicle for manufacture or patent protection. This is the research that many corporations are more directly concerned with and which their laboratories are largely engaged upon. This is the research generally carried on behind locked doors carrying the sign "positively no admission." This is the research which provides the manufacturing secrets of a corporation. Our contemplated program leaves such research where it is to-day, solely with the manufacturer where it rightly belongs. Our program does not even hint at unlocking the door or removing the sign. Competitive or development research is a company activity and must remain such.

Careful discrimination between this competitive or development research and intensive and explorational research must be constantly kept in mind. Research of the intensive character will tend to increase possibilities for competitive and development research rather than restrict them.

Considering the influence of turbulence in connection with the internal combustion engine, the knowledge of turbulence elevates the standard of practice of the entire industry to a higher and wider level on which each corporation interested has greater possibilities for individual development, patent protection, etc. It is only by a recognition of this that we will progress in knowledge as the demands of the day require.

May we interpolate, "research gives to man nothing he might not educe for himself, but it gives it to him easier and quicker." So with intensive research; the cost is so great and the time needed so long that only by co-operation and organization in the long chain of tests can we secure the knowledge quicker, easier, cheaper, and are sooner able to incorporate the results in industry. Do not forget, art is long and time is fleeting.

One great need to-day is the training of men competent to carry out the intensive research, needs not alone of our colleges but of our industries. Our colleges are not graduating enough men of research caliber to care for the needs unless co-operation and organization are used. We must conserve the human material we have available. No persons are more conscious of this shortage of research personnel than our college heads, and no one regrets this more than they do. Too frequently the curriculum are not conducive to such training.

Up to the last few years there has been little thought of co-operation for conservation in college research, and still less thought of co-operation in intensive research in industrial plants. There is to-day not only a lack of appreciation of research by the engineers but by company executives, and, just as our standardization program met with opposition at its inception and still does in some quarters, so we may anticipate opposition in research until it is more adequately understood.

Research is not going to deprive any engineer of his present work, rather it is going to enable him to obtain results which otherwise might not be possible. It is going to provide him with an arsenal well stocked with knowledge that will serve him and speed his efforts to better work.

Our research committee has had one specific object in mind; namely, securing as the director of this work a man competent not only to carry on intensive research work but to be capable of the more difficult task; namely, to correctly interpret the results obtained from such. There is a lack of uniformity of interpretation of results obtained and a consequent failure to reach conclusions and make correct deductions. In some intensive researches conducted by one engineer certain factors are neglected in experiments, so that comparison of results of experimentation covering the same field by other groups of engineers cannot be made. The measure of result that should have been achieved for the effort expended is not achieved. The money has been expended. The useful time has been consumed; the human energy has been consumed, but results are not what they should have been. A competent director should, with reasonable co-operation, be able to eliminate such losses.

Had we a surplus of human research talent our program for intensive research would scarcely be necessary, but with a shortage of available men the need for such co-operative work becomes imperative. In considering our research problem we suggest that the word research be divested of early associations and your conception of it be revised and that it be weighed in the light of the work to be done, the end to be accomplished and the tools and personnel available, keeping in mind the differences between intensive and competitive research. Do not forget that the confines of competitive and development research are not to be invaded or molested by our work, but that the field for such is to be broadened and lengthened by the intensive research program contemplated.

No time could be more appropriate than the present for the commencement of such work. In times of prosperity, when a company wishes a result along a certain research line, the answer is wanted almost immediately. Such is not possible. By beginning now the program will develop with a readjustment of the industry, and some progress will be made by the time urgent demands are coming in.

There is no thought in a co-operative intensive research program such as outlined of discouraging similar researches by corporations equipped and manned for such or of interfering in such work; but as with similar researches in the electrical and other fields, those corporations privately equipped for such work have been liberal in contributing their aid and finances for co-operative research. Such work will have a very desirable influence by creating greater self-reliance on the part of the individual engineer which will be engendered by such work. Those institutions that have made greatest progress in such work tell us that the personnel has very largely to be trained to the work.

Colleges by virtue of their curricula do not make research engineers. Individual training is necessary. Self-reliance is essential. Ability to proceed step by step from the known to the unknown is essential. The French philosopher, Rene Descartes, in the sixteenth century gave us a good example of what can be accomplished where self-reliance is developed. In his "Discourse on Method," in which Descartes laid the foundation work for modern thought and made possible the whole modern philosophic development, he says:

"Men should gather the greatest satisfaction from progress made in the search after truth. In the same

way I thought that the sciences contained in books composed as they are of the opinions of many different individuals massed together are further removed from truth than the simple inferences which a man of good sense, using his natural and unprejudiced judgment, draws respecting the matters of his experience. . . . The long chain of simple and easy reasonings by which geometers are accustomed to reach the conclusions of their most difficult demonstrations has led me to imagine that all things to the knowledge of which man is competent are mutually connected in the same way, and that there is nothing so far removed from us as to be beyond our reach, or so hidden that we cannot discover it, provided only we abstain from accepting the false for the true and always preserve in our own thoughts the order necessary for the deduction of one truth from another."

To-day, as always, the greatest problem in engineering is the engineer. Man dominates here as in all other spheres and only in proportion as the man, tagged as he may be with the title of engineer, etc., plays his part and considers the attainment of knowledge as the chief end in life, will our industry develop and will we reach that stature and be capable of measuring ourselves successfully with the nations of the world as we should.

We have been parties of an industry whose lot has been an easy one. As an industry we have grown by leaps and bounds. Our progress has been comparable to that of an army in the field that has made great gains of territory without adequately consolidating its position as it progressed and suddenly finds itself in an unexpected situation. We have not at all times taken accurate measure of our progress nor taken a sufficiently long-distance survey of the future. We are now at a time when looking ahead is more necessary than it has been heretofore. We require better qualifications to cope with the situation. For the first time we are in a world's competitive market; a market in which merit counts, and no effort must be neglected, no stone left unturned to fit us in the highest stage of perfection to meet the tasks that lie ahead.

The report of the treasurer showed the society to be in excellent financial condition, the net assets being over $130,000. This is about the same as last year, despite the heavy depression period through which we have passed.

C. F. Scott, chairman of the Meetings Committee, reviewed the last few meetings in his report and stated that seven general technical sessions have been held. Among the future meetings which have been arranged are several special sessions, including a joint gathering of the S.A.E. and A.S.M.E. at the Aberdeen, Md., Proving Grounds. This meeting will be held some time in October and has been arranged at the invitation of the Ordnance Department.

The annual motor boat meeting will take place as usual in New York City during the motor boat show. The date of the annual winter meeting has not yet been fixed. It will not be determined until the date of the New York show has been announced. It has been suggested that the winter dinner and carnival be combined into one affair this year. The Meetings Committee is considering the holding of extension meetings in industrial centers where no sections are now located.

The Sections Committee reports that there are now eleven sections in the society. The new additions since last year are Boston, with a membership of 57; Dayton, with 60, and Washington, with 25. The members in California have had two luncheon meetings, but a section in that State is not being planned at this time. The number of section members for 1921 is 1209 as compared with 1085 a year ago. The Society now has 5468 members. A year ago there were 5231. The membership committee reports a steady growth in all grades of membership. The full members now total 2790, an increase of 84 for the year.

Three members of the Nominating Committee were elected at the meeting to-night. Because this committee is to complete its work during the meeting held here, it was required that all the nominees be present. Those elected were: George P. Dorris of St. Louis, Elmer A. Sperry of New York, and R. E. Northway of Boston.

The other members of the Nominating Committee are elected and reported by the various sections. They are: Boston, L. W. Rosenthal; Buffalo, H. R. Corse; Cleveland, A. E. Jackman; Dayton, T. A. Midgley; Detroit, Russell Huff; Indiana, W. G. Wall; Metropolitan, H. W. Slauson; Midwest, Force Bain; Minneapolis, A. W. Scarritt; Pennsylvania, F. W. Germane; Washington, H. C. Dickinson.

The Standards Committee held one of its most successful meetings. It passed practically all of the standards as printed in AUTOMOTIVE INDUSTRIES of last week. The exceptions were that portion of the parts and fittings division which affects studs and the report on battery ratings for isolated plants. Both were referred back to their respective committees for further consideration.

Hard Copper

EACH month numerous requests are received by the Bureau of Standards for information concerning the hardening or tempering of copper. As the information desired by all those writing to the Bureau appears to be about the same, it has seemed desirable to make a short statement on this subject.

There is nothing new or mysterious about hardened copper. It is not one of the lost arts; immense quantities are in commercial use and added uses for it are being found every day. There are two well-known methods of hardening copper, the first being by means of mechanical working, while the second is to alloy it with a certain amount of another metal and in some cases with more than one metal. As examples of the first kind of hardened copper, we may consider hard drawn copper wire and cold drawn tubing. The wire used for every-day trolley systems is a good example of one of these classes. Copper hardened by the second method is not usually referred to as copper but as brass and bronze. Many persons apparently ignorant of the fact that hardened copper is in use every day have so manipulated the melting of copper in their experiments that the resulting melt is impregnated with oxide. Cuprous oxide is soluble in molten copper and alloys with it in exactly the same sense as the metals mentioned above. Copper treated in this way is considerably harder than the pure metal but is unsuited for most commercial purposes.

The above information will come as a disappointment to the many thousand metallurgical sharps who have rediscovered the secret of the ancient Egyptians within the recollection of the present generation alone.

S. A. E. SUMMER MEETING

Cylinder Actions in Gas and Gasoline Engines

Condensed from a paper prepared for the Semi-annual S.A.E. Meeting by Sir Dugal Clerk, the eminent British authority on gas engines. Inflammation, turbulence, specific heat of gases and other items are discussed.

SIR DUGALD CLERK, in his paper prepared for the S.A.E. Summer Meeting, discusses various phases of the combustion in engine cylinders in the light of experimental results obtained by himself and others. Most of his experiments were made with coal gas, and while the numerical results are not exactly the same as would be obtained with gasoline, they throw much light on what may be expected in gasoline engines. The principal actions common to all internal combustion engines are described as follows:

During the suction stroke of the ordinary four-stroke internal-combustion engine, the charge of air and gas or air and gasoline vapor and spray flows through the valve opening at a velocity which usually exceeds 100 ft. per sec. or 68 m.p.h. It enters the cylinder and fills it with a mixture of the fresh charge and the exhaust gas remaining from the last power stroke, all in a state of violent agitation or eddying. This agitation dies down in time, but at the end of the compression stroke, just before ignition, there remains a considerable internal motion. In a gas engine of 9-in. cylinder diameter and 17-in. stroke tested by me I found the residual turbulence at that point sufficient to increase the velocity of the spread of the flame after ignition to three times that which occurs in a still mixture of the same composition. As this state depends on the piston speed, an increase of the piston speed causes an increase of the initial turbulence, and hence a more rapid spread of flame to meet the increased rate of piston movement. Without this automatic change of ignition rate the high-piston-speed gasoline engine would have been impossible.

During the suction stroke the mixed charge passes through the valve opening at the temperature of the atmosphere, in the case of the gas engine, but somewhat below it in the usual case of the gasoline engine, due to evaporation of the liquid fuel; and as the valves and piston-end and cylinder walls are hotter than the charge, heat flows into it, and whenever the charge is complete its temperature is raised in a gas engine to about 212 deg. Fahr., partly because of the heat-flow into the charge and partly because the cool charge is mixed with a certain proportion of hot exhaust-gases at beginning of suction stroke, whose temperature is about 930 deg. Fahr.

This mixture at the suction temperature of 212 deg. Fahr., when compressed in the engine mentioned which has a 5.5 compression-ratio, rises to about 680 deg. Fahr. at a pressure of about 120 lb. per sq. in. above atmosphere. On ignition the temperature rises to a maximum of 2912 deg. Fahr. in about 1/40 sec., and the maximum corresponding pressure becomes about 330 lb. per sq. in. above atmosphere at nearly 1/20 of the forward stroke. The speed of this engine is 200 r.p.m., so that one revolution takes 0.30 sec. and a single stroke 0.15 sec. Had turbulence been absent at the time of ignition it would have required nearly 0.1 sec. to complete the spread of the flame and the maximum temperature would not have been attained till half stroke forward.

The time of inflammation necessary for a gasoline engine running at 1200 r.p.m. is much shorter; at this speed it should not exceed 1/120 sec., and at higher speeds much greater rapidity is required to give reasonable efficiency. The late Dr. W. Watson gave 1/300 sec. as the time in a small gasoline engine tested by him. Assuming the flame to travel 4 in. to fill the small cylinder, then its velocity must be 100 ft. per sec.

With gasoline engines operating at 1600 r.p.m., with overhead valves opening directly into the cylinder which was 7.25 in. in diameter with an 8.50-in. stroke, Sir Dugald obtained an indicated thermal efficiency of 33 per cent, and this value is about 0.7 of the air standard and about 88 per cent of the actual working-fluid standard. Mr. Ricardo has designed and built a special single-cylinder gasoline engine arranged so as to permit of altering the compression-ratio while the engine is running. He has published (Table 1) the maximum indicated thermal efficiency obtained at values of 1/4, 1/5 and 1/7 respectively for $1/r$. To enable this wide compression range to be attained he used benzol. Mr. Ricardo followed Sir Dugald in giving an approximate formula for the actual working-fluid efficiency at different compression. The latter proposed the use of a value of 1.285 for γ for the particular fluid of the gas engine; for the products of combustion of benzol and gasoline Mr. Ricardo uses 1.295.

TABLE 1—VARYING COMPRESSION-RATIO EXPERIMENTS USING BENZOL

Compression-Ratio	Maximum Indicated Thermal Efficiency Calculated $E = 1 - (1/r)^{0.295}$	Maximum Indicated Thermal Efficiency Observed	Ratio of Observed to Calculated Thermal Efficiency	Air-Cycle Efficiency	Ratio of Observed Thermal Efficiency to Air-Cycle Efficiency
1/4	0.337	0.277	0.82	0.425	0.650
1/5	0.380	0.316	0.83	0.475	0.665
1/7	0.440	0.372	0.85	0.540	0.685

The change from ¼ to 1/7 compression-ratio raises the indicated thermal efficiency from 27.7 to 37.2 per cent; that is, only 74.5 per cent of the fuel used at the low compression is required to produce the same power at the higher, and the ratio between no heat loss and practice rises from 82 to 85 per cent. The mechanical efficiency also rises, so that the saving is well worth making. The air-cycle ratio varies from 0.650 to 0.685, practically 0.7, the same as with the gas engine.

Sir Dugald referred to the subject of detonation and said that it was a very old trouble, as he experienced it with the first (two-stroke) engines he built in a very pronounced form. In later engines he overcame the trouble

by using what he refers to as exhaust super-compression, that is, injecting cooled exhaust gases into the cylinder at the charging end of the stroke so as to raise the pressure of the charge to 3-5 lb. p. sq. in. above atmosphere before compression began. He expressed the opinion that trouble from knock in present day kerosene engines could be eliminated by using a mixture of exhaust gas from the engine with the air entering the cylinder.

Turbulence

Reference is also made to the subject of turbulence, and in this connection Sir Dugald claims to have discovered that the turbulence created by the high velocity of the air and gas in entering the cylinder, persists during the compression stroke of the gas or gasoline engine to a sufficient extent to affect profoundly the rate of inflammation of the compressed mixture. This investigation was made in 1911. Long before that time he was fully aware that (*a*) turbulence existed in the engine cylinder during the admission of the charge through the inlet valve and passage and (*b*) that if turbulence be produced in a mixture of gas and air the inflammation of the charge proceeds more rapidly.

The flame velocity in an engine varies with the suction velocity and also with the gaseous or liquid fuel employed. Thus in one large cylinder gas engine of 22-in. diameter and 34-in. stroke, running at 160 r.p.m., the explosion period with Mond gas, suction gas and coal gas was respectively 1/21, 1/24, and 1/38 sec., and the corresponding flame velocity 47, 54 and 85 ft. per sec. The inlet velocity was 160 ft. per sec. In a smaller gas engine the inlet velocity was 100 ft. per sec. and the flame velocity 37 ft. per sec. With the richest mixtures used in gas and gasoline engines the flame temperature rises as a maximum value to 3632 deg. Fahr., although one set of experiments made by Professors Dalby and Callendar reached 4352 deg. Fahr. In both gas and gasoline engines the rate of flame transmission with turbulence varies from 30 to 100 ft. per sec.

Sir Dugald says that in a book on The Gas Engine published in 1886 he developed the thermodynamics of the engine and deduced the equation for thermal efficiency in terms of compression ratio as follows:

$$\epsilon = 1 - (1/r)^{\Upsilon-1}$$

where $1/r$ is the compression ratio. This is now often referred to as the air standard efficiency. It has the following values for different compression ratios: ½ — 0.246; ⅓ — 0.360; ¼ — 0.430; 1/5 — 0.480; 1/6 — 0.510; 1/7 — 0.550; 1/10 — 0.610; 1/20 — 0.700; 1/100 — 0.850. A Committee of the Institution on Efficiency of Internal Combustion Engines adopted this standard. It made tests on three engines, of 5.5, 9 and 14 in. bore respectively, all using a compression ratio of 5.5, and by dividing the indicated thermal efficiency by the air standard efficiency the result was 0.61 for the 5.5 in. bore engine, 0.65 for the 9-in. bore and 0.69 for the 14-in. bore engine. As a result of many tests it can be accepted that in practice, if we calculate the maximum indicated thermal efficiency from the corresponding ratio of the air standard, 0.6 can be taken as the minimum and 0.7 as the maximum.

It was known in 1905 that the specific heats of the products of combustion are higher than that of air and that they increase with rise in temperature, but the specific heat values were very uncertain. Accordingly Sir Dugald set to work with the largest engine available to the Committee on Efficiency of Internal Combustion Engines and determined the specific heat of the flame in the combustion chamber by a new method depending on alternate compression and expansion of the flame within the cylinder. As a result he reached the conclusion that the engine converted into indicated work 88 per cent of the heat which it possibly could have converted into work, considering the properties of the working fluid. These tests were made on a slow speed large bore engine, but recent experiments made by Mr. Ricardo have shown that equally good results can be obtained with gasoline engines.

In 1911 Sir Dugald observed that the rate of explosion rise in an engine varied with the rate of revolution, and he ascribed this to the turbulence or eddying caused by the rush of gas into the cylinder during the suction stroke, which persisted during the compression stroke. In most gas and gasoline engines the mean velocity of charge-flow through the inlet-valve is at the rate of 100 ft. per sec., and flame carried at this rate would completely fill the combustion space of this engine in about 1/130 sec., as the distance from each igniter to the extreme wall-limit is about 9 in. The actual time taken for normal complete inflammation was respectively 1/27 and 1/30 sec., so that the rate of normal flame-propagation with turbulence was about $100 \div 4.5 = 22.25$ ft. per sec., while the rate with trapped ignition and turbulence nearly-died-down was about 8.9 ft. per sec. From this it appears that the effect of suction turbulence is to increase the rate of inflammation about 13 ft. per sec. in this particular engine running at 180 r.p.m. The rate of inflammation in Clerk's closed-vessel experiments with a similar mixture was about 4 ft. per sec., and in Bairstow and Alexander's corresponding experiments 2.5 ft. p.s. In a large vessel having a capacity of 6.2 cu. ft. with a similar mixture, Hopkinson found the rate of inflammation 5 ft. p. s. The velocity of inflammation in an actual engine is thus from 4 to 5 times that found in a closed vessel by Clerk and Hopkinson, and 9 times that found by Bairstow and Alexander. Clerk's experiments would suggest a residual turbulence effect in this engine at the moment of about 20 ft. p. s.

The late Professor Hopkinson experimented on turbulence at the same time, but he operated in a closed vessel and produced his turbulence by the rotation of a fan within the mixture. He used a cylindrical vessel 12 in. in diameter by 12 in. long, with the fan mounted at the center. The experiments showed a great increase of the speed of inflammation consequent on the motion of the gas. With a mixture of 1 part of gas and 9 parts of air by volume, the time from ignition to maximum pressure with the gas at rest was about 0.13 sec.; with the fan running at 2000 r.p.m. it was reduced to 0.03 sec., and at 4500 r.p.m. to 0.02 sec.

Method of Measuring Specific Heat

To study the phenomenon of heat loss and the variation of specific heat, Sir Dugald in 1904 devised a new method of experimentation already referred to. By it the actual working fluid behind the piston could be made to give information on these points during the process of explosion. A 14 x 22 in. single cylinder engine was used, and the exhaust and inlet valve levers were furnished with pins of extra length, so that the rollers on these pins could be moved into and out of the range of the cams.

A spring-and-trigger gear was arranged so that the rollers could be put out of range of the cams at any required instant. By this contrivance the engine could be run in its normal way in accordance with the Otto cycle at either light or heavy load, and any given explosion could be selected for the purpose of the experiment by operating the trigger at the proper moment. It was thus possible to run the engine at its normal speed under the usual propelling explosions, and to select at any given moment any particular charge, move the rollers out of the range of the cams immediately the charge entered, and so obtain an explosion and expansion stroke in the usual manner, with the usual charge. But both inlet and exhaust-valves were held closed and the charge was retained in the cylinder.

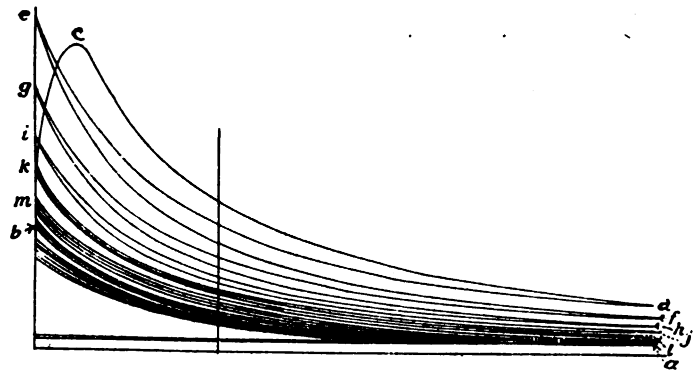


Fig. 1—Diagram of the explosion and alternate compression and expansion of hot gases in an internal-combustion engine cylinder.

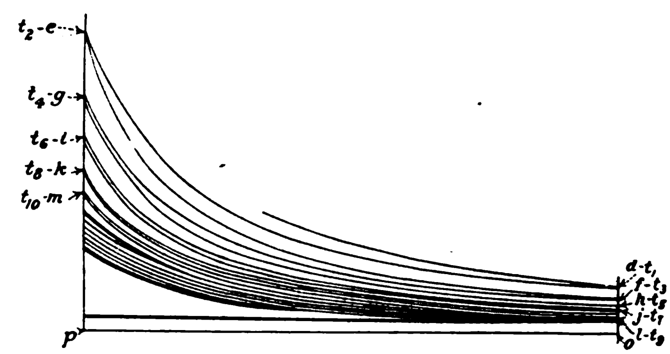


Fig. 2—A compression and expansion diagram with the explosion line omitted.

When the exhaust period was approached, the exhaust-valve remained shut, and accordingly the hot exhaust-gases were retained in the cylinder and compressed by the return stroke of the piston into the combustion space at the end of the cylinder. The energy of the flywheel was sufficient to keep up the rotations of the engine, with but little fall in speed during the short period of observation. The piston was thus caused to move to and fro, alternately compressing and expanding the hot gases which were contained in the cylinder.

An indicator-card taken from such an initial explosion and expansion and the subsequent series of compressions and expansions is given at Fig. 1; *a b* is the ordinary compression-line indicating the compression of the charge before explosion, *b c* is the usual explosion-line, and *c d* the usual expansion-line after explosion. At *d*, however, instead of the pressure falling to atmospheric by the opening of the exhaust-valve, as the exhaust-valve remains closed no escape of the hot products of combustion is possible, and accordingly the return of the piston produces the compression-line *d e*; the next outward movement of the piston produces the expansion-line *e f*, followed by the compression-line *f g*; expansion-line *g h*; compression-line *h i*; expansion-line *i j*; compression-line *j k*; expansion-line *k l*, and so on.

In Fig. 2 is shown the expansion and compression diagram without the explosion line. Referring to this diagram, the fall in temperature between *e* and *g* is not entirely due to cooling, which may be shown as follows: When the expansion *e f* takes place, the gases perform work on the piston equal to the area *e f o p*; when the compression *f g* takes place, the piston performs work on the gases equal to the area *f g p o*, so that more work has been performed by the gases on the piston than by the piston on the gases. Some work has therefore been done by the gases during the interval between points *e* and *g*. That is, part of the temperature difference t_2-t_4 is due to work done; it is not all due to heat lost through the cylinder walls. The difference between the two work areas is *e f g*.

If the specific heat of the gaseous mixture at the temperatures between t_2 and t_4 be known, then the temperature-fall due to the work-area *e f g* can be calculated, and when deducted from the total temperature-fall it gives the temperature-fall due to heat-flow through the cylinder walls. It is found that the specific-heat value need be only approximately known, as the temperature-fall equivalent of the work-area *e f g* is small in comparison with the total temperature-fall, and little error is introduced by a considerable error in the specific-heat value. This method enables a true temperature-fall curve to be drawn, showing the progressive fall of temperature incurred from revolution to revolution under the actual working conditions of the engine.

Proceeding in the manner described, Sir Dugald prepared cooling curves from the 14 x 22 in. engine under two conditions, viz. (*a*) without load, the cylinder kept cool and the engine running at 120 r.p.m.; (*b*) with full load, jacket at 160 deg. Fahr. and engine running at 160 r.p.m.

The cooling curves show the temperature fall due to heat loss, with mean temperature of the gases varying from 212 to 2732 deg. Fahr. and the exposure calculated to one second. Fig. 3 gives the temperature falls incurred per second for different mean temperatures, calculated in time. Curves *a a′* refer to no load operation at 120 r.p.m. with the cylinder kept cold by running water at 55 deg. Fahr. through the jacket. Curve *a* is for the complete stroke, while curve *a′* is for the first three-tenths of the stroke only. Curve *a* when prolonged to the zero of temperature fall cuts it at the temperature of 149 deg. Fahr. This

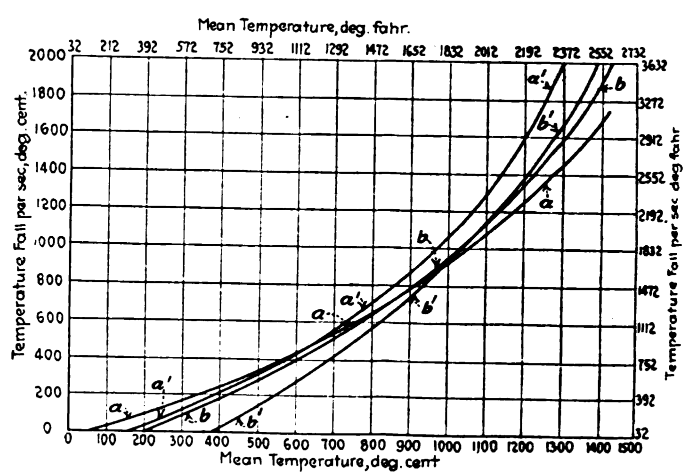


Fig. 3—Fall in temperature per second for different mean temperatures.

means that when the gases reach this temperature no further loss of heat to the cylinder wall takes place, and this therefore must be the mean temperature of the cylinder wall. This cylinder wall, of course, includes valve surfaces and piston head.

Curve *a′* when extended cuts the zero line at 329 deg. Fahr., which indicates that the mean temperature of the cylinder walls is much higher during the first three-tenths of the stroke than during the whole stroke. The curves *b b′* refer to full load operation at 160 r.p.m. with the jacket temperature at 176 deg. Fahr. As before, curve *b* is for the whole stroke and curve *b′* for the first three-tenths of the stroke. Curve *b* cuts the zero line at 374 deg. and curve *b′* at 752 deg. Fahr., indicating these to be the mean temperatures of the cylinder wall during the full stroke and the first three-tenths respectively.

From the curves of temperature fall given in Fig. 3 and specific-heat values of the gaseous contents of the cylinder, heat-losses can be calculated on the explosion-expansion line independently of any knowledge as to the completeness of combustion at any point, and for this purpose Sir Dugald determined the specific heat of the gases (Tables 2 and 3) in the following manner: If a gas be compressed without gain or loss of heat from volume V_0 to V_1, and the temperature rises from T_0 to T_1, the mean specific heat of the gas per unit volume at 0 deg. Cent. (32 deg. Fahr.) and a pressure of 760 mm. (29.92 in.) of mercury at constant volume between the two temperatures is

$$C_v = W \div [\Psi_0 (T_1 - T_0)]$$

where

C_v = the mean specific heat
W = the work done upon the gas
Ψ_0 = a constant depending upon the quantity of gas in the cylinder

TABLE 2 — APPARENT INSTANTANEOUS SPECIFIC HEATS IN FOOT-POUNDS PER CUBIC FOOT OF WORKING FLUID AT 32 DEG. FAHR. AND 29.92 IN.

Temperature, deg. Fahr.	Specific Heat at Constant Volume, ft-lb.
32	19.60
212	20.90
392	22.00
572	23.00
752	23.90
932	24.80
1,112	25.20
1,292	25.70
1,472	26.20
1,652	26.60
1,832	26.80
2,012	27.00
2,192	27.20
2,372	27.30
2,552	27.35
2,732	27.45

TABLE 3 — MEAN APPARENT SPECIFIC HEATS IN FOOT-POUNDS PER CUBIC FOOT OF WORKING FLUID AT 32 DEG. FAHR. AND 29.92 IN.

Temperature, deg. Fahr.	Specific Heat at Constant Volume, ft-lb.
32- 212	20.3
32- 392	20.9
32- 572	21.4
32- 752	21.9
32- 932	22.4
32-1,112	22.8
32-1,292	23.2
32-1,472	23.6
32-1,652	23.9
32-1,832	24.1
32-2,012	24.4
32-2,192	24.6
32-2,372	24.8
32-2,552	25.0
32-2,732	25.2

This is true of expansion as well as compression. The dynamical value of the rise or fall of 1 deg. Cent. (1.8 deg. Fahr.) for 1 cu. ft. of the gas will be given by the formula:

$$D_v = W \div [V (T_1 - T_0)]$$

where

W = the work done on or by the gas in foot-pounds
V = the volume in cubic feet
D_v = the dynamical value in foot-pounds

From cooling curves determined during the actual operation of the piston in the gas-engine cylinder in the manner described, and the dynamic value of the temperature-falls at high and low temperature in foot-pounds per standard cubic foot of working fluid, calculated from specific-heat values, balance-sheets of the engine have been prepared from indicator measurements only. No gas measurements or determinations of heat-flow to jacket-water are required. A heat balance sheet taken from the 50 hp. engine running at full load is given in Table 4.

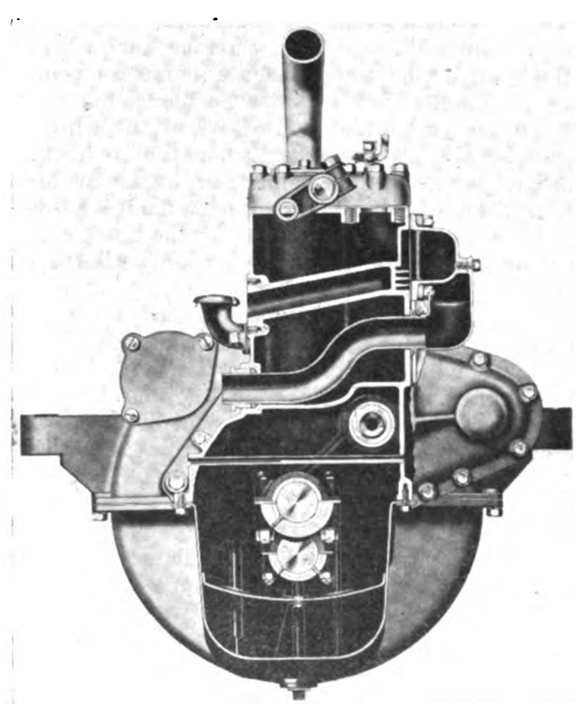
TABLE 4—HEAT BALANCE-SHEET

Card No.	22	
	Ft-lb.	Per cent
Heat-flow during Explosion and Expansion	12,480	15.4
Heat Contained in Gases at End of Expansion	39,800	49.0
Indicated Work	28,900	35.6
Total Heat	81,180 (104 B.t.u.)	100.0

If the combustion is nearly complete at the end of the stroke, the heat present found in this way should be equal to the evolved by the gas known to be present in the charge. The gas present in the charge is known to be approximately 0.183 cu. ft. at the working temperature of the measuring meter, and its lower calorific value was 574 B.t.u. per cu. ft. The heat of combustion of the gas is therefore $0.183 \times 574 = 105$ B.t.u. It is thus seen that the approximation is very close. The indicator has been able by the new method of application to account for the heat present in the charge.

Hot Air and Inlet Pipe on New Supreme Engine

THE accompanying photograph shows a sectional view of the new Model S-4 Supreme engine. In this engine the carbureter is located on the opposite side of the engine from the valves, and the arrangement of the hot air pipe from the exhaust manifold to the carbureter and of the inlet pipe from the carbureter to the manifold is rather neat. The inlet pipe is cast integral with the cylinder block. It extends across the cylinder block between the second and third cylinders and ends in the hot spot inlet manifold cast integral with the cylinder block. The hot air inlet tube is a bent pipe extending from the air heater secured to the under side of the exhaust manifold to the opposite side of the engine. Note the manner in which water-tight joints are made with the jacket walls. Another interesting feature is the control tube across the crankcase.



Arrangement of hot air tube and inlet pipe on Supreme S-4 engine

The Modern Motor Truck

THE construction and operation of all the leading tyes of gasoline and electric trucks are discussed in a detailed and practical manner by Victor W. Pagé in the 1921 edition of his volume entitled "The Modern Motor Truck." The book is designed for the use of truck owners, users and drivers and contains information of great value to the practical mechanic for use in his daily work. Pagé's work is too well known to readers in the industry to render necessary any detailed discussion here.

S. A. E. SUMMER MEETING

Flame Characteristics and Their Influence Upon Combustion

A paper which deserves study even if its application is not at first apparent. The analysis of factors controlling combustion and detonation and the means suggested for controlling these phenomena are considered.

By C. A. French*

THE present state of our knowledge does not permit of an exact scientific definition of flame, for the reason that it may be the result of either electrical, thermal or chemical action, or, perhaps, a combination of two, or all of them. Flame does not necessarily indicate combustion. The flames in the Moore tube, the Geissler tube or the mercury vapor lamp, do not arise from combustion; neither can their glow be attributed largely to thermal action. Solar protuberances, according to the common view, are gases whose glow is of purely thermal origin, but colorless gases in a tube cannot be made to glow by thermal action alone.

Combustion, either slow or fast, is not always accompanied by flame. Burning hydrogen and oxygen, if both are pure and dustless, make no visible flame even in the darkest room, according to the experiments of J. S. Stas. This is consistent with the fact that the line spectrum of hydrogen lies wholly within the ultra-violet. In the combustion of ethylene and chlorine the attendant radiation is below the pitch of visibility. In catalytic flameless combustion, which may begin with the hydrocarbon mixture and catalyst below zero fahr. and end 2000 to 3000 or more degrees above, there is no flame whatever, nor does the catalyst propagate flame even when surrounded by an excess of very rich combustible mixture. Surface combustion, which is entirely distinct from catalytic flameless combustion, may be regulated so as to show no flame, but that is on account of the very great luminosity of the white hot refractory surfaces back of the transparent blue flame. It will always cause a visible flame if an excess of mixture is supplied. The cause of transparent flames is doubtless largely electrical, while the cause of the opaque luminous red, yellow and white flames is probably almost entirely thermal.

A consideration of these facts will show the present impossibility of a strict definition. For the purpose of this paper, flames will be regarded as gases rendered temporarily visible by reason of chemical action; their physical rather than their chemical aspects will be discussed; and, unless otherwise indicated, it will be understood that only the flames of common gasoline and kerosene are referred to.

Many combustion phenomena can be explained only by the assumption that in normal blue flame the fuel burns from the molecule. In explosive combustion present-day gasoline and kerosene refuse to burn with an entirely blue flame under the conditions we use them. They burn with a very objectionable luminous sooty flame, which causes detonation and carbon deposits; while lighter fuels of the same general character burn in an inoffensive manner and give much higher thermal efficiencies. To gain a reasonably clear understanding of the requirements and characteristics of the different kinds of flames it is necessary to start with a study of atoms and molecules. Dr. Irving Langmuir says of atoms, "If a lump of ordinary matter the size of a baseball could be magnified to the size of the earth, the atoms in it then would have become about the size of baseballs." Atoms are believed to be composed of charges of positive and negative electricity. The positive electricity is concentrated into a very small particle called the nucleus, located at the center of the atom. The negative electricity exists in the form of electrons which arrange themselves in space around the nucleus. The electrons in different kinds of atoms are alike, but there are as many different kinds of nuclei as there are chemical elements. These differ from one another only in the amount of positive electricity they carry. For the simplest element, hydrogen, the nucleus has a unit positive-charge which is able to neutralize the charge of a single electron. Thus a hydrogen atom consists of the nucleus and a single electron. The next element, helium, has a nucleus with a double positive-charge, and the atom thus contains two electrons. Atoms of carbon have six and oxygen eight electrons. The electrons are not stationary but each revolves in its own orbit about a certain equilibrium position. It is thought that all atoms occupy about the same spaces.

As atoms are thought to be spherical, it is possible that molecules usually are of the same compact symmetrical shape; at least their behavior in combustion is best explained by this assumption. If we take any number of ½-in. balls less than 13, and arrange them in a symmetrical spherical form, it will be seen that none is entirely covered and cut off from contact with the outside. By taking the 13 balls it will be found that there is one ball in the center that is entirely surrounded. As we know that nature abhors a vacuum, we imagine that there is one atom in the exact center of any ordinary stable gaseous molecule. We find that by starting with one ball, or atom, in the center we can arrange 12 more around it so that all of the 12 will touch it. The arrangement will be symmetrical and the group will resemble a sphere. As there is no other equally symmetrical arrangement of spheres it is reasonable to assume that 13 atoms are the nucleus for any larger number. Hexadecane, $C_{16}H_{34}$, the largest molecule usually found in kerosene, has 50 atoms. Such a molecule would be likely to have 13 atoms inside and 37 on the outside. While 37 atoms would not quite symmetrically cover the 13 inside ones, if all of the atoms were rigid and unyielding, still there would perhaps be enough elasticity to the whole

*Paper presented at the semi-annual meeting of the Society of Automotive Engineers.

mass to allow the outside to be fairly symmetrical; there would therefore be three layers of atoms in such a molecule.

Molecules are thought to be vibrating and rather reacting on one another as they come near each other at rates depending upon their temperatures. In a mixture of combining proportions of air and fuel molecules the molecules of fuel, nitrogen and oxygen could bombard each other for days without starting oxidation, as it seems that some forms of chemical action between molecules are impossible. We know that two atoms, or one molecule, of hydrogen unite with one atom, or one-half molecule, of oxygen, and that one atom of carbon unites with first one atom of oxygen and the carbon monoxide formed by this union later unites with one more atom of oxygen. In other words a hydrogen molecule is satisfied with an oxygen atom, while a carbon atom requires an oxygen molecule but it can only use half of it at a time. It seems certain that the oxygen must be dissociated and ionized before combustion can begin. It is known that the radiation of a hydrogen flame is entirely in the ultra violet; that ultra violet rays dissociate and ionize oxygen; that oxygen ions spontaneously ignite many organic substances. Other means of producing oxygen ions will be discussed later, but as the blue flame of the electric spark we use for ignition is sufficient to ionize oxygen we are now ready to start the combustion of a 50-atom fuel molecule.

Beginning of Combustion

The electric spark ionizes enough oxygen to start the combustion of some one or more of the 37 atoms on the outside of the molecules. The ultra-violet rays from the burning of the first atoms ionize enough oxygen for the next few atoms but evidently not much more, for the blue flame never "runs away" or causes detonation as it would likely do if there were a large excess of ions. During the combustion of the outside layer of the molecule each atom is being bombarded by molecules of nitrogen and molecules and charged ions of oxygen. As the fuel atoms burn they send out new molecules of water and carbon dioxide, two first-class commercial fire-extinguishers, to replace the oxygen with which they united. If we imagine the atoms in the outside layer of the molecule to be about $C_{12}H_{25}$, there would be 24½ new molecules of carbon dioxide and water to replace the 24½ molecules of oxygen used. The flame during the entire combustion of the outside layer of atoms is the perfectly unobjectionable transparent blue flame of almost entirely electrical properties with which every housewife is familiar from long use of it in the gas range or blue-flame oil-stove.

When this combustion started, assuming that there were no burned gases present from a previous explosion, each fuel molecule was surrounded with 125 N_2, and 33 O_2, but when the 37 outside atoms have burned away we find 125 N_2, 12 CO_2, 12½ H_2O and only 8½ O_2. It would be extremely difficult, if not impossible, to propagate a flame in a cold mixture of these proportions. A hydrocarbon flame cannot be propagated in an atmosphere containing less than 17 per cent of oxygen. With 149½ other molecules in the way, all of them the very best kind of fire-extinguisher, the 8½ molecules of oxygen must have considerable time if they are to reach the remaining fuel atoms. In the meantime the 13 inside atoms have been subjected to the full flame temperature in the absence of air. If heated sufficiently in the absence of air all hydrocarbons will dissociate into hydrogen and lamp black. Probably some of the atoms immediately recombine into much smaller molecules; conditions at this time favor the formation of very small, highly endothermic hydrocarbons, such as acetylene C_2H_2; but in any event there is much free hydrogen and free carbon.

Free carbon atoms tend to form aggregates of tangible size, far too large to burn quickly, among which the free nascent hydrogen burns, heating them to incandescence. The flame now becomes first red, next yellow, then intensely luminous, opaque and radiant. The interstices between the solid carbon particles act as miniature refractory-lined reverberatory furnaces in which the free hydrogen is burned, thereby raising the temperature of the burning mass several hundred degrees. When the flame was in the stage of burning the outside layers or the blue stage only about 8 per cent of its energy was in the form of radiant heat; now more than 30 per cent of it is radiant.

When dissociation or cracking occurs at high temperature there is a large production of charged ions of probably all constituents of the mixture. A pressure wave, per se, probably could not be made to travel through molecular air in excess of the velocity of sound but charged ions undoubtedly greatly exceed that velocity. We will imagine that by this time one-quarter of the mixture is inflamed. The flame-front is still blue but the flame around the spark-plug, having been ignited first, has burned off the outside layers of the fuel molecules and has, by reason of the dissociation of the inside layers, arrived at the white-flame stage. Radiant heat with the velocity of light, and charged ions at something greater than the velocity of sound, are being sent out by the white-flame spot. The transparent blue-flame area between the flame-front and the white spot offers no resistance to the radiant heat and probably not very much resistance to the passage of the ions.

The vapor of hexadecane ($C_{16}H_{34}$) is very dense and opaque as the molecules are very large. Radiant heat is incapable of heating transparent vapors or gases, but it is absorbed in great quantities by a vapor as opaque as that of hexadecane. Heavy-hydrocarbon vapors when subjected to radiant heat of a moderate temperature will crack into smaller hydrocarbons when the cracking is done in the presence of enough air or neutral gas, but if subjected to radiant heat of a high temperature, if in the presence of air, they will ignite as they crack. Neither the radiant heat nor the charged ions can penetrate the dense cloud of vapor beyond the flame-front to a very great depth, but between them they instantly crack some of the molecules and ignite a very large quantity of highly compressed unburned mixture. This action causes a sudden severe increase in pressure, which, on a time and pressure diagram, shows a high peak occurring some little time after ignition.

This new flame very soon reaches the white-flame stage and causes perhaps another auto-ignition of a still more remote portion of the unburned mixture, causing a second pressure-peak. The more opaque fuel molecules would show a greater number of auto-ignitions or pressure peaks than those of less opacity. It is easy to imagine that if a cylinder were large enough the pressures and temperatures would ultimately accelerate auto-ignition to a detonative rate of burning. Auto-ignition is often seen in forest and prairie fires where ignition occurs ahead of a flame-front when there is no possibility of sparks being carried to the area ignited. In experiments with burners auto-ignition is often seen when opaque vapor becomes ignited from a white flame some distance away with which the unignited vapor has no connection. There is little probability that a pressure wave causes auto-ignition as it would simultaneously ignite the whole body of unignited mixture, and we know that kerosene, for example, usually gives three pressure peaks, fuel oil five, etc., which seems consistent with the differences in the opacity of their vapors. There is no doubt that acetylene is occasionally formed and detonated. A glass window in the cylinder of a detonating engine on rare occasions shows a flash that is much more blinding; the noise is much louder than the ordinary detonation. Apparently this happens only with rich mixtures and an early spark.

It should not be imagined that the rate of oxidation increases after a dissociation, for such is far from being true. The rate of *inflammation* increases very considerably, but a careful study of the mixture proportions and ingredients after dissociation occurs will show that further oxidation, of the carbon at least, cannot be otherwise than a very slow process. Rich mixtures and unvaporized fuel greatly aggravate our combustion troubles. Inasmuch as it is positively known that hydrogen and carbon require definite quantities of oxygen for their combustion, it is not likely that we will ever be able to use rich mixtures, as we now use them, without undesirable complications. Unvaporized fuel has little opportunity to burn in a normal manner, as by the time it is vaporized and ready to burn the oxygen supply is much depleted and the dilution with burned products makes it exceedingly difficult for the oxygen to reach it in time to oxidize any of it before dissociation occurs.

Inoffensive Combustion

Having studied a very inefficient type of combustion, we should now study the requirements and characteristics of the inoffensive variety. It should be understood that unless complete dissociation occurs immediately previous to ignition, any kind of a visible hydrocarbon flame cannot be propagated without an initial area, or period, of transparent blue flame, in which the air and fuel are in explosive proportions. Whether the fuel is burned in a supporting atmosphere, as a homogeneous explosive mixture, or even in a complete inversion of combustion, i. e., the burning of air in an atmosphere of fuel, makes not the least difference with the flame characteristics of color in the initial area or period. Entirely green, lavender, red, yellow or white flames cannot be propagated except as above stated, nor can they be maintained if too widely separated from transparent blue flame. If a yellow flame is examined through a yellow color-screen, it will be found to be permeated with a thin blue flame, and if a supporting atmosphere is available it will be seen that the yellow spot is entirely surrounded by blue flame. This is also true of spots of green, red and white when examined through the proper color-screens. In the oxidation of stable fuels spots of green, red, yellow or white indicate either a temporary or a permanent lack of oxygen, and the fuel atoms that actually cause spots of those colors are not at that instant burning. Hydrogen makes no visible flame; nor does carbon in burning to carbon monoxide; carbon monoxide usually burns with a transparent blue flame; therefore, a transparent blue flame is the only *visible* sign of oxidation. Spots of any other color indicate the cracking of the fuel into new smaller hydrocarbons and the large production of carbon monoxide, or the complete dissociation into free carbon and free hydrogen.

In the blue flame the reactions are simpler, more complete and the flame is more compact than any other. The molecules are in more rapid vibration and the oxidation is completed in much less time than when dissociation occurs. It has only about 8 per cent of its energy in the form of radiant heat, it is incapable of depositing soot, and its progress is not seriously affected by contact with cold surfaces. The only known requirements of blue flame are enough air and a fuel that will remain in the molecular state until fully oxidized. Nearly all liquid and gaseous hydrocarbons can be burned with an entirely blue flame, but, beginning with molecules of 12 atoms, more time for the burning must be given as the molecules become larger. Leaving out the ethers, the acetylenes and a few other hydrocarbons that are incapable of burning without more or less explosive dissociation, it can be said that any fuel molecule of 12 atoms or less will burn with an entirely blue flame under any pressure so long as there is no excess fuel.

There is, of course, what might be called a gradual decomposition of the fuel molecule even in a normal blue flame. Products of a limited oxidation of kerosene by catalytic flameless combustion are composed of a large number of alcohols, aldehydes, acids, and saturated and unsaturated hydrocarbons. In the green area of the Bunsen flame there is a very great amount of cracking into new molecules, but so long as complete dissociation does not occur the flame does not become luminous. In the so-called wickless blue-flame kerosene-stoves small jets of air are burned in an atmosphere of kerosene vapor until the fuel molecules are cracked down so small that they will burn above the stove in a supporting atmosphere without luminous flame. It is apparently impossible to produce complete dissociation when enough air or neutral gas is present.

Fuels of the benzol series can seldom be made to burn explosively with a white flame unless a great excess of fuel and very high compressions are used. They can be caused to dissociate and make a cloud of black fluffy carbon, but as benzol series molecules are all small, they do not dissociate until practically all of the oxygen is used; there being very little oxygen left after dissociation, the free hydrogen usually cannot burn enough to heat the carbon particles to incandescence. Used in stoichiometrical proportions such fuels probably cannot be made to detonate under any pressure. Fuels of the saturated series, when used in excess, have more tendency to become luminous; they are almost certain to have some large molecules as they are nearly always a mixture of a large number of different members of the series.

For every fuel molecule larger than 12 atoms there is a rate of oxidation that will cause it to dissociate, but for use in present explosive engines a molecule of 20 atoms or less would burn fast enough to be perfectly satisfactory, provided that there were no highly endothermic bonds in it. Its vapors would be so nearly diathermous that they could not be much affected by radiant heat. Fuels having the largest molecules have the most opaque vapors. The large molecules cannot burn rapidly without dissociation. The excess of ions from the dissociation and the radiant heat from the incandescent free carbon particles cause auto-ignition in unignited portions of the mixture. Therefore, to burn heavy fuels with a blue flame in present engines, one or all of the following remedies should be used:

(1) Thoroughly vaporize fuel
(2) Retard speed of oxidation
(3) Crack opaque vapors before ignition by use of radiant heat
(4) Raise compression and use reasonable excess of air
(5) Ionization previous to ignition
(6) Induce great turbulence
(7) Destroy reverberatory action of combustion-chamber walls
(8) Eliminate pockets in the combustion chamber
(9) Locate spark-plug in exact center of combustion-chamber

Oxidation and Flame Propagation

Oxidation can be retarded by careful cooling of the combustion-chamber, and by the use of plain diluents such as an excess of air or cool exhaust gas. The compression should be high, 125 lb. or more, to gain in thermal efficiency. The diluents can then be used with more effect and economy than when the dilution is secured by lowering the compression. It might be worth while to try a very small amount of chlorine as a diluent, as this substance is an ionizer and whenever a hydrogen atom is freed from a molecule, leaving the molecule in an unstable equilibrium, the chlorine would be likely to replace the hydrogen and preserve the molecular structure.

To best promote flame propagation the oxygen might be

(*Continued on page* 1123)

A New Method of Cooling Automotive Engines

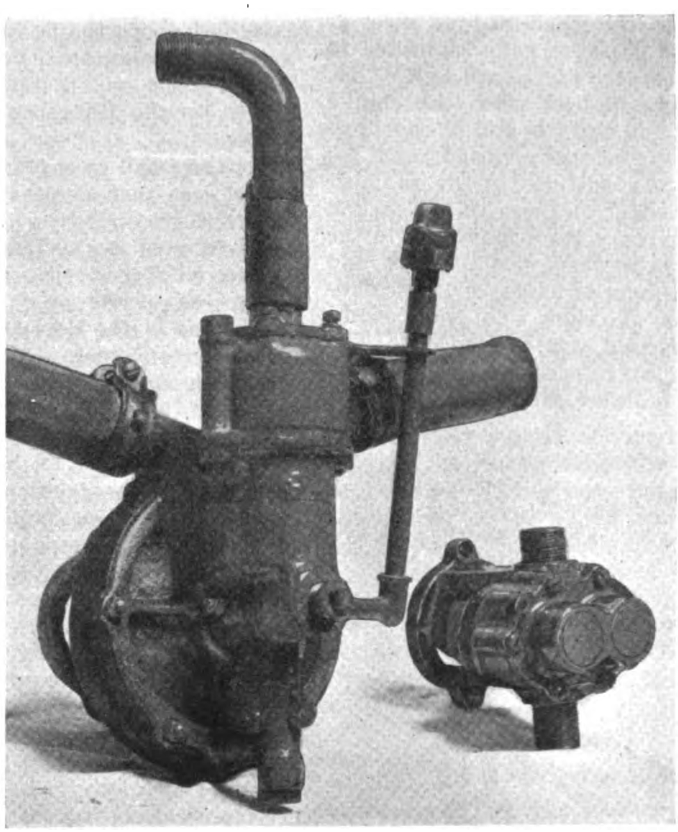
Normal temperature of jacket is raised above the boiling point of water by using a closed system in which steam is generated at about 5 lb. per sq. in. pressure. Radiator not completely filled with water.

By P. M. Heldt

THERE has been very little progress in cooling systems for years past, aside from the introduction of the thermostat, which is designed to ensure quick warming up of the engine when starting from cold and maintaining a fairly constant jacket temperature thereafter. The necessity for quickly heating up the engine and for maintaining it hot irrespective of load changes arises from the low volatility of our present fuel. There is no doubt that the higher the cylinder wall temperatures, within the limit at which trouble begins to be experienced from preignition or burning of the lubricating oil, the more rapid and complete the combustion of the fuel, and the less the trouble from crankcase oil dilution. Air cooling, of course, affords these higher cylinder wall temperatures, but the great majority of engineers seem disinclined to tackle the problems involved in the development of a successful air-cooled engine.

Samuel W. Rushmore, well known to the automotive industry as a former manufacturer of searchlights (headlights) and of an electric starting and lighting system, has recently developed a cooling system which is in a way intermediary between the air cooling and the ordinary water cooling systems. Water is used as the cooling medium, but the jacket outlet temperature is constantly maintained above the boiling point of water. There is ordinarily little or no water in the radiator above the bottom tank. The radiator core is filled with steam to a certain height depending upon the relation between heat absorption in the cylinder jackets and heat dispersal per unit of core surface. It is obvious that the radiator becomes much more effective with a cooling medium at 220 to 240 deg. on the inside of the core than with water at from 100 to 200 deg., especially at high atmospheric temperatures.

The great practical advantage of the new system, and which should ensure for it a wide field of application, is its simplicity. Imagine an ordinary water cooling system with pump circulation and having a thermostat in the top connection between jacket and radiator. The thermostat is removed and the connection to the top tank of the radiator eliminated. The outlet from the jacket is connected to the bottom tank of the radiator, the radiator overflow pipe is provided with a blow-off valve set to about 5 lb. per sq. in. and the centrifugal pump is replaced by some type of positive pump. (Mr. Rushmore has so far used gear pumps.) The bottom tank of the radiator is preferably enlarged in size. This completes the system.



Centrifugal pump and thermostat (left) of Cadillac car and gear pump (right) which Mr. Rushmore substituted for these parts

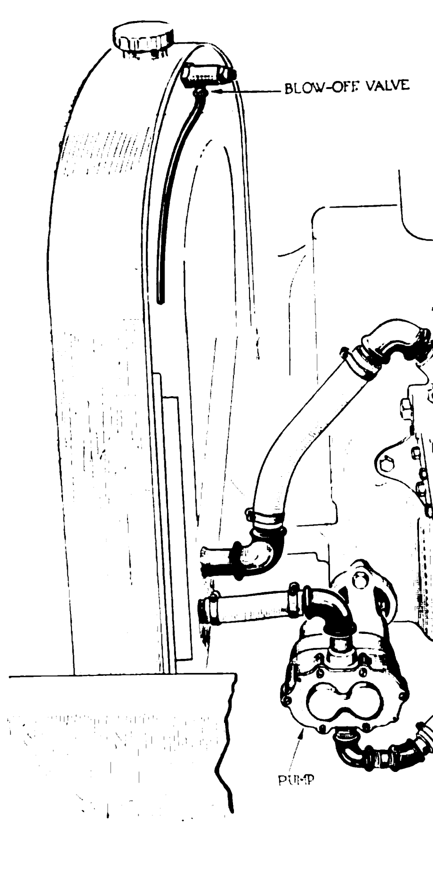
Even though the thermostat is removed, the same advantages are obtained as with the ordinary system with thermostat, because when starting a cold engine there is no circulation of the cooling fluid through the radiator, and the engine therefore quickly approaches its normal working temperature. In fact, the cooling action of the radiator core begins only when the water leaving the jacket reaches the boiling point. This very fact also insures a nearly constant temperature throughout the operating range because the maximum temperature in the system cannot greatly exceed the boiling point, as it is limited by the setting of the blow-off valve, and as soon as the water outlet temperature drops below 212 deg. the cooling action ceases almost entirely, so even at very light loads the water outlet temperature is constantly above 212 deg.

Mr. Rushmore has applied the system to a number of cars, including a Cadillac, a Crane-Simplex, a Studebaker, Mack 5½-ton truck and a Locomobile. The Crane-Simplex is fitted with thermometers and pressure gages for test purposes. A pressure gage of the Bourdon tube type is connected to the engine jacket outlet, as is also a thermometer of the circular dial type, the dial being mounted

on the toe-board. A mercury column pressure gage is connected to the top of the lower tank which has a nipple soldered to it on the forward side, over which the end of a rubber tube is slipped.

Ordinarily only the lower tank is to be filled with water, and to this end it is provided with a filler spout centrally in front, but to show that no harm would result if a driver unfamiliar with the system filled the radiator to the top, Mr. Rushmore did this and then started on a drive, accompanied by the writer. The thermometer showed a rather rapid rise in temperature at the jacket outlet, and after some time cold water began to escape through the blow-off valve. Thereupon the engine was shut down, and this greatly hastened the expulsion of the surplus cold water, no doubt because, when the fan is stopped, the cooling action is greatly reduced and the heat stored in the piston and other metal parts of the engine is transferred to the cooling water and generates steam. Owing to the use of a positive pump, circulation stops completely when the engine is shut down, and the generation of steam in the jacket manifests itself in blowing off all water in the radiator core.

The car was driven a considerable distance over a variety of roads, the route followed including one long hill with grades up to 18 per cent, and the system appeared to work very satisfactorily under all conditions. Most of the time a large part of the radiator was screened off by a sheet of pantasote in front of it. The pressure gage connected to the jacket outlet showed a pressure of from 5 to 7½ lbs. per sq. in., the pressure being highest when the engine had run for some time under full throttle and at considerable speed. The water outlet temperature varied from 230 to 240 degrees. The pressure conditions in the radiator were apparently quite independent of those in the jacket, the pressure shown by the mercury gage connected to the bottom tank varying roughly between plus 3½ lbs. and minus 3 lbs. per sq. in. Thus here is under certain conditions a vacuum in the radiator. To show what these conditions are the following experiment was carried out. The engine was run for a while at considerable speed with practically the whole of the radiator core screened off by the pantasote, so that the radiator filled with steam practically to the top and showed considerable pressure. The screen was then entirely removed and the car driven down an incline where very little power was required and consequently very little heat was absorbed by the jacket water. The mercury column very soon showed a vacuum in the radiator, while pressure above atmospheric continued at the jacket outlet.



Sketch showing system as applied to Cadillac car.

This difference in the pressures of the jacket and radiator indicates that the pressure shown by the gage connected to the jacket outlet is largely due to the friction head in the pipe leading from the jacket outlet to the bottom of the radiator. The pressure in the cooling circuit naturally will vary slightly from point to point and the pressure at any particular point will depend upon three factors. There is first the pressure due to the static head, which is nil at the highest point in the circuit, a maximum at the lowest point and varies uniformly with the distance between the two points. Then there is the pressure due to the friction head, which is nil at the inlet to the pump and increases around the circuit to the outlet of the pump in a non-uniform manner depending upon the sectional area of the water passage. Finally there is a pressure due to the temperature of the water, which is the same at all points of the system. To make this plain, assume that there is no circulation. Then if any part of the water is raised above the boiling point, steam will be generated and pressure created, but the pressure per unit area will be the same on all interior walls of the cooling system, except for the difference due to the effect of gravity on the water.

As the small gear pump employed delivers to the engine jacket less than one-tenth the volume of water necessary where the heat is transferred to the radiator by the usual water circulating system, the return pipe from the jacket to the radiator carries chiefly steam, with which is carried along the excess or unevaporated water, and thus the resistance to the flow is somewhat greater than if water alone were present. On the Cadillac, on which the system has been applied, the outlet pipe is much larger in proportion to the size of the engine, so that the friction head never exceeds ½ lb. per sq. in. Although, by making the steam outlet pipe of proper diameter and by avoiding sharp bends the friction head need not exceed ½ lb. per sq. in., it has been found that at the lowest engine speeds the centrifugal pumps usually employed will not give even that much pressure and therefore a positive pump is required to insure proper circulation at idling speeds. This is the only reason a positive pump is required, and not the pressure due to the temperature of the water, as this pressure is equal at the pump inlet and delivery sides and does not affect the working of the pump.

Only a comparatively small pump is needed, for the reason that in this system the heat absorbed by the jacket is used to convert water into steam, instead of merely raising its temperature from 10 to 20 deg. The latent heat of one pound of steam is 966 thermal units, whereas the heat required to change the temperature of one pound of water 20 deg. Fahr. is only 20 thermal units. Hence it would seem that with this system the water needs to be circulated only one-fiftieth as fast as with the ordinary system. However, extreme conditions must be provided for and we have no assurance that a temperature gradient of 20 deg. in the ordinary system will take care of extreme conditions; besides, it is not safe to figure on all of the water being vaporized during each round, which would mean that only steam would pass through the return pipe. Therefore, while a much lower rate of circulation is permissible than with the ordinary system, it would not be safe to cut down the circulation in the proportion above mentioned.

One feature of the new system about which there was

some uncertainty at first was the ability of the condensate to descend in the very narrow passages of the radiator core when steam is constantly passing upward. This, however, has caused no difficulty whatever. The lower part of the radiator core is constantly filled with steam which is being condensed by the cooling action, while the upper portion of the core is absolutely cold. There is usually a sharp line of demarkation between the hot and cold sections, this line rising and dropping with the conditions of engine operation. The upper part of the radiator is filled with air and water vapor which is normally under a slight pressure. This is a fortunate thing, because if the radiator were filled with steam to the top, if the driver removed the radiator cap in a careless manner, he might possibly scald his hands.

In the earlier experiments Mr. Rushmore ran a pipe from the inlet to the bottom of the radiator part way across the tank, this pipe being drilled with a considerable number of small holes in the bottom and sides, with the idea of separating the water from the steam without forcing any of the water into the passages of the core. It was found, however, that this precaution was unnecessary, and he now employs only a simple pipe connection to the lower tank.

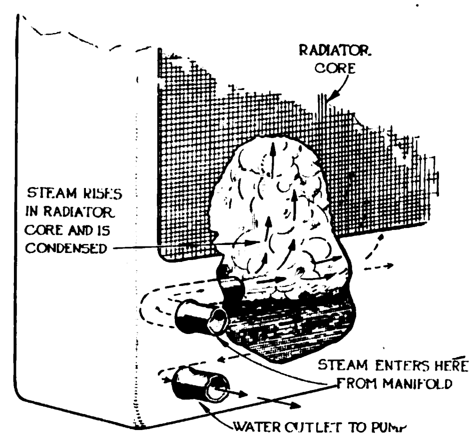
That neither the splashing of the water in the lower tank nor the returning condensate cause any noticeable obstruction to the upward flow of the steam is accounted for by the fact that with an air-cooled radiator the amount of steam condensed per minute per unit of cooling surface is extremely small. In the case of the Cadillac. the maximum evaporative effect at full load is only about one pint of water per minute which, divided among the 150 vertical tubes in the standard Cadillac radiator, amounts to only a few drops of returning condensate per minute per tube, and in any type of air-cooled radiator the flow of steam is so slow that the condensate merely trickles downward without interference. In fact tests with a radiator fed with steam from a stationary boiler and cooled by a powerful electric fan have shown that even though excess steam be forced out of the top of the radiator, none of the condensate appears at the top.

So far the system has been adapted only to existing cars, and therefore probably has not worked under as favorable conditions as would be possible on a car specially designed with it. As to its advantages, there can be no doubt that it ensures more complete combustion of the fuel, especially at small engine loads, and tends to minimize crankcase oil dilution. It is simpler and cheaper than other systems, and ensures a quick heating of the engine to the normal working temperature and a fair regulation of that temperature. The danger of the fine passages of the radiator becoming clogged with deposits from limy water is eliminated, and owing to the much greater cooling effect of a unit radiating area when in contact with steam than when in contact with water at the normal jacket outlet temperature, probably a much simpler and more robust core construction could be used, or the depth of the core diminished.

No stock cars are as yet being fitted with the system, but it will probably be applied to a number of 1922 passenger car models. It is particularly applicable to motor trucks, for it tends to reduce crankcase dilution due to the engines running idle for long periods in cold weather. On the Mack truck above referred to a considerable saving in fuel was shown and, by reason of the higher radiator temperature, the system provides ample cooling capacity, even in mountainous country where the boiling of the water in the ordinary system often greatly reduces the working capacity.

A further important advantage over thermostat control is that as the radiator core contains no water it cannot freeze when on the road, as often happens unless a large percentage of alcohol is employed. Manufacturers employing the thermostat control advise customers to cut the thermostat out during freezing weather, the very time automatic temperature control is most needed. Several cars equipped with the Rushmore system were in constant service all through the past winter and gave no trouble from freezing.

As the temperature of the jacket water will depend upon the steam pressure carried, an inexpensive reducing valve



Sketch showing location of radiator inlet and outlet in Rushmore system.

may be put in the pipe leading from the jacket to the radiator to hold the jacket temperature constant at all loads regardless of the percentage of alcohol that may be employed to prevent freezing when the car is left standing for long periods in cold weather. With the present-day water cooling system using alcohol the maximum temperature cannot much exceed 175 deg.

The motometer is now connected to the engine jacket direct with dial on dashboard where it can be seen more easily and particularly at night and where it is not so easily stolen.

The new system should be of particular value on airplanes. Airplane radiators are now mostly of the hexagon tube type. It has been found that with the steam system the tubes can be placed much closer together, thus effecting a reduction of fully 20 per cent front end area for the same amount of air cooled surface. As the cooling effect per unit of cooling surface is from 50 to 80 per cent greater with steam, the area may be still further reduced, and in consequence of the saving in weight of water, additional fuel may be carried and the speed of the plane increased.

A Wire Wheel with Bolt Attachment

THE popularity of the bolt attachment for demountable wheels in Great Britain has induced the Dunlop Company to introduce a fitting of this kind for their wire wheels. The center of this wheel has a drum of pressed steel from which the usual wire spokes lead to the tire rim. The drum is secured to the hub by means of six studs and nuts in accordance with the usual arrangement of this principle of fixing. It thus eliminates threaded hubs and special locking devices for the wheel nut of the usual type. It is claimed that this arrangement not only simplifies the form of attachment and thus recommends it to the user, but it also represents a cheaper form of construction. In appearance, however, it suffers as compared with the usual type, for the central drum gives it a somewhat heavy appearance by comparison.

S. A. E. SUMMER MEETING

Developing a High Compression Automotive Engine

This summary describes some of the problems involved in the development of a Diesel type automotive engine. Particulars given apply largely to factors involved in design and construction of the fuel injection system.

AN S.A.E. Summer Meeting paper prepared by Fred C. Ziesenheim, bearing the above title, naturally divides into three parts. The first relates to the fuel problem, giving the proportion of gasoline, kerosene, gas and fuel oil and lubricating oil produced from crude petroleum in 1920, the change in the distillation curve of gasoline from 1915 to 1920, and the variation in the prices of crude petroleum and its distillates from 1913 to 1920, etc.

In the second part all present internal combustion engines are divided into three classes, low compression, medium compression and high compression. The first class includes all automobile engines, the second class the hot bulb, surface combustion or semi-Diesel engines, and the third group the Diesel engines. The advantages and disadvantages of each class are given.

In the third part Mr. Ziesenheim describes some development work on mechanical injection systems for high compression engines which he has done at the Mechanical Laboratory of the Carnegie Institute of Technology. A small surface-ignition engine was used, after increasing the compression-pressure to 500 lb. per sq. in. by the substitution of a new piston and a new cylinder-head. The engine is a vertical two-stroke-cycle two-port type, with crankcase precompression. The bore is $5\frac{1}{2}$ in. and the stroke is 6 in., which is reduced to $4\frac{3}{4}$ in. by the width of the ports. The compression of 500 lb. per sq. in. was selected for the initial tests, as it can be decreased when desired by simply raising the cylinder-head. The compression necessary for auto-ignition depends upon the ignition temperature of the fuel; the temperature from the compression must be high enough to insure starting with the engine cold. The lowest compression that will permit cold starting is about 350 lb. per sq. in.

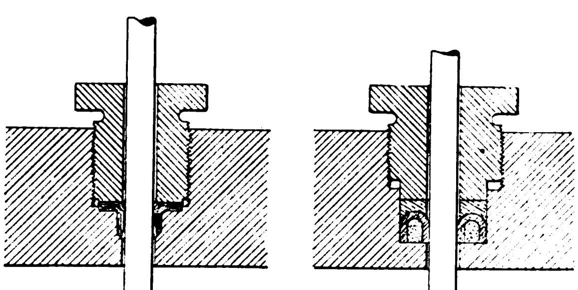


Fig. 1—Two types of leather valve packing, the packing at the left is of the flange type while that at the right is what is termed a U-packing.

Ignition temperatures of fuels as applied in engines cannot be satisfactorily determined by ordinary laboratory equipment, as the manner of injection and the temperature of the cylinder walls are not considered. Apparatus consisting of a combustion chamber fitted within a gas furnace and equipped with an injection valve, and pressure, temperature and time recording devices has been used by the British Admiralty Experimental Laboratory for determining the ignition temperatures and the time interval between the moment of injection and the moment a pressure rise is indicated in the combustion chamber.

Mechanical injection can be accomplished by variable pressure, in which the fuel injection valve opening is controlled by fuel pressure difference; or by constant pressure, in which the fuel injection valve opening is controlled mechanically by means of a cam and lever and the fuel pressure is constant.

The variable type of compression valve consists of a spring-loaded differential plunger that opens when the fuel pressure exceeds the spring resistance. The fuel pressure variation producing injection is independent of the action of the fuel pump and governor, which action should cause the injection to take place in accordance with the conditions insuring optimum pulverization. In addition, the quantity of fuel to be injected must be metered accurately, and the time and duration of injection must be under control. The small quantity of fuel to be injected before each working stroke is responsible for some of the principal problems in the design of a small high speed engine. In the experimental engine under discussion the quantity of fuel injected per revolution at full load is about 0.1 cc.

By the usual method of metering the fuel, the governor holds open the suction valve or a by-pass valve during the initial portion of the pump stroke and, upon the closing of the valve, the fuel is pumped into the injection valve. Another method consists in varying the stroke of the pump plunger by a wedge which is actuated by the governor. With accurate metering by the fuel pump the problem then consists in discharging exactly the desired quantity of fuel from the injection valve, and in discharging uniform quantities of fuel for uniform speed and load conditions.

Conditions which may interfere with or prevent the injection of the metered quantity of fuel are the (a) elasticity of the fuel, (b) elasticity of fuel-containing system, (c) elasticity of entrained or entrapped air and (d) leakage within the fuel system. The elasticity of the fuel at the pressures used is approximately 2 per cent. This makes it necessary that the quantity of fuel in the system, between the pump and the ignition nozzle, be the least possible.

To overcome elasticity in the fuel containing system it is obvious that the fuel pipes, connections and the like must be made heavy enough to insure absolute rigidity. The poor injection action of many surface-ignition engines can be attributed to failure to meet this condition. Air gets into the fuel system by being entrained with

the fuel, by leakage past the injection valve during the compression stroke and by leakage during the suction stroke of the fuel pump. It is sometimes entrapped during the assembly of the fuel system, or it can accumulate while the engine is idle. Air is so highly elastic that a small bubble in the fuel system will become a minute volume during the working stroke of the fuel pump but, when the pump starts on the suction stroke, the bubble expands and prevents the pump from drawing in a full fresh charge of fuel. During the following working stroke of the pump either no fuel will be discharged or the quantity will be less than that desired. This produces an erratic "hit and miss" injection action that may cause the injection of an excessive quantity of fuel, thereby producing abnormal pressures in the cylinder. Provision must be made for draining the air from the highest point in the fuel system, preferably in the injection valve. The fuel system must be arranged so that the air will not accumulate at any other point.

The quantity of fuel in the system, particularly in the injection valve, should be a minimum in order to secure as complete and rapid a discharge of the fuel and entrained air as possible. Fuel leakage occurs around the pump plunger packing gland and around the packing gland or similar device of the injection valve stem. High pressure packing glands are a source of trouble. A form of plunger packing used with satisfaction in hydraulic machinery at pressures exceeding that encountered in injection engines is shown in Fig. 1 and consists of Vim leather molded into the shapes shown. In the flange packing at the left the nut clamps only the flanged portion; the body of the packing has clearance so that the liquid can surround and force it tight on the plunger. In the U-packing at the right the pressure of the liquid within the U forces the leather against the plunger and the walls of the receptacle, thus sealing the joint. The space within the U can be filled with hemp to prevent collapse of the packing when there is no pressure acting. Leakage may occur at the suction or discharge check-valves, which are usually placed in multiple. Poppet, cylindrical and ball-check valves are shown in Fig. 2.

A form of pipe connection used satisfactorily in Diesel engine practice is shown in Fig. 3. The male part is made of brass or copper, the tubing being brazed into it.

The simplicity of the injection valve is the advantage of the variable pressure method; the operation of the valve is entirely automatic, avoiding the complication of valve-gear. The quantity of fuel for each charge can be metered accurately by simple and reliable mechanism incorporated within the fuel-pump, but the disadvantage of the method lies in its inability to discharge the desired quantity of fuel at the correct time and in the manner necessary for achieving complete combustion. The reasons for this inability have been enumerated. Of these (*a*) the elasticity of the fuel and (*b*) the elasticity of the fuel-containing system can be partially obviated by proper design, but (*c*) the elasticity of entrained and entrapped air and (*d*) leakage within the fuel system are more difficult to control. Due to the small quantity of fuel to be discharged the presence of any air will interfere with or prevent regular injection of the fuel, and a very slight

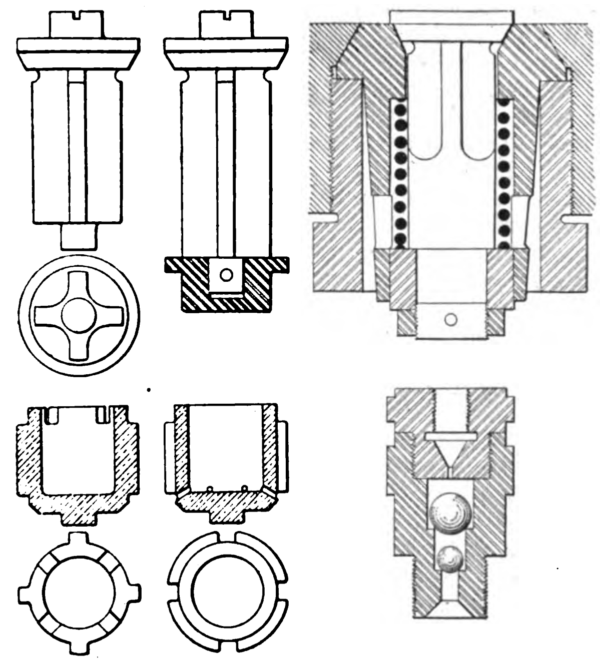


Fig. 2—Types of poppet, cylindrical and ball check-valves used in internal-combustion engines

leakage can easily equal the quantity of fuel it is desired to inject. These adverse conditions make the variable pressure method practicable only for large slow speed single-cylinder engines, where the amount of fuel to be injected is a relatively large quantity. The method is in use on all surface ignition engines and is therefore to be found on many high compression engines developed by companies building both types. The high compression engines using this method are usually of the slow speed single-cylinder type, which can be assembled also as twin-cylinder engines. The conclusion arrived at is that this method is not satisfactory for high speed multiple-cylinder engines suitable for automotive purposes.

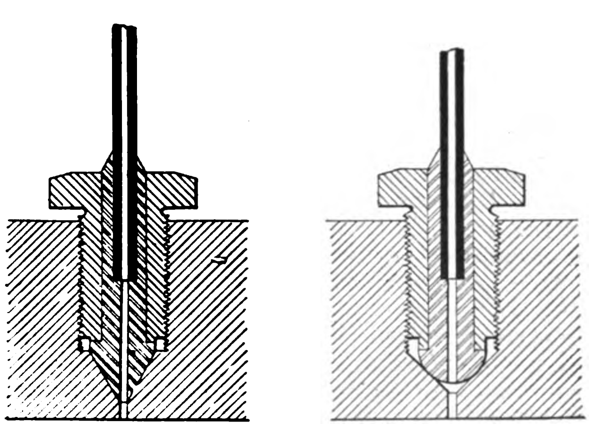


Fig. 3—A form of pipe connection used with great satisfaction in Diesel engine practice

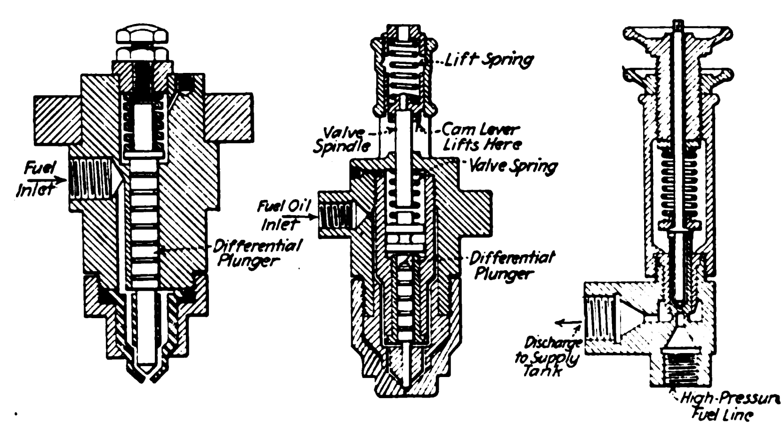


Fig. 4—Three types of injection valve. The valve at the left is controlled by the fuel-pressure difference and that in the middle has the fuel opening controlled mechanically by a cam and a lever. The valve at the right is pressure-regulating valve

The fuel is supplied to the injection valves of all the cylinders from a single main supply line which is maintained at constant pressure. The fuel injection valve shown in the center of Fig. 4 is mechanically operated by a cam and lever; the metering of the quantity of fuel for injection and the time and duration of the injection are under control of the governor acting on the fuel cam and lever. The fuel pumps are designed to pump two or three times the quantity of fuel necessary for full load conditions. The fuel pumps are made preferably from a forged steel block; the pump cylinders and valve seats being machined in the block. Packing glands for the pump plungers have been shown in Fig. 1 and the check valves in Fig. 2. Due to the high pressures that the pumps work against, the pump shaft and the eccentrics must have liberal bearing areas and positive pressure lubrication. The use of several plungers of small cross-sectional area reduces the bearing loads. The pressure of the fuel is maintained constant by a pressure regulator holding suction bypass-valves open during a portion of the pump stroke, or by a spring loaded relief valve similar to the valve shown at the right in Fig. 4. The flat seat of the pressure regulating valve gives less trouble from chattering and wear than a mitered seat. The seat parts are made of hardened steel.

The constant pressure injection valve shown in the center of Fig. 4 consists of a differential plunger, spring loaded by a valve spring and also by a lift spring which forces a valve spindle onto the differential plunger. A cam operated lever lifts the valve spindle, relieving the lift spring and permitting the fuel pressure to lift the differential plunger against the valve spring. The movement of the differential plunger removes the injection valve from its seat and permits the fuel to be injected into the combustion chamber. The fuel cam action controls the (*a*) time of injection; (*b*) lift of the injection valve; (*c*) duration of injection; (*d*) quantity of fuel injected and (*e*) manner of injection. Variations in the time of injection can be accomplished by angular advancement or retardation of the fuel cam. The lift of the injection valve and the duration of the injection are determining factors in the quantity of fuel that will be injected. The injection valve lift, determined by the fuel cam lift, must be sufficient to permit free injection of the fuel without dribbling. The duration of injection depends upon the angular period of the fuel cam. As the fuel pressure is constant, the injection valve lift should remain practically constant during the period of injection. Varying the quantity of fuel for different load conditions should be accomplished by varying the duration of the injection period; in other words, varying the cut-off ratio, or the length of the constant pressure line. The rapidity with which the injection valve opens and closes is a determining factor in attaining the conditions of maximum pulverization. With the injection valve filled with fuel maintained at constant pressure and the fuel cam acting directly on the injection valve, the injection action can be much more rapid than with the variable fuel pressure generated by a cam and pump removed from the injection valve.

The constant pressure method is not subject to the adverse conditions which interfere with injection in the variable pressure method. The constant fuel pressure obviates trouble from the elasticity of the fuel and its containing system and also does not permit the entrapped air to expand and cause erratic injection. Any leakage that occurs in the fuel system with the variable pressure method is a wastage from the metered quantity of fuel that it is desired to inject. In the constant pressure method the metering is done within the injection valve so that leakage in the system does not affect the quantity to be injected.

In view of the considerations stated, the constant pressure method is preferable for small high speed engines in that the exact metered quantity of fuel is positively injected at the desired time, and in that uniform quantities are injected for uniform speed and load conditions. The experimental work has shown consistent progress but has not advanced to a point where further disclosure of methods and results is advisable.

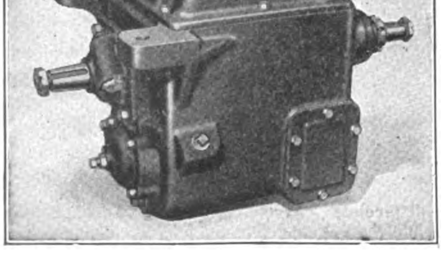
A New Model of Transmission

A NEW model of gearset known as Model 55 has been added to the line of the Brown-Lipe Gear Co. The new product was designed to fill a gap in its range of sizes and has several individual features.

Model 55 is of the main-frame type and in capacity is substantially midway between Models 50 and 60. Regular features are selective gears that give four speeds forward and one reverse; a rear mainshaft bearing cap that takes a speedometer drive, and two S. A. E. standard pads, one on the right and one on the left side of the case, intended respectively for a one-speed power take-off and a pump.

Optional arrangements include either overhead or side shift and—when a power take-off is not used—the mounting of the pump on the right side of the case. Of course, the option of shifts necessitates the selection of one of two forms of case, cover, etc., but the pump can be mounted on the right side at any time by adding to it a 2-in. filler block, furnished by the pump manufacturer.

The illustration given here shows the overhead shift. The side shift type transmission is less in depth by the height of the shifter housing, but slightly greater in width.



New Gearset Model

THE consumption of gasoline in Australia is increasing rapidly and is leading to an investigation of the possibilities of the Commonwealth. In 1910 the consumption was 25,725,000 gallons; in 1915, 43,000,000 gallons, and by 1919 it had increased to 51,000,000 gallons. Although the presence of oil is evidenced by its oozing from the ground in numerous places, drilling has failed to discover deposits of commercial value. The Commonwealth Government has offered a prize of £10,000 to stimulate further search, and the South Australian Government has also voted a bonus of £5,000 to the person or company that first obtains from a well in South Australia 100,000 gallons of crude petroleum containing not less than 90 per cent of products obtainable by distillation. So far the rewards have not been won.

Features of Mechanical Interrupters for Ignition Systems

Part II

In this installment the author describes the features of several commercial types of interrupters and discusses the advantages and disadvantages of these types. This completes the article and thus covers all the important considerations involved in the design of interrupters.

By Harry F. Geist

WE have magnetos made with stationary coils and magnetos made with rotating coils. In the cases where stationary coils are used the interrupter parts are also stationary and the interrupter is actuated by a rotating cam, but in the case of rotating coils, the interrupter parts are also in rotation and co-act with stationary cams for the actuation of the interrupter. In special cases where collector spools or buttons are used the stationary type of interrupter may be used with rotating coil type magnetos, but this construction is the exception rather than the rule. These two general differences in interrupter designs bring out entirely different considerations which are of interest.

In the rotating type of interrupter, all the moving parts are mounted upon the rotating breaker plate as shown by Fig. 1, so that the radius at which the bumper block of the lever arm actuates with the cam is fully twice as great as that of a rotating cam actuating a stationary type of interrupter.

With these two different arrangements, arguments for and against either type of interrupter may arise, but experience with both types has proven that both, in the highly perfected designs of the present day give very satisfactory service.

In order to show the different conditions that obtain in these two different types of interrupter mechanism, Fig. 8 is presented for an analysis.

The bumper of the rotating breaker arm is shown just at the point of striking the stationary cam, at the point O, from which point, instead of following the circular arc OB it follows the line of the cam contour O'A, so that the angle through which the bumper is forced inward may be expressed roughly by BOA, giving the bumper an inward motion equal to AB or M.

If the distance from the arm pivot to the contact point is equal to the distance from the pivot to the bumper, then M will also be the amount of contact separation. At the higher speeds the bumper may receive a throw so that the motion it receives may be greater than the distance AB.

The force tending to hold the bumper against the cam contour or tending to hold the contacts closed will be the force of the spring F_s plus the centrifugal force of the lever arm F_c and plus or minus a force due to the inertia of the arm in its motion M that may be expressed by F_m. It is the usual practice in the design of rotating interrupters to so design the arm that the centrifugal force acting on the bumper end of the arm will be greater than the centrifugal force acting on the contact carrying end of the arm so that the rotation of the interrupter as a whole will give a resultant centrifugal force to the arm that will always tend to aid the spring. This is to assure that centrifugal force will never cause the contacts to separate, but on the other hand, will help to close them and is a very important consideration in the development of rotating types of interrupters.

The force F_m is the most difficult to control. At the higher speeds it may become greater than F_s plus F_c and cause the bumper motion to exceed the amount AB. This force depends upon the mass of the lever arm swinging upon its pivot and upon the rate of bumper motion M. It is controlled to some extent by making the lever arm as light as possible without sacrificing mechanical strength. It is no doubt this force that is responsible for the vibrations of the contacts that was previously discussed.

In order to make a direct comparison, let us assume that it is desirable to have the contacts opening the same amount for the same amount of angular rotation of the magneto rotor in the case of the stationary interrupter and rotating cam. Under this condition, which is represented in Fig. 8, the rotating cam will force the bumper along its contour O'A', so that the angle at which

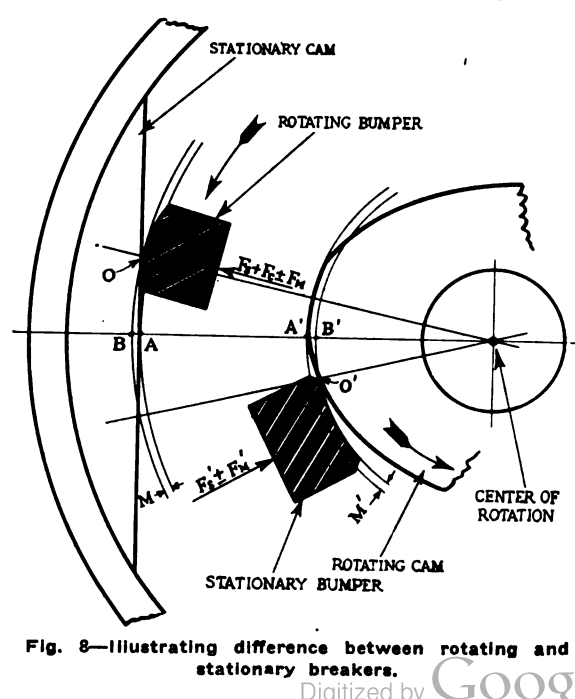


Fig. 8—Illustrating difference between rotating and stationary breakers.

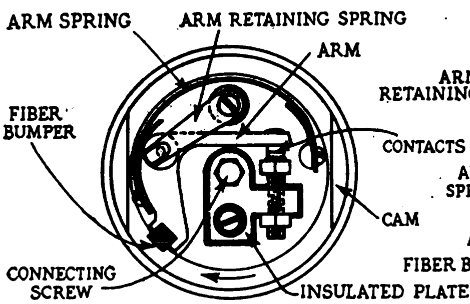


Fig. 9—A much used type of rotary interrupter.

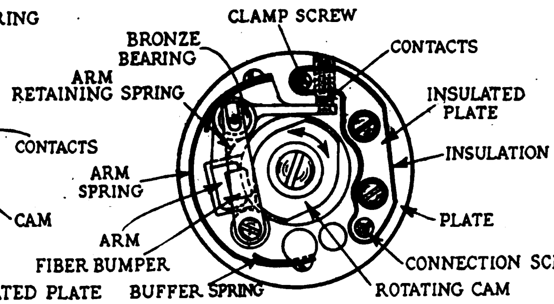


Fig. 10—A widely used type of stationary interrupter.

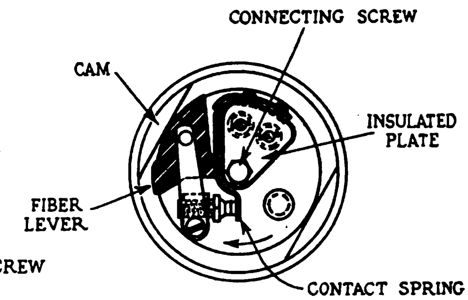


Fig. 11—A well known interrupter of novel design.

the bumper is forced with reference to the cam may be expressed by A′O′B′. This angle is roughly about twice as great as the angle AOB when the radius of action between the rotating cam and the stationary bumper is one-half the radius of co-action between the rotating bumper and the stationary cam, and provided A′B′ equals AB.

For the same rotor speed, therefore, the rotating bumper will travel at twice the peripheral speed of the rotating cam, but in moving inward on an average cam angle of only half as much it is evident that the speed at which the rotating bumper travels the distance M will be the same as the speed at which the stationary bumper makes the motion M′.

The stationary bumper is held inwardly by the forces F'_s plus or minus F'_m, where F'_s is the force of its spring and F'_m is the force represented in the inertia of the arm due to motion M′. Centrifugal force does not enter into play in this type of interrupter. In this stationary type of interrupter, just as was shown for the rotating type, the force F'_m may at higher speeds be sufficient to overcome F'_s and give the bumper a throw such that M′ will exceed O′A′ and may also be the cause of vibrations of the lever arm.

The advantage of the stationary interrupter lies in the fact that it is free from centrifugal force, since it does not rotate. It certainly facilitates the development of an interrupter not to have to take that force into consideration, but on the other hand this same centrifugal force serves to counteract the inertia that comes into play tending to give the arm excessive motion at higher speeds, so that while it may complicate the development, it must be given credit as a valuable assisting force to the spring in holding down the contact motion and the vibrations that the lever arm is subject to.

In general interrupters are intended to open the contacts only from about .015 to .020 inch, and it would seem that for this small amount of interrupter lever action that the possibility of excessive contact separation and of vibrations would not be very great, but experience has shown that these results do take place at times even at average operating speeds.

The following interrupter designs are presented because they show a wide variation in the manner in which interrupters can be designed to meet the conditions set forth in the foregoing paragraphs. They are also excellent examples of exclusive features and distinctive design found in the present day ignition systems.

Interrupter Designs

Fig. 9 shows the features of the complete interrupter illustrated in Fig. 1 and the arm retaining spring that is adapted to hold the lever arm in place upon the breaker plate.

This interrupter is perhaps the best known and most copied of all ignition system interrupters. It is used by a number of different manufacturers both in the United States and abroad. The features that contribute to the success of this interrupter, which is of the rotating type, is the perfect balance of the arm for all speeds at which it is designed to give service. There is just enough mass in the fiber bumper end of the arm which is located farther from the center of rotation than the contact carrying end of the arm to assure just enough centrifugal force to make certain that the contacts will not open due to rotation alone and that the force of co-action of bumper and cam will not give the contacts an unnecessary or an undesirable amount of opening.

The main spring is backed up by two buffer springs, one at each end, that keep the springs from breaking, relieving as they do any tendency for a sharp bend that would produce early fatigue. The cams are oiled by wicks embedded in them. No other oiling is required, hence oil cannot get to the contacts. The centrifugal force due to rotation tends to keep all the oil away from the rotating parts of the interrupter.

For right- or left-hand magneto rotation entirely different interrupters are necessary.

Fig. 10 shows the most widely used stationary type of interrupter. The arm is a drop-forging carrying a platinum contact on one leg and a hard, polished bumper that is formed to have a radius to suit the cam at the other leg. The arm pivot bearing is of bronze and fits a hardened steel pivot, which in some cases is hollow, making it possible to oil the pivot bearing through a vent in the stationary breaker plate. The condenser and primary winding are connected to the interrupter by a common lead that is secured to the insulated plate by means of a screw. This insulated plate, of course, carries one of the contacts.

The cam is designed for either right- or left-hand rotation by merely turning it over on the shaft, and it has lobes to correspond to the number of sparks that the magneto is designed to deliver per revolution of the rotor. Other features are as shown. The breaker plate is set and locked by screws to the magneto bearing plate in timed relation to the magnetic break between rotor and stator of the magneto for "fixed" spark installations and to the rocking member of the magneto for variable spark ignition.

In Fig. 11 is illustrated another well-known interrupter mechanism of very novel design. This interrupter is of the rotating type. In this design the insulated contact is carried upon a spring that is secured at one end to an insulated plate. The adjustable contact is the grounded one. A triangular fibre lever that is pivoted at the center acts through one of its corners upon the cams, which force the contacts apart. The third corner is merely to balance the lever during its rotation.

In the discussion connected with Fig. 6 it was pointed out that a rocking break was very apt to be obtained in interrupters in which the contact was mounted directly upon the spring, due to a strengthening out of the spring between the points F and F_1 immediately following the application of the force F_1.

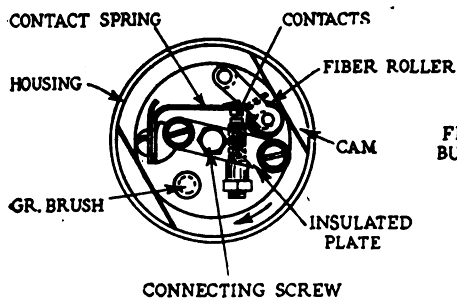


Fig. 12—A type of interrupter used in England.

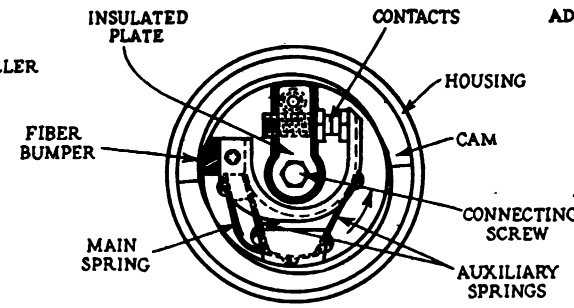


Fig. 13—A recent design of interrupter.

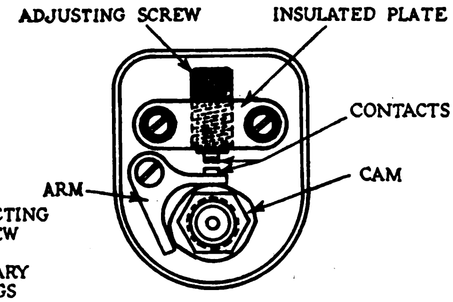


Fig. 14—A positively operated interrupter.

In this particular application of this general type of interrupter it will be noticed that the spring has a double bend between the contact point and the point at which the fibre lever acts. This stiffens the spring in the region of the bend. The tension of the spring in this case is, therefore, almost entirely on the other end of the spring, so that when the force tending to open the contacts is applied it is accomplished very effectively. The secret of the success of this particular application in avoiding the rocking of contacts is due to the bends in the spring at the places shown.

During rotation, the fibre lever is under the influence of centrifugal forces. These are intended to be balanced by the triangular shape of the lever, but the forces are allowed sufficient surplus to always keep the lever away from the spring except when in engagement with the cams.

Fig. 12 illustrates another novel design of rotating interrupter that is produced in England. In this mechanism the grounded contact is mounted directly upon the spring. The end of the spring projects considerably beyond the contact and is turned up at an angle, as shown. The insulated plate also sets at an angle to the spring, so that it and the bent end of the spring form a "V" in which a loosely bearinged roller is located. The action of the mechanism during rotation throws the in contact with the cams, which, in turn, force the roller into the "V," tending to lift the spring and its contact away from the insulated contact to break the circuit.

The liability of a rocking break of the contacts and its coincident troubles, as pointed out in connection with Fig. 6, is alleviated by the fact that the roller, which is of fibre, acts upon the spring at a point that is very close to the contact. This close application of the roller force to the contact tends to open the contacts without rocking.

Centrifugal force in this interrupter always keeps the roller as far from the center of rotation as possible, and it, therefore, can exert no force upon the contact spring until compelled to do so by the cams.

The interrupter represented in Fig. 13 is a compara- new product. It is also of the rotating type and differs from the other arm types in that it has no pivot or bearing for its arm. A main spring serves to perform the same functions of the usual interrupter arm spring; namely, to hold the contacts normally engaged. In addition, there are two auxiliary sets of leaf springs which tend to guide and support the motion of the arm. The purpose of the arrangement is not only to do away with the pivot and bearing but to give the moving contact a parallel motion with respect to the insulated contact. The advantages of this parallel motion were pointed out under the discussion of Fig. 7.

The cam in this breaker mechanism is produced by grinding two eccentric circles at 180 degrees displacement from each other and at equal distances at either side of the center of rotor motion.

The interrupter illustrated in Fig. 14, which is of the stationary type, is also comparatively new and has some very interesting and novel features. The arm is free from springs and forms a "V," in which a cam rotates and performs both the functions of closing and breaking the circuit at the contacts.

In order to take up the mechanical shock of closing and to allow for variations in production and for adjustment, the insulated contact is mounted upon a sliding plunger that is backed by a compression spring in a knurled and threaded barrel. Adjustment is made by means of this threaded barrel.

The principal advantage gained by this construction beside the simplicity of its construction, is that the time of make of the circuit is definitely determined at all times by the relation of the angle of the arm "V" and the cam lobes.

Another very interesting type of interrupter mechanism is that illustrated in Fig. 15. This type is based upon the principles discussed under Fig. 7. In this particular design it is shown for use with rotating winding types of magnetos, but the principle back of it is applicable to the stationary type of interrupter as well. The principal merits of this interrupter are the parallel motion of the separating contacts and a very quick and definite break of the circuit for a very small throw of the arm, so that the wear and the forces due to inertia to which this interrupter is subject are reduced to a minimum. The arm is also of very light construction, having, as it does, only one projecting end from the pivot, so that the forces to which the contacts are subject in closing are reduced to practically only that of the tension of the spring. Any centrifugal force at play upon the arm aids the spring.

The tendency is in this type of interrupter action for the spring to close the contacts very quickly following the separating action, so that this type of interrupter lends itself very effectively to battery and coil types of

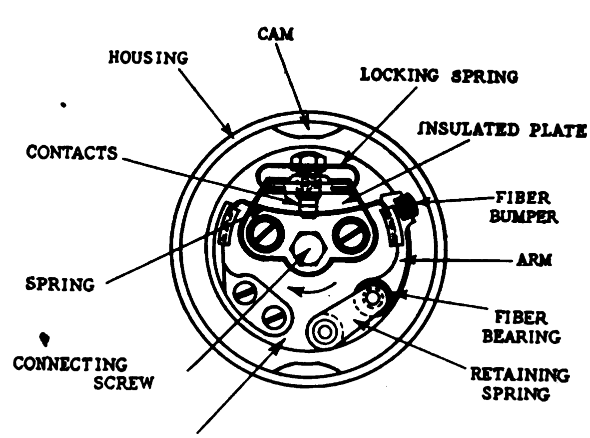


Fig. 15—A novel type of interrupter possessing many advantages.

ignition systems, because of the fact that the period necessary for the sparking action of the coils is very short and the interrupter allows a large percentage of the complete cycle of the action to be on closed circuit. This is a decided advantage in battery systems operating at high speeds.

Interrupter with Tungsten and Silver Contacts

During the war with Germany platinum supplies were limited, and ignition manufacturers did considerable experimentation with contacts made of other material. Tungsten had been used for a number of years and had given satisfactory results under special conditions. Its principal objection was that of oxidization. It has been found in rotary magneto work that tungsten will function properly as long as the magneto is in continuous operation, but if the magneto stands over night with its contacts separated the oxidization may be sufficient at times to make starting very difficult. In special cases, such as in so-called oscillating magnetos in which the normal rest position is always one in which the contacts are closed, this trouble is very much reduced, so that with tungsten comparatively cheap it made a very good substitute.

To solve this problem, in the case of rotary magnetos, a very novel interrupter was invented and developed by C. T. Mason for the Splitdorf Electrical Company. This interrupter consisted of two sets of contacts, one set acting for starting service and the second set operating for running service. The starting contacts were of silver and the running contacts were tungsten.

Fig. 16 illustrates the essential features of the design as used with magnetos having stationary coils.

The principal difference of this type of interrupter from other types is as follows: The silver contact on the grounded side is rigidly connected to the lever arm in the usual manner and it makes contact with another silver contact that is adjustably mounted in an insulated plate, to which the primary lead makes connection as in the usual construction. In addition, the lever arm carries a spring that extends parallel over the top side of the arm and terminates over a hole in the lever arm. A tungsten contact mounted upon this spring extends through the hole in the arm and engages with another tungsten contact that is also adjustably mounted in the same insulated plate with the silver contact. The tension of the tungsten contact carrying spring is such that it exerts a pressure downward. The adjustment of the interrupter contacts must be such that the silver contacts separate before the tungsten contacts do.

When the cam strikes the fibre bumper of the lever arm it first lifts the arm and therefore breaks the contact between the silver contacts. The break between the tungsten contacts occurs a very short time afterward—as soon as the bend of the contact carrying spring is taken up.

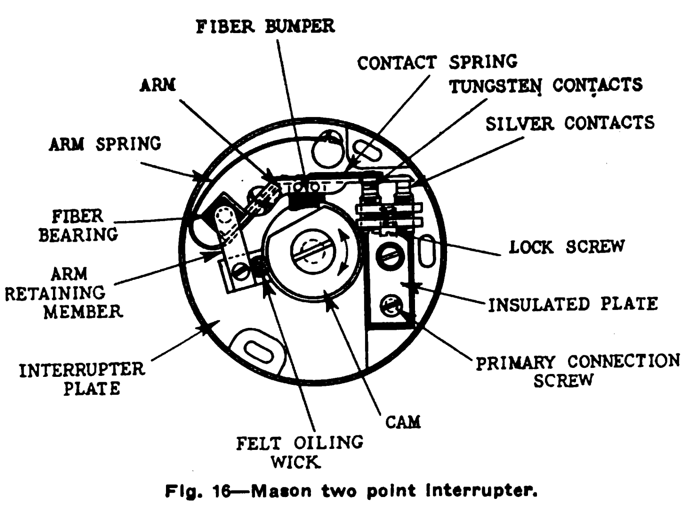


Fig. 16—Mason two point interrupter.

The result of this sequence of contact separations is such that if the tungsten contacts should be oxidized to such an extent at starting that the high resistance of the oxide makes the magneto inoperative, the completed circuit through the silver contacts which do not oxidize readily will allow the magneto to function and the spark will be produced when the silver contacts separate. The engine will therefore start up on the action of the silver contacts.

After a few revolutions of the engine the mechanical action between the tungsten contacts of the interrupter cleans them, and because of the fact that the tungsten contacts separate last, the final interruption of the circuit transfers to the tungsten contacts as soon as they begin to conduct current. It therefore follows that the tungsten contacts operate for running service.

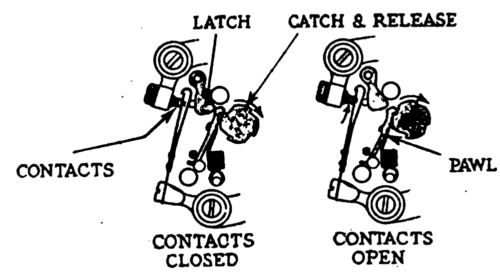


Fig. 17—The Atwater Kent interrupter.

All the arcing and welding action of service is taken up by the tungsten contacts, and the silver contacts are thus protected during the running service, and they do not function electrically again until the tungsten contacts again become inoperative except to carry a part of the primary generated current. The action of this interrupter is entirely automatic.

The only objection to this type of interrupter lies in the fact that the trade has not been educated to the adjustment of this device, and it would no doubt be considerable of a task for a layman to make the adjustments of this mechanism properly and intelligently.

The supply of platinum to ignition manufacturers was never completely cut off, hence it never became necessary to change to the double contact type. It does illustrate, however, how the tungsten contacts can be pressed into service in spite of its tendency to oxidize.

Battery and Coil System Interrupters

From the very earliest days of battery and coil ignition systems it was recognized that for ordinary make-and-break circuit interrupters the average user would very often forget to switch off the ignition circuit after stopping the engine and allow the ignition system to drain the battery during idleness of the engine if the contacts chanced to be closed.

It was also recognized that for the slower speeds of engine operation the ordinary make-and-break igniter interrupter would take a great deal more battery energy than was necessary for effective operation of the system compared with that required for running speeds.

To overcome these two drawbacks a special battery and coil ignition system interrupter was developed and marketed by the Atwater Kent Mfg. Co. This interrupter is illustrated in Fig. 17.

The illustration shows a catch and release device which, during its rotation, catches a pawl and advances it against the tension of a coil spring to a position above

a latch. After reaching this position the pawl is automatically released and is then drawn back toward its normal rest position due to the tension of the coil spring. In returning to this rest position the heel of the catch and release tooth so guides the pawl that it is compelled to strike against the latch. The motion imparted to the latch by the pawl in turn causes the contacts to close momentarily and separate again after the pawl passes the latch. This make-and-break action takes place at a very high speed, and at a speed that is independent of the speed of rotation of the catch and release member. This special type of battery and coil circuit interrupter

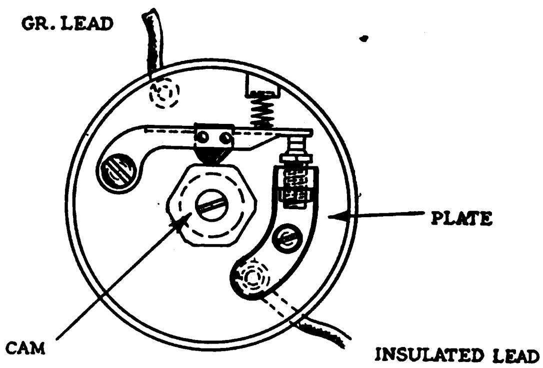


Fig. 18—Typical battery and Coil system interrupter.

therefore assures that the spark will be of the same value for all engine speeds within the limits that the device is designed for and that the battery energy required per spark will also be practically constant for all speeds.

It must also be evident that when the engine is at rest the pawl will be at rest and so cannot close the circuit, and it can never remain in a position that will keep the contacts together.

The particular mechanism shown in Fig. 17 has a catch and release with four teeth and so is designed for four-cylinder engines, being operated at half engine speed in this case. The figure shows both open and closed positions of the contacts.

Fig. 18 shows a simple battery and coil system interrupter that is representative of the more usual types. It has a six-lobe cam and is designed for a six-cylinder engine, but can be converted to a four-cylinder system by using a cam with four lobes. It is evident that in this type of mechanism it is possible for the engine to stop at such a position that the contacts will remain closed, so that this interrupter requires a switch for cutting off the battery when the system is not in use. It is also evident that the period of time allowed for the closing of the contacts depends upon the speed at which the cam rotates, so that at slower speeds more energy will be delivered to the coil for spark production than will be the case at higher speeds.

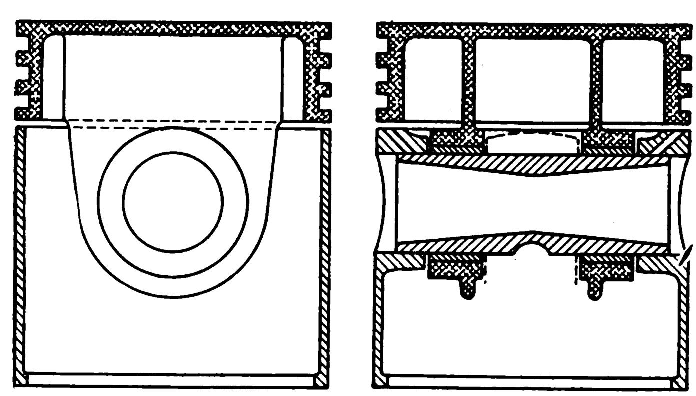
This difference in amount of battery energy consumption for different operating speeds used to be a very important consideration in the days of dry cells, but in the present time the use of storage batteries and recharging generators as part of the equipment makes this difference of battery economy of little importance. Furthermore, since the advent of high-class lock switches the user has become accustomed to switching off the battery, so that the general type of battery and coil system interrupter shown in Fig. 18 serves its purpose very well.

In the foregoing paragraphs the writer has endeavored to cover all the important interrupter considerations that have come to his observation, and, while all the different designs of interrupters now in use have not been shown, the few selected as illustrations are presented because of some very distinctive features employed to meet the conditions under which an interrupter must function.

A New Cross-Head Piston

A CROSS-HEAD type of piston designed to take advantage of the properties of both aluminum and cast iron has recently been made the subject of a patent application. The combined aluminum and iron piston is not new to the trade, but the design shown herewith includes also the cross-head characteristics, the upper part of the piston floating on the wrist pin. The piston can be fitted or adapted to the ordinary cast iron piston by cutting this off above the wrist pin and applying the aluminum upper portion. The aim in pistons of this type is to use aluminum, which has the quality of high conductivity, for the parts exposed to heat. The cast iron skirt acts as a seal and guide, and because of its lower expansion under heat, can be fitted more closely than aluminum. In this case the skirt, being insulated from heat transfer from the head, remains comparatively cool and consequently does not expand appreciably. There is a gap between the aluminum and iron portion, so that differences in expansion between the aluminum and iron make no difference in the fit or shape of the piston. This also permits of oil drainage. The bronze bushing for the wrist pin is carried in the aluminum portion of the piston, thus transmitting the explosion forces directly to the wrist pin.

This piston, which is the design of O. E. Barthel, weighs approximately the same as a light-weight, semi-steel piston.



Barthel Cross-head piston.

ONE thousand and forty-one motor cars were imported into British India during September, 1920, and of them, 723 were consigned from the United States, and 287 from the United Kingdom. During the six months, April to September, 1920, the number of motor cars imported was 7,498, as against 2,553 in the corresponding period of the previous year. The United States recorded 5,654; the United Kingdom, 1,902; Canada, 542; France, 49, and Italy, 43. Bombay imported 2,775 cars; Bengal, 2,694; Madras, 908; Sind, 590, and Burma, 531.

Lumber Used in Motor Vehicle Manufacture

Here is an interesting and informative study of the lumber consumption based on 1920 production figures. The U. S. Forest Products Laboratory prepared the statement as the result of studies made by its engineers.

By Arthur Koehler*

THE rapid increase in the proportion of closed cars manufactured is an outstanding feature of the automobile industry. An official of a large company recently expressed his belief that in five years one-half of their output would be closed cars. Already one out of every eight passenger cars of a well-known make is a sedan or coupe. This means a large consumption of lumber, as the closed car takes from two to three times as much lumber as an open car, and a better grade of lumber is required to insure rigidity and freedom from warping in the closed body.

An engineer of the United States Forest Products Laboratory, Madison, Wis., recently visited a number of manufacturing plants to determine what woods are being used in the automobile industry, to what extent substitution of one species for another is taking place and what troubles manufacturers are having with wood.

The question of what kind of lumber to use in auto bodies is becoming a perplexing one. Ash has always been considered the most desirable wood for most of the parts above the running gear. It combines the properties of moderate weight, easy workability, high degree of toughness and comparative freedom from twisting. With keen competition in the trade and the high price of ash it is gradually being replaced by other kinds of woods in order to reduce the cost of production.

No data are available showing how much lumber of each kind is used in the automobile industry. From a visit to a number of automobile and body factories the writer is inclined to believe that maple leads in the construction of passenger car bodies and elm is next and ash third. Besides these species many others are used or are being tried out. The following brief description of the more important woods used in automobile construction gives some of their relative advantages and disadvantages, and in Table 1 is given the strength of these woods as compared with forest grown ash.

Ash: The cut of ash lumber consists almost entirely of white ash, green ash and black ash. The green ash is sold as white ash and is practically identical with it in properties, but black ash is not so strong.

A number of years ago commercial white ash was the principal wood used for passenger cars, but its great demand for this purpose, airplanes, etc., brought the price up so high that substitutes are used except in some of the high priced cars which still use ash for the sills, or throughout the whole body. Because of the higher quality of closed bodies, and the necessity of avoiding warping of the parts as much as possible, ash is used by some manufacturers for closed bodies but elm for open bodies.

In Table 1 the strength of second growth white ash and of black ash are given in per cent of forest grown white ash.

*Assistant in charge, Section of Timber Physics, Forest Products Laboratory.

On account of the greater difficulty of machining maple than ash, some prefer the ash from an efficiency standpoint even though it costs a little more originally.

Much of the white ash growing in the northern states has been cut out, and over half of the supply now comes from the states bordering on the lower Mississippi River. Unfortunately, ash like other hardwoods growing in the southern swamps, produces a certain amount of light wood which is apt to be brash, especially in the swelled butts of the trees. This necessitates sorting out the material and eliminating all light pieces for purposes where strength is important.

Maple: Very little soft maple is used, nearly all of the wood which goes into bodies being hard maple. It is extensively used for sills of passenger cars. In some cars it is also used for the framework of the body and even for the floor and running boards and battery boxes.

Maple is fully as strong and stiff as a beam or post as white ash, but not as shock resisting, as is indicated in Table 1. It usually is cheaper than ash and runs more uniform in strength. Maple warps very little, in this respect being superior to elm. On the other hand, maple is more difficult to season without checking than ash or elm, and it is said not to hold screws so well in use in automobile bodies.

On account of the smooth fine texture of maple, paint and enamel will rub off more easily, especially on curved surfaces which receive considerable wear, than on birch which is slightly more porous.

Because of its smooth wearing qualities and comparative freedom from slivers maple is preferred to all other woods for the floors of delivery wagons.

TABLE 1.—STRENGTH OF WOODS USED IN AUTOMOBILE CONSTRUCTION IN PER CENT OF THE STRENGTH OF FOREST GROWN WHITE ASH*

Species	Strength as a Beam or Post	Stiffness	Shock Resisting Ability	Hardness
Hardwoods:				
Ash, white, forest grown	100.0	100.0	100.0	100.0
Ash, black	71.3	79.3	90.1	62.3
Ash, white, second growth	122.5	117.6	119.6	118.9
Basswood	59.1	80.6	40.5	29.6
Beech	93.5	96.9	96.0	90.0
Birch, yellow	104.8	116.8	120.6	80.9
Chestnut	66.0	71.9	58.4	49.2
Cottonwood	60.6	79.0	54.3	35.3
Cucumber	85.4	112.4	76.7	54.9
Elm, rock or cork	98.8	92.9	140.5	101.6
Elm, white	79.2	79.5	89.5	57.1
Gum, red	80.7	91.5	75.5	59.0
Gum, tupelo or cotton	81.4	82.5	63.5	77.3
Hickories, pecan	103.5	103.8	119.7	139.6
Hickories, true	126.6	120.2	173.9	150.4
Maple, red	90.0	101.2	78.7	75.4
Maple, silver	66.9	68.5	71.7	64.3
Maple, sugar	104.7	105.9	90.5	103.0
Oaks, all kinds	92.6	101.3	94.9	104.5
Poplar, yellow	67.3	93.8	41.5	37.9
Conifers:				
Firs, Douglas, Pacific Coast type	95.7	122.1	59.9	58.3
Pine, loblolly	93.7	105.6	71.0	60.0
Pine, longleaf	112.2	122.1	77.7	74.8
Pine, shortleaf	94.1	100.6	69.7	64.0
Pine, western, white	75.5	99.7	53.8	37.0
Pine, western, yellow	67.0	75.6	42.9	41.0
Spruce, Sitka	69.5	94.1	63.3	44.9

*For information on actual strength values of these and other species see United States Department of Agriculture Bulletin No. 556, "Mechanical Properties of Woods Grown in the United States."

Elm: Soft or white elm is the principal species of elm used in automobile manufacture. A little rock elm is used for some of the bent parts, but otherwise white elm is preferred because it is more easily worked and is less subject to warping. Lumber from old white elm trees, usually called "grey elm," is preferred to that from younger, or vigorously growing trees, because it is more easily worked and gives less trouble in seasoning and manufacture because it warps less.

The principal use of elm is for frames, seat backs and doors; very little, if any, is used for sills. Old white elm is not so strong or tough as ash on the average, but it varies less in strength than ash, especially that which comes from the southern swamps.

Birch: Yellow birch is used considerably in automobile manufacture and is a close rival of maple. It is used for sills, framework and other minor parts. It is preferred to maple on exposed painted parts because it is said to hold the paint better. Its use probably is increasing.

Hickory: The use of hickory in automobile manufacture is confined almost exclusively to the spokes and felloes. In recent years the wooden felloe in automobile wheels has been replaced to a large extent by a steel rim into which the ends of the spokes fit. If this substitution proves satisfactory it will be of decided economic significance, since it will leave a large amount of hickory for the manufacture of handles for which there is no satisfactory substitute. The present trend toward the all metal wheel already eliminates thousands of hickory spokes, but it is too early to say how far this substitution may be expected to go. There is a certain resiliency in the hickory spoke which is not easily duplicated with other materials.

No distinction is made between the true hickories, such as shagbark, big shell bark, mockernut, and pignut, but the pecan hickories, such as pecan, bitternut, nutmeg and water hickory are, as a class, inferior in strength to the true hickories, especially in shock resisting ability. The pecan hickories might be used in place of ash, elm, birch or maple in the body, although their hardness and tendency to twist might prove a serious drawback to such uses.

Red Gum: This species name includes both the sapwood and heartwood. It is used for floor boards, seat risers, seat boards and other minor parts, but it is too weak and soft for the sills or other major parts of the frame. One of the principal drawbacks to the use of gum is its tendency to warp when used in places where it is subject to changes in moisture content. Quarter sawed gum boards give less trouble in warping than plain sawed boards.

Oak: In automobile construction no distinction is made, as a rule, between the different species of oak or even between the red oak and white oak groups. In passenger cars oak is rarely used for the frame or sills. Wormy oak is used for running boards, floor boards and seats. Some sound oak is used for instrument boards and battery boxes.

Top bows are made almost exclusively of oak, second growth being preferred.

In trucks, on the other hand, oak is one of the leading woods. It is used for sills, cross sills, frame of body, floor and stakes.

In Table 1 all the oaks in which tests have been made are grouped together under one name.

Southern Yellow Pine: Under this heading are included longleaf, loblolly, shortleaf, and some of the minor southern pines. The use of yellow pine in automobile manufacture probably is increasing. It is used for running boards, floor boards, seat boards and a number of small parts in the seats and frames.

Other Species Used: The above descriptions cover the principal woods used in passenger and freight automobiles. Numerous other species are used to a limited extent. Cottonwood is used for dash boards of passenger cars and the boxes or bodies of trucks. Sycamore, beech, basswood, yellow poplar, cucumber, tupelo, gum, chestnut, Douglas fir, western yellow pine and possibly other woods have been used in small quantities.

In addition to these, fancy woods, such as walnut, cherry, mahogany, rosewood, tulip wood, etc., are used for trim in high priced cars.

Table 2 shows the kinds of wood used in the different parts of an automobile, based on a study of those companies which made bodies for a number of automobile manufacturers.

Table 2—Kinds of Wood Used in Open Cars

Sills, longitudinal and cross—Ash, hard maple, and occasionally elm, red gum, magnolia and soft maple.
Floor boards—Sound and wormy oak, hard and soft maple, red gum, beech, wormy chestnut, elm.
Seat risers, or "heel boards"—Hard and soft maple, red gum, yellow pine.
Seat boards, or seat frame—Hard and soft maple, red gum and numerous other species.
Seat lids—Maple, gum, elm and numerous other species of plywood.
Pillars and posts—Hard and soft maple, ash, elm, sycamore and red gum.
Seat rails (arm and back)—Ash, elm and maple.
Strainer slats, or "spring slats"—Maple, ash and gum.
Doors—Hard and soft maple, ash and elm.
Trim rails—Rock elm.
Running boards—Wormy oak, yellow pine, maple, Douglas fir.
Steering wheels—Walnut, maple, red gum.
Spokes—Hickory.
Rims ("felloes")—Hickory.
Top bows—Oak.
Dash—Cottonwood and maple.

It is estimated by the Forest Products Laboratory that the total amount of wood used in the construction of automobiles and motor trucks in the United States amounted to 384,751,000 ft. b.m. in the year 1919. The total consumption of wood used in the industry is roughly estimated in the accompanying Table 3.

Table 3—Amount of Lumber Used Annually in the Manufacture and Shipment of Passenger Cars and Motor Trucks, Based on 1919 Production of Cars

Total output of passenger cars	1,883,158	
Average number of board feet of lumber used per car	160	
Total lumber used in passenger cars		301,305,280 bd. ft.
Total output of motor trucks..	322,039	
Average number of board feet of lumber used per truck, including body	200	
Total lumber used in motor trucks		64,407,800 bd. ft.
Total number of passenger cars exported	141,477	
Average number of board feet of lumber used in export crating of passenger cars...	660	
Total lumber used in export crating of passenger cars		93,374,870 bd. ft.

Total number of trucks exported	29,288
Average number of board feet of lumber used in export crating of trucks	760
Total lumber used in export crating of motor trucks	22,458,880 bd. ft.
Grand total	481,546,780 bd. ft.

Computation on basis of 1920 figures made by AUTOMOTIVE INDUSTRIES.

The amount of lumber used in each car varies from 75 ft. b.m. for a small open car to 200 ft. b.m. for a medium-priced touring car. An average given by a large body manufacturing corporation is 140 to 150 ft. b.m. for open cars for each body. A small sedan requires 225 ft. b.m. and a large sedan, not including running boards, uses about 310 ft. b.m. One company stated that the average waste was about 30 per cent, including drying losses, cutting and minimum jointer waste, although others place the waste as high as 40 per cent.

In automobile work, first and seconds are used nearly exclusively. One company used 75 per cent first and seconds and 25 per cent No. 1 common. A large body company used 40 to 50 per cent first and seconds, and the rest No. 1 common of maple, elm, and oak. Another company making high-priced cars will take only 20 per cent of No. 1 common.

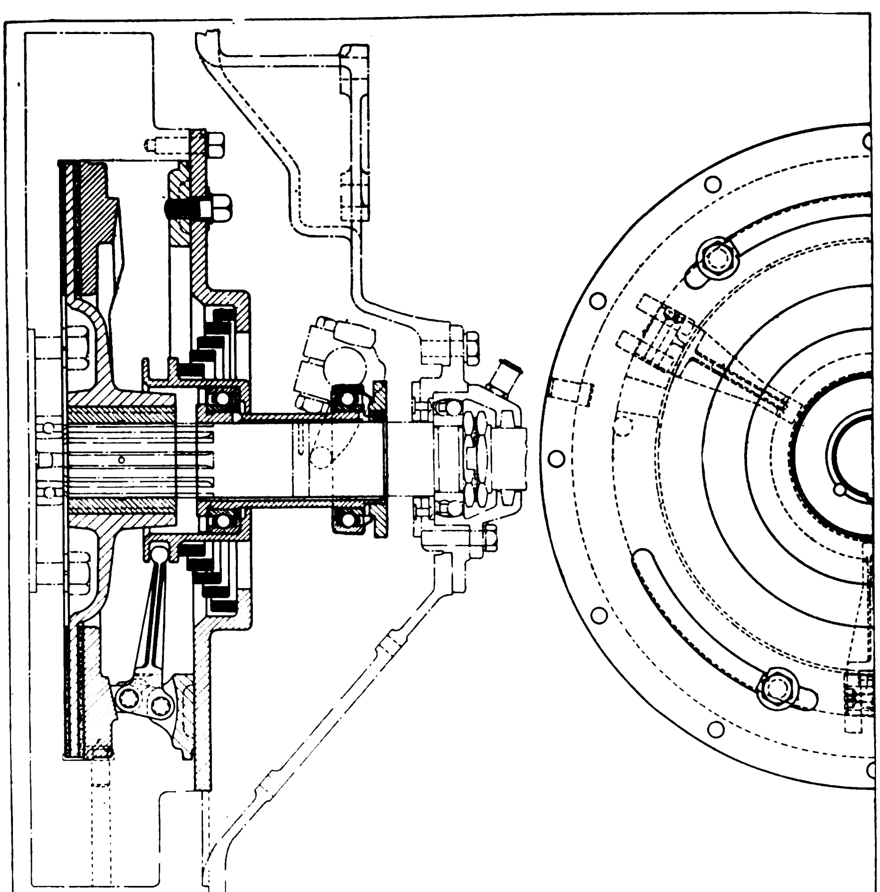
A Heavy Duty Single Plate Clutch

A NEW 14-in. heavy-duty clutch has been placed on the market to meet a demand for a single plate clutch which will satisfactorily transmit a torque of as high as 350 lb.-feet. This clutch is intended especially for tractor and heavy-truck service. The area of the friction surface is 100 sq. in. and the unit pressure on this surface approximates 30 lb. per sq. in. The friction mats are of a type recently developed for the Borg & Beck clutch and are said to have shown satisfactory results even with a unit pressure of 60 lb.

The drive is transmitted from the friction disk to the shaft through a 1¾-in. diameter 10 spline S. A. E. standard fitting, the length of this fitting being 2½ in. Lubrication of the splines is provided for by turning a groove centrally in the bore of the friction disk, slightly larger in diameter than the top diameter of the splines. This groove communicates, by means of radial holes in the shaft, with an axial hole extending the entire length of the shaft, so that when this hole is fed grease either from a compression cup or grease gun, the pilot bearing, splines and thrust bearings are simultaneously lubricated.

The thrust bearings are alloy steel, heat treated and ground to close tolerances. These bearings are claimed to possess advantages in respect to efficient lubrication, quiet operation and ability to withstand constant use.

Three adjustment screws pass through the cover of the clutch, and each screw has only one repeat hole, spaced equi-distant from the bell crank, so that the mounting ring is always held rigidly to the cover, thus eliminating any tendency of the ring to spring and cause drag when the clutch is released. This clutch is known as type F.J.X. and is manufactured by the Borg & Beck Co.



Model F.J.X. Borg and Beck heavy duty single plate clutch.

Chemistry of the Earth's Crust

ASSUMING the earth's crust to be a layer about 10 miles deep, Henry S. Washington of the Geophysical Laboratory, writing in the Journal of the Franklin Institute, estimates that 95 per cent of the crust is made up of igneous rocks, mainly silicates of Al, Fe, Mg, Ca, Na, K. Silica itself represents nearly 60 per cent of his mass of the crust. His percentages are in round numbers: Oxygen, 46; silicon, 28; aluminum, 8; iron, 5; calcium, 3.6; sodium, 2.8; potassium, 2.6; magnesium, 2.1. All the other elements are calculated to be present in less than 1 per cent each: titanium and phosphorus, each, 0.13; hydrogen, 0.127; manganese, 0.01, etc., and in order fluorine, chlorine, sulphur, etc., with bromine, tellurium and platinum at the end of the series. The first-mentioned elements down to manganese are supposed to make up 99.6 per cent of the crust, while the interior of the earth would, it is concluded, consist largely of magnetic nickel-iron. These estimates are based upon varied considerations and upon the analyses of some 5000 rocks.

Factory Service Relations with Dealers

The part played by the engineering department in regard to defective parts was one topic discussed at a recent convention of factory service managers. The dealer is now in the position of a buyer in a buyers' market and seems to be getting more consideration than heretofore. Parts prices and return of parts to factory for credit discussed.

By J. Howard Pile*

THE outstanding feature of the convention of Factory Service Managers, held under the auspices of the National Automobile Chamber of Commerce at the Hotel Iroquois, May 16, 17 and 18, was the changed attitude of the factory toward the dealer and distributor. In past conventions of this kind there has been a dictatorial attitude, and the theme of the papers and discussions has been what the factory shall "allow" the dealer. With the factories now seeking to sell more cars, and the dealer in the advantageous position of a buyer in a buyers' market, these things have changed and many agreements and practices to the advantage of the dealer are approved which six months ago would have been turned down flat.

The attitude of some of the factory managers toward parts prices was somewhat disappointing. While owners have been looking for more satisfactory prices on service work, and dealers and distributors have, in many cases, devoted much thought and time to the development of service stations that could render more economical service, the attitude of some of the factories seems to be to put as much on parts prices as the traffic will stand. While the prices of the parts may not seem so high according to lists, there are transportation charges, handling charges and taxes which have to be undertaken by the purchaser, and several suggestions that parts price lists to the car owner be discontinued, so that he would not know how much he was going to have to pay, seemed to meet with approval, although some objected.

The relation of the engineering and service departments of the factory was discussed at some length, following papers by Bachman of Autocar and Rippingill of Hudson. The point of contact between these two departments is in the return of defective parts to the factory. In some factories the practice is for the engineering department to pass on credit for these parts, the idea being that the engineering department thereby will see what parts are falling down and will be able to redesign where necessary. As a matter of fact, it would seem that ordinary defective parts can be just as well decided on either by the factory service department or the local service department with quicker action, which would result in benefit to the owner. Reports could be made out on these ordinary defective parts and turned over to the engineering department. Any extraordinary defective part could, of course, be returned to the engineering department for personal inspection. Very few factories require all parts to be returned to the factory before credit will be granted, but most every factory requires that certain classes of defectives be returned. It was suggested at one point that all service departments should be self-supporting, and this view was very vigorously attacked by Chairman Cummer of Autocar, who stated that he felt that the service department was not a profit-making department and was in the same class with advertising, auditing, etc., which departments, while they produce good and assist in the sales of the cars, cannot be expected to pay their own expenses or even a portion. This frank statement was very generally approved of.

There seems to be a tendency on the part of dealers at the present time to return parts to the factory for credit. This situation has been brought about by unwise orders placed during times when stocks were scarce at the factory, and dealers are now seeking in many cases to reduce their inventory. The remedy for this would seem to be to place a charge of 10 per cent on all material returned for credit, with the exception of parts made obsolete by new designs. Current parts should be checked up pretty carefully to prevent dealers from cutting their stocks down below the minimum required amount. The deterioration of equipment on cars which have been in stock for from five to six months was brought up for discussion, and H. Barcroft White, a dealer in Syracuse, suggested that manufacturers get together and handle this situation along safe and sane lines. A discussion of topics covering transportation charges on parts to dealers at distant points brought up the advisability of furnishing the owner with a printed price list of parts. Inasmuch as some factories allow the dealer to charge the owner transportation charges and sometimes handling charges, it was felt that the owner would have a legitimate kick if he found the prices actually charged, including all these items, was very greatly in excess of the printed list gotten out by the factory. It developed that a good many factories did not furnish such lists to car owners.

*Technical Editor, *Motor World.*

Who's Got the Button?

Editor AUTOMOTIVE INDUSTRIES:

I would like to have the addresses of the company building the highest type of four-cylinder, high efficiency motors. This company is planning a new type of high efficiency four-cylinder motor car and wishes to obtain the very best engine that it is possible to obtain. Only the superlative product will meet the requirements.

FINN S. HUDSON, U. S. Products Corp.

An Experience in Foreign Automobile Advertising

One of the very interesting points about this paper is that it applies so directly to domestic advertising. The big factor appears to be to decide on an objective, then on a method, sticking as closely as possible to both.

By Frederick Dickinson*

THE company which I represent entered the field of foreign advertising, as a great many companies in the early days entered it, at the point of least resistance. Within two years of our establishment we had secured a good, strong foothold abroad, largely through the efficacy of a rather daring and remarkable piece of "stunt" publicity. Within a very short time after that we had established ourselves rather firmly, because of the timeliness of our entry and the peculiar adaptability of our product to the foreign demand.

Advertising, in a formal sense, played a very small part at the beginning of our export merchandising. It is amusing to look back at those early days and note that out of the mass of formal advertising which grew out of our entry into the foreign field, the bulk of it was used in this country to establish ourselves in the domestic field. It apparently never occurred to us that information concerning our remarkable world tour could be disseminated through the export publicity media in such a way as to develop our export market. We used this information right at home, and profited by it greatly. But that, speaking generally, was as far as it went. The reason for this was our complete ignorance, even after a couple of years of export merchandising, of the ways and means by which export advertising, in a formal sense, is accomplished.

That ignorance, by the way, exists to-day in the minds of many organizations selling in the foreign field, and I am frank to say that after all of these years, and after considerable study and marked improvement, our organization has not entirely solved the export advertising problem. Hence the necessity and the desirability of such discussions as these in which we are now taking part.

But to go back: Circumstances were considerably kinder to us than we were to ourselves. In spite of our almost criminal ignorance of how it could be developed by advertising, our foreign demand increased. The impetus given it by our dramatic entry had not died out, and it was further stimulated by what was practically a repetition of the original stunt.

Again, I must confess that that repetition was undertaken largely to furnish material for domestic use. It seems unbelievable, doesn't it, that intelligent men could be so blind as not to realize the possibilities of what they were doing for use in one field, and so keenly conscious of its use in another field? But, again, I must give as an excuse the seemingly impenetrable darkness which surrounded formal foreign advertising.

Speaking from the standpoint of an advertising man, we did not deserve the success we secured; but nevertheless success was ours. Our distributors dotted the globe, and they were selling all of our product that we could, or thought we could, afford to give them.

Then, one by one, these distributors, in a very limited and groping way, began to advertise. In those days they advertised, I sincerely believe, not because they needed it, and not because they had a complete realization of what advertising could do for them, but because it seemed the natural and expected procedure for a man in business to spend a certain sum, very indefinite in amount, and very haphazard as to method, in advertising. A great many people, at home and abroad, are still advertising in this manner. They literally know not what they do, or why they do it. It is part of the game, just as the chiropodists, twenty years ago, all wore high hats, and the undertakers to-day all wear frock coats.

But as the years went by, this natural and necessary burden of advertising increased. The publications which profited by it kept pushing our distributors farther and farther along, and tempting them to more expensive efforts. Competition entered, and increased. Our distributors, with a vague conception of the possible good that might come from advertising, increased their own advertising burden to the point where they began to look around for some one to help them carry it. They naturally looked in our direction.

This marked the beginning, with our company, of the division of expense between the factory and the distributor on advertising bills, on the basis of a certain definite amount per car shipped, as the factory share. The distributor wrote his own advertising copy, selected his own advertising media, and determined the size and extent of his schedule.

Having entered upon this arrangement, it was continued for a number of years, and it is entirely to the purpose of my address to-day to tell you that on the whole it was a very unsatisfactory arrangement, and to tell you why.

I am not saying that it could not have been made satisfactory or that all similar arrangements have proved, and are still proving, unsatisfactory to other organizations. If I am to preserve the integrity of my remarks in a way that will make them, in the slightest degree, helpful to you, I cannot go beyond our own experience.

As to copy and the things that were printed in public regarding our product, we were at the mercy of about eighty separate individuals; practically all of them untrained as writers of advertising, many of them unacquainted with our product except in a most limited sense, most of them, because of distance and widely varying environments, unable to grasp our ideas and ideals. This condition made not only for inefficacious and useless copy, but for actually dangerous copy. Statements were made,

*Advertising Manager Hupp Motor Car Co. Paper presented at the Eighth Annual Foreign Trade Convention.

if not literally over our name, virtually with our sanction, that we could not substantiate. Misstatements were many, exaggerations the rule. In those countries where the precept "Let the buyer beware" still held sway, representations were made that got us into trouble. I recall one instance in particular where our product was advertised as "guaranteed for life." The ambiguous nature of that guarantee, interpreted according to our ideals, cost us money.

The question might be asked at this point: "Why didn't you furnish your own copy, thus helping the dealer out, and preventing unpleasant complications?" We did that very thing, but our distributors still had their own ideas. It wasn't strong enough for them. Some of them *wanted* to exaggerate and distort. It did not contain that evanescent "something," the absence of which even a child can detect, but the presence of which no one seems to recognize—local color. Many of them were willing to use our copy but no two of them wanted the same kind of copy. We were placed in the position of writing special stuff for every important country in the world, and submitting it to a captious critic in every one of them.

"Why, then, did you not force the issue, and refuse to participate in the expense of advertising of which you did not approve?" We did that, too; and became involved in endless disputes. We were pitted against four score "fathers," each fighting for his advertising child; and, what was more important, fighting for hard cash in the shape of an advertising allowance. Now, an endless dispute, carried on across a hemisphere, with a man who does not speak or write your language, is a difficult and unpleasant thing. Distributors were alienated. The friction arising from advertising controversies interfered with sales and service. We found ourselves giving in where we should not have given in, simply for the sake of preserving an important connection. Thus bad precedents crept in. Money was allotted for advertising that never found its way into advertising channels. A bad way of doing business, you will say, but I will defy any one with as much at stake as we had, to have done differently.

I have dwelt at some length on the matter of copy, in order that I may save time on some of the other factors. The difficulties that arose around copy typify, in a measure, the difficulties that arose around the selection of media, and the size and extent of schedules.

Theoretically, a man doing business in Australia should know what Australian advertising media to use for his advertising. Actually, that man knows no such thing, unless he is an advertising man. The same thing, by the way, holds true in this country. Our distributors by and large were not advertising men. They selected publications because they themselves read those publications, or because their friends read them, or because their wife's uncle owned them, or because the publisher was a good fellow, or because the business manager would give them a rake-off, or because their solicitor happened to drop in at the time the advertising was being placed. We found our advertising appearing in media that would not sell a car for us in a thousand years. Many distributors displayed a fondness for advertising in their own trade publications, read only by men selling the kind of things that they themselves had to sell—dealers advertising to each other, in other words. Dealers would select an absolutely worthless medium, whose circulation was confined to their own territories, and pass up an excellent medium that would actually sell cars for them, because part of that medium's circulation was in another dealer's territory. Shortsightedness, ignorance, and lack of experience controlled our list.

And the disputes and misunderstandings that arose over copy were duplicated and aggravated by the disputes that arose over media.

The differences of opinion that arose as to size and extent of campaigns were not as numerous and serious as were the other bones of contention. Nevertheless, in this respect, and in many places, conditions were not altogether satisfactory. Although we made a certain allowance per car, the amount was intended as a limit, and not as a definite recommendation. Hence, we found some distributors wasting their own money, and ours as well, simply for the purpose of absorbing the maximum allowance. One-half the amount, or two-thirds, would have been adequate. As in the case of a distributor who had a limited territory, a fairly active market, and only one inexpensive publication covering the entire market, we would find that distributor blossoming out into full page schedules, where half the space would have accomplished the maximum results.

My enumeration thus far has included only what I will call, for lack of a better phrase, the basic difficulties of our advertising arrangement at that time. There were many other accessory and supplementary difficulties. In order that our plan might work with some degree of system, and be not altogether haphazard and inefficient, a considerable amount of checking had to be done. Hence this rule: that a distributor, in order to receive his advertising allowance, must submit to us monthly clippings of his advertising, accompanied by receipted bills for the payment thereof. Hardly any distributor, it seemed to us, even after months of education and stimulation, seemed able to comply with these simple requirements. Entire campaigns would be represented by a few scattered clippings. Clippings came without receipted bills; some without bills at all. Clippings would not correspond in size with the lineage shown on the bills. Additions and extensions were wrong. Rates fluctuated, even in the course of a short campaign. Repeated urgings and warnings failed to secure monthly or regular submission of these claims; and they would all come piling in at the end of the year, or the middle of the year following their appearance. We, on our end, occasionally made mistakes; credits that should have been passed, were not passed, or the amount was incorrect. All of this entailed endless correspondence, and an increasing burden of misunderstanding and suspicion, and a decreasing amount of actual advertising efficiency.

After convincing ourselves that this particular method of handling foreign advertising was not working out in our particular case, we decided to make a radical change. We inaugurated an entirely different system—the system under which we are now working. That system is not perfect, either in itself or in our application of it, but it is at least, to our way of thinking, a decided advance over its predecessor. Again, let me say that my implied condemnation of the older plan simply applies to our experience. We could not make a "go" of it. Possibly others smarter than we can do it. It has points in its favor.

Some three or four years ago, we announced to all of our foreign distributors that at the expiration of the current season no further advertising allowances were to be made. We told them that from then on we proposed to handle our export advertising in much the same manner as we were handling our domestic advertising. We would make up a list of publications having circulation in the territories of our export distributors, and would run in those publications a consistent advertising campaign composed of advertising which we prepared ourselves. We carefully explained to them our reasons for the change, which were, briefly, as follows: We wanted to be sure that our story was being told regularly and steadily throughout our market, and told in our own words. We wanted to guard ourselves against misstatement, exaggeration, and insuffi-

ciency of statement. We were going to pay the entire cost of this venture ourselves. It was probably the significance of this last statement that smothered the fury of the reaction which we expected. Only those distributors who were obviously misusing and diverting our advertising allowance made any great protest.

So we started in, with all of the resources and ability and ingenuity at our command. We made many mistakes —some of them as ludicrous as had ever been made by our distributors. But our mistakes were not perpetuated, because we had it completely in our power to rectify these errors as fast as they were discovered. We had no differences of opinion to iron out, no long-winded and long-distance correspondence to conduct. We were treading on no one's toes and wounding no one's sensibilities.

We are still handling our foreign advertising after this manner, and we are still making mistakes, and still, in some instances, wasting money. But these mistakes and these wastes are decreasing. On the whole, every one concerned is as satisfied as one could expect a large and scattered and heterogeneous group to be.

Before going on to more discussion of our methods and experience, and the points of general information that have arisen out of them, let me say that in a few scattered instances, where circumstances seem to warrant it, we are still continuing our allowance system. These places are so few that we are able to keep them entirely under our direction and control.

Our change of plan brought with it very many problems, the discussion of which I hope will throw some light on everybody's foreign advertising problems.

First came the handling of the machinery and routine connected with an activity of this size. We decided that this could best be handled by an agency—certainly an agency acquainted with the foreign field and having established relations with the publications and having knowledge of conditions in that field, and preferably an agency located in this country.

We had many bids for our business from agencies located abroad, but we could not see where an agency located in a foreign country, when it came to placing advertising outside of that country's boundaries, would have any advantage over a similar agency located in the United States. We were not established to conduct negotiations with agencies located in each country in which we did business. We felt that the complications involved in those dealings would be equal to the complications formerly involved in dealing with each of our distributors. The responsibility would be too much divided. In many countries, of course, no reputable agencies were available. So to an agency located in this country, and familiar from long experience with the foreign field, we turned over the burden of our routine.

The next problem was the compilation of a list. For the sake of saving time and getting started, our first list was largely the work of our agency; but no sooner was advertising started in that list than we began to check up on its individual units, through our distributors, through our foreign travelers, and through all other sources of information at our command. Little by little, and here and there, it was changed—in some places expanded, in others contracted, in still other places wholesale substitutions were made.

In making such adjustments, this has been our procedure: Whenever a doubt has arisen as to the availability of a certain publication, or group of publications, for our purpose, we have gathered together from all of our sources of information, both friendly and unfriendly, all the facts that we could muster; and we have decided the issue on the weight of evidence, combined with our conception of the job we were trying to do. This process will continue, I expect, as long as we are doing foreign advertising. For conditions are constantly changing; the fortunes of various publications are constantly rising and falling; our individual problems are by no means fixed. So much for our list and its history from the beginning to the present.

Copy was the next nut to be cracked. On the question of foreign advertising copy there were, and are, as many opinions as there are individuals engaged in the production of it—plus, I might say, as many individuals as there are engaged in reading it or hearing about it. (This is equally true of domestic copy, and equally true, I believe, of all phases of advertising practice. But I don't want to get off the track on that subject.)

We attacked our copy problem, and are still attacking it, from three different angles.

FIRST: What specific purpose were we trying to accomplish aside from the general purpose—which is the general purpose of all advertising—of selling our product?

SECOND: Placing ourselves in the position of the people who were to read our advertising—half informed or misinformed or totally uninformed—what did our common sense tell us should be said in order to accomplish our immediate purpose?

THIRD: How near to, or how far from, accomplishing our purpose had the independent advertising of our distributors come, and in what way had they registered success or failure?

The first point was easy. The success of all of our advertising effort (and we have been successful, I believe, in that respect) has depended on our ability to establish for our product a certain definite reputation. I will not go into a discussion of the right or wrong of our opinions on that subject, or of the technique involved, because it is a big subject and takes us far away from the purpose of this meeting. But, assuming that our ideas on the subject of advertising copy in general were right, we could see no reason why the immediate purpose of our foreign advertising should differ from the immediate purpose of our domestic advertising.

The disposal of the second point was not so easy. There were so many things that could be talked about, and so many ways of talking about each one of them, that, with the limitations of a moderately sized advertisement and a moderately sized campaign staring us in the face, the decision of what to include and what to discard was a hard one to make. We finally decided that our campaigns should be limited to very brief, simple statements concerning these three things:

1. Brief cataloging of our product—just enough to pretty definitely locate it as to general type and position in respect to other similar products. For example, to explain what I mean, we wanted them to know it was a four-cylinder car, of a certain size, made in certain models, and with certain equipment.

2. A modest statement of those qualities which gave our product a certain reputation.

3. With an eye to establishing or promoting confidence, an indication of the age, size and reputation of our company.

Opinions may differ regarding the wisdom of our confining ourselves to these points, but nevertheless we have so confined ourselves, and the results seem to justify our decision.

Quite regardless of its merits from a propaganda standpoint, the simplicity of our copy plan commended itself from a purely practical standpoint. In the first place, it permitted considerable condensation where only limited

space was available. It was not so complicated but what it could be embodied in the kind of simple, direct phraseology that was most likely to be comprehended by the average reader. It contained the minimum of possible complications when the question of translation came up. Let me say that our copy plan, also, has undergone changes and modifications from time to time. The general idea, however, has always remained the same.

With the list and the copy out of the way, the size and extent of the campaign came up for consideration. In this, too, our decision was based on our practice in domestic advertising. We have always been believers in regular and continuous advertising, as opposed to variable and irregular advertising. Our foreign campaigns have always been consistent and regular. We have taken the amount of money available for advertising in any given country, and spent it in the largest, consistent, regular campaign that it would buy; the amount of money available limiting the maximum size of space; common sense and the determination of what was necessary to command attention limiting the minimum size of space. For example, generally speaking, we prefer twelve half pages in a monthly publication to six full pages. This is not an entirely good example, because other considerations might affect our procedure; but I am sure that you get the idea.

So much for the fundamentals of our present plan of foreign advertising, and what preceded and led up to it. But there are other little side issues that are almost as important as the fundamentals themselves. Take the matter of what constitutes eligibility in a publication for inclusion in our list. We have found that, considering the limits of a modest appropriation, the best results are obtained from publications of general circulation, locating their circulation, insofar as may be, among the classes most likely to purchase our goods. This is in the nature of advertising first principles, and requires no elaboration. Where general publications of proper character are not available, we are driven to something more local. We have no objection to the more localized publication, such as newspapers, except that the use of them usually involves the expenditure of a great deal more money than is available. More of them have to be used. While they may carry our message closer home, and spread it more thickly, we cannot afford, nor do we need, in normal times, to cultivate our foreign market thus intensively and extensively.

It must be borne in mind that we are not producing goods exclusively for the foreign market. A certain volume must of necessity be maintained at home. The intensity of our foreign merchandising must be determined by the quantity of our goods that we decide to allot to the foreign field.

I will admit that at present, along with most every one else, we could allot to the foreign field much more of our product than they are taking; but I am speaking of normal times under normal conditions.

A foreign advertising appropriation is not an easy thing to determine. We are not entirely satisfied with our method; but this is it. We base our total advertising appropriation, domestic and foreign, on the amount of goods we plan to produce in a given year, influenced and modified by the amount of sales resistance we expect to encounter, and we allot to the foreign field, generally speaking, an amount in proportion to the number of units we plan to sell abroad.

There is one question which may be in the minds of some of you, the answer to which I did not consider in its proper place because it seemed to break the continuity of the discussion, and that is this: "Are you not, by financing your big foreign advertising campaign out of your own pocket, encouraging your foreign distributors to lie down on their end of the merchandising job?" We are, unless steps are being taken to counteract the influence. Those steps are being taken.

We are telling our foreign distributors that our advertising in their respective territories is in the nature of general reputation-building propaganda, such as we carry on in this country in our magazines of general circulation; and that they, too, like our domestic distributors, must see to it that their immediate local markets do not remain uncultivated. We are suggesting, and that suggestion is rapidly developing into a demand, that they spend in their territory a sum equal, if not greater, than we spend in that same territory.

While our advertising is opening up and developing their market in a broad, general way, their advertising should be cultivating and re-cultivating that same market. We are meeting with a marked degree of success, and I predict that when things open up again abroad in a big way, we shall be able to do infinitely more than we have done in this respect.

In conclusion, let me offer this apology, if such an apology is necessary. The purpose of the addresses and discussion at this convention is to promote the dissemination of general information—the kind of information that can be assimilated and used by concerns marketing widely differing products under widely differing conditions. In the light of this, it may seem as though my discussion were too closely confined to personal experiences, in a particular line of merchandising. But, after all, what real information can one man give to another man except information gathered from his own experience? All other kinds of general information can be gathered from books, and reports, and the experiences of other men. The only thing that an individual has that is really his own, is his own reactions and conclusions, based upon his own experience. If his reactions and conclusions differ in no way from those of other men undergoing similar experiences, he can at least throw them in to swell the average and help establish a rule. If they differ in some respects, they should be, in that degree at least, informative. Although my experience has been largely a specialized one, I have tried to draw from it only those conclusions that seem to me in some way pertinent to the subject of foreign advertising in general.

One more word: There are many stages in the process of development which I have described, that from necessity had to be omitted. There are kinks and angles of our present plan that could not be included for the same reasons. If you can think of any of these, and if the brief discussion of them will be interesting to you, I hope you will not fail to bring them up in the general discussion which is to follow.

British Motorcycle Registrations

JUDGING on the basis of figures available at present, it would seem that the United States has a considerably larger number of motorcycles in use than Great Britain. Under the new British registration law it will be possible for the first time to determine exactly the number of motorcycles and automobiles in use in the British Isles. There have been 186,000 motorcycles registered up to March 1, while authoritative estimates place the total which will be reached when all the machines get on the road for the year at about 200,000.

This is considerably below the American registration of last year, which was 234,000. In this country, moreover, there are undoubtedly many thousands of motorcycles which are never officially registered.

The Possibility of Developing Leaders

The older leaders received their business education when business was small and when rules and regulations were few. Present methods tend to remove from the individual the necessity for judgment. Consequently competent leaders are not being developed as rapidly as they are needed.

By Harry Tipper

FROM time to time we have considered the question of standardized method of dealing with human relations in industry, the adoption of many rules of selection, examination and training, and the danger of uniformity. The matter cannot be stressed too strongly.

Year after year in my lecture work at the New York University some student has asked continually for a rule governing this point in human action or that point. He is not willing to spend the time and labor necessary to discover the fundamentals, digest and understand the principles. What he wants is an educational pill which will work while his intellect sleeps, and give him a solution of the problem.

The biggest job for the man who lectures to such young men is the job of awakening the mind to thought, so that it will get some measure of understanding. In human affairs there is no uniform problem. There is an infinite variation in the individual quality, action and expressed capacity.

The individual differences and the friction of activity arising from the differences are the bases of improvement. We have already molded men's work by system, rule and regulation to the point where there exists an undesirable uniformity in their surroundings. In the minds of many men who are concerned with industrial relations, either in industry or out of industry, the idea of further uniformity, miscalled standardization, is the ideal toward which they strive.

Until we are clearly informed as to the principles upon which human action depends we cannot standardize, because such principles themselves are the only standards by which a measure can be made.

The laws of physics are the basis for all mechanical calculations, and out of them grow the other formulæ with which we shorten the time of our calculations and improve the quantity of work. Without a knowledge of these laws the formulæ themselves would be impossible.

So-called standards of examination for quality, fitness for work and character reading are entirely arbitrary and simply relieve the man who is charged with the responsibility from the amount of study and labor necessary to a proper examination of the individual. Obviously they cannot take count of the infinite variety and the effect which this variation has upon the individual quality and capacity. Skill can be measured because of its tangible result. Quality, character and capacity cannot be measured because the fundamentals out of which they grow are not clearly understood, and the infinite variety of their development and expression can only be determined by a study of each individual.

There is a general complaint through industry that we are not breeding leaders; in the movement of subordinate executives to the places of larger responsibility we find them hidebound by rule and regulation, limited in knowledge beyond the scope of their special skill, and unable to meet changes in condition with courage, firmness of action and self-reliance.

The agent of a hundred years ago who represented his principal in a city a thousand miles away from the office was in effect entirely responsible for all the operations, the decisions and the developments within his sphere of action.

If we quote from the records of such a merchant we find: "Upon my return to this territory, after three years' absence, I was pleased to find that my agent had invested the monies I left with him to such advantage in the business and in other enterprises that they had yielded me a handsome profit, which he delivered to me upon my arrival."

This man was for months without any knowledge of the operations of his agent, the adventures which the agent had undertaken or the purpose to which the funds had been devoted. Communication and transportation were very difficult, the machinery of commerce was very cumbersome, and, as a consequence, there could be no centralized control. To-day the rapidity of communication, the effectiveness of transportation and the unified systems of mass operation enable the control to be centered in the hands of a few to such a degree that the responsibility of the subordinate supervisors is extremely limited and definitely bounded by rule and regulation.

The decisions to be made by these men are governed by the system laid down. In many instances they are governed in extreme detail. This discourages the development of the capacity for decision, limits the knowledge to the specialized series of operations under the immediate supervision and destroys, rather than develops, the capacity for wise leadership.

Not long ago I was in conference with the president of a large company employing many thousand men. We were talking about some obvious deficiencies in various departments of the organization. The president of this company asked me what, in my opinion, was the important reason for the defects.

In reply I said, "Most of your supervisors are not leaders; they are only skillful operators, and consequently they do not know how to handle men."

His reply was illuminating, he said, "You are probably right, Tipper; but we have to have a thousand supervisors; where can you find me a thousand leaders?"

It is interesting to note that most of the older leaders in business, whose wisdom and vision have been acknowledged and whose capacity was outstanding, received their education in business at a time when business in this country was small, the

rules and regulations were few and the powerful, centralized systems of control were not established.

These men grew out of the very opposite conditions of business from those which they left at the close of their career, without realizing the effect of the change upon the capacity of the younger executive.

It is not without interest that lawyers, newspaper men and energetic, dissatisfied men from many lines of industry have been responsible for the growth of the automobile, advertising and other new developments. In these new lines they have a sphere for decisive action, developments which permit them to govern the system instead of obeying a system already established.

Because these highly centralized, controlled, detailed systems of operation in industry and commerce tend to decrease the capacity for leadership among the supervisors there is a great necessity for a broader and more fundamental type of education to the supervisors, a better acquaintance with the structure and elements of business, more encouragement by the decentralizing process and more incentive for the improvement of their own departments by the allowance of flexibility in the interpretation of the system.

In many concerns salesmen are obliged to fill out a report blank so cumbersome in its detailed formality that it clogs any inspiration. Results as to calls, routing over the territory, methods of approach and so forth have gone so far that in some organizations the actual words of a solicitation are rehearsed and standardized. Similarly in the factory side of business, the systems under which the foremen and department heads are required to work are formally determined in such detail as to require little or nothing but obedience to these uniform developments. These things do not make for the education of supervisors into leaders.

There is little or no opportunity for the exercise of judgment, for the quality of decision or the expression of human understanding. Consequently we are crying for leaders, executives and men of understanding in industry to fill the places of those who pass out, most of whom were educated under a free industry and developed by the necessity for continuous decision and responsibility for action.

Meeting of German Automobile Manufacturers' Society

THE Society of German Motor Car Manufacturers held its annual meeting at Berlin recently. Dr. Sperling, the general secretary, made a report in which he referred to the fact that during the war productive capacity had increased enormously in all countries, whereas the sales possibilities had shrunk greatly. After numerous appeals to the Government the control of the sale of gasoline had been discontinued, but in view of the deliveries required by the Entente the sale of benzol could not yet be freed of control by the Government.

The Society co-operated with the National Committee on Aerial and Motor Vehicle Transport with a view to the revision of the motor vehicle law of Feb. 3, 1910, with the result that already the regulations regarding admission of types, the hauling of trailers, test runs and the trailing of drivers had been materially eased. Other matters under consideration were a revision of the lighting and warning signal requirements and the admission of small motorcycles.

Referring to the readjustment of prices, the speaker said that automobile prices had increased less in proportion than prices of raw materials, and the Society had begun negotiations with the raw material associations which were still pending, as without a decrease in the cost of raw materials it was impossible to reduce the prices of automobiles, as present prices barely covered the cost of production. Under these conditions it was impossible for the automobile manufacturers to meet requests sometimes made of them to fill old contracts at the agreed prices and that the Supreme Court in several decisions had agreed with this view of the matter.

In response to urgent requests of the Society during the past year the national government provisionally removed the export tax, in order to enable German manufacturers to compete in foreign markets. The export tax planned by the Entente would, it was said, absolutely exclude German motor cars, cycles and accessories from Entente markets and must therefore be declared unacceptable.

It was unanimously decided to hold an automobile show the coming fall. A resolution of protest was adopted against the proposed increase in the tax on motor cars and trucks. Finally Dr. Sperling reported on import and export policies, referring particularly to the closing of neutral and Entente markets by embargoes or excessive duties which in their effects were similar.

Flame Characteristics and Their Influence Upon Combustion

(*Continued from page* 1102)

ionized by some of the catalytic processes. Great turbulence also accelerates inflammation and aids in keeping temperatures down by the scrubbing action of the burning gases upon the cold walls. To decrease the noise of detonation and to prevent extremes of temperature the combustion-chamber should be without pockets and very compact, *but without parallel surfaces*, so that neither heat nor sound can be concentrated by reverberatory action. The spark-plug should be located so as to give the flames the shortest possible travel.

It is likely that kerosene and gasoline can be more effectively burned by so stratifying the mixture that ignition occurs in a very rich portion which burns out into an excess of air, or a supporting atmosphere. If properly done detonation could not occur as the fuel would occupy but a small place in the combustion-chamber. Being a very rich mixture the rate of inflammation would be high. Complete dissociation would not be likely to occur and could not cause auto-ignition if it did, as there would be very little opaque vapor beyond the flame-front. A well vaporized, very rich mixture burns first blue, then green, the green indicating a cracking into new smaller hydrocarbons. If enough air is available immediately after the cracking the green flame becomes blue again and is in no way objectionable except that it is about 50 per cent more radiant than the blue flame. With this method the air is not throttled; the fuel only is governed. An engine using this method of combustion would have steam-engine characteristics in a reasonable degree, without sacrificing economy, which is much more than can be said for present engines.

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U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
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A Highway Platform

THE resolution on highways adopted by the Chamber of Commerce of the United States is a clear, direct statement of a reasonable highway platform. It is here printed:

"The importance of improved highways has already had recognition by the Chamber, and the highway development in the country has attracted wide attention. In order that funds now to be spent for highway construction may adequately serve the economic purposes which are becoming clearly recognized, the following fundamental principles should govern:

"Bonds should be issued by states and territories, counties or municipalities and Federal assistance furnished only for portions of highway construction which are reasonably enduring and permanent in character.

"Federal appropriations should be made only for assistance to state highways which will become a part of an interstate system.

"Federal assistance should be continued only to those states which adequately maintain highways for which there has been Federal aid.

"Most careful study should be made by the Federal Government, in co-operation with State governments, as to routes, the probable character of service over such routes, and the best form of construction to meet such service. These studies should include ultimate economies of location and design."

The S. A. E. Summer Meeting Papers

THIS editorial, written in advance of the semi-annual meeting of the Society of Automotive Engineers, but after opportunity has been given to read several of the papers to be presented, is to advise engineers who are prevented from attending the meeting not to overlook the valuable information contained in the papers contributed to the program. A number of the latter deal with the fuel problem or closely related subjects and add much useful information to that published as a result of research and reports made at earlier meetings. The current papers, some of which appear in this issue or will appear in later numbers of AUTOMOTIVE INDUSTRIES, are, on the whole, rather more specific than in many of the earlier papers on fuel subjects, indicating that much-needed data is being secured and that ideas heretofore expressed are beginning to take a more definite form.

As usual, the Bureau of Standards has contributed largely to the program, and the data contained in the paper by W. S. James, with its appendices by other members of the bureau's staff, are pertinent and of exceptional value in pointing out weaknesses in present designs of automotive equipment and in many other ways.

The discussion by Dr. H. C. Dickinson on the present status of knowledge regarding the so-called "knock" phenomena should help clarify and correlate in the minds of many interested the various more or less hazy theories in this regard which have been advanced from time to time.

The number of papers dealing with research are a pleasing indication of the increasing importance attached to this vital phase of engineering and industrial progress. If the appreciation of work of this character continues to grow at the present rate, and especially if executives come more and more to understand its value and see that it is adequately supported, it is safe to predict astounding progress in automotive development—a development that seems certain to maintain the commanding position which the automotive industry now holds as being the most progressive of all the great industries of to-day.

Help Secretary Hoover

IT is extremely interesting to note the friendly attitude of Congress toward increased appropriations for Secretary Hoover's proposed work in the promotion of business in this country and for export.

Secretary Hoover's ideas as to the function of the Department of Commerce are sound. His ideas of

gathering production data and publishing it for the benefit of all business interested is an especially good move at this time. Within the last few months a State investigating committee working in New York has shown that there is much secret gathering of data going on in some of the building trades and that the data so gathered is used exclusively for the purpose of maintaining prices by those firms which belong to the particular organization gathering these data. This plan is workable merely because these figures have not been otherwise gathered and published.

It would be well for the men concerned in the automotive industry to urge upon their congressmen the need for more intelligent data in business. A congressman is likely not to appreciate the importance of such figures. Perhaps he has never studied sales building. A letter to him from a manufacturer is likely to be very illuminating on this subject. There is no reason why the automotive industry should not court the fullest publicity, as it has nothing to hide.

Perhaps if the manufacturers would stop to think how much data can be gathered for the amount necessary to build one 16-inch gun, they would be better able to make a definite argument to the lawmaker to whom they write. Manufacturers should be quick to take advantage of the sales statistics figures that Secretary Hoover proposes to offer to them.

Loose Tax Talk

IT seems more than passing strange that the railroads, after a period of quiet, should again bring forth so prominently the cry against the motor truck running on public highways without paying a high tax for the privilege of doing so. This sentiment, which has often appeared in railroad literature of late, became the prominent feature of Julius Kruttschnitt's testimony before the Senate Committee on Interstate Commerce.

One would hardly believe that the chairman of the Southern Pacific or any other western railroad would enter much of a protest against public aid to transportation in the interest of the development of the country. Certainly the western railroads have profited by public lands and funds.

But why this constant and everlasting dispute as to the use of the highways and who pays for their use? The people of the country, in their tax bills, supply the money for the building of the highways. The motor vehicle owners pay a special tax for the maintenance of the highways—or at least that is what the money should be used for. If special interests are taxed for the use of these highways, it merely means that this special interest will add this tax money to the price of the product hauled and in that way get it away from the mass of the people. In passing on this tax the special interest will take its toll coming and going. So the bill paid by the consumer mounts.

Does anyone suppose that if one of the large oil companies is compelled to pay additional truck license fees of $1,000,000 a year that this company will not raise the price of kerosene? And make an additional profit on the advance? If there is any such person—but why go on?

Why should a fleet owner, who handles his transportation units efficiently and moves freight economically for the benefit of the people, be taxed merely because railroad management is so inefficient and because the railroad equipment belongs to a day that has passed?

How can this country advance if progress is to be taxed to enable the business of yesterday to pay a profit? It would be just as reasonable for Mr. Kruttschnitt to advocate a return to earth roads and ox-carts and to sailing vessels, so that his road can have a monopoly of freight haul. Why not a rule of reason as to motor vehicle taxes?

Inaccurate Statistics

THERE appears to be an epidemic of articles being circulated and printed about the automotive industry that are based on figures that are weird and wonderful. Where these figures are obtained is impossible to state. They are not the figures compiled by the N. A. C. C., the several Government bureaus nor by AUTOMOTIVE INDUSTRIES. One of these articles was recently submitted to the Society of Automotive Engineers by a manufacturer for the program at the semi-annual meeting at West Baden. This paper was carefully read by the S. A. E. papers committee and rejected because of wrong figures used to reach conclusions. Later this paper was printed in the main in *The Annalist* of New York and, since its printing there, has been distributed to the press by an advertising agency. What reason either the writer of the paper or the agency may have for attacking the industry through inaccurate figures is not apparent. An article based on correct figures would be just as effective in promoting the use of alloy steel.

Benefits of Leadership

WHEN a supervisor, foreman or executive possesses the power of the well-known centurion of the Bible, he is strongly tempted to exercise that power without regard to its ultimate effects. Why take the time and trouble necessary to lead a group of workers when all you really have to do is to tell them?

There is one purely selfish reason, besides other more altruistic ones. There is always likely to come a time when the balance of power is changed. The supervisor may want the workers to do something that they do not have to do unless they so desire. If he is a leader and has been in the habit of leading them in small things, they will voluntarily follow him in the big things as well. But if they have done his bidding merely because of necessity, they are almost certain to exercise their power when the tables are turned. Some such psychological reaction is responsible for many of the labor troubles of the last few years. Intelligent handling can prevent its being responsible for future difficulties of a similar nature. The present time is favorable to the study of this problem. Leaders will be needed in the future; their development can begin now.

Bank Reserves Ample, Harding Says

Credit Situation Again Near Normal

Reserve Board Head Urges Business on Substantial Lines—Defends Bank Forms

KANSAS CITY, May 23—Governor Harding of the Federal Reserve Board came to Kansas City Saturday as the guest of the Kansas City Motor Car Dealers' Association. In two conferences with directors of the association and representatives of the industry from the various states of the Tenth Federal Reserve District and in an address to 350 bankers and automotive distributors of the district, the Governor declared that methods of handling paper offered for rediscount could now be changed in view of the strong situation of the Federal Reserve Bank. **He implied that individual banks were also in unusually strong position, and could doubtless modify the restrictions they had been making.**

Governor Harding went so far as to urge aggressive merchandising, and there was more than a hint that the conditions of banks offered a welcome to borrowers for legitimate business purposes. There was also more than a hint that among these borrowers, especially among those whose papers would be acceptable to all Federal Reserve Banks, was the automotive industry. Governor Harding did not explicitly declare that motor car paper would now be rediscounted at all Reserve Banks, but he gave suggestions to the distributors present on preparing forms in such a way that their paper could be handled with a minimum of delay in rediscounting processes. The explicit prediction that paper heretofore not accepted for rediscount might soon be accepted was made by Governor Miller of the Kansas City Bank, the Federal Reserve Bank of the Tenth District, which has not rediscounted motor car paper for many months.

Meet in Conference

Governor Harding was met by the directors of the Kansas City association at the train Saturday morning. At breakfast and during the motor car ride following with the distributors and again in the afternoon Governor Harding discussed with the dealers the relation of the Federal Reserve Banks to the automotive industry. The afternoon conference included representatives of automotive associations from many States. Governor Harding spoke at the City Club at noon; outlining the financial history of the past two years. His main address was at the dinner in the Muehlbach Hotel given by the Kansas City Motor Car Dealers' Association in his honor, at which 350 local and territory bankers and automotive distributors of passenger cars, trucks and tractors were present. E. E. Peake opened the meeting, John B. Butler, president of the Kansas City association, acting as toastmaster. The governors and chairmen of the Federal Reserve Banks of San Francisco and Minneapolis, who had come to Kansas City for conferences with Governor Harding, were introduced. The toastmaster then called on J. Z. Miller,

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New Goodyear President a Schlesinger Protege

MILWAUKEE, May 23—Edward G. Wilmer of Milwaukee, who on May 17 assumed charge of the Goodyear Rubber & Tire Co. of Akron as president, has been for several years regarded as one of the coming leaders of business and finance in American affairs. He is 38 years old and a graduate in law at George Washington University, Washington, D. C., but he never has devoted himself to exclusive practice.

Upon being graduated, about twelve years ago, Wilmer was engaged by the late Ferdinand Schlesinger of Milwaukee, one of the most prominent figures in the American iron, steel and chemical industries, as a personal adviser and legal representative. Wilmer rose rapidly and became one of the most prominent men in the vast Schlesinger enterprises, serving as vice-president of the Steel & Tube Co. of America, a consolidation of a dozen large concerns; the Newport Co., one of the largest chemical concerns in the world, and the Milwaukee Coke & Gas Co. He is regarded as one of the keenest business executives, particularly in financing, that this country has produced in the last decade.

His accession to the presidency of one of the world's largest rubber and tire concerns is recognition of this remarkable ability. It also is significant of the entrance of the vast Schlesinger interests into a new field and a financial participation in the reorganization of the Goodyear company, which is backed by a historic record in iron, steel and chemicals.

THOMART TRUCK CUT $690

KENT, OHIO, May 21—The Thomart Motor Co. announces a reduction of $690 in the price of the Akron multitruck chassis, making it $1,995, f.o.b. Kent. The explanation is made by W. G. Thompson, president of the company, that the company's inventory has been liquidated and that production costs have been reduced to such a point that a lower price is justified.

Parts Orders Drop in Last of Month

Factories Report Hold Up in June Releases—Price Uncertainty Held Cause

NEW YORK, May 25—Uncertainties in regard to retail market conditions are leading manufacturers of motor vehicles to proceed with extreme caution in making commitments for materials. This fact is disclosed by reports made by the leading motor and accessory manufacturers of the country.

The total of business for May probably will equal that of April, but it was heavier for the first two weeks than for the first half of last month. Since that time many releases have been countermanded and there have been a few cancellations of new orders. Indications now are that the volume of business for June will not equal this month. A considerable number of June releases have been held up in the last ten days.

While orders for supplies are showing a tendency to decline, however, collections for May have been better than at any time since the slump began. The gratifying improvement recorded in April has continued and in numberless cases past due accounts have been liquidated. There has been heavy liquidation in the last three months in the current indebtedness of automobile manufacturers, and there is no evidence that payment of obligations in future will be any less prompt.

Although parts makers have felt a slowing up in business from vehicle manufacturers, there has been no slump whatever in the trade with jobbers and wholesalers. In fact, it has steadily continued its upward trend, and June promises to be better than May. Collections in this branch of the trade are excellent.

It is evident car and truck makers are determined not to pile up inventories. The experience of last summer in this direction has made them exceedingly wary. They are buying on a hand-to-mouth basis to meet only immediate needs. The falling off in orders from them is bound up closely in the question of price cuts.

Lines which have not cut have suffered a sharp decline in sales, while those which have made reductions this spring have felt a marked rebound. The buying public seems to take no further account of price reductions made last fall. The market is decidedly jumpy and gives every evidence of needing the stabilizing influence which would come with immediate determination by manu-

(*Continued on page 1136*)

Dealers Protest Excise Tax Burden

Senators Are Told Why Levy Is Unfair

Harry Harper Spokesman for N. A. D. A. Committee—Strong Arguments Presented

WASHINGTON, May 23—Vigorous protest against the assessment of proposed increases in the excise taxes on automobiles and other forms of discrimination was made here to-day by the National Automobile Dealers' Association in presenting its recommendations for internal revenue revision to the Senate Committee on Finance. It expressed the belief that any further addition in taxes upon the motor vehicle would have to be borne in large measure by the dealers and that the sales resistance engendered by such increase would seriously jeopardize the success, progress and prosperity of the entire industry. While the general tax program of the Association is in harmony with the plan of the National Automobile Chamber of Commerce, its argument differed in that it showed the harmful tendencies of present and proposed taxes from the standpoint of the dealer.

The case of the organized dealers was presented by H. B. Harper, chairman of the association's taxation committee. The Senate committee listened attentively and there were few questions to interrupt his speech. He escaped the grilling which the committee forced upon witnesses for the manufacturers.

Harper pointed out to the committee that the interests of the dealers are separate and distinct from those of manufacturers. He said that dealers are large tax-payers in their own communities in addition to taxes paid to the Federal Government: excise, excess-profits and income taxes. It was his contention that the automobile industry as a whole is not protesting against its fair share of taxes but believed it was time for a more equitable distribution of the tax burden to other commodities and trades.

Dealer Mortality Highest

As to the reported profits of automobile dealers, Harper directed the attention of the committee to the fact that the average dealer nets a profit of between 3.5 per cent and 4.5 per cent of his gross sales. He laid emphasis upon the contention that "in no other American industry is the mortality so high as among automobile retailers. Hundreds of dealers, in order to stimulate the sales that have fallen off so noticeably in the last six or eight months, are absorbing the tax and the handling charge and in addition, in 90 per cent of all sales they are taking in a used car for considerably more than its value in order to sell, mainly for the sake of keeping their organizations moving and looking forward to a betterment of business conditions."

To establish the fact that the automobile is essential, the spokesman declared that it is a business car first and foremost and any recreational uses it may have are but incidental to its primary purpose, which is personal transportation. Sixty per cent of all automobile mileage is for business purposes. Ninety per cent of all automobiles are used, more or less, in business. Instead of being a burden upon its owner, the automobile has added 57 per cent to the productivity and effectiveness to the average automobile owner.

Denial was made of the theory that a tax on automobiles is to pay for surplus wealth. Harper said: "The tax

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Business Paper Editor to Be Hoover Assistant

NEW YORK, May 21—Fred M. Feiker, vice-president of the McGraw-Hill Co., Inc., and one of the best known men in the business paper field, has been appointed assistant to Secretary of Commerce Hoover, to assist the department in effecting a contact with business. The Secretary is also holding monthly conferences with the National Conference of Business Paper Editors, with which work Feiker has been very active.

Feiker has been engaged in business paper work for fourteen years. He received an electrical engineering degree at Worcester Polytechnic Institute in 1904, was two years in the technical publicity department of the General Electric Co., went with the Shaw papers to start *Factory* and became chairman of the editorial board, remaining eight years with Shaw. He then joined the McGraw-Hill Co. as editor of *Electrical World*, and became vice-president of the company.

He has secured a leave of absence of several months from the McGraw-Hill Co., with which he has been for six years, and expects to begin his work with Hoover before June 1.

LEACH OFFICERS RENAMED

LOS ANGELES, May 23—M. A. Leach was re-elected president and all members of the board of directors also were renamed at the annual meeting of the stockholders of the Leach Biltwell Motor Co. Other officers also were reelected. More than two-thirds of the stockholders were present. Financial reports showed that the company had successfully weathered the depression.

Canada Tax Finds Favor of Dealers

Domestic Made Vehicles Will Be Benefited Over United States Products

TORONTO, May 21—Realizing the Government's need of revenue, the motor manufacturers, importers, distributors and dealers are not disposed to adversely criticize the budget. The importers of United States cars and trucks are faced with a considerably greater additional impost than the distributors and dealers in domestic made motor vehicles for not only do they face a doubling up of the sales tax, but also an increase in duty arising out of the new basis of its determination—the United States price plus exchange.

They are naturally not jubilant over the change, especially as it slightly increases the differential in favor of Canadian-made cars and trucks. However, this offsets the advantage given the importers under the initial imposition of the so-called sales tax.

On the whole, the automotive trade and industry is delighted that automotive products have not been singled out for special taxation, especially as this is generally believed to indicate an appreciation by the Government of the fact that motor vehicles are no longer luxuries or non-essential, but utilitarian necessities—the greatest of time and labor-saving devices.

In giving the lie to wildcat rumors to the effect that extortionate taxes were to be imposed—rumors that carried with them the assurance that they were inspired by authorities in the confidence of the Government—the budget relieved the minds of many who lent these rumors credence, of apprehensive tension and anticipatory worry.

The duty now applies on the United States manufacturers' price plus exchange at time of shipment, and the sales tax applies on the resultant. Comparatively, however, the prices of cars have not been much advanced, and some not at all.

ADD EMBEZZLEMENT TO THEFT

WASHINGTON, May 23 — Senator Nelson's bill amending the "Act to punish transportation of stolen motor vehicles in interstate or foreign commerce," was passed by the Senate without change. The amendment adds the word "embezzlement" so as to include not only cases where the automobile is stolen but as well cases of embezzlement. It relates to transportation of embezzled property in interstate, not in state commerce.

Willys's Cars Join in New Price Cuts

Overland Down to New Low Point—Knight Drops $300—Scripps Off $250

TOLEDO, May 20—Willys-Overland and Willys-Knight have announced price reductions effective June 1 constituting the second drop in Overland cars within the last year, totaling 33 per cent from the price last summer. Open models now selling at $895 are reduced to $695, coupe from $1425 to $1000, and the sedan from $1475 to $1275. Willys-Knight prices for the touring car are reduced from $2195 to $1895 and the same reduction is made on the roadster. The coupe was reduced from $2845 to $2550 and the sedan from $2945 to $2750.

The new price on Overlands is $150 less than the lowest price for which this car ever sold. It is made possible, according to John N. Willys, by the sale of the car which already has passed the 140,000 mark and by the anticipation of the great saving through increased factory efficiency, manufacturing cost and increased volume.

"We have decided to anticipate every possible saving and are setting our prices at rock bottom June 1," said Willys. "We are going the whole route right now. The price is one which we have long anticipated we might some day reach in Overlands and the car itself is better than ever. At present we will take a loss on every Overland we sell, but expect to make this up in increased volume and increased material saving."

Scripps Reduction $250

DETROIT, May 21—The Scripps-Booth Corp. announces a price cut averaging $250, effective to-day. Prices for the touring car are $1,295, roadster $1,275, coupe $1,950, sedan $2,100. This is a decrease on the touring car of $250, roadster $270, coupe $265 and sedan $195. This is the first cut for Scripps-Booth, but the company did not increase prices when others did last spring and summer.

Ford Discontinues Bonus; Will Increase Wages

DETROIT, May 20—The Ford Motor Co. has abolished the yearly bonus, according to the Ford *News*, its official organ, and in lieu thereof has increased wages in an amount aggregating what each employee would receive annually under the bonus system. This is paid in 26 installments on the regular semimonthly pay day. Announcement was made this week that the bonus was being paid in installments in order to protect men leaving before the end of the year. The *News*, however, corrects the announcement and states it is designed as a wage increase and applies to every man on the payroll May 1.

The statement also says the plan to supplant the bonus was decided on last January, and all employees on the roll May 1, who have been working since the plant reopened in February, will receive back pay in an amount equal to the difference between the wages already received and the amount they would have received under the increased wage plan.

In order that every employee may understand the bonus has been discontinued and know what his increased rate will be, together with the number of back payroll hours to which he is entitled, cards bearing the information are being inserted in pay envelopes. Men employed since May 1 are being paid the standard rate, which the *News* says provides a minimum of 75 cents an hour. Discontinuance of the bonus does not affect the investment plan under which employees may invest up to one-third of their wages.

Paige Report to Show Satisfactory Earnings

DETROIT, May 21—The annual report of the Paige-Detroit Motor Car Co. is now being prepared and is expected to show satisfactory earnings. In the first quarter of 1921 Paige shipped 3004 cars, against 4755 the first quarter of 1920. Since the first of the year the company has paid off all supply bills and is in a position to discount all its bills. Its bank balances are around $1,000,000 and bank loans have been cut in half. The company now is operating on a 60 per cent basis, turning out between 50 and 60 passenger cars a day. The reduction in production schedules was ordered in anticipation of unsettled market conditions. Best sales conditions are found in New England, New York and Pennsylvania, with Ohio, Indiana and Wisconsin coming next.

Employment Drops Off First Time in Months

DETROIT, May 20—A net decrease of 1776 men employed was shown by the labor report of the employers' association here today. It was the first week the employment situation had not improved by several thousand since the industrial revival began. The 79 member firms now employ 116,721 workers.

TRUCKS NOW SECOND CLASS

NEW YORK, May 23—The traffic department of the National Automobile Chamber of Commerce has been advised by the chairman of the western classification committee that favorable action has been taken on the request for reclassification of motor trucks and chassis shipped in carload lots west of Chicago and the Mississippi River. This classification will be changed from first class to second class. The consequent saving in freight charges on a 15,000 lb. load of trucks will amount to $35.35 on shipments to Kansas City or Omaha; $68.25 to Dallas, Galveston and Houston, and $88.50 to Denver with other western points in proportion. Pacific Coast rates are not changed.

Used Cars Pile Up as New Sales Grow

Coast Business 85 Per Cent Trade-Ins—Lower Gasoline Stimulates Demand

SACRAMENTO, CAL., May 23—Developments of the spring have worked for the benefit of motor car dealers here, generally speaking. Business has returned to a semblance of pre-war conditions, although disturbing factors have not been wanting.

One of these is the recent price drops of some cars. These have worked to the advantage of the dealers in these lines, but on the other hand, have caused some little difficulty among would-be purchasers of other makes, who show a tendency to hold off in the hopes of more price cutting.

The reduction in the price of gasoline, coupled with the announcement that there is plenty of motor fuel in sight for the summer, has stimulated sales. The uncertainty of gasoline last year was a very disturbing factor to the trade here.

The used car market is sluggish. Second-hand cars are piling up, as 85 per cent of the sales here are estimated to be trades for old cars. Vacant lots about the city are being used to store and display these used cars, which are the chief concern of the dealers.

The Miller Automobile Co., Dodge dealers here, have instituted the practice of rebuilding all used cars taken in, turning them out with a "Maco" guarantee. This has been quite successful, as has also the plan of the Sacramento Buick Co. along the same lines, in rebuilding, repainting and retopping its used cars and selling them with a new-car guarantee.

Pointing out that the buyer of a used car saves the dealer's profit, war tax and freight charges, the latter not inconsiderable in this territory, these two firms have been keeping their used car departments quite clear of any undue accumulation of second-hand automobiles.

CHEVROLET MOVES OFFICES

NEW YORK, May 20—The production, material, purchasing, traffic, engineering and production and plant engineering departments of the Chevrolet Motor Co. have been moved to Detroit on April 15 and will be located in the General Motors Building. These departments will be under the general direction of K. T. Keller, manager of manufacturing. The offices of the general manager and of the general sales and accounting departments remain in New York.

INDORSE RETURN GOODS CHARGE

CHICAGO, May 20—The Midwest Rubber Manufacturers' Association at its meeting here adopted a resolution recommending that a minimum charge of 5 per cent be imposed on merchandise returned for credit or exchange or on the shipment of new goods.

Price Concessions Necessary, Says Bank

Appreciation of Reductions Will Stimulate Business, Declares Wisconsin Institution

MILWAUKEE, May 23—"There is some uncertainty as to whether or not the improvement in the motor car industry is permanent," says the May issue of *Business and Financial Comment*, issued monthly by the First Wisconsin National, the largest bank in Milwaukee. "Judging from recent and somewhat radical reductions in the prices of passenger cars and tires, concessions were found necessary to stimulate new business and hold the ground gained early in the year. So far as Milwaukee is concerned, the automotive equipment industry did not gain as much in the past month as in the previous month. Orders were more numerous, but probably ruled 50 per cent below the corresponding month in 1920. Operations are running on the average from 45 to 55 per cent. The trend of prices is regarded as uncertain."

Speaking of the Milwaukee metal trades, the report says: "The metal trade shops, with the exception of those supplying the automotive industries, practically marked time during the past month. All lines using iron and steel are clouded with uncertainty and improvement is contingent upon wages and prices in the basic industries. Machine shops of all descriptions in Milwaukee are probably operating on the average of not more than 40 per cent. Certain firms supplying machinery for road making, oil production and the automotive market make a better showing. In the steel industry at large, sheets and structural materials for building make up the greater proportion of the available business."

In the last week to ten days a number of passenger car manufacturers in and near Milwaukee have reduced production schedules because of the accumulation of finished products resulting from a decline in distributers' and dealers' orders in the first half of May, largely because of adverse weather conditions. This is believed, however, to be only a temporary matter, as new business is again developing more actively.

Business Made to Improve

Encouragement is found in the keynote paragraph of the First Wisconsin's review, which says: "The events of the last 30 days have yielded much justification for confidence. Business improvement cannot be expected unless somebody does something to make it improve. A good deal of appreciation is now being displayed. Just as depression resulting from sharply falling prices last year spread from some lines of business to others, so renewed activity in cotton and woolen goods, motor vehicles and new construction applies a stimulus to set other lines of trade going again.

"Prospects are brighter than they have been for many months. But much remains to be done before this depression will become a memory. The sticking points that will still have to be overcome are: The readjustment of labor costs in conformity with the movement of prices; the reconcilement of prices with one another; some having gone too low and others not low enough; and perhaps most important of all, the devising of means whereby we can use our superior credit position as a basis of selling goods to foreign countries."

Los Angeles in Turmoil

LOS ANGELES, May 24—Dealers here refuse to commit themselves to an opinion upon the effect of announcements of price reductions upon the automobile sales conditions. One point upon which all agree and none is reluctant about expressing an opinion is that the used car business is again in a state of turmoil. One dealer is reported to have said the price reductions announced within the past two weeks have cost him $10,000 in shrinkage on used car values. It is too early now to hazard a prediction as to the stimulus that will result in increased sales of those cars prices of which have been reduced.

The Al G. Faulkner Co., California distributor of the Marmon, has been placed in the hands of a receiver upon petition of the Nordyke & Marmon Co., which is said to have claims against the dealer amounting to $150,000. The Faulkner company has been operating on a large scale throughout the State. Two large establishments have been maintained here and another in San Francisco.

Cleveland Acts to Stop Ohio Truck Weight Bill

CLEVELAND, May 23—The Cleveland automobile industry has never been aroused over a matter as it has been with respect to the Burke bill, which limits the weight of truck loads. The measure has been passed by the general assembly and it is now awaiting the signature of the Governor before it becomes a law.

One hundred representatives of the city's automotive and commercial interests at a meeting in the Hotel Winton unanimously voted to send a delegation to Columbus to protest against the bill, which was pronounced an "economic disaster" should it become a law, not only to Ohio's truck and tire industries, but also to every consumer who benefits from transportation provided by trucks.

SPROUL SIGNS FUEL TAX BIIL

HARRISBURG, PA., May 23—Governor Sproul to-day signed the "cent-a-gallon" gasoline tax.

This law affects every sale of gasoline to a consumer in Pennsylvania. More than $2,000,000 a year will be realized in revenue by the measure's operation.

The tax becomes effective on Sept. 1. It is estimated that Philadelphia, for instance, will receive $350,000 a year.

Reduced Cars Hold Sales Leadership

Wholesale Business Advances in New York Territory—Truck Sales Grow

NEW YORK, May 21—The passenger cars whose prices have been reduced within the past three weeks are still selling strongly in the New York territory. In most cases retail sales have not been as strong as they were during the first week, but the volume of business, as compared with what it was before the reductions, is satisfactory to the distributors and branch houses concerned. In the wholesale, the past week's volume of business has been considerably better than the first week of the reduced prices, indicating that out-of-town dealers have not been able to take their story to the public quite as quickly as metropolitan merchants.

In the case of two or three cars whose prices were reduced during the present week, the response of the buying public was practically instantaneous and there is a more general feeling among New York distributors than there was a few months ago that the price question is of paramount importance in the view of the public.

In lines which have not cut, or if they have cut did so months ago, there is marked stagnation. One or two of the most popular lines in this class have come somewhere near resuming their old stride after two weeks of slow sales immediately following the most sensational of the price cuts. However, even these lines are having to batter down strong sales resistance based on the price question. Some other lines which hitherto have been selling well have been practically standing still since May 1. Generally speaking, business outside of that enjoyed by dealers in cars recently reduced in price cannot be said to be good.

Truck sales are showing a slightly upward trend. Sales are particularly good in two or three classes of low and medium priced light weight trucks.

The heavier trucks are beginning to feel the competition of offerings here of American and foreign trucks brought in from former war areas of Europe, and priced at low figures. When these trucks first appeared in the open market, buyers were suspicious of their condition and sales were not numerous. Within the past two or three weeks, however, there have been enough of these sales to cut in a considerable degree the revenues of dealers and branch houses handling several prominent lines.

Accessory sales continue to run along on something like 60 per cent of last year's volume.

TRUCK MERGER EFFECTIVE

KENOSHA, WIS., May 20—The merger of the Winther Motor Truck Co., the Marwin Motor Truck Co. and the Kenosha Wheel & Axle Co. became effective to-day.

Crop Outlook Helps Business in South

May Leads April in Sales and Prospects Are Numerous—Credit Steady

NEW ORLEANS, May 23—The period of readjustment in the automotive industry in the territory supplied by the dealers and distributors of this city seems to be nearing an end. May sales, up to the 20th of the month, were greater for virtually every dealer in New Orleans than they were for the first three weeks of April, while prospects were reported as more numerous than they had been since June, 1920.

This steady improvement in automobile sales is considered by the dealers to be due, to a great extent, to the recently-devised co-operative sales plans for the cotton crop, and the revival of the War Finance Board, with accompanying aid from it in disposing of the South's cotton in Europe. Two other considerable factors are the temporary tariff on sugar, the effects of which already are being felt in an increased optimism among the sugar planters and their workmen, and the development of a better class of automobile salesmen.

Payments are much steadier and more regular, and collections considerably easier than they have been since last year. Improvement in this regard also is shown in the country, where conditions generally have been much slower to readjust themselves than in the cities. Improvement in collections has been so great that virtually all the New Orleans dealers are taking their cars promptly out of the railroad warehouses, meeting their notes as they fall due, and discounting some of their paper in advance.

All this has put the dealers on a more independent footing, and has considerable influence with the banks, for some of the short-sighted bankers, it must be said, were expressing themselves widely and freely as to the doubtful future of the automotive industry. All of these doubters have been discredited and cast out by the gain in this industry in the past 60 days in all the Southern states.

One of the greatest aids in this development, especially among the Louisiana dealers, has been the steady, consistent and encouraging work of the New Orleans Automobile Dealers' Association.

TEXAS ROADS TO OPEN STATE

FORT WORTH, May 20—With the spring time and the new automobile season has come the greatest road-building boom in the history of North and West Texas. Pikes costing $50,000,000 are under construction from the four corners of the state. And on top of this huge sum, bond elections will be held in many farming and ranching communities this month to authorize more funds.

Each new bond issue voted and each new highway contract awarded means sections hitherto inaccessible to the machines will be opened up.

STUDEBAKER BUSINESS NEAR YEAR'S TOTAL

NEW YORK, May 20—A summary of sales of Studebaker cars in the Greater New York district to April 30 shows 1029 sold to this time, only ten less than for the whole year of 1920. Sales in April were 386 cars, as compared to 149 in April, 1920. The 1029 cars sold in the first four months of this year represent an increase of 529 over sales for the first four months of 1920.

Toledo Plants Active As Business Revives

TOLEDO, May 23—There are 1200 workers now on the payroll at the plant of the Electric Auto-Lite Corp., one of the subsidiaries of the Willys Corp., according to C. O. Miniger, president. Two weeks ago the force numbered only 800. The farm lighting business as well as the automobile lighting plant orders are picking up, he reports.

Nearly 200 men are now being employed at the Toledo Chevrolet plant where transmissions are assembled. A few at a time are being called back to work.

Daily additions to working forces are also being made at other automotive equipment plants here. The Mather Spring Co., the Bunting Brass & Bronze Co., the Milburn Wagon Co., and the Champion Spark Plug Co., all report increased business in the last two weeks.

Premier Starts Suit for Skelton Insurance

INDIANAPOLIS, May 21—Payment of a $200,000 insurance policy on the life of L. Sherman Skelton, former president of the Premier Motor Corp., is being fought by the Travelers Insurance Co. on the ground that Skelton misrepresented the condition of his health when he took out the policy. A cross complaint was filed by the insurance company in answer to a suit brought against it by the Premier Motor Corp. and other administrators of the Skelton estate, who sought payment on the policy under which the Premier company was the beneficiary. The policy was assigned by the motor car company to the Fletcher American National Bank of this city.

CONFER ON BRAKE LININGS

WASHINGTON, May 20 — Recommendations for a standard method of testing brake lining materials for automotive purposes, made following a recent conference at the Bureau of Standards, were discussed last week by engineers of the bureau with representatives of nearly all the manufacturers of this class of material, as well as of the Motor Transport Corps and the standards committee of the Society of Automotive Engineers.

Continued High Sale Looked for in June

Central Ohio Territory Finds Weather Big Aid—Truck Business Increases

COLUMBUS, May 23—With the arrival of better weather conditions, there is a noticeable increase in the demand for automobiles in Columbus and central Ohio territory. This is the report of a large number of retailers in the passenger line of vehicles and it is believed by them that conditions will continue to improve from this time on. At least preparations have been made for a good demand for passenger cars during the month of June and possibly for a portion of July.

Dealers in passenger cars report a growing demand for closed jobs. The closed body is now the popular thing and there is a growing scarcity of such cars in central Ohio territory. Touring cars are still selling well and the open runabout is also in good demand.

In the farming sections a gradual increase in the demand for cars is reported and dealers in the strictly rural sections are becoming quite busy again.

Truck sales are now increasing appreciably. For a time there was a lull in the demand for trucks, but now commercial houses are doing considerable shopping around. The strongest feature of the commercial vehicle market is for the one, the one and a half and the two-ton trucks. The heavier trucks are not selling as well as the lighter varieties. The light delivery wagon is moving fairly well under the circumstances.

There is also a sort of spurt in the repair business in Columbus. All of the service stations and many of the repair shops report a good run of business. The overhauling of passenger cars is going on rapidly and most of the larger shops are pretty well crowded with work. Parts departments are doing a good business and many replacements are being made.

GASOLINE STOCKS INCREASE

WASHINGTON, May 20—Increased use of automobiles is reflected in the refinery statistics of the Bureau of Mines, showing that the daily average consumption of gasoline for March was 2,600,000 gal. larger than that of February, and 2,900,000 gal. than in March, 1920. The daily average production of gasoline for March was 322 gal. less than the production for February, though it exceeded the production for the same month last year by 165,000 gal. Stocks of gasoline increased during March to 713,043,480 gal., the largest stock of gasoline on record.

The daily average production of lubricating oils was 2,354,945 gal. during March, a decrease of 232,000 gal. Total stocks of lubricating oil on hand at the refineries March 31 amounted to 223,414,093 gal. as against 130,632,597 gal. for March, 1920.

Dayton Entertains Engineer Delegates

McCook Field Inspection Followed by Instructive Talks on Aircraft Studies

DAYTON, OHIO, May 21—Several of the S.A.E. members en route for the West Baden convention, and members of the A.S.M.E. bound for their Chicago meeting, were entertained here to-day by the Dayton Section of the S.A.E., McCook Field and the Dayton Engineers' Club.

Given as a joint meeting of the A.S.M.E. and S.A.E., those who attended were afforded an unusually complete exhibition of all types of aircraft both on the ground and on the wing. During the entire morning McCook Field was thrown open to the engineers, who were taken on a complete tour of inspection through practically all the departments.

After luncheon at the field a technical session was held at which military and civilian members of the McCook field staff presented a series of papers covering phases of airplane engineering. The evening was given over to a dinner at the Engineers' Club where C. F. Kettering, Joseph Steinmetz, head of the aircraft section of the mechanical engineers and V. E. C. Handley Page, were the speakers.

Twenty planes of all descriptions were lined up on the field, eight of them taking the air. Among those flying were the Junker all-metal plane, the big 1200 h.p. Caproni, and the 60 h.p. Messenger, which, with its three-cylinder engine, afforded an interesting contrast with the roaring giants equipped with two and three Liberty engines.

Members of both societies exhibited greatest interest in the radio-controlled wagon which was started, stopped and steered to left and right by wireless. The wagon is a torpedo-shaped box and its manipulation from a distant station made its movements seem almost uncanny as it would run up to a group of visitors, stop, blow a horn, ring a bell and then whirl about and start off in another direction.

Technical Session Interesting

The technical session proved to be one of the most interesting aeronautical meetings the S.A.E. has held. Papers were presented on aluminum air-cooled cylinders, by E. H. Dix, Jr.; radio-telegraphy and telephony by O. E. Marvel; carbureter design, C. F. Taylor; radiators, Lieut. Bayard Johnson; camouflage, C. R. Young; air-cooled engines, S. D. Herron; air photography, Lieut. E. E. Aldrin, and synchronization of propeller and machine gun fire by H. O. Russell.

Through these varied papers the engineers present were given a rapid panorama of late developments in the field of airplane activity. Speaking of the attempts to cast an aluminum air-cooled head on a steel cylinder, Dix stated that experiments had gone far enough to show that the idea is feasible. In effecting a juncture between the steel and aluminum various coatings were used. Tinning and sherardizing were best with advantage in favor of the latter because the melting point of zinc is higher. Micro-photographs of steel cylinders with the aluminum head show that there is a good juncture between the two metals. After various experiments for materials to be used as valve seat inserts and spark plug bushings, low phosphor-bronze has been found best because of the nearness of its coefficient of expansion to that of aluminum.

Discuss Aluminum Alloys

In making the castings elaborate care must be taken to prevent cracking. The cores in the later castings are being preheated to 500 deg. Fahr. before pouring and then the entire mold is placed in a core oven and kept at 500 deg. Fahr. for an extensive length of time. The best aluminum alloy for the purpose so far has been aluminum-silicon. Its strength falls off 2½ per cent at 300 deg. Fahr. and 20 per cent at 500 deg. Fahr. It is satisfactory within the limits of working temperature in the engine. It is also good on porosity test. The Bureau of Standards is at present obtaining data on other physical characteristics. The alloy has about 7 per cent silicon.

In discussing air-cooled engines generally Mr. Herron stated that it is now possible to show just as good m.e.p. and output figures as with water cooled, without the disadvantage of freezing in a nose-dive. To date, 12 cylinder engines up to 240 h.p. have been built and give satisfaction. Brake m.e.p.'s of 130 lb. per sq. in. have been attained and the cylinders have been built up to 8 by 10.

Lieut. Johnson in discussing airplane radiators pointed to the depth of core possible because of high air velocity. He stated this to be the leading difference between airplane and automobile radiators. For the Liberty engine it is necessary to pump 73 gal. of water per min. through the jackets to meet the required minimum of 18 deg. heat range. For this reason there must be no restriction of flow.

The method of testing radiators is to climb the machine at its maximum rate and then take readings at every 1000 ft. The results are plotted curves of mean water temperature and air temperatures being drawn.

Plea for Cheaper Planes

At the dinner both Messrs. Handley Page and Kettering made a plea for lower-priced planes and engines. Kettering said that the first step in securing "commercial aviation" would be to develop a 150 h.p. engine to sell at $750. The reason there is no commercial aviation to-day is because there are no planes which can be built economically. To put it in his own inimitable way, "There are too many gim-cracks—There is not enough intelligent ignorance among aircraft engineers—There are too many reports on matters which 'can't be done'."

Non-Combatants Offer Strong Car Markets

Studies by Secretary Hoover Show Stabilized Exchange Helpful Factor

WASHINGTON, May 26—Study of markets for American automobiles in the Netherlands, Norway, Poland, Spain, Sweden and Switzerland as conducted by the Commercial Attachés of the Department of Commerce shows that American exporters have a wide field which could be easily cultivated to their advantage. Results of the survey are made known in the second of a series of reports on the European industry and trade. Most of the countries which maintained neutrality during the recent hostilities show evidence of stability in exchange, an important factor in the development of American foreign trade.

Holland is less affected by the depressing conditions in the European market for the sale of motor cars than any other country on the continent except, perhaps, Spain. Official reports indicate that money is available and that the American producers control the market to a greater extent than other nations, although the French cars manufactured have a good standing in this country. With the exception of the Spyker plant, which produces about 100 cars per month on the 1921 schedule, there is relatively little domestic production of cars. The Spyker is a six cylinder car selling for approx'mately 20,000 florins.

There are 27 American agencies listed in Holland, as compared with 26 French, 24 English, 19 German, 7 Italians, 3 Dutch, 3 Belgium and 1 Swiss. The simplicity of the American design and the interchangeability of parts with the quick supplying of spare parts are advantages that the European makers do not afford their customers. In the opinion of C. S. Johnston, Commercial Attaché at The Hague, the matter of service is very important and should be developed because the best sellers are those combining the lowest first cost and economical maintenance and operation. He believes that Europe has long been acquainted with the small-bore high-speed motor which has demonstrated to the satisfaction of the buyer that it is not an extravagant fuel user and is the most economical car to own.

Waterways Handicap Trucks

The waterways of Holland have a natural tendency to prevent the development of a large truck business. It is reported that American truck producers who have investigated the situation feel that it will not be worth while to force the market with anything over a 1½-ton truck. The narrow streets and roadways make it impracticable to operate heavy trucks. The emigration to America has stripped many of the farms of their labor supply and, as a consequence, has directed interest to farm machinery.

(Continued on page 1136)

Tractors and Horses to Meet in Contests

N. I. V. A. Arranges Series of Meetings to Demonstrate Mechanical Economy

CHICAGO, May 23—The National Show and Demonstration Committee of the N. I. V. A. has decided to hold a series of contests between horses and tractors in field operations. There will be three demonstrations, the first of which is scheduled for Fargo, N. D., June 28, 29 and 30. Another demonstration will be held in the Southwest and the third in the Central West, time and location of each to be decided later.

Two shows also have been authorized; one for Minneapolis and the other for Kansas City, provided suitable quarters can be furnished rent free, and provided also that all other suitable and satisfactory arrangements can be made between the local and national committees.

The horse and tractor contest is of special interest and in order that the results of these comparative tests may be unbiased, fair and convincing, the committee resolved that:

"The observations and data for such records be taken by a committee composed of representatives from the American Society of Agricultural Engineers, from the State University either of the State where the demonstration is held or the university of any other State; from tractor manufacturers, from the Society of Automotive Engineers, from the Horse Assn. of America and from the United States Department of Agriculture."

As an inducement to secure the very best horsepower available, it was decided to award suitable prizes to horse owners entering the contest and making the best records on the cost of preparing their land allotments.

The dollars and cents cost comparison between horse power and tractor power in plowing and preparing seed bed as provided in these demonstrations will not take into account some of the most vital considerations in successful tractor operation, especially belt work, but new rules are provided by the committee so that manufacturers of belts and belt driven machinery of any kind, operated with a tractor, are eligible to exhibit at these demonstrations. It is expected that the educational work of belt operations will be among the most interesting features of the demonstrations.

No individual records of tractor performance and no comparisons between individual tractors will be given out for publication by the committee in charge of the demonstration. Each tractor manufacturer, however, will be provided with the record of his own machines.

JANESVILLE BUYS TRAILERS

JANESVILLE, WIS., May 23—The Janesville (Wis.) common council has placed a contract with the Highway Trailer Co. of Edgerton, Wis., for four 2½-ton trailers with dump bodies and hoists as initial equipment of a new municipal garbage collection system. The trailer is a special design known as the Highway Garbage and Ash Trailer, which is now being manufactured in quantities for municipalities. The cost of the four trailers is $7,280, less 25 per cent, f.o.b. Janesville, or net $5,460.

Delaware Law Requires Ownership Certificate

WILMINGTON, DEL., May 23—Under a law passed at the last session of the Delaware Legislature, which becomes effective June 1, a sworn certificate of ownership, with minute details of the car, must accompany every application for a motor license in the State. New forms, in compliance, with this law, have been issued by Secretary of State Alden R. Benson. They require the name of the owner of the car, with his business and home address, also a complete description of the vehicle, under oath taken before a notary.

There is also space on the form for the name and address of the vender from whom the car was obtained. All of this information must be sent to the office of the Secretary of State, in Dover, where it is kept on file. The penalty for making a false statement is a fine varying from $500 to $5000, or imprisonment from six days to five years.

The effect of this law, it is understood, is that every sale of a motor vehicle shall be known to public officers, and it will be kept on file.

After Sept. 1 it will be unlawful to have in one's possession a motor vehicle for which a certificate of title has not been issued.

BAR ACCESSORY INSURANCE

ATLANTA, May 21—The Southern Underwriters' Conference has decided to write no more insurance against the theft of automobile accessories. This action has been taken because of heavy losses on the theft of such equipment as spotlights, motormeters and spare tires. These losses have been general throughout the South. The Southern Underwriters' Conference comprises the States of Virginia, North and South Carolina, Georgia, Florida, Alabama, Louisiana and Arkansas. Practically every insurance company in these states is a member. Insurance now in effect will not be cancelled until it expires.

WISCONSIN ADDS NEW MODEL

MILWAUKEE, May 23—The Wisconsin Truck Co. of Loganville, Wis., engaged for three years in manufacturing motor trucks for general farm and light commercial trucking, has added to its line a larger model produced for several years by the Luverne Motor Truck Co. of Luverne, Minn., with which the Wisconsin company is closely affiliated financially. The larger model is equipped with a six-cylinder Continental motor and has a capacity of three tons.

Inspection to Lower Insurance Losses

Wisconsin Agencies Make Careful Survey of Risks to Prevent Imposition

MILWAUKEE, May 23—In several cities in this section automobile insurance agencies are inaugurating an inspection service as a device to lower the losses of insurance companies, especially on theft and collision coverages. As is becoming known, some companies are declining to write full collision policies. Others are now beginning to limit their liability on theft coverage.

The inspection service being installed varies with different insurance agencies. A typical one operates as follows:

When a car is written for fire, theft or collision, an inspector is sent to see the car and report on it in detail as to condition, number and age of tires, approximate usage, date of purchases, etc. A copy of the report is filed with the assured. If a used automobile is insured, inspection is followed up at least every six months.

The insurance men state that frequently when the owner of an automobile receives the report, insurance is cancelled. An underwriter here said:

"We claim that the insurance companies are imposed upon, especially in cases of reported thefts of tires. The claims always seem to be for brand-new tires. When a claim comes in, under the inspection system, we can refer to our records. Defects of tires are noted at the time of inspection. Radiators are examined. It is a fact that the greatest savings we have made come from cancellations of policies by the insured when they find out that we have a complete report in every detail of the car, tires and all. Losses have been a heavy drain on the companies, and it is necessary to reduce losses or make the rates practically prohibitive."

S.A.E. Discusses Means to Check Theft of Cars

NEW YORK, May 20—The subject of automobile theft prevention was discussed from several angles at the Metropolitan Section meeting of the Society of Automotive Engineers May 19. The opinion was voiced by some that the insurance companies by granting insurance to the full value of the car tended to encourage carelessness on the part of the owner. The advisability of granting insurance for only 75 per cent of the value was discussed.

The car owner is chiefly responsible for most thefts, according to several of the speakers, because of his failure to use the lock and safety devices even when his car is equipped with them. There was also some sentiment expressed indicating that the manufacturers of locks did not always provide enough key changes on their product.

Production in 1919 Dwarfs 1914 Figure

Industry Grows Almost Five Times in Five Years—Michigan Far in Lead

WASHINGTON, May 21—Official statistics compiled by the Bureau of Census reveal the tremendous growth and importance of the automobile industry. Production figures received from 315 establishments in 1919 show that the total output amounted to $2,387,834,000. In 1914, 300 establishments reported manufactures valued at $503,230,000. About 56 per cent of the automobile industry is located in Michigan, as the output of 68 establishments in that state amounted to $1,332,076,000. There were 1,683,938 automobiles produced in 1919, with a valuation of $1,555,129,000, as against 573,039 in 1914 valued at $465,058,000, an increase of nearly three times.

The government figures, which are preliminary and subject to final revision, show that 101,837 trucks valued at $193,351,000 were produced in 1919, as compared with 19,519 trucks and a value of $34,741,000 in 1914. Delivery wagon production totaled 18,122, valued at $16,570,000. In 1914 the production of this type of vehicle aggregated 4391, with a value of $12,750,000. All other types of business vehicles not specified amounted to 955 machines in 1919, valued at $2,283,000, as compared with 262 machines in 1914 with a value of $787,000. In the aggregate there were 120,914 business vehicles manufactured in 1919, with a value of $212,204,000. In 1914 there were 24,172 vehicles valued at $40,278,000.

The total valuation of $2,387,834,000 as given by the Census Bureau did not include, for 1919, 5012 automobiles and 80 trailers to the value of $8,067,562, and in 1914 4258 automobiles valued at $6,296,558, which were reported by establishments engaged primarily in other industries.

Parts Gain Enormous

Comparison of chassis production is impossible because it was not reported separately in 1914, but the 1919 figures showed 192,418, which were produced at a valuation of $181,889,000. The same condition obtained with trailers, which were not reported in 1914. In 1919, 15,606 trailers were manufactured with a value of $6,534,000. The total valuation of bodies and parts for 1919 was $533,068,000.

Segregating passenger vehicles it is found that 1,552,349 machines valued at $1,318,038,000 were manufactured in 1919. Production figures of 1914 showed 543,438 vehicles, valued at $413,696,000. No record was kept of production of roadsters in 1914, but in 1919, 51,360 roadsters were produced, valued at $58,033,000. The total production of touring cars in 1919 amounted to 1,224,347, with a value of $977,411,000. In 1914 the 451,032 touring cars were valued at $345,973,000. Closed cars turned out in 1919 aggregated 156,328, valued at $200,015,000. During 1919 only 10,809 closed cars were produced with a valuation of $21,833,000. All other passenger vehicles manufactured in 1919 amounted to 1216 with a value of $2,056,000.

Public Vehicles Doubled

Classified as public conveyances and known as cabs, omnibuses, etc., the census figures showed 877 machines valued at $3,101,000, were produced in 1919 and 443 machines valued at $846,000 in 1914. Of a total production of 2786 machines valued at $13,619,000 for 1919, there were 391 ambulances valued at $613,000 produced. In the same year there were 759 motorized pieces of fire apparatus manufactured valued at $6,939,000. All other machines manufactured for Government and municipal service such as mail delivery, tanks, patrol wagons, street sweepers and oilers, amounted to 1636 machines in 1919, having a valuation of $6,067,000, as compared with 17 machines and a valuation of $45,000 in 1914.

It is interesting to note that this enormous production of gasoline propelled machines far outstripped electric and steam driven automobiles. Comparison of production statistics shows that fewer electrics and steamers were produced in 1919 than in 1914. In 1919 there were 3034 electrics and 406 steam propelled machines manufactured, as against 4669 electrics and 401 steam automobiles in 1914. The total valuation mentioned for bodies and parts did not include production by establishments engaged primarily in other industries.

Comparative Automobile Statistics, 1919 and 1914

Type	Number 1919	Number 1914	Value 1919	Value 1914
Total (1)			$2,387,834,000	$503,230,000
Passenger vehicles	1,553,349	543,438	1,318,038,000	413,696,000
Roadsters	51,360	(2)	58,033,000	(2)
Runabouts	120,098	81,597	80,523,000	45,890,000
Touring cars	1,224,347	451,032	977,411,000	345,973,000
Closed cars	156,328	10,809	200,015,000	21,833,000
Other cars	1,216	(2)	2,056,000	(2)
Public conveyances:				
Cabs, omnibuses, etc.	1,877	443	3,101,000	846,000
Government, municipal, etc.	2,786	728	13,619,000	3,941,000
Ambulances	391	49	613,000	139,000
Fire department apparatus	759	662	6,939,000	3,757,000
All other (mail delivery, tanks, patrol wagons, street sweepers, oilers, etc.)	1,636	17	6,067,000	45,000
Business vehicles	120,914	24,172	212,204,000	40,278,000
Delivery wagons	18,122	4,391	16,570,000	4,750,000
Trucks	101,837	19,519	193,351,000	34,741,000
All other	955	262	2,283,000	787,000
Chassis	192,418	(2)	181,889,000	(2)
Trailers	15,606	(2)	6,534,000	(2)
Bodies and parts	......	......	533,068,000	(2)
All other products	......	......	119,381,000	44,469,000

(1) In addition, in 1919, 5,012 automobiles and 80 trailers to the value of $8,067,562, and in 1914, 4,258 automobiles valued at $6,296,558, were reported by establishments engaged primarily in other industries.
(2) Not reported separately in 1914.

BUY TRUCKS FOR CATTLE CARS

WASHINGTON, May 20—By order of the Minister of Agriculture, two motor trucks of the type used during the war were recently purchased from France for hauling cattle for the use of the Brazilian Agriculture College. The bodies of the trucks are covered and closed, each having a capacity for four full grown cows.

To Speed Compilation of Export Statistics

WASHINGTON, May 23—More prompt service by the Bureau of Foreign and Domestic Commerce in publishing statistics of the nation's foreign trade will result in announcements of the detailed figures from two to four weeks earlier than before.

The figures, according to the announcement of the Bureau, will be published in two parts, the first of which will be given out on or about the 23rd of the succeeding month. This part will contain "the figures most urgently needed by the trade and will include imports of merchandise by articles and principal countries and exports of domestic merchandise by articles and principal countries, followed by an index of articles and statements of total imports and exports."

Preliminary statements summarizing imports and exports will be given out within 10 or 12 days after the close of month. This will be from 10 days to two weeks earlier than has been the rule.

The service will be speeded up without additional cost to the Government, the statement sets forth, as a result of some changes in the compilation methods. The Bureau co-operates in this work with the Treasury Department which furnishes the original data.

Austin Creditors Agree to Business Continuance

By Cable to AUTOMOTIVE INDUSTRIES

LONDON, May 21—Creditors of the Austin Motor Co., after a full discussion of its financial position, agreed unanimously that the business should be continued so that a plan can be formulated to put the company on its feet. For this reason they have asked that hearings be indefinitely postponed on the petition for compulsory winding up of Austin's affairs.

Dealers Enter Protest Against Excise Taxes

(*Continued from page* 1127)

upon automobiles is a tax upon modern incomes. Seventy-five per cent of all the cars and trucks outside the Atlantic States are in 37 states which have but 45 per cent of the National wealth."

Because Congress has evinced a desire to protect the farmer, the dealers' organizations mentioned that a tax on motor vehicles "is as much a tax on farm production as would be a tax on threshers, plows, tractors, or farm implements. This burden is felt directly by the farmer in the purchase of motor trucks, and is felt acutely by the farmer when he is forced to pay a 5 per cent tax upon his repair parts."

In recommending the repeal of the excess-profits tax, it was declared that "this form of taxation is a deterrent to the initiative enterprise because in productive years it is nearly impossible to set aside sufficient reserves that all enduring business must have to tide them through periods of financial stress such as we are now experiencing." It was further asserted that in times of rising prices the excess-profits tax leads to the "loading" of prices and extravagance in business management, and at best is always an uncertain factor in price making.

In suggesting a reduction in the higher brackets of the income surtax, the dealers expressed the belief that it would induce capital now in exempt securities to return to industry. It was said, "this return would likewise restore the purchasing and investment power to the individuals thus employed who in turn would be a considerable prospect for the absorption of the tax-exempt sucurities so abandoned."

Should Not Set Standards

Discussing the question of essentiality, the dealers declared: "We do not believe that it is a function of free government to set up standards, arbitrarily, of essential or non-essential industry, nor classification of necessities or luxuries. We believe that in a government such as ours, the government should guarantee to all business perfect freedom of existence, expansion of opportunity, and should permit each individual to make the choice as to what is essential to his own welfare and happiness. What are luxuries for some are necessities for others and we do not believe that it is a legitimate function of government to bestow official sanction upon some and impose official condemnation upon others."

Harper stated that the automobile dealers favor the sales tax provided that it is extended to all commodities. He explained that dealers were convinced that a sales tax would be an ethical and equitable form of taxation for all and would produce the desired and needed revenue.

The N. A. D. A. stressed the necessity for economy in governmental expenditures in order to reduce tax rates. It was suggested that the war debt should be distributed over several generations. They recommended the refunding of the present war debt in such a manner that it will be amortized in installments over a period of 50 years. They declared themselves in favor of a moderate protective tariff.

To illustrate the tremendous amount of money paid in taxes on automobiles other than Federal taxation, the Association pointed out that the only state money that is at all available to match Federal aid funds in highway construction and maintenance is derived from motor or vehicle registration fees.

KANSAS CITY RESERVE TO ACCEPT CAR PAPER

KANSAS CITY, May 25—Governor Miller of the Kansas City Federal Reserve Bank announced after a conference to-day with representatives of the automotive industry that he was willing to have automobile paper accepted as collateral at the Federal Reserve Bank. A general statement on the subject will be made public through the press of the district. This follows the visit to Kansas City by Governor Harding of the Federal Reserve Board and is expected to exert a strong stimulating influence on the industry in this section of the country.

Federal Reserve Head to Address N. A. C. C.

NEW YORK, May 23—The annual meeting of the National Automobile Chamber of Commerce, to be held Thursday, June 2, will be addressed by W. P. G. Harding, governor of the Federal Reserve Board. There has been so much misunderstanding relative to the position of the Federal Reserve in connection with loans to certain industries that Governor Harding is desirous of telling all the facts as they relate to the general credit and business situation.

Another interesting feature of the annual session will be a debate at the truck manufacturers' meeting on the subject, "Which Best Serves the Motor Vehicle Users—A Parts Service Rendered by Dealers or a Parts Service Rendered by Parts Manufacturers?"

SHARON RESUMES STEEL WORK

SHARON, PA., May 21—Announcement is made by Harry W. Torney, recently made president of the reorganized Sharon Pressed Steel Co., that its financial difficulties have been satisfactorily adjusted and that it now is in position to handle production of frames up to 1500 a day. Production is now in charge of Arthur W. Swan, general manager, who formerly was chief engineer and works manager of the Crucible Steel Co.

Harding Says Banks Now Have Ample Funds

(*Continued from page* 1126)

governor of the Federal Reserve Bank of the tenth district.

Governor Miller's speech was short and very much to the point. He said:

"The tenth district was not exempt from the national joy ride beginning in October, 1919. It was called upon to distribute credit equal to its entire lending power. By April, 1920, it had rediscounted and borrowed $10,000,000, which sum will be later increased $35,000,000 from other districts. Lending by this bank had to stop, that our credit be conserved. It was necessary to scrutinize all paper for rediscount. Every class was scrutinized. It is true that in accordance with our responsibility to the general agricultural situation we felt that we should accept the most essential paper.

"The impression prevailed that the Federal Reserve Bank had declared automobile paper not essential. We never suggested to a member bank that it should not freely lend to dealers. We did say to banks, 'You have ample loans on agriculture and live stock to take up your limits. We prefer you send us that and keep the other in your portfolio.' Twelve to fifteen per cent of a bank's portfolio is the usual proportion for rediscount with the Federal Reserve Bank. There is ample room in each bank's portfolio for all the automobile paper it might wish to take. The year 1920 was a hard one with the reserve close to the irreducible minimum. We had a liability to those member banks which had not used our facilities, of $60,000,000. Our responsibility to the district was for the best good of all, including yourselves. If we had not acted in the way we did act, you wouldn't be selling cars now, but the corner seems to have been turned. We can see it more clearly to-day than thirty days ago. If nothing extraordinary happens in the next week or so we can congratulate ourselves that we are fast getting back to normal, and there will be no further scrutiny of paper other than for solvency and desirability."

Two Points Singled Out

This statement was greeted with applause and cheers. Governor Harding, following, urged two points upon the automotive industry interesting in view of prospective relaxation in attitude of member and Federal Reserve Banks toward motor paper. The Governor urged that dealers observe punctiliously the forms prescribed for preparation of paper, and forget their objections to those requirements which many have considered annoying. He also urged that, in the coming period of larger business, care be taken to build substantially, aiming to give real service and not anticipating a boom with extraordinary profits. Governor Harding declared that dealers would congratulate and be thankful to Governor Miller for the masterly manner in which the Kansas City Federal Reserve Bank was handled.

Durant Controls Sheridan Motors

Youngest Line Sold by General Motors

Burke President Under Changed Ownership—Main Durant Plant at Lansing

NEW YORK, May 25—Developments came rapidly to-day in the affairs of Durant Motors, Inc. The two most important were:

That Durant has acquired a controlling interest in the Sheridan Motor Car division of the General Motors Corp.

That the main Durant factory will be located in Lansing and will be under the direction of Edward Ver Linden.

The first formal statement in reference to Sheridan came from the headquarters of General Motors. It said:

"Arrangements have been made by the General Motors Corp. whereby D. A. Burke will purchase the Sheridan Motor Car division and continue it as a separate line."

This announcement brought from the Durant offices the statement that Durant Motors, Inc., had acquired the controlling interest in the Sheridan Motor Car division and that it would be conducted by a $3,000,000 corporation which probably would be known as the Sheridan Motor Car Co. Production will be continued in the factory at Muncie of a car which will be virtually identical with the Sheridan now being made for the General Motors Corp. It is understood that the consideration was in the neighborhood of $5,000,000.

Burke, who spent many months in developing the car, will continue at the head of the company, under the new ownership. He formerly was Buick distributer in Chicago and sold Durant on the idea of turning out at a moderate price a car embodying most of the refinements usually found in higher priced models.

Factory Now Operating

Production began only a few months ago and much attention has been paid of late to building up a dealer organization. One of the prominent distributers selected was Eddie Rickenbacker, famed as an aviator.

This statement was made in reference to the main Durant plant:

"Durant Motors of Michigan, with a capital of $5,000,000, will have its main plant at Lansing, Mich., with a capacity of 40,000 cars a year. E. Ver Linden, who has been responsible for the building up of the Olds Motor Works, will be president and general manager. The plant will assemble and distribute Durant cars between the Adirondacks and the Rocky Mountains under contract and control of Durant Motors, Inc."

Announcement that Ver Linden had joined the Durant organization was made in AUTOMOTIVE INDUSTRIES last week. The ground already has been broken for the Lansing plant and it is expected to be ready for occupancy by Nov. 1.

The report is not denied that T. W. Warner, head of the Muncie Products division of General Motors, soon will relinquish his position to join forces with Durant. His retirement is not expected to involve any change in the present ownership of Muncie Products. The plant of the T. W. Warner company at Muncie, Ind., was acquired under lease by General Motors during 1919, with option to purchase after Jan. 1, 1923. Warner also heads the Toledo-Chevrolet Co., which manufactures transmissions.

Klingensmith Mentioned

F. L. Klingensmith, former general manager for Henry Ford, who now heads the Gray Motor Co., declines to deny reports that he will be associated with Durant with the Gray company as a unit of the Durant organization. He asserts, however, that his company will be in the market at the end of the year with its own car.

R. H. Collins, former president of the Cadillac company, now is spending all his time in the main building of the old Cadillac plant which was purchased from the General Motors Corp. for the Collins Motor Car Co., now being organized. The portion of the former Cadillac plant purchased by Collins contains more than 300,000 sq. ft. of floor space.

There is reason to believe that when production actually is begun by Collins and Ver Linden, they will add to their organizations several of the men who served under them in executive capacities at the Cadillac and Olds divisions of General Motors. It also is understood that Durant already has opened negotiations with some of the most successful distributers of the General Motors Corp.

NASH DECLINES STATEMENT

KENOSHA, WIS., May 23—Charles W. Nash refused to-day either to confirm or deny persistent reports that the Nash Motors Co. would acquire a substantial interest in Lafayette Motors Co. of Indianapolis. Nash himself is president of Lafayette Motors and has a large personal interest in that company.

Distributorships Combined

INDIANAPOLIS, May 24—New distributers in Chicago and Philadelphia were named this week by E. C. Howard, vice-president of Lafayette Motors Co.

Chicago-Nash Co., under the direction of H. T. Hollingshead, will handle the Lafayette in Chicago. A Nash association has also been made in Philadelphia.

Reimported Trucks Throttling Trade

New York Dealers Unable to Meet Prices on Ex-Army Vehicles

NEW YORK, May 26—Metropolitan motor truck dealers are beginning to feel acutely the competition of low priced trucks from the former European war areas offered for sale here by representatives of an European corporation which purchased them from foreign governments for export to the United States. The imported trucks, including several American makes and one or two of European manufacture, are being offered at ridiculously low prices as compared with quotations on vehicles manufactured for domestic trade. The imported trucks are also being advertised extensively.

Dealers in some of the higher priced trucks are losing in some cases four or five, and in a few instances more, sales per month.

Representatives of the European corporation which purchased these war trucks from France and some of the other governments which participated in the recent war bought the vehicles, which are new, and in most cases in good condition except for the electrical equipment, at very low prices. Under the present law they are able to ship them into this country, providing the trucks are of American make, without duty. Along with the American trucks a few new vehicles of foreign make also are being brought here. These necessarily have to pay duty, but their purchase prices abroad were so low that they can undersell American trucks with similar specifications 30 to 50 per cent.

Buyers Look for Bargains

For a time dealers in New York, as well as in some other cities, did not show much interest in the truck reimportation situation, but now that these trucks are being brought into the market in increased numbers and their sales are being supported by vigorous advertising, dealers are realizing that there has been raised up a very serious item of sales resistance. The fact that the present period is one in which a great many buyers are looking for bargains, naturally helps the agents.

Dealers here are looking to the National Automobile Chamber of Commerce and the National Automobile Dealers Association to exert the utmost pressure upon Congress and officials of the Administration to place a duty on these reimported trucks which will force their prices up to the domestic level.

Overland Cuts Down Current Liabilities

Annual Report Shows Reduction of $14,000,000 in Year—Inventory Drops

NEW YORK, May 27—The facts that made it necessary for the Willys-Overland Co. to ask for extension of its bank loans in 1920 were revealed in the annual report issued yesterday. This showed, however, that important progress had been made in marking down current liabilities, as that item at the close of last year stood at $28,868,386, compared wih $42,519,660 at the end of 1919.

Notes payable, including bank loans of $20,985,000, totaled $24,288,653 on Dec. 31 last, contrasted with $30,360,000 the corresponding date of the previous year. Inventories were reduced in the two-year period from $38,716,624 to $35,309,825. As regards the company's bank loans, bankers state that since the first of the year a further reduction has been accomplished.

Net earnings of the company for 1920, after deducting repairs and maintenance of the properties and bad and doubtful accounts, but before deducting adjustment of inventories to market value and losses on investments in affiliated companies were $8,822,152. From this was deducted $2,114,243 for interest, $3,768,264 as reserve for accruing renewals, depreciation and provision for tool replacements, leaving a balance of $2,939,644.

After allowing for preferred dividend requirements there remained a surplus for the $56,146,675 common stock, $25 par value, of $1,750,934, equal to 77 cents a share. This compared with $2.26 a share earned in 1919. After payment of the dividends on both classes of stock there was an actual deficit of $173,166.

In a letter to stockholders accompanying the report, John N. Willys, president, explained that the company's surplus account had been adjusted through the application of extensive depreciation and reserve items on inventory and material accounts.

Operating Condition Good

"It is believed," Willys stated, "that the reserves and depreciation thus taken are sufficient to place the company in a satisfactory operating condition. The effect of the application of reserves and depreciation provided against inventories and materials is to place the company's whole inventory and forward commitments upon the basis of low current market replacement values. In addition to the reserves and depreciation thus taken, a depreciation of $6,931,693 has been taken on investments in affiliated companies, the total of all depreciation and reserves being $26,101,711.

"Readjustment of the company's plant account has been made on the basis of 20 per cent less than the actual sound value determined by the American Appraisal Co. Branch house properties are carried at their book value, $5,961,811, whereas a recent valuation gives these properties a sound value of approximately $10,000,000."

Mr. Willys said the business of the company had increased steadily since the first of the year, resulting in a substantial liquidation and a betterment of cash position. The company's total indebtedness on May 1, he said, was approximately $20,000,000 less than on the corresponding date a year ago.

Exports of Automobiles, Airplanes, Trucks, Farm Tractors, Motorcycles and Parts for April and Nine Previous Months

	Month of April				Ten Months Ending April			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	3	$10,214	2	$15,000	42	$216,694	56	$416,955
Airplane parts....	..	53,651	..	5,486	..	435,194	..	148,930
Commercial cars..	2,659	4,169,743	609	811,841	18,465	32,503,156	16,714	28,176,471
Motorcycles	4,061	1,118,227	864	299,172	28,160	7,716,070	23,593	7,453.259
Passenger cars...	14,367	15,067,211	2,469	2,931,233	87,796	94,463,419	79,987	98,756,146
Parts, not including engines and tires	..	6,791,967	..	3,195,734	..	50,480,715	..	61,992,710

Engines

	Month of April				Ten Months Ending April			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas..	2,735	$464,250	1,108	$223,311	31,340	$4,773,511	12,429	$2,288,174
Marine, gas.......	814	281,255	498	146,156	7,779	2,763,186	6,231	2,357,265
Stationary, gas...	2,509	435,143	804	138,415	22,492	3,370,152	21,888	4,227,058
Tractor, gas......	2,488	2,762,687	50	62,289	16,236	15,256,309	13,389	13,446,086
Total..........	8,546	$3,943,335	2,460	$570,171	77,847	$26,163,158	53,937	$22,318,583

MITCHELL REDUCES PRICES

RACINE, WIS., May 26—Mitchell Motors Co., Inc., announces reductions ranging from $210 to $260 in the price of its cars. The factory price of the touring model has been cut from $1750 to $1490 and the sedan from $2900 to $2690.

DE PALMA SETS TRACK MARK

INDIANAPOLIS, May 26—Ralph De-Palma, driving the Ballot special in which he will compete in the 500 mile race Monday, broke the track record for 183 cu. in. piston displacement cars on the Speedway yesterday in qualifying for the contest. His average speed for 10 miles was 101.1 miles an hour.

DODGE DOWN FOR HOLIDAY

DETROIT, May 26—Employees of the Dodge Brothers Motor Car Co. were informed when they quit work last night that they need not report again until next Tuesday. The plant will operate two or three days next week.

CORRECTION

Prices on the Matthews light and power plants have been reduced $50 on the 300-watt and 6 kw. plants, and from $3,600 to $2,975 on the 6 kw. plant. It was erroneously stated in the May 19 issue that prices had been reduced $150. The plants are made by the Matthews Engineering Co., Sandusky, Ohio.

Parts Orders Drop in Last of Month

(*Continued from page* 1126)

facturers regarding what course they are going to pursue on the question of prices. Definite and positive announcements in this respect are needed, parts makers and dealers believe.

Even those watching the situation most closely are uncertain about what the next few weeks will bring in the way of business. Conditions are so topsy-turvy there seem to be no precedents to be followed in making preparations. As a consequence, caution is being exercised all along the line in the manufacturing end of the industry. There is no pessimism, however, and the general feeling is that the present decline in business is partly seasonal and partly due to uncertainty about prices.

Goodyear Sees Falling Off

AKRON, May 24—An official statement issued to-day by the Goodyear Tire & Rubber Co. now in control of the banking syndicate which refinanced it says:

"The seasonal spring spurt of the automobile industry has settled back to a less active situation and curtailment of production of automobiles and parts, including tires, seems likely at once."

No definite information has been given out concerning the Goodyear production plans but there probably will be a reduction in the number of employees.

"We are sending out inquiries as to where men are wanted and efforts will be made to steer the men now laid off to these jobs," said the statement.

Goodyear had reached a production of 19,000 tires a day and reemployed nearly 4000 men since March. Other rubber companies in Akron which also had increased production have begun to reduce their forces.

INDUSTRIAL NOTES

Standard Crucible Steel Casting Co., Milwaukee, is planning important improvements and enlargements to its plant, which is widely known in the automotive industries. Plans are under consideration for a new pattern storage and office building, 3 stories, 35 x 120 ft., and the present foundry and core-room will be enlarged and modernized throughout. George F. Birkel is secretary-treasurer and general manager.

Luthy Co., Inc., has acquired the plant formerly owned by Berger & Carter, manufacturers of cannery machinery, Hayward, Cal. The output of the plant is to be 400 batteries a day. Executive offices are in San Francisco.

Rome Wire Co. has opened district sales offices at 50 Church Street, New York, which will be in charge of H. S. Hammond. Manufacturing facilities have been extended at the plants in Rome and Buffalo.

Robinson Carburetor Co., Birmingham, Ala., has been granted a permit to erect a plant for the manufacture of the Robinson carburetor. The company has been operating on a small scale.

H. H. Franklin Mfg. Co., Syracuse, N. Y., is pushing construction on its new manufacturing building and power plant. Both buildings will be completed by Sept. 1.

Motch & Merryweather Machinery Co., Cleveland, has taken over the sale of the Gordon Cam Turning Lathe in Cleveland, Cincinnati, Detroit and Pittsburgh.

Clark-Turner Piston Co., Los Angeles, has appointed Harkness-Hillier, Ltd., Sydney, Australia, as distributor in Australia of its pistons.

Rice-Fern Hub. Co. will move its plant from Marengo, Ind., to English, Ind., where it has two sites under consideration.

Hirsig Sales Co., Nashville, has been appointed southern representative for Multibestos brake lining.

Dyneto Creditors Seek Plan for Refinancing

SYRACUSE, N. Y., May 23—C. Hamilton Sanford, chairman of the creditors' committee of the Dyneto Electric Corp., has sent to creditors a statement of the assets and liabilities of the company as compiled by certified accountants. With the statement is a letter from Sanford discussing a new financing scheme. The letter in part says:

"Shipments have been running at a rate of about $50,000 per month and will continue until July 1. After that date orders are booked that will amount to about $15,000 or $20,000 per month.

"Your committee has asked interests representing a large amount of capital stock to submit to them plans for the refinancing of the company not later than June 1 and upon receipt of any such plans a meeting of the creditors will immediately be advised, providing such plans are worthy of consideration."

The statement of the company as of Dec. 31, 1920, shows current assets of $56,453, compared with current liabilities of $674,782. Included in the company's assets are the inventory figures, $436,515. According to the accountant's calculations the amount should be approximately $43,000 less. Account receivable from R. M. Owen & Co., and investment in Owen unit tools, machinery and development, totaling $458,177, are excluded from current assets.

The company experienced a net loss of $95,977 for the year ended Dec. 31, last, having the balance in its surplus account reduced to $75,617, the statement shows.

Skelton Motors Held by Estate of Founder

ST. LOUIS, May 23—The formal announcement made here early in March that the assets of the Skelton Motors Corp. of this city had been purchased from the late Dr. L. S. Skelton by W. F. Traves of Kansas City, was premature. No change in the ownership of the Skelton Motors Corp. has taken place and no successor to Dr. Skelton has been appointed. The administrators of his estate are looking after his interests in the company.

Traves is in no way connected with Skelton Motors and John A. Schroeder, chief engineer, severed his connection with the corporation a month ago. The only acting officers at this time are W. A. Chapman, vice president and general manager, and Sidney Penniman, secretary and treasurer.

Since the death of Dr. Skelton last January, Skelton Motors has been in process of reorganization. Plans are now being formulated for the furtherance of the business and an announcement regarding them is expected soon.

Havana Show Closes After Successful Run

NEW YORK, May 23—Information just received by El Automovil Americano, the Spanish automotive business magazine of the Class Journal Co., is to the effect that the automobile show at Havana, Cuba, closed after an eminently successful four days. Known as the Feria de Sevilla, the exposition was quietly arranged by Havana dealers with little help from American manufacturers. Thirteen makes of passenger cars, twelve makes of trucks and two tractors were shown in a large tent in the Almendares athletic field and so satisfactory was it that the Havana Asociacion de Comerciantes y Industriales are contemplating the holding of a larger and more complete show.

The car exhibits were Stutz, Studebaker, Singer, Cunningham, Oldsmobile, Minerva, Benz, Paige, Hudson, Westcott, Packard, Chandler and Cleveland. The trucks were Maxwell, Packard, Garford, Benz, Panhard-Levassor, Republic, Ford, Armleder, Delahaye, Latil, Maccar and Mack. The tractors shown were Case and Fordson.

F. WILLIAM GARTMAN DIES

YORK, PA., May 21—The death is announced of F. William Gartman, vice-president of the York Electric & Machine Co.

METAL MARKETS

WITH the state of morbid drowsiness that has come over the steel market becoming more and more pronounced from day to day, the rest cure, which is being prescribed in some quarters as the most sensible treatment, calls for very little restraint on the part of the patient. Up to now automotive demand furnished a fairly sustaining diet, which was all the more beneficial as it was thought that meanwhile other classes of consumers would set their house in order and re-enter the market as buyers. This expectation has proved false, and what automotive demand is now in the market is of so pronounced a hand-to-mouth character as to furnish to producers little of a dependable basis on which to frame operating programs. Here and there one hears advocated as the most efficient cure a major operation to remove with one incisive cut of the knife most of the adipose fat that has clung to steel prices ever since the war. For the time being, however, quotations will in all probability be permitted to stand, which portends one or two conditions. Either the limited demand will be sufficient to allow of the maintenance of a modicum of operations, and, in that event, intensive competition, accompanied by much price cutting, may be anticipated. The other alternative is that demand will drop to so low levels as to make it less costly for producers to shut down than to continue operations. Should there be many such shut-downs, buyers would be confronted with hardships even greater than those encountered in a market in which demand exceeds capacity production. It is, therefore, decidedly to the buyer's interest not to permit his sources of supply to dry up, if he can at all prevent it. The immediate outlook is for drifting prices, cuts under published quotations expressing the individual eagerness of mills to avoid shutting down to maintain operations on a self-sustaining basis. In the pig iron market a much better tone is in evidence. The same is true of those non-ferrous metal markets in which liquidation has been thorough. That further downward revision of steel prices is a prerequisite to its recovery is generally admitted by producers. Wherein they differ is as to the proper time for proclaiming this lower scale of prices. Possibly the course toward which the present drifting market is heading may force the hands of those who hold that price revision should be postponed.

Pig Iron.—While large transactions are lacking, the market, as a whole, is in much better spirits. Automotive foundries are buying in a retail way, but consumers show much more confidence and seemingly would buy much more liberally if conditions in their own trades warranted.

Aluminum.—From what can be learned regarding the probable recommendations of the Committee on Ways and Means with reference to the rates of duty on aluminum under the new tariff law, it is certain that the duty that will be enacted into law will be far below that provided in the Payne-Aldrich law, i.e., 7c. per lb. on aluminum in ingots, scrap and alloys and 11c. per lb. on aluminum plates, sheets, bars and rods. The American producer has been advocating re-adoption of this scale of duties. Consumers have been driving home to the legislators the argument that, if such increased duties protected the American aluminum industry from foreign competition, they would so curtail American consumption that in the end the American producer would be little the gainer by them. Activity in the aluminum market is absolutely confined to last year's contracts.

FINANCIAL NOTES

Westinghouse Electric & Mfg. Co. reports gross earnings from sales for the year ended March 31, 1921, as $150,980,000, an increase of $15,000,000 over gross earnings for the previous year. Manufacturing and selling cost was $138,774,000, leaving $12,618,000 as the net income available for dividends, or 16.8 per cent on the company's capital stock. Included in the cost is $5,315,000 for depreciation and adjustment of inventories.

Stromberg Carburetor Co. of America, in a comparative balance sheet as of Dec. 31, shows total assets of $3,390,301, included in which are current assets of $841,702 for inventory and $109,322 cash and demand loans. Accounts receivable total $242,274. Current liabilities include accounts payable $102,934 and notes payable $150,000. Profit and loss surplus is $2,344,943, and there is $311,954 reserve for depreciation.

Hood Rubber Co. is contemplating the issuance of $3,000,000 to $5,000,000 in notes for the purpose of paying off bank loans and for working capital. As of Dec. 31 the company had notes payable of $3,610,000 as against $4,860,000 at the close of 1919. Current assets at the first of the year were $17,829,206, against which were current liabilities of $10,051,222, leaving net current of $7,777,894.

United States Rubber Co. directors are aiming to reduce bank loans aggregating $50,000,000 on Dec. 31, 1920, by one-half during the current year. The company is not considering any new financing and does not expect to find this necessary. The company has used up practically all of its high-priced rubber and is taking advantage of current low prices to pick up a reserve.

Rolls-Royce of America, Inc., in a comparative balance sheet as of Dec. 31, shows assets of $7,952,502, which includes an inventory of $1,003,699; cash and accounts receivable, $272,026; deferred charges, $385,225; patent rights, trademarks, goodwill, $3,600,000, and interest during construction, etc., $788,-750. The company's surplus is $4,849.

Maxwell-Chalmers Co. stockholders of Class A and Class B stock have been notified by the reorganization committee, which is headed by Walter P. Chrysler, to pay the balances on this stock by June 1 to the Central Union Trust Co. Failure to make the payments will forfeit all rights of purchase under the subscription warrants.

Stevens-Duryea, Inc., in a comparative balance sheet as of Dec. 31, shows total assets of $6,075,394, which include $2,438,565 inventory and $264,054 cash and accounts receivable. Liabilities show a surplus of $1,282,137 and a reserve for contingencies of $243,856.

American-Bosch Magneto Corp. has sold through Hornblower and Weeks and Harriman & Co. $2,500,000 in 8 per cent 15-year bonds at 98½ and interest, the proceeds of which will be used to pay off floating debt and provide additional working capital.

Mason Tire & Rubber Co. has made financial arrangements for building the Western Reserve Cotton Mills Co. for the manufacture of tire fabrics. It has issued $4,000,000 8 per cent cumulative preferred stock and $20,-000,000 common stock in the new company.

Gruber Tire Co., Monticello, Ohio, will increase its capital stock from $50,000 to $250,000, and will change its name to the Monticello Tire Co. H. O. Altenberg of Davenport will be superintendent.

Goodyear Tire & Rubber Co. has deposited $18,000,000 with the Central Union Trust Co., New York, for payment of a credit of that amount extended by New York bankers. This credit matured May 15.

Fisk Rubber Co. has declared the regular quarterly dividend of 1¾ per cent on the second preferred stock, payable June 15.

G.M.C. Merges Sales of Electric Products

NEW YORK, May 25—Announcement was made to-day by the General Motors Corp. that there is no truth in the report that it proposes to sell the Frigidaire Corp., the Sunnyhome Electric Co. and other units not directly connected with automotive products. On the contrary, the sales of the Frigidaire refrigerator will be extended through the sales organization of the Delco-Light Co. of Dayton. The Sunnyhome company will be consolidated with the Delco company. Both of them manufacture light systems, but there are considerable mechanical differences between them. Sale of the Frigidaire through the Delco organization is considered logical because the refrigerator is electrically operated and is attached to a Delco generator.

It is understood to be the intention of General Motors to continue operation of all three plants for the present at least. Both the Frigidaire and Sunnyhome are located in Detroit.

Townsend Bill Kills Spoils, Says Chapin

WASHINGTON, May 24—Opposition to the Townsend highway bill was indicated by Democratic members of the Senate Post Office and Post Roads Committee to-day in their questioning of Roy D. Chapin, chairman of the higways committee of the National Automobile Chamber of Commerce, who advocated abandoning the present system of Federal aid. Chapin insisted that unconnected stretches of roads were a part of the "spoils" system similar to the erection of large post offices in small towns.

Senator Heflin of Alabama devoted his attention to questioning Chapin concerning the farm-to-market roads. It is this feature of the road situation which inspires opposition from representatives of large farm communities. Chapin pointed out that all progressive states were building such systems connecting with county systems, and thus making a most complete farm-to-market route. He strongly advocated research into highway problems because the industry is only in its infancy. Some of the Senators who questioned Chapin asserted that the automotive industry is the greatest beneficiary from the present Federal aid system.

OBENBERGER PLANT RESUMES

MILWAUKEE, May 23—The plant of the John Obenberger Forge Co. of Milwaukee, a concern which is now passing through the bankruptcy courts, has resumed operations by authority of the referee upon the application of the trustee, J. Frank Gerdis.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, May 28—The local call money market showed a firmer undertone last week with a comparatively light supply of loanable funds. After renewing at 6½ per cent on the opening day of the week, the rate for call money was advanced on Tuesday to a uniform rate of 7 per cent, at which figure it was quoted for the remainder of the week. The firmer tone was in part a reflection probably of the shifting of funds in connection with the Government operations on May 16 and the payments made on subscriptions to the Great Northern-Northern Pacific joint issue. The time money market was unchanged with little activity and few offerings at rates of 6½ per cent to 6¾ per cent, for 60 to 90 days' and 4 months' paper, and 6 per cent to 6½ per cent for 5 and 6 months' paper.

The Federal Reserve system again made substantial improvement in its reserve position last week. The ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 55.9 per cent to 56.8 per cent, the highest ratio since the summer of 1918. Federal Reserve notes in circulation at $2,767,415,000 marked a decrease of $37,518,000 for the week and were $637,516,000 below the peak reached on Dec. 23, 1920. Gold reserves increased $15,353,000, while total bills on hand declined $187,774,000. This decrease was largely accounted for by a $142,828,000 decrease in bills discounted and secured by U. S. Government obligations. Deposits declined $16,802,000.

A most significant announcement affecting the railroads and indirectly the general labor situation was that of the Railroad Labor Board in making public its intention of revising the wages of about one million railroad workers to take effect on July 1. The extent of the wage cut to be made has not yet been determined and will be announced on June 1 for all wage disputes submitted to the board prior to April 18. Disputes submitted since that date will be heard on June 6, but will be disposed of with the intention of making the decisions effective on July 1, 1921. This decision concerns, in the main, the unskilled railroad employees, although at least two roads had prior to April 18 asked for wage reductions for all classes of workers.

The stock market was unfavorably affected by announcements of further dividend reductions, etc., in spite of the favorable reception given to the decision of the Railroad Board. The Chesapeake & Ohio and the Hocking Valley railroads deferred action on their dividends and several steel companies passed their dividends. In the bond market there was no marked activity except among the foreign issues, where the smoothing out of the foreign situation and the continued rise in foreign exchanges have been exerting a favorable influence.

MEN OF THE INDUSTRY

Fred H. Williams, for the last seven years an executive in the home office of the White Co. in Cleveland, where he was in charge of the general sales department before being made vice-president of the company, has been appointed, at his own request, general manager of the Philadelphia branch. Operating as a part of this organization are branches in Wilmington and Washington.

Myles Bradley, a former Flint, Mich., newspaper man who directed the affairs of the Durant Corp. while W. C. Durant was at the head of the General Motors Corp., has taken charge of publicity for the new Durant organization. Bradley has had a wide newspaper experience in New York State and Michigan.

John M. Robbins has been placed in charge of the sales department of Huffman Bros. Motor Co., Elkhart, Ind., manufacturers of Huffman trucks. He was formerly with Lozier, Chalmers and Fulton truck, and was also president of the company which formerly bore his name.

Roy E. Breeden has been appointed division sales manager for Service trucks in Michigan and northern Ohio. Walter Dix has been appointed to the Maryland-Virginia district; L. A. Poundstone to the Pennsylvania-New Jersey district, and Fred G. Whipple, the California district.

W. H. Hurley has been appointed general sales manager of the McGraw Tire & Rubber Co., succeeding C. E. Pumphrey, resigned. He has been associated with McGraw for some time in several capacities and before joining the company was connected with Ajax.

J. P. Winterson, a ten-year veteran of the automobile business, has associated with the Stutz Motor Car Co. of America, Inc., as special representative. Winterson has been connected with several of the larger automobile manufacturers, including Lozier and Chalmers.

Glenn A. Toaz has resigned as staff engineer at the Cleveland Automobile Co., Cleveland, to accept appointment as assistant chief engineer of the Butler Mfg. Co., Cleveland, manufacturers of a vacuum street cleaner.

Ivor McCulla has been appointed service manager of the Bijur Motor Appliance Co., Hoboken, N. J. He was formerly with Willys-Overland in a technical service capacity, and before that was with Trego Motors, New Haven, and Packard.

Shirley M. Howe, former general sales manager of the Haynes Automobile Co., has been appointed general sales manager of the passenger car division of the Yellow Taxicab Co., Chicago, manufacturer of the Ambassador.

F. M. Goodman, who has represented the Elgin Motor Car Corp. in the Central States for the past five years, has been appointed district manager of all eastern territory. Goodman's headquarters will be in New York.

Harrie R. Williams, director of sales and advertising for the Milwaukee Auto Engine & Supply Co., manufacturers of timers and bumpers, has resigned. After a rest he will announce his plans for the future.

F. Elbert Glass has been appointed sales manager of the Oakes Co., Indianapolis, manufacturers of accessories. He has been with the company eight years as a sales engineer.

J. T. Lawson has been appointed district supervisor in the Chicago district for Maxwell-Chalmers. He has been connected with the industry for a number of years as field representative, branch manager and dealer.

Judd Colwell, for ten years connected with the Goodyear Tire & Rubber Co. in Chicago, has been made Chicago branch manager of the Miller Rubber Co.

Harry W. Anderson has resigned as sales manager of the Templar Motor Corp., Cleveland. His plans for the future will be announced within a short time.

Andrew Scharff has been appointed northwest district manager for the Multibestos Co., Walpole, Mass. His headquarters will be in Minneapolis.

William Mackone Milner has resigned as advertising manager of the Bergougnan Rubber Corp., Trenton, N. J., and will announce his plans for the future in a short time.

W. K. Swigert has resigned as vice-president and general factory manager of the Oakes Co., Indianapolis. His plans for the future are not announced.

Universal Tool Wins in Reboring Tool Fight

GARWOOD, N. J., May 23—The Universal Tool Co., formerly of Detroit, which now has a factory here, has been granted an injunction by the Federal court, restraining the Flinchbaugh Machine Co., of York, Pa., from further manufacture and distribution of the Universal cylinder reboring tool, invented by R. E. Roseberry. The injunction was granted on the ground that patent rights and trade mark had been infringed.

The Flinchbaugh company has notified jobbers that it has discontinued the sale of these tools and that they now are sold exclusively by the Universal company.

Production of the re-boring tool, embodying new features based on original patents granted Roseberry, was begun here Jan. 1 in the new factory. All tools shipped since April 15 have been of the new design, but no advance in price has been made. Business of the company in April reached normal. February showed an increase of 50 per cent over January and March an increase of 102 per cent over February. The plant now is operating on a 10-hour-a-day basis.

REEVES ANSWERS ATTACK

NEW YORK, May 25—General Manager Alfred Reeves of the National Automobile Chamber of Commerce today began distribution for publication of an answer to statements recently made concerning the automotive industry by F. R. Pleasonton, general manager of the Parish Mfg. Co. Pleasonton's attack, which has been published by several papers, and which has since then been given wide distribution by a large Philadelphia advertising agency, made charges of "dangerous inflation" against the automotive industry, says "distribution has been forced on an unwarranted basis. . . . Millions of cars now in use must be abandoned by their present owners," and claims that no income less than $2,000 should support a car. Reeves points out that many of the statistics in Pleasonton's paper are wrong and that his attack is unsound and unjust. The papers committee of the S. A. E. some time ago refused Pleasonton's document as inaccurate.

Austin to Push Sales of Tractor in Canada

LONDON, May 6 (By Mail)—Austin Motor Co. has a plan arranged to supply Canada with tractors backed by a full service organization including oversight of machines by mechanics from the British works. These men will instruct the agents, their mechanics and the owners how to run and manage this particular tractor.

This development is being awaited with great interest by other British firms, and, if successful, will probably be copied by them, for it was reported at a recent inquiry instituted by the Ministry of Agriculture that British tractor makers will have to look more and more to oversea markets if they are to be able to manufacture in quantities sufficiently large to ensure a selling price on a level with those machines made elsewhere.

This information came through before the announcement of Austin financial trouble; therefore it is possible that the plan may be held up; if not abandoned.

The Ruston-Hornsby Co., which holds the British rights in the Wallis Junior (U. S. A.), also has been named in this connection, but inquiries have failed to prove or disprove the report.

BANTAM DEMAND INCREASES

BANTAM, CONN., May 23—Stockholders of the Bantam Ball Bearing Co. were told at their annual meeting that while orders on the books are not as large as those of previous years, they indicate an increasing demand for the products of the company, and also that an ample organization has been maintained to fill all the orders which come through. Thanks to a conservative policy, the stockholders were told, the company is in an excellent financial condition. The following directors were elected: W. S. Rogers, L. J. Nickerson, H. H. Edwards, N. M. Scott, H. L. Schoonmaker, C. D. Heath and J. L. Buel.

ROLLS SIGNS A. J. ROWLEDGE

LONDON, May 9 (By Mail)—It is announced that Rolls Royce, Ltd., has secured the services of A. J. Rowledge for a long term of years. Rowledge was for many years chief designer with the Wolseley Motor Co., Birmingham, and for the past seven years has been chief designer for the Napier company. With the latter firm he was very largely responsible for the Napier aero engines. as well as for the most recent Napier passenger car chassis.

Calendar

SHOWS

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

July 4-9 — Mackinac Island, Mich., Summer Meeting Automotive Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

RACES

May 30 — Indianapolis, International Sweepstakes.

June 3-5 — Reno, Nev., First Annual Nevada Highway Road Race.

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

Twenty-five Entries for Indianapolis Race

INDIANAPOLIS, May 26—Following are the entries and drivers in the 500-mile sweepstakes to be run Decoration Day:

CAR.	DRIVER.
ReVere Special	Eddie Hearne
Ballot Special	Ralph DePalma
Leach Special	Ira Vail
Durant Special	Tommy Milton
Duesenberg Special	James Murphy
Duesenberg Special	Roscoe Sarles
Duesenberg Special	Edw. Miller
Duesenberg Special	Eddie Pullen
Frontenac Special	Ralph Mulford
Frontenac Special	———
Peugeot Special	Howard Wilcox
Talbot-Darracq Special	Andre Boillot
Sunbeam Special	Rene Thomas
Sunbeam Special	Dario Resta
Junior Special	R. J. Brett
Junior Special	———
Peugeot Special	Jean Chassagne
Duesenberg Special	John A. Thiele
Frontenac	Jules Ellingboe
Chicago-Frontenac Special	Percy Ford
Duesenberg Special	Joe Boyer
Duesenberg Special	Albert Guyot
Frontenac Special	C. W. Van Ranst
Frontenac Special	M. E. Headley
Frontenac Special	L. L. Corum

India Presents Field for Rebuilt Engines

WASHINGTON, May 24—A specific need for light internal combustion engines in India for direct coupling to centrifugal pumps, used to carry water from wells, has come to the attention of Trade Commissioner Batchelder. A light engine is desired, similar to the motor car engine, which can be directly coupled with suitable centrifugal pumps and thus save the extra cost of belting, the friction and slip losses. In connection with coupling the pump with the engine an arrangement will be necessary to start the engine light, preventing the water from pumping and thus loading the engine, until sufficient speed has been gained. The average depth of the wells may be assumed as 150 ft. and the average discharge 160 gal. of water a minute. As the water will be used for irrigation the exhaust fumes of the engine will not affect its use for that purpose. Batchelder, who has been advised that this is one of the best fields for American machinery in India, thinks that rebuilt automobile engines might be fitted for such purposes, or that manufacturers might design the exact type of engine that is needed.

Mulford in Paige Makes Chassis Marks

UNIONTOWN, PA., May 20—Ralph Mulford, driving a Paige, broke all records for stripped stock car chassis in a spectacular performance at the Uniontown Speedway to-day. He established new world's records for five miles, 10 miles, 15 miles, 20 miles, 25 miles, 50 miles, 75 miles, one hour and 100 miles. In the run is a new record for one mile on such a course, although the mile and time remain to be chosen, approved and announced officially by the American Automobile Association contest board.

Mulford's record, unofficially, was 89.6 miles per hour average for the 100 miles. He actually made 89.9 in the hour but it is understood that under rulings of the Three A regarding completion of the mile, he can be credited with only 89 miles, flat, for the hour.

The event was under official sanction of the Three A with G. E. Edwards, chairman of the technical committee, and A. H. Means, secretary of the contest board, in direct charge, assisted by Frank H. Rosboro, local representative of the Three A.

Trucks in Philippines Cut Railroad Earnings

SEATTLE, May 23—So intensive has been the development of motor truck transportation in the Philippine Islands during the last year that the Manila Railroad Co. has appealed to the Government for relief, claiming that the automotive carriers are cutting heavily into the profits of the company.

In the annual report of the general manager of the company it is stated that if the truck, operating as a common carrier, is taxed with a view to reimbursing the Government for the wear and tear it occasions to the road surface, plus its proportionate share of the interest on investment in the highway, then the problem is automatically solved.

Service Lack Ties Up Car Usage in Peru

LIMA, PERU, May 2 (By Mail)—Automotive dealers of Lima and other cities of Peru consider that the present is a big opportunity here now for the sale of spare and repair parts and repair materials. Many cars and trucks, not only in Lima, but also throughout Peru, are laid up because of a lack of service facilities. Firms manufacturing standardized parts should endeavor to reach this market in order that these vehicles may be put back on the roads at once.

Efforts are being made to have the road between Lima and Callao repaired so that truck traffic over it may not be delayed. Callao is the port of entrance for imports to Lima and many of the shipments are transported from there by truck. About twenty of the firms most interested in the handling of such shipments have combined in an effort to obtain betterment of the present conditions. Otherwise they are threatened with a cessation of transport.

Preparations are continuing apace for the opening on July 15 of the industrial exposition to be held in connection with the centenary celebration of Peruvian independence. Although there is a market stagnation, several automotive companies, it is understood, will have exhibits. It is suggested that manufacturers of repair and service parts would undoubtedly find this to be a profitable exhibition.

FORT WAYNE PLANTS BUSY

FORT WAYNE, IND., May 21—The increase in business at the plants of a number of local companies indicates that the worst of the depression which has been affecting local companies for some months is past.

The Dudlo Mfg. Co., makers of magnet wire, which started to show increased signs of life several weeks ago, is continuing to add to its forces by recalling former employees. The plant is now operating on a basis of 75 per cent normal. For the first time since the depression started, some of the departments have been operating overtime. This is particularly true of the department making wire for Ford.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

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S. A. E. SUMMER MEETING

S. A. E. Holds Another Important and Successful Meeting

Semi-annual gathering is well attended and highly profitable. Papers presented are of great educational and engineering value. B. B. Bachman, Standards Chairman, nominated for president.

WITH a surprise attendance—the total reaching 700—the recent meeting of the Society of Automotive Engineers at West Baden Springs, Ind., will be written into the records of the Society as one of the most profitable gatherings. It was anticipated early in the season that the attendance would be rather low compared with recent years, but the meaning of the attendance can be seen by comparing it with that of 1920, which was 757.

The program was an excellent one and the fuel papers and discussions marked an exceptionally high point of interest. An unusually large proportion of the men were present, interested to learn the advances that have been made in engine design and what is indicated by the research that is under way. Apparently most of the engineers in the industry realize the grave task that is before them in working to a higher economic standard. Without doubt the engineers are taking their work more seriously.

The social and sport side of the meeting was excellent. The hotel was commodious and few complaints were registered. The only drawback was the heat and the showers. Fortunately, all comers had experienced a taste of hot weather before leaving home and they were not inclined to blame the Southern Indiana location. The great atrium of the hotel furnished an ample playground on the wet days.

The nomination for president of B. B. Bachman, chairman of the Standards Committee, met with general approval. The other nominees for the various offices were as follows:

First vice-president, J. V. Whitbeck; second vice-presidents — representing Motor Car Engineering, F. E. Watts; Marine Engineering, H. E. Morton; Tractor Engineering, O. W. Young; Aviation Engineering, V. E. Clark; treasurer, C. B. Whittelsey. Councilors, two-year term, Lon R. Smith, C. F. Scott, H. M. Crane. Councilor, one-year term, W. R. Strickland.

This ticket will be voted upon by mail ballot of the membership and the vote canvassed at the annual meeting of the Society in January in New York. The constitution of the Society provides means for naming a second ticket if the regular ticket is not acceptable, but there has never been a contest.

Probably the greatest professional interest of the meeting, was in the paper on Turbulence, by Harry L. Horning, but W. S. James' paper on Elements of Fuel Economy was the subject of much favorable comment and would doubtless have resulted in as much discussion had it not been the last paper at the concluding session.

The Combustion Session

B. B. Backman, nominee for president.

President David Beecroft.

THE combustion session was in many ways interesting and instructive. Grouping together some of the most advanced ideas on what is believed to take place in the combustion chamber of an engine cylinder, the meeting held forth a promise that the highest thermal efficiency possible with the Otto cycle may be realized in the near future.

The session was presided over by Thomas Midgley, and papers by H. L. Horning on Turbulence, C. A. French on Flame, and Sir Dugald Clerk on Cylinder Actions in Gas Engines were presented. While the discussion showed that there are minor discrepancies in theory and in the interpretation of experimental results at the present time, there is, on the other hand, a remarkable unanimity of opinion on the general fundamentals which apply to flame and its propagation in the combustion chamber.

The discussions brought out the fact that the research work covered has produced many practical results. Increase in the thermal efficiency of automotive engines is not only possible, but in view of the information brought out it is clear that we are standing on the threshold of some very important commercial developments.

Horning Discusses Turbulence

Horning, in his paper on Turbulence, stated that since the subject was actively revived a little more than a year ago, considerable interest and experiment has resulted. The paper, which is printed in condensed form below, is the result of a collection of notes gathered from investigation of the subject in the literature covering past work and also from a large number of experiments conducted under the author's observation.

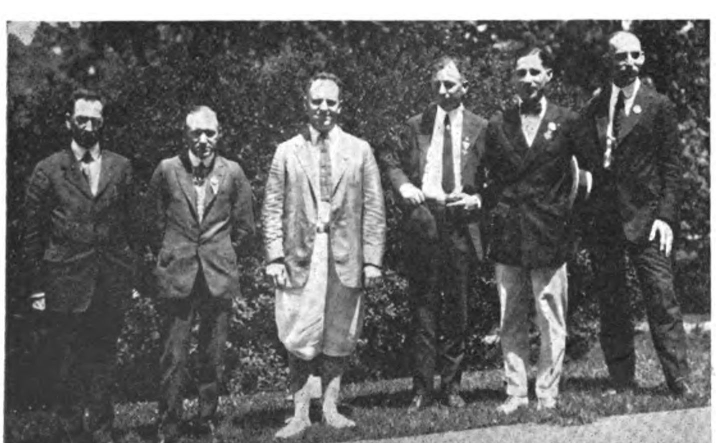
Turbulence hastens the contact of two substances in a semi-liquid, liquid or gaseous state. Le Chatelier and Mallard noted its effect in their classic investigation of flame propagation. Wheeler and Mason noted a doubled flame velocity in a closed tube as compared with a quiescent mixture. Prof. Bertram Hopkinson noted an increase in flame velocity in a closed vessel when a fan was used to promote turbulence, and Sir Dugald Clerk in 1912 showed that where turbulence is employed there is a noteworthy increase in the speed of pressure development. This increase under the conditions of the experiment reaching 150 per cent.

Harry Ricardo has studied turbulence in recent years and determined that with normal timing, gas velocities through the intake valves of from 130 to 160 ft. per sec. give the highest brake m.e.p., whereas velocities of 160 to 180 ft. give the maximum brake thermal efficiency and velocities of from 180 to 200 ft. give the maximum indicated mean effective pressure. Ricardo has also designed a number of efficient combustion chamber shapes to take advantage of turbulence.

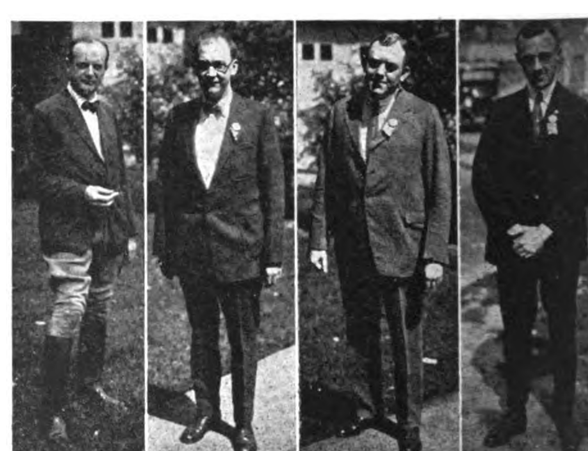
Horning also gives credit in his paper to Woodward, Lewis and Canby of E. I. Du Pont de Nemours & Co., the Bureau of Standards and P. S. Tice for investigations along this line.

An examination of a large number of flame photographs indicates that there are four phases of velocity in a tube of uniform cross section. The first phase is known as the phase of first acceleration. The second phase is one of uniform velocity. The third phase is that of second acceleration and the fourth phase is that of a high uniform rate known as detonation.

The first phase represents a condition which, if it were possible to continue it throughout the entire range would result in the highest efficiency. In this phase the flame is blue. In the second phase the flame becomes green. In the third and fourth phases the liberation of energy is so rapid that incandescence of some of the carbon particles occurs and rapid loss by direct radiation takes place. The second phase represents the combustion of the most economical mixtures at loads at and under those giving maximum economy, providing that there is no marked or incipient auto-ignition. This is at nearly full load performance and with lean mixtures in



Some members of Nominating Committee, left to right, R. E. Northway, A. W. Scarratt, H. W. Slauson, G. P. Dorris, Mark Smith, H. C. Dickinson.



Some Committee Members, Hugh R. Corse, Chairman Sections Comm.; John R. Cautley, Meetings Comm.; H. G. McComb, Meetings Comm.; C. F. Scott, Chairman Meetings Comm.

Sport and Social Events

Photographs by Lazarnick

(1) The meeting place. (2) Men's 50-yard dash. (3) Ladies' clock golf tournament. (4) Ladies' 25-yard dash. (5) Shot put. (6) H. A. Coffin, Chairman of Sports Committee. (7) Three-legged race. (8) H. L. Spohn, in charge of social events.

low compression engines. This phase is not characterized by a roughness in the performance of the engine. The third phase is obtained in an engine having a compression just low enough to avoid detonation at the most economical mixture but running with a richer mixture. This may be also representative of an engine running where the compression ratio is somewhat too high for available fuels. It is typical of the large class of cars built in the past for more volatile fuel. The fourth phase is characterized by very rough performance. In the third phase the flame is yellow and in the fourth it is brilliant white.

Since the usable velocity must not exceed that at the end of the second phase the problem boils down to securing a maximum area of flame in order to increase volume consumed in a given time. In other words, the design of a combustion chamber permitting rapid spread of the flame crest, developing at each successive advance an increasing area of contact with the unburned mixture.

By the use of turbulence in combination with ideal geometric form of combustion chamber exceptional economies can be obtained. There are three points which generally have a temperature above the average. These are the center of the piston, the center of the exhaust valves and various points in the spark plug. Turbulence tends to prevent the layers of gas over these points from reaching the point of auto-ignition.

Where these layers occur in shallow pockets there is less opportunity for turbulence to keep the gases moving and the high temperature of the mixture at these sections must be kept in mind in locating spark points, as it has been proved by many investigators that the spark plug should be placed in such a position as to ignite the hot portion of the mixture during the early stages of combustion when it is relatively cool rather than allow a flame traveling some distance to set this hot portion off by auto-ignition toward the latter part of combustion when temperatures and pressures are high and the maximum of radiant heat is flooding the combustion chamber. When three high temperature spots and a pocket claim the location of the spark plug, it is necessary to compromise, giving preference to that locality which will set off the hot sections in a pocket first and then the mixtures of lower temperature. Generally speaking, after the pocket is taken care of, the spark plug should be as near as possible to the greatest turbulence and the center of gravity of the mixture.

There are three spots where a spark plug should not be placed: at any point remote from a pocket; at any point remote from a hot surface; at a point where it will be washed by the exhaust and the pumping action of the rings.

Two Methods of Producing Turbulence

Turbulence is produced by two fundamental methods based on the means by which the circulation is initiated. The first and most common method is by means of the intake gas velocities. There is a fundamental defect in this method, inasmuch as it depends on a high gas velocity, which means relatively low volumetric efficiency.

Turbulence is produced primarily by the velocity of flow past the intake valves during the suction stroke of the engine, and secondarily through the subsequent flow of the gases on the compression stroke. The flow through the intake valve is at high velocity but discharging into a relatively large chamber the velocity tends to drop abruptly due to the volume of the space and particularly to its shape. The turbulence which may be developed during the suction stroke is particularly susceptible to the dampening influences that generally exist during the compression stroke when the gas is being forced into a smaller space, and at this period the persistency of turbulence is particularly subject to the influence of combustion chamber shape. Whatever the natural direction of the gases, the shape of the head and all parts of the chamber should be such as to introduce no irregularities into the path. The flow during entry into the cylinder should induce a high velocity and symmetrical course of the gases after the valve is closed, this path merely lengthening or shortening, but keeping its general course when the piston is at its various positions. The energy available for turbulence is limited; hence the most regular and undisturbed paths tend to conserve the velocities. The moment of ignition is the moment of utmost importance. Whatever is done to produce or maintain turbulence must be done entirely in reference to the moment of ignition, for it is the turbulence at this instant which determines the distribution of flame throughout the cylinder.

Turbulence Due to Intake Velocity

In engines depending on intake gas velocities for turbulence there is always a restricting influence in the compromise between high turbulence and volumetric efficiency, and this points to a more effective and convenient method of producing turbulence. Fig. 1 shows a design which is due to Ricardo. This design was developed by him after he had observed the very effective way in which the design shown in Fig. 2 handled kerosene in his tank engines with a relatively high compression without a knock. It was almost impossible to make this engine knock on kerosene at compression ratios of 4.75-1. It is obvious that in this design turbulence is set up at the proper moment through the velocity produced by the piston forcing almost the entire cylinder contents past the opening between the cylinder proper and the valve chamber. This opening need not be restricted to produce high initial velocities, for there is no intervening time for the turbulence to die out before the spark passes; in fact the design can be worked out so that the turbulence is reaching its very maximum when the spark passes. In this form the great problem is the flat section between the piston and the cylinder head, which gives opportunity for the flame to run and knock from auto-ignition. From a turbulence standpoint this form is very effective and it can also be made so as to have a very favorable area-to-volume ratio. It is very favorable because of its compactness for an effective spark location. By making the combustion chamber a hemisphere the most compact form possible is introduced.

There is still another way in which turbulence can be produced, namely, by forcing the contents of the cylinder at high velocity through a venturi of small area into the combustion chamber on the compression stroke. Fig. 3 illustrates this for a valve-in-head engine and Fig. 1 for an L-head engine. Fig. 4 illustrates still another development. The fundamental difference between these methods and those met with in conventional systems is, first, that compression backed up by the piston furnishes a much more positive means for causing turbulence than the atmospheric pressure during the suction stroke; second, gives an opportunity for producing a much more general movement of the gases and, third, turbulence occurs immediately before and during ignition, thus obviating its dying out. The defect of these systems is the increase in combustion chamber area and the introduction of thin layers of gas at some points. So far as the main chamber is concerned there can be no detonation, but unless highly stable fuel is used there will be detonation in the shallow sections over the pistons. The main combustion chambers of these forms have a relatively small area-to-volume ratio.

Turbulence produced by piston compressions is the most

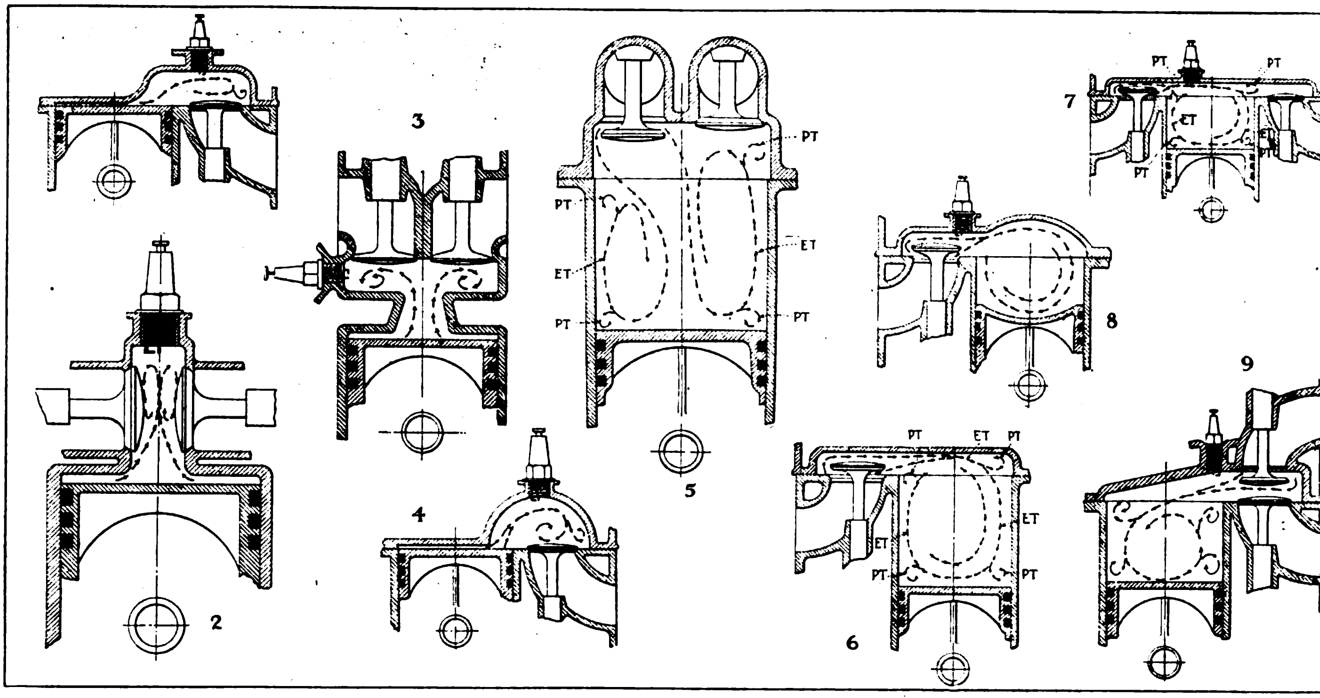


Fig. 1—Cylinder Designed by Ricardo
Fig. 2—Design Which Used Kerosene as Fuel in the Ricardo Tank Engine
Fig. 3—A Design of a Valve-in-Head Engine Which Produces Turbulence by Forcing the Contents of the Cylinder at a High Velocity Through a Venturi of Small Area into the Combustion Chamber on the Compression Stroke
Fig. 4—Another Development to Secure Turbulence in the Valve-in-Head Engine
Fig. 5—Diagrammatic View of the Cylinder of an Overhead Valve Engine Showing the Path of the Major Currents in the Gas

Fig. 6—An Ordinary Type of L-Head Combustion Chamber
Fig. 7—The Usual T-Head Type Engine Which Must Be Run at High Speed to Get Sufficient Turbulence for a High Mean Effective Pressure and Thermal Efficiency
Fig. 8—Another Form of Combustion Chamber Design by Ricardo
Fig 9—High Speed is Usually Required to Give Sufficient Turbulence for the Maximum Mean Effective Pressure and Thermal Efficiency in this Type

effective known for a given speed of engine. The gas must go through two passages, the valves and turbulence orifice, on the suction stroke; therefore, large areas at these points are advisable and permissible to sustain volumetric efficiency. However, because of the effectiveness of the method and the simplicity of flow and high velocities of the mixture at the moment of ignition, it is doubtful whether such high velocities of mixture through the turbulence orifice are needed as have proved necessary when producing turbulence by intake gas velocity in normal types of combustion chamber.

Figs. 5, 6 and 7 are marked *ET* to show points of effective turbulence. The paths shown indicate the major currents in the gas and should be provided for by design. They represent the greatest velocities and should involve a high percentage of the total mass of the mixture. The most effective turbulences are those involving the entire mass of the mixture in a general movement of highest velocity and along one simple course. This involves less loss in velocity and minimizes the eddies which generally may be considered as parasitic turbulence, marked *PT*. Since these eddies derive their energy from the main stream, they impede it. They are also of lower order of velocity and therefore less effective.

In engines of a design depending on intake gas velocities for turbulence the proper combustion chamber is that which follows most closely the lines of flow of the mixture. Such a form is illustrated in Fig. 8. Another form is shown in Fig. 9 in which the path of turbulence is indicated.

Characteristic Turbulence in Typical Cylinders

Fig. 5 shows diagrammatically the general currents in an overhead valve engine of well known design. It is obvious that when the contents are compressed the contending currents will tend to wipe themselves out; this is the reason why overhead valve engines take higher gas velocities to attain maximum brake mean effective pressure, brake thermal efficiency and indicated mean effective pressure. This type is the least effective from a turbulence standpoint. Fig. 6 shows an ordinary flat type of L combustion chamber, the eddy currents illustrating how ineffective it will be. The large area volume ratio makes it ineffective. This type will have low mean effective pressure and thermal efficiency. Fig. 7 is the usual T-head type which must be run at high speed with spark plug located as shown to get sufficient turbulence for a high mean effective pressure and thermal efficiency.

Fig. 8 shows a form of combustion chamber which Ricardo claims to have used on his design of the Mark Webber engine. While the reported results are remarkable we have never attained satisfactory results with the spark plug placed over the piston as shown in his reports. In fact, we always had very severe knocking.

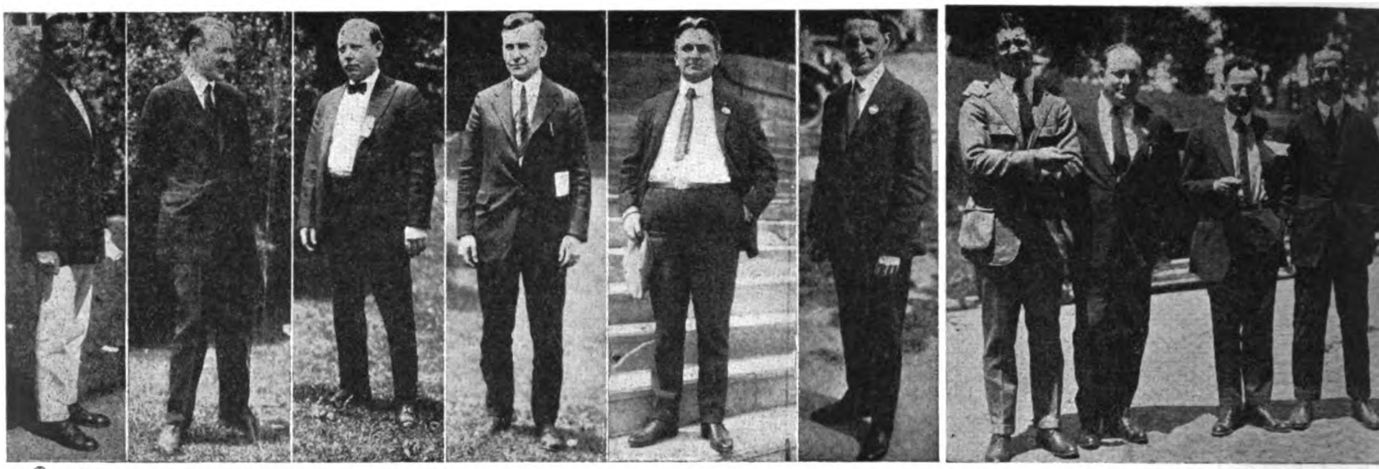
Fig. 9 is a type which has shown good results when the piston and head are like those illustrated in Fig. 8, but as shown here usually requires high speed to give sufficient turbulence for maximum mean effective pressure and thermal efficiency.

Fig. 1, Ricardo L-head type, gives a high turbulence and excellent brake mean effective pressure and thermal efficiency at all speeds and with a very small spark advance.

Fig. 4, the Tyler type, in which the combustion chamber is hemispherical in form, gives excellent results.

Fig. 2, Duesenberg type, is the same as that used in Ricardo's tank engine and the Bugatti aeronautic engine. It is very fine from the turbulence standpoint, gives high mean effective pressure and economy at all speeds and takes a relatively small spark advance.

Fig. 3 shows a turbulent overhead valve type in which



Al. Reeves — O. W. L. Coffin — A. J. Scaife — E. W. Templin — M. L. Heminway — B. G. Koether — R. E. Mackenzie, H. L. Spohn, C. S. Hyman, H. S. Downe.

the piston forces the cylinder contents into the combustion chamber at high speed and thus makes it one of the best types from a turbulence standpoint.

While turbulence tends to cause an increase in the direct heat loss, it decreases the dissociation losses and those due to after burning are brought to a minimum. With a rapid combustion resulting from turbulence it may be expected that the ignition need not be advanced as far as usual. This is found to be true and the spark advance may, all other conditions being equal, be considered an excellent index to turbulence. That is to say, with the same compression ratio, gas velocity, fuel-to-air ratio and volumetric efficiency, the spark advance in degrees may be considered inversely proportional to the combustion efficiency.

We have found it possible to attain with a combustion chamber of L-head type, of the general shape shown in Fig. 8 with cast iron walls, an efficiency of 64 per cent of the air cycle efficiency, as against 54 per cent with a shape approximately like that shown in Fig. 6. With a similar engine of valve-in-head type and at slightly higher compression ratio, we secured an efficiency of 65 per cent of the air cycle efficiency under laboratory conditions with a gas velocity of 170 ft. per sec. and a relative efficiency of 56 per cent with a speed of 110 ft. per sec. and slightly inferior carburetion.

The relatively poor turbulence is markedly shown in the greater spark advance required in a valve-in-head engine, and the high combustion efficiency due to turbulence is shown in the low spark advance in forms of combustion chamber in which the turbulence is highest, such as the high valve pocket L-head design (see Figs. 2, 4 and 8).

We have found a spark advance of 64 deg. necessary in a valve-in-head engine of 4 to 1 compression ratio having a gas velocity of 110 ft. per sec. with a poor carburetion efficiency running at 1000 r.p.m. with a 15 to 1 air-to-fuel ratio.

We have found a spark advance of only 11 deg. necessary on an L-head engine of the high valve pocket design at the same speeds and conditions as specified for the valve-in-head engine above. In this case the relative efficiency was very high, offsetting a low compression ratio.

Conclusion

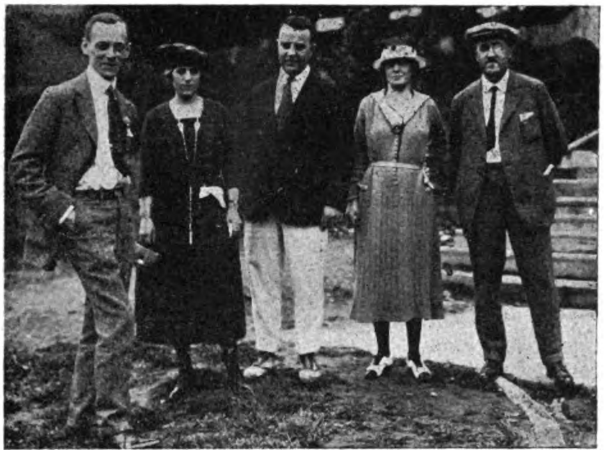
The effects of turbulence upon performance may be summarized as follows:

(1) By developing high turbulence in a mixture it is possible to drive off the surface layers of the combustion chamber and thus force their full contents to contribute to the heat and pressure before the expansion-stroke commences. The fundamental conception of the constant-volume cycle is based on the working fluid receiving all its heat at constant-volume and instantaneously. Neither of these conditions is attainable for obvious practical reasons; however, the wide departure from this ideal with slow-burning mixtures, great spark-advance, low maximum pressures, bad after-burning during expansion, hot cooling-water and exhaust pipes are marked symptoms of low turbulence, and result in low combustion efficiency. Since the air-cycle efficiency is constant in any case, a high combustion-efficiency means a high thermal efficiency and since the indicated mean effective pressure is the product of the indicated thermal efficiency, the volumetric efficiency and the energy content turbulence is directly responsible for increased power.

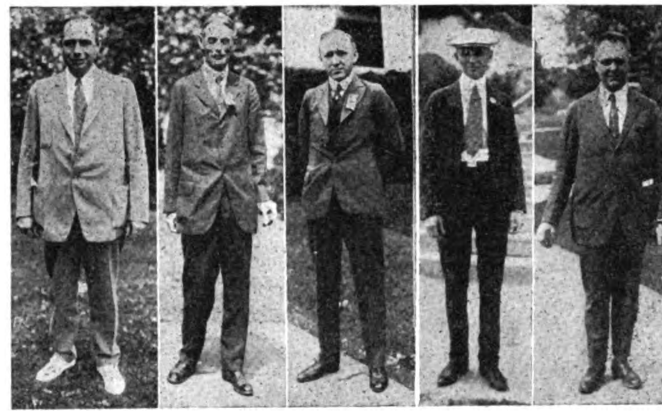
(2) Turbulence tends to hurry the combustion of the entire mixture volume without allowing any part to attain high flame-velocities manifested by preignition, detonations or auto-ignitions within certain limits. These limits are difficult to express, there being no generally accepted scientific method for the purpose. Roughly speaking, the common fuels of 1915 and the spring of 1916 furnished by the Standard Oil Co. of Indiana were such as to allow a cylinder of the general form shown in Fig. 2 to run at a 4.6 to 1 compression-ratio without knock. Whereas, it is impossible to run with this shaped combustion-chamber with the present fuels without a knock at a compression-ratio of 3.7 to 1. With a combustion chamber of the shape shown in Fig. 3 it is possible to run on the present fuels produced by the above-named company with a 4.2 to 1 compression-ratio without knock, whereas with kerosene it is necessary to keep down to a 3.9 to 1 compression-ratio if it is desired to run without knock and without water-injection. These results are on a heavy-duty engine running at 1000 r.p.m., and with chemically correct mixture proportions. It is obvious that so far as compression-ratios are concerned we have not been able, under the above stated conditions, to offset entirely with combustion chamber design the decline necessary in compression-ratios to prevent knocking with present fuels.

(3) On kerosene-burning engines turbulence has made possible a combustion efficiency at fairly high compression-ratios without use of dopes, water or exhaust gases, giving an indicated thermal efficiency of 26 per cent and an indicated mean effective pressure of 80 lb. per sq. in. without special carbureter designs.

(4) Since the fuel of 1915 allowed a compression-ratio of 4.6 to 1, its air-cycle efficiency was 45.8 per cent. The 1921 fuels permit a 3.7 to 1 compression-ratio



B. B. Bachman A. K. Brumbaugh Mrs. H. L. Horning H. L. Horning



A Group of Officers of the Society

E. A. Johnston H. M. Crane A. W. Scarratt J. G. Vincent Coker F. Clarkson

with an air-cycle efficiency of 40 per cent; therefore the decline in fuel value shows a loss of 14 per cent in efficiency due to a necessary drop in compression with old styles of combustion chamber. With new designs of combustion chamber, similar to those shown in Figs. 4 and 6, an air-cycle efficiency of 43.5 per cent is possible, cutting down the air-cycle loss due to fuel to 5 per cent. However, since 1916 we have improved the combustion efficiency from 54 per cent of the air-cycle efficiency to a possible 64, a gain of 18 per cent.

(5) Turbulence makes all high speeds possible by speeding up the flame propagation.

(6) Turbulence makes high speeds possible without an excessive advance of the spark, and with high mean effective pressure and high thermal efficiency.

(7) Due to turbulence, L-head engines of the form shown in Figs. 2 and 6 will be generally superior or at least equal to I-head engines with respect to knocking, all other conditions being equal, including compression-ratio, mixture ratio and volumetric efficiency.

(8) Turbulence has the effect of preventing knocking at a given speed equivalent to one-half a volume in compression-ratio, whereas dopes can improve the compression between three and four volumes, or an improvement of 7 per cent for turbulence against 33 per cent for dopes in air-cycle efficiency.

(9) Turbulence is indispensable to efficient combustion with dopes or without dopes. It is possible to wipe out entirely all the advantage of increased compression allowable with dopes by low turbulence effects.

(10) Flame propagation in combustion chambers is influenced by the following factors in order of their importance. (*a*) The chemical constitution of the fuel molecules. (*b*) Temperature. (*c*) Pressure. (*d*) Turbulence. (*e*) Mixture ratio. (*f*) Compactness and shape of chamber. (*g*) Location and number of points of ignition. (*h*) Some property of the spark. (*i*) Sound-waves in the mixture.

H. M. Crane, in discussion, stated that he has built both L-head and I-head engines with practically identical dimensions. He found that the I-head had just a slightly higher m.e.p. Owing to better turbulence the spark advance in the L-head did not need to exceed 25 deg., while in the I-head engine it had to be carried up to 65 deg. with one plug and with two plugs to 30 or 35 deg. Owing to the big spark advance on this engine it was really firing during the compression stroke.

Crane stated that in his belief the most effective turbulence to utilize is that secured on the compression stroke on the engine and not that due to intake velocity, because the latter soon dies away and is not active enough at the time of firing or near the top of the compression stroke.

Crane also pointed out that the action of the valve passage is to create a whirling vortex action which would interrupt the straight swirl spoken of by Mr. Horning as being desirable. He also stated that in some cases aluminum pistons help relieve detonation because the center of the piston is cooler. Another point noted by Crane is that there is a great difference in efficiency with two spark plugs in the overhead valve engine considered.

Professor Wilson of the Massachusetts Institute of Technology said that he doubted if turbulence greatly increased the number of molecular collisions. Mass motion does not affect the number of collisions, which follow a natural law. He said that in his opinion if anything had any effect it is eddying. On the other hand he thought that the dead pocket theory advanced in the paper is of great interest and value.

Mr. James of the Bureau of Standards stated that the presence of exhaust gases in the combustion chamber has a marked effect on combustion. Increasing the turbulence mixes the exhaust gas with the incoming charge and allows it to cut down the efficiency, while if the inert exhaust gases can be kept stratified on top of the piston and remain at rest conditions are better and there is not so much effect from the dilution of the charge.

In making comparisons between combustion efficiency and air cycle efficiency it must be remembered, said James, that the definition of air cycle efficiency involves eight assumptions. Air cycle efficiency is the efficiency of expansion. If we can burn the charge so rapidly that the peak of the combustion curve is close to the beginning of the combustion stroke and not late, we are getting the best results. The efficiency is dependent upon the fuel as well as on the cycle.

Hugo Gibson said that he was in general agreement with Mr. Horning. He brought up the point that the Knight engine, with its particular type of intake passage and smooth combustion chamber surface, had ideal conditions for smooth turbulence, and consequently had a minimum of eddy or parasitic turbulence. Regarding residual gases the smooth turbulence permitted allows of excellent results in mixing up the fuel, but the picture is spoiled because, he jokingly remarked, "Turbulence does not decrease knocking in the Knight engine because the Knight engine does not knock."

Answering Professor Wilson, Horning agreed with his ideas regarding molecular impacts, but said the object of turbulence is to increase the rapidity of combustion. Turbulence carries the flame into different parts of the mixture, thus creating new starting points for combustion. Since the entire mixture is rapidly inflamed the distance

(*Continued on page* 1157)

Fuel Research Session

MANY of those who attended the fuel research session which was held on Saturday morning regretted the fact that such important papers were scheduled for presentation so late in the meeting that the discussion was necessarily hurried. Many were unable to remain for this session. Nevertheless, the session was highly successful and enlivened by much timely discussion. O. C. Berry presided.

The first paper presented was that on Development of a High Compression Oil Engine by F. E. Ziesenheim, an abstract of which was published in last week's issue of AUTOMOTIVE INDUSTRIES. In introducing the speaker, Berry said that fuel is as necessary to the automotive industry as food is to the human race. Some people believe that the present generation need not worry about the supply of petroleum fuel, but others are of the opposite opinion. Some suggested solutions of the fuel problem are in the nature of a palliative while others are expected to effect a permanent cure.

Thomas Midgley, who opened the discussion, said that we could not hope to obtain more than 20 per cent of the liquid fuel needed for our internal combustion engines from the distillation of coal. He did not agree with the author of the paper that there was little hope for alcohol because it required as much heat to produce alcohol as could be gotten out of it; alcohol could be made with very little heat expenditure. On the other hand, he was not very enthusiastic about shale oil, as the best gasoline that could be made from shale oil would make the worst Mexican oil ashamed of itself. There is, he said, enough cellulose material grown in this country to produce alcohol sufficient to run all our automotive engines on, and it was therefore not even necessary to look to the tropics for the raw materials.

Diesel Pressures Not Higher Than Otto

Hugo Gibson said it was not necessary that a Diesel engine be made exceedingly heavy on account of the high compression pressures. You start with approximately 500 lbs. per sq. in. at the beginning of the power stroke and don't go above it, and this is not very much more than the pressures obtained in Otto cycle engines under full throttle conditions. In fact, under conditions of detonation we go even above it in Otto cycle engines. The problem of starting large Diesel engines can be easily solved by placing a friction clutch between the crankshaft and flywheel and bringing the flywheel up to speed first by means of an electric starter for instance, and then letting in the clutch. If the clutch holds well this method gives very satisfactory results.

W. G. Gernandt said the small high speed Diesel engine has been a hobby with him for some years. He had recently built a single cylinder, two-stroke engine of 2¾ in. bore which had a cylinder head thickness of 5/16 in., a wall thickness of ¼ in., a piston head thickness of 3/16 in. and a flywheel weighing 94 lbs. This engine burned gasoline, kerosene, distillate or fuel oil without change or adjustment. Its speed could be varied from 225 to 2250 r.p.m. by simply varying the amount of fuel injected, and there was absolutely no missing.

In reply to a question Mr. Ziesenheim said that the four cylinder Hvid engine built by the Pittsburgh Filter & Engineering Co. had as good distribution of the power between the cylinders as the regular Diesel engine. Mr. Brewer said that during the war he came in contact with Hvid engines belonging to the Shipping Board and they experienced great difficulty in keeping all cylinders working evenly.

Prof. Berry voiced the opinion that the Otto engine must always be the dominating type because we need the lubricating oil of crude petroleum for lubricating the world's machinery. There is no substitute for this lubricant, and the crude petroleum must therefore be distilled and cannot be burned as crude. Thomas Midgley, Jr., said that the biggest claim made for the Diesel engine was its high thermal efficiency, but substantially equal efficiencies can be obtained from the Otto engine if the compression is raised to a point corresponding to a compression ratio of 7 to 1. This is rendered possible by the use of anti-knock substances. He then gave some characteristics of several anti-knock chemicals, including ethyl iodide, ortho toluidine, di-ethyl celenide, and di-ethyl tolluride. Dr. Dickinson said that we must recognize that there are other lines of industry which demand a portion of the crude oil. In Mr. Ziesenheim's paper it had been shown that only about 28 per cent of the oil produced was converted into gasoline, and it was a mistake to assume that if an automotive engine was produced that would burn any kind of oil up to crude, this would render 100 per cent of the oil produced available for automotive purposes. The shipping interests have recently come to realize the value to them of burning oil under their boilers, with the resultant saving in shipping space. The shipping men can, he said, probably afford under present conditions to pay $10 per barrel of crude.

Mr. Mock observed that the Diesel engine would be limited in its field of application to the marine and tractor fields, to which Mr. Ziesenheim replied that if the Diesel engine took over the marine, tractor and truck end of the automotive industry the fuel situation would be greatly relieved.

The discussion on the Ziesenheim paper had to be cut short on account of lack of time, and the next paper to be presented was that by G. P. Dorris on Eliminating Crankcase Dilution by Manifold Development, and is printed below.

Dorris on Manifold Development

About 1912 the gasoline began to carry heavy ends in such amount that the application of a hot-water jacket around carbureters and manifolds improved the operation of the internal-combustion engine. Then the heavy ends increased up to 1915 and 1916, when a further revision became necessary to provide still higher temperatures than were possible with the limit of 212 deg. supplied by the hot-water jacket. Exhaust-heated manifolds and hot-spots helped to maintain the same degree of efficient operation with the then increased heavy ends of fuel. About 1917 the heavy ends of the fuel sold as gasoline required such an amount of heat to vaporize them that the expression "crankcase dilution" appeared. Now the heavy ends of the gasoline have increased to a maximum boiling point of 446 deg. Fahr. This has made it necessary to go still further in the direction of the heat application to get satisfactory results.

Relative Heat-Absorption of Air and Fuel

In the development of the internal-combustion engine it has become evident that the application of heat to the fuel through hot air is only a mild method of heat application and very detrimental to the volumetric efficiency

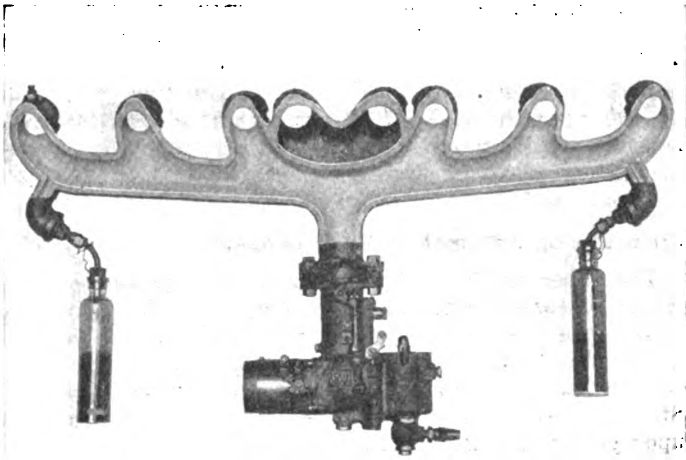


Fig. 1—Admission pipe of a six-cylinder engine in which the two exhaust ports at the center form a hot-spot immediately above the carbureter inlet

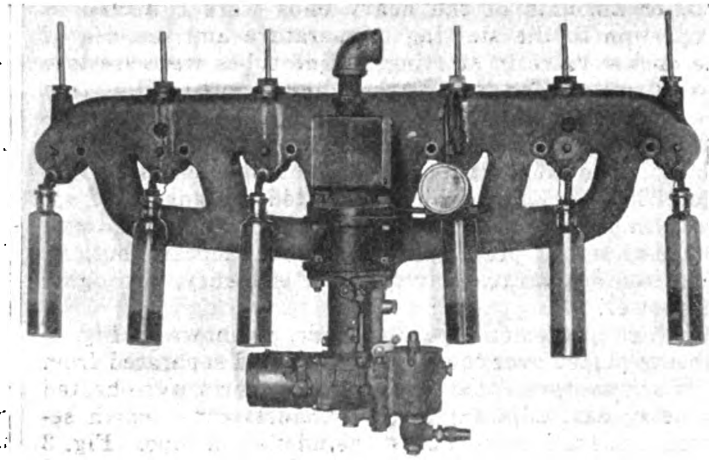


Fig. 2—An improved type of manifold in which the admission pipe is cast integrally over the exhaust pipe, thus securing better vaporizing of the heavy ends

and power output. It soon became recognized that the application of heat through the air was not a method of sufficient intensity to get desired results, and on further investigation it was seen that the direct application of heat to the fuel is a more efficient method as the relative heat-absorption capacity of air and fuel is approximately in proportion to their weights; hence the desirability of the elimination of hot-air jackets and the introduction of direct fuel-heating devices.

To the casual observer gasoline appears to be a definite fixed fuel not readily divided into several grades or degrees of combination of hydrogen and carbon. By subjecting this gasoline or fuel to a vacuum, it becomes evident that the vacuum readily separates the light ends from the heavy and gives a satisfactory gas with a cold engine, which is desirable in starting. Taking advantage of this fact, it is desirable to delay the delivery of the heavy ends of the gasoline until such time as the proper amount of heat can be applied to vaporize and pass them over to the cylinder in a readily mixed fuel for combustion.

Time Factor Required for Vaporizing

As the average motor car engine requires approximately 1/25 sec., at a car speed of 30 m.p.h. to vaporize, compress and expand one charge, it is plain that the time required to vaporize the heavy ends is considerably longer than that available at this rate of operation; therefore it becomes very desirable to provide for delayed passage of these heavy ends so as to supply sufficient heat for their thorough vaporization, to use them as a vaporous fuel and to prevent any liquid fuel, or heavy ends from entering the engine cylinders. The latter has caused disastrous results in crankcase oil dilution and premature wear in the engine bearings.

Fig. 1 represents an admission pipe of a six-cylinder engine, the two center ports of which being exhaust ports form a hot-spot immediately above the carbureter inlet, so that all heavy ends are thrown against the hot wall between the exhaust and admission pipes. The light ends are passed on to the cylinder as a vaporous fuel and the heavy ends vaporized against this hot-spot. This pipe was satisfactory using the fuel which was obtainable from 1917 to 1919. For experiment, the ends of the manifold were tapped for drains, whereby an inspection could be made of the process of delivery of the fuel to the cylinders. In starting the engine at a temperature of 32 deg. Fahr., 2 oz. of liquid fuel was collected in getting the engine warmed up to the operating temperature. The bottles would continue to fill slowly after the engine was warmed up. An inspection of the fuel in the bottles showed a 46-deg. Baumé gravity, while samples taken from the vacuum tank supplying the carbureter showed 68 deg. Baumé gravity. This test proved conclusively that the fuel yielded freely to an evaporation of the light ends, leaving the heavy ends to trail along the bottom of the admission pipe to the two end cylinders. From this it was obvious that a better utilization of fuel could be had under improved operating conditions.

Fig. 2 shows a revised manifold, wherein the admission pipe is cast integrally over the exhaust pipe, whereby considerable additional heat is applied and better vaporizing of the heavy ends accomplished. In making this pipe a pocket was provided between the two center exhausts, which is the lower pipe shown in the illustration, this pocket being an enlargement of the admission pipe and set below the point at which the fuel enters the admission pipe. This pocket collects considerable of the heavy ends on starting. The two center exhaust walls provided heat for vaporization after the engine was thoroughly heated up. Additional pockets were provided below the inlet ports, so that all heavy ends that might be projected over to the engine ports would be collected and their delivery delayed until such time as sufficient heat could be applied to vaporize them. To complete this experiment bottles were connected to these ports and

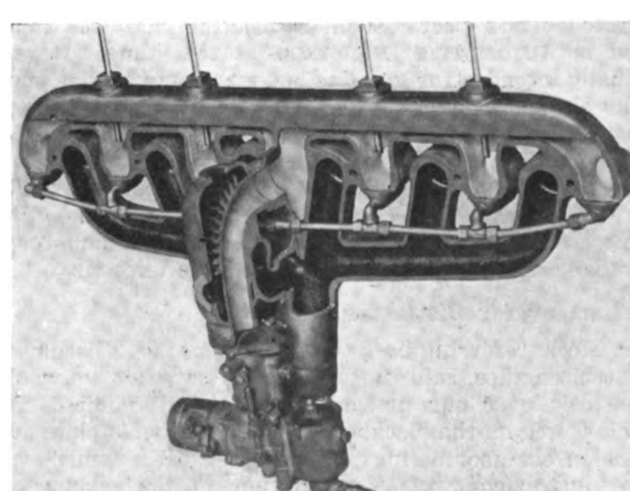


Fig. 3—View of the admission pipe as finally developed. One-half is removed to show the pipe employed to return the heavy fuel ends to the center vaporizing pocket

smaller amounts of the heavy ends were collected in proportion to the starting temperature and the use of the choker valve in starting. Blind tubes were set into the admission pipe down to the point of port-opening into the cylinder so that thermometers could be set into the pockets and the temperature of the gas at the point of admission to the cylinder noted. This temperature averaged 235 deg. Fahr., which permitted the engine to operate in a very satisfactory manner, with very clean combustion and practically no carbon deposit, but, on account of the decreased volumetric efficiency, the engine lost power.

A third admission pipe was made, as shown in Fig. 3, it being placed over the exhaust pipe and separated from it by air spaces so that the admission ports were heated by being cast adjacent to the exhaust ports, which secured a reduction in heat to the admission pipe. Fig. 3 illustrates this admission pipe with one-half removed and four of the thermometers in place. Six were used in the original experiment, but for production reasons the two end bosses have been eliminated. The thermometers show an average temperature, with the changed manifold, of 175 deg. Fahr.

By utilizing a vacuum a large portion of the light ends of the gasoline is vaporized, but the air is not heated or the admission pipe temperature raised unduly.

Figs. 2 and 3 show auxiliary heaters of different capacity bolted to the admission pipe. These heaters are controlled by valves, more or less hot gases passing from the exhaust to them. Fig. 3 shows the admission port pockets with the piping to return all heavy fuel ends collected to the central pocket or vaporizing still where they are stored until sufficient heat is accumulated to vaporize them.

With this type of manifold it has been possible to eliminate crankcase oil dilution completely and effect a reduction in carbonization. The lubrication efficiency has been improved. An improvement has been effected in acceleration and quick starting, and the engine will run at a constant speed with a good torque within 1 min. after starting. A 4000-lb. car has covered 17 miles on a gallon of gasoline in a straight run at 30 m.p.h. In a 1-gal. test, using kerosene as fuel, a car equipped with this manifold made 17.1 miles. These results prove the efficiency of the equipment in preventing the passage of liquid fuel to the engine cylinders.

A. W. Scarratt gave a description of a manifold which he developed for the trucks of the Minneapolis Steel and Machinery Co. This manifold was also referred to by Mr. Scarratt at last year's summer meeting and was illustrated in AUTOMOTIVE INDUSTRIES at that time. It was originally intended for gasoline but was found to give good results also with kerosene and has been used mainly with the latter fuel. On a 3½ ton truck a fuel economy of 6.8 to 7.1 miles per gallon is obtained. An interesting point is that the temperature at the outlet of the manifold is 175 deg. Fahr., with gasoline and 210 deg. with kerosene. The same manifold also works well with alcohol, although considerable heat must then be supplied to the inlet air.

One Remedy for Distribution Troubles

Mr. Mock, referring back to the paper of Mr. Ziesenheim on Diesel engines, said that within a few years we would be entirely over our present distribution troubles. He drew a sketch on the blackboard showing a baffle plate and expansion chamber acting as a fuel separator which was placed just beyond the Venturi tube of the carbureter. The liquid fuel particles separated out due to the low velocity in this chamber, drop onto a hot spot and are distilled off, thus rejoining the air stream. He predicted that when this device is fully developed there will be no need for limiting the manifold cross sectional area. Mr. Horning, referring to Mr. Dorris' paper, said that he had run an experiment in which he collected the unvaporized portion of the fuel from the bottom of the inlet manifold. At 400 r.p.m. he took off 50 per cent of all the fuel fed, and "the engine never knew it." This accumulation measured from 49 to 51 deg. Baume as against 58 deg. for the fuel itself.

Elements of Automobile Fuel Economy

The paper by W. S. James analyzes the power requirements of cars and traces these through to the source of supply, the energy in the fuel, showing where the various losses occur. The six appendices written by S. W. Sparrow, R. L. Wales and H. C. Dickinson of the Bureau of Standards cover the influence of air to fuel proportions upon power and efficiency, metering characteristics of several carbureters, mechanical efficiency of engines at various loads, ignition timing, the various theories of fuel knock and the relative merits of large, low speed and small, high speed engines. Both the paper and appendices will be printed in condensed form in early issues of AUTOMOTIVE INDUSTRIES.

In presenting his paper, James laid stress upon the need for atomization of fuel as an aid to vaporization, and pointed out that change in spark advance is more important with change in throttle position than with change in speed, so far as its effect upon economy is concerned. The character of the spark is also important, especially when combustion conditions are poor.

Little is known at the present time about the rate of energy liberation during combustion, said James, yet this is an extremely important factor.

James laid stress upon the importance, from a fuel conservation standpoint, of taking steps to secure better economy from the many million cars now in use, and suggested that car manufacturers might well advise present owners or assist them in making simple changes which would result in far better economy.

The time available for discussion of Mr. James' paper was so short that but few speakers could be heard.

Prof. Wilson described experiments he has been conducting at Massachusetts Institute of Technology for the purpose of determining the average dew point of commercial fuels such as gasoline and kerosene. This point is easily found in the case of fuels such as alcohol and benzol, which are not blended with other hydrocarbons, but has heretofore been difficult to measure in the case of complex fuels containing several hydrocarbons of various boiling points. The temperatures thus determined indicate that both gasoline and kerosene can be readily vaporized at temperatures well below that of the exhaust gas.

Mr. James stated that the results obtained by Prof. Wilson could be applied in determining the temperature of mixture entering the cylinder. A thermometer in the inlet pipe is usually welted with fuel, and is therefore supposed to record a temperature below that of the mixture.

W. G. Gernandt, who is interested in the development of high compression oil engines drew attention to the fact that many of the troubles caused by the difficulties in vaporization of even so good a fuel as gasoline are avoided in the injection type of engine which uses a much lower grade fuel.

Thomas Midgley, Jr., in discussing the use of indicators for measuring rapid rise of pressure, mentioned in the paper, drew attention to the fact that recent investigations have shown that certain lines of the spectrum change position with pressure change in the burning gas whose spectrum is being examined. This discovery suggests the possibility of using spectrum analysis as a means of determining the rate of pressure rise.

General Research Session

THE general research session, so called, was opened by Chairman H. M. Crane, who read by title only a paper on industrial research by L. A. Hawkins of the General Electric Co. This paper describes methods, facilities and results obtained in extensive research work conducted by the company with which the author is connected.

C. W. Stratford, well known to Society members and other engineers because of his long study of lubrication and lubricants from both the automotive and oil refiners' standpoint, presented a comprehensive outline of problems relating to lubrication which are in need of careful study and require much research work before solution can be anticipated. The following are among the many points of importance which were touched upon in the informal talk which he gave in lieu of a written paper.

The development of more comprehensive and satisfactory methods of determining the qualities of lubricants was mentioned as being a very real and pressing need, from both users' and producers' standpoints. Work in this direction is in progress at the Bureau of Standards (as recently described in these columns) and further work is needed. Lack of standard testing methods covering several known qualities of lubricants makes it difficult to draw intelligent specifications intended to secure uniformity in quality.

The fact that grease is a poor lubricant was emphasized. It is, the speaker stated, only a soapy sponge serving or intended to serve as a carrier for oil which gives it a certain lubricating value, without which it would be practically useless. The desirability of constructing transmissions, axles and other parts in such a way as to use oil instead of grease, and to retain the oil indefinitely was pointed out, and the considerable saving in power and fuel thus realized was mentioned.

The advantages and disadvantages of pressure feed and splash lubrication were touched upon briefly. Pressure feed systems are more positive and can be designed to assist materially in keeping bearings cool, but are inclined to result in somewhat higher oil consumption than splash systems, according to Stratford.

Graphite and soapstone are solids sometimes used for lubricants, but it is very generally agreed that oil is by far the best lubricant.

Lubrication of cylindrical bearings by oil is not facilitated by the use of oil grooves. An oil film once established in a cylindrical bearing without grooves is not difficult to maintain so long as the temperature is kept within reasonable bounds.

Decomposition and oxidation of hydrocarbon oils begin at about 200 deg. Fahr. The best operating temperature for oil depends upon many factors, but in general it is only slightly above atmosphere. Temperatures above 300 deg. Fahr. cause rapid oxidation.

Screens of fine mesh, intended to strain oil passing from bearings, are apt to become clogged and are not necessary if a sump allowing settling of foreign matter is provided and provision for drawing off sediment is made.

There is a wide variation in viscosity as between so called light oils, and the same is true for medium and heavy. Furthermore, there is seldom consistent uniformity in viscosity over considerable periods of time as between oils of the same brand.

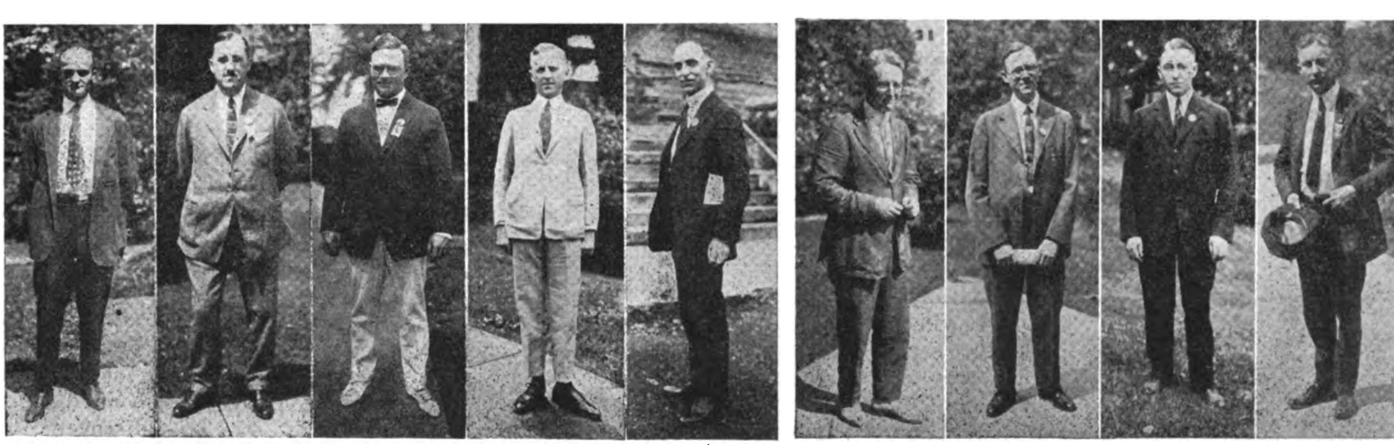
Tests of oils under a government or other unbiased authority with results of samples from various localities compared and published might aid in assuring uniformity.

Frequent change of lubricant tends to conserve the life of an engine. Oil drawn off should not be thrown away; 70 to 90 per cent of it can be recovered by blowing with steam after soda ash is added to break colloids, at a cost probably less than 5 cents per gal.

In opening the discussion on Stratford's paper, H. M. Crane said that the difference between splash, pressure and flooding lubrication should be emphasized. At exceedingly high speeds, splash cannot be depended upon for lubrication of the connecting rod bearings, because the centrifugal force is then so great that no oil from the outside can get to the rod bearings. At low speed, even a heavy duty engine can be effectively lubricated by splash. As regards the subject of strainers, a small screen of 70 mesh, which they had been using for a long time, was sufficient to remove a lot of sand (that always adhered to the aluminum castings) and other solid contaminating elements.

James N. Heald said that we have more cause to worry about the oil problem than the fuel problem. There is only comparatively little oil in a barrel of crude. A manufacturer of high-grade piston rings had told him that by the use of his rings he had been able to reduce the oil consumption of a certain car by about one-quarter. He claimed that much oil was being wasted. If we want to save oil, the best way to do it is to produce a first-

Among Those Who Read Papers



W. S. James | H. L. Horning | V. E. Clark | F. E. Ziesenheim | H. C. Dickinson | W. E. Lay | Herbert Chase | C. W. Stratford | G. P. Dorris

class cylinder bore. The high-grade manufacturers are doing this, but not the others. Boring and reaming, he said, do not produce a first-class job.

In reply to a question from Col. William G. Wall, Stratford said that there is little free carbon in a finished motor oil. He had never found more than 2 per cent free carbon in samples of crankcase oil, and where the carbon reached this proportion it was usually due to extra thin piston heads which heated to such a temperature as to cause the oil adhering to them to crack. Col. Wall wanted to know what caused the deposit inside the oil passages of the crankshaft, whether it was heat or the centrifugal force, and what the deposit consisted of. Stratford said that all contaminating elements were probably represented in this deposit and that centrifugal force was the cause of its formation in the oil channels.

William M. Britton said that vendors of asphaltic base oil state that the carbon deposit from this class of oil is of a soft nature and can therefore be removed easily, and the vendors of paraffin base oil tell one not to use asphalt base oil because it disintegrated so easily and gave no end of trouble in forming hard carbon. He wanted Stratford to tell him just what the facts were. In reply Stratford said that some acid-treated oils break up very readily at high temperatures, especially if they contain sulphur compounds. A good test of any lubricating oil is to heat a small sample of it to about 550 deg. Fahr. for 10 min. The carbon deposit is much the same whether the oil is of paraffin or asphalt base. When the oil is poured out of the cup in which it has been heated, the poor oil will always show a sediment, while the good oil will not. Much research still remains to be done before workable specifications for lubricating oil for any particular purpose can be written.

Chase Discusses Clutches

The third paper scheduled at this session was presented by Herbert Chase, the title being "Practice and Theory in Clutch Design." This paper will be printed probably in full in an early issue of AUTOMOTIVE INDUSTRIES. In opening the discussion, Chairman Crane said that our clutches are required to accomplish two very antagonistic things. Owing to the fact that the clutch must be released for brief moments in order to permit of shifting gears, it is necessary that the spinning weight of the driven element be as small as possible; while, on the other hand, the clutch must be sufficiently large to hold under the maximum load and also not wear excessively under normal slippage. It is the spinning weight problem that militates against the cone clutch, as the cone clutch, having only a single friction surface, must be of large diameter. One well-known foreign car that he knew of has a cone clutch that made it almost impossible to shift from a higher to a lower gear without what is known as double clutching; that is, disengaging the clutch and, after a slight interval, bringing it into engagement again for an instant. There is also much misunderstanding of the real function of the clutch brake. A clutch brake is of no service in changing from a higher to a lower gear, as in that case the clutch needs to be speeded up rather than retarded. Crane had a good word to say for the single plate clutch with lubricated asbestos lining. More than 100,000 miles of service of such a clutch had resulted in no appreciable wear.

Prof. Lay said that another pair of conflicting requirements was that in hard pulling you want the clutch to hold without slipping, while, when first engaging you want it to slip, but Crane thought this requirement could easily be met by suitable arrangement and handling of the control members.

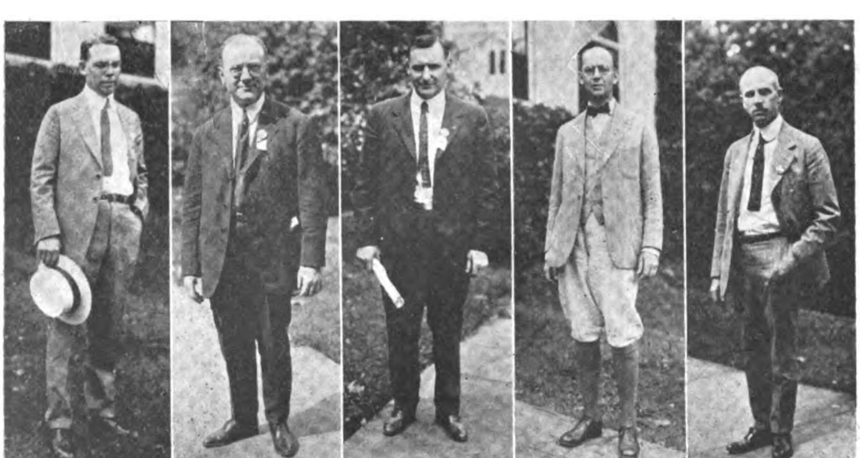
B. B. Bachman complimented Chase on the nature of his paper, saying that it represented an excellent type of research. He added that, in connection with the standards work, he had always insisted on the importance of gathering data from practice. One factor which was not covered in the paper, but is important, is the unit pressure on the splines. If this was obtained for the different clutches surprising differences would be discovered. Another item to which he called attention was the clutch pilot bearing. This bearing is located in an inaccessible place and is sometimes hard to lubricate, and for this reason the use of a ball bearing at this point is, he said, beset with difficulties.

F. E. Moscovics called attention to the coil type of clutch used on the early Mercedes cars. These clutches, he said, were exceedingly compact, yet held firmly when under load, and also slipped well when handled carefully. Crane said his firm repaired a Mercedes 1906 car and in that way gained some experience with that type of clutch. Owing to the small inertia of the driven part the gears shifted very readily—it almost felt as though there was nothing removed by the shifting lever. The clutch had to be handled carefully, however, as otherwise it was likely to grab. Another defect was that if the clutch was allowed to slip for any length of time the wear was very rapid. Other members, including Messrs. Sperry and McGeorge, attested to the excellent qualities and extensive use of this type in various lines of industry.

In closing the discussion Chase said that he believes the need for low spinning weight emphasized by Crane is best realized by the multiple disc design, since sufficient capacity can be had without using friction faces of large diameter or weight.

While acquainted with the Mercedes type of clutch the author said he had omitted reference to it for the same reason that reference to other types not now extensively used had been omitted—namely, that he preferred to confine the discussion to widely-used commercial types.

Prof. W. E. Lay of the University of Michigan presented the concluding paper. It was entitled "Co-operation in Research." He contrasted industrial and technical school research and defined the field for each. The major portion of the paper was devoted to a description of the new testing laboratory of the University of Michigan, which is specially well equipped to make engine and chassis tests as well as tests of a metallurgical character.



W. G. Wall — F. M. Germane — A. D. T. Libby — R. E. Huff — J. E. Hale

The Aeronautic Session

AT the aeronautic session held on Wednesday morning J. G. Vincent occupied the chair. Three papers were presented, one of a somewhat technical and the other two of a commercial or economic character, as follows: Aviation Powerplant Development, by G. C. Mead and L. E. Pierce; Air Transportation and the Business Man, by Col. V. E. Clark, and Need for Federal Control in Commercial Aviation, by S. H. Philbin. Following is an abstract of the paper by Messrs. Mead and Pierce.

Aviation Power Plant Development

Aeronautical engineers unconsciously consider that an engine must weigh less than 2 lb. per hp., and that the fuel consumption is satisfactory if it is in the neighborhood of 0.50 lb. per h.p.-hr. Such an engine rarely lasts more than 50 hr. without a top overhaul, which is equivalent to 6000 miles of air travel. The airplane designer is inclined to believe he must have maximum power and minimum weight at any cost. In this case, the cost is the reduced life of the engine. The commercial requirements involve the use of entirely new factors, since the prime requisites of commercial work are efficiency and durability, which changes the engine design considerably. Our definition of durability is long life. All aeronautical engines must be reliable, but in the past durability has been sacrificed for light weight per horsepower. The weight factor for engines with these requirements becomes at least 3½ lb. per hp. Commercial engines should run at least 16,000 miles without a top overhaul, with a fuel consumption approaching 0.40 lb. per hp.-hr. These constants contrast sharply with those for the military requirements. In this connection it is interesting to compare these figures with those for the Wrights' first engine, which weighed approximately 7.6 lb. per hp. This is a decided indication of the progress that has been made.

The power available from a single cylinder depends upon the dimensions of the cylinder, the speed of operation and the compression ratio. Taking up the cylinder dimensions first, we find that a 5½-in. bore cylinder was practically the limit at the close of the war, which made available some 45 hp. per cylinder and resulted in a large number of cylinders where considerable power was required. The limiting factor for the bore appears to be the reciprocating parts. With large bores, the pistons become difficult to cool in the usual manner. This is not an insurmountable obstacle, since several expedients are known for cooling pistons in other ways. The principal reason is that the power required to overcome the inertia of the reciprocating parts increases rapidly with the increase in the cylinder bore at a given speed. Indicated mean effective pressure is independent of cylinder size, at least so far as our experience to date goes. Therefore, as the cylinder bore increases, the reciprocating weights increase and the speed of the crankshaft must be decreased to permit of a good brake mean effective pressure. At present, cylinders of 7-in. bore are being operated successfully at speeds as high as 1400 r.p.m., with brake mean effective pressures corresponding to those obtained with any of the smaller cylinders. Powers as high as 65 hp. are now obtainable from a single cylinder of this size, a gain of 30 per cent.

Taking up the question of stroke, it has been found that a "square" engine, one having the bore equal to the stroke, makes the lightest possible construction. When the valves are placed in the head, it is very difficult with long strokes to secure sufficient valve area, and still cool them properly so that they will stand up under the temperatures resulting from the high mean effective pressures.

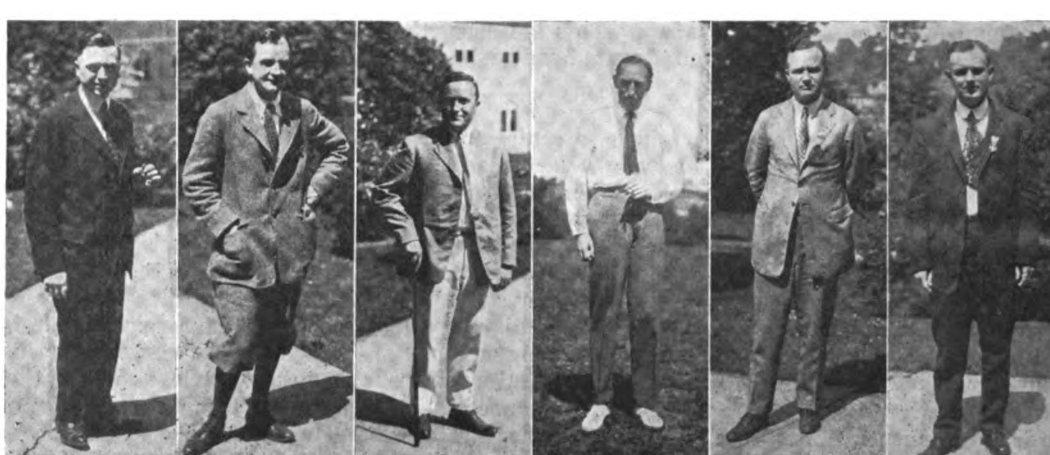
The speed of the engine, or its rate of doing work, is quite important. The limiting factor here becomes the propeller speed. With the pursuit ships it is possible to run the propeller up to 2100 r.p.m., but for commercial work, due to lower flying speeds, it is not desirable to turn the propeller nearly so fast, because of the effect on propeller efficiency. A propeller speed of 1800 to 2000 r.p.m. is considered more or less standard for military work, and from 1000 to 1400 r.p.m. for commercial work. In the case of a dirigible, the propellers turn about 550 r.p.m. The question immediately arises, Why not gear the engine? For military work, no commercially manufacturable gearing has been devised which permits a reasonable powerplant weight per horsepower.

It has been found desirable to increase the compression-ratios as much as possible, to permit the maximum power output of the engines at great altitudes. The maximum compression-ratio from which a gain in power can be secured is 7 to 1. So far, the size of the cylinder does not seem to limit the use of such a compression. Above 5¼ to 1 it is desirable to use some anti-knock substance such as benzol, if it is necessary to operate the engine on the ground under full power.

M. E. P. Possible With and Without Dope

Without dope, it is possible to secure 130 lb. per sq. in. mean effective pressure in water-cooled cylinders, and with dope as high as 145 lb. per sq. in. it follows that we shall be able to produce much larger powerplants with fewer cylinders than formerly, if a demand for them arises.

Great strides are being made in the development of air-cooled cylinders for aviation work. The British report be-



Alex. Taub — Al. Poole — E. B. Ross — J. W. Watson — Thomas Midgley, Jr. — O. C. Berry

ing able to obtain as high mean effective pressures as with water-cooled cylinders. So far, the maximum mean effective pressure which has been developed in this country with large air-cooled cylinders is in the neighborhood of 110 lb. per sq. in. With relatively small cylinders, pressures as high as 125 lb. per sq. in. have been secured. Thus far satisfactory air-cooling has been limited to radial engines. Air-cooling has advantages for an airplane, due to the tremendous differences in temperature under which the engines are forced to operate. It also makes the engine somewhat less vulnerable when used for military purposes. This does not seem to be a very important feature, since most planes that are shot down apparently fall because of fire rather than any other cause. The disadvantages of this type of cooling are that it allows, so far, relatively low mean effective pressures, increases the parasite resistance of the airplane considerably, and does not permit easy temperature-control.

Four cylinders in line are not satisfactory, due to both the power limitations and the vibration. Six cylinders form an ideal combination, since it is possible to obtain powers as high as 400 hp. from this number, and the engines are perfectly balanced mechanically. The weight factor for a six-cylinder engine is from 2.5 to 3.5 lb. per hp., depending upon the service. The limit of the number of cylinders that can be put satisfactorily in one line is eight, due to the torsional vibrations of the crankshaft. The weight of such an engine is about 20 per cent greater per horsepower than for a six-cylinder engine, due to the long crankshaft and crankcase, but for such uses as dirigible work the durability and efficiency of this type are sure to recommend it. Over 500 hp. is available in a single unit of this type.

The V-type eight-cylinder engine is undoubtedly the lightest water-cooled engine known, for the reason that it has the shortest crankshaft for a given power. Weight factors of 1.45 lb. per hp. have been secured from this type of engine.

It has already been proved that eight cylinders of sufficient power to give 400 hp. at 2000 r.p.m., which is a pursuit propeller-speed, do not involve reciprocating parts of sufficient weight to make the vibration serious to the plane structure.

V-type 12-cylinder engines are used considerably for short-distance bombing airplanes, where the engine weight is a factor. Small engines of this type will undoubtedly be in demand for pleasure purposes, just as they are in automobile work. The best weight-factor from a 12-cylinder engine is in the neighborhood of 1.9 lb. per hp. With a given displacement the 12-cylinder engine presents much more exposed cylinder and port area to the cooling water and therefore a considerably larger radiator is required than for a fewer number of cylinders. This increases the total weight of the powerplant and also its head-resistance.

Radial Engines

Serious consideration has been given to radial engines, particularly by the British. The weight-factor for this type of engine is about 2 lb. per hp., when the design is such as to permit the engine to operate satisfactorily for 50 hr. This is practically the same weight-factor as for the V-type eight-cylinder water-cooled engine complete with water and radiator, so that there is really no saving in weight. Moreover, a radial engine of a similar power to that of the V-type eight-cylinder engine has an enormously increased parasite resistance. Radial engines properly balanced are very smooth-running and compact as regards the concentration of weight. The temperature control is very difficult. Fuel consumptions similar to those obtained with water-cooled engines are now possible, but the oil consumptions are just about twice those for the standard water-cooled types. Water-cooled radial engines have been built, such as the Salmson, made in France, but there does not seem to be any particular value in such designs.

In a summary the authors made the following statements: We have not reached the limiting size for any type of engine as regards the maximum power available. No increase in engine performance can be expected unless new materials of construction, new fuels or new cycles of operation are made available. Continued development will refine the practices of the art and result in bettering the life of the engine and the service it renders, rather than its performance. Therefore, increased airplane performance must be secured mainly by improvement in airplane design. Great advance seems to be possible in this direction. One reason for the tremendous powerplants available for airplanes has been the effort to secure performance by brute strength. Absurdities can soon be reached if this trend of development continues. It is certainly worthwhile to consider what can be done with a reasonable-sized power-unit, by altering the design of the airplane. As shown in the last Pulitzer Trophy Race, excessive horsepower is not necessary to secure high speeds. The next few years should see a reduction in the power demanded of pursuit engines.

More Miles Per Gal. of Fuel Desirable

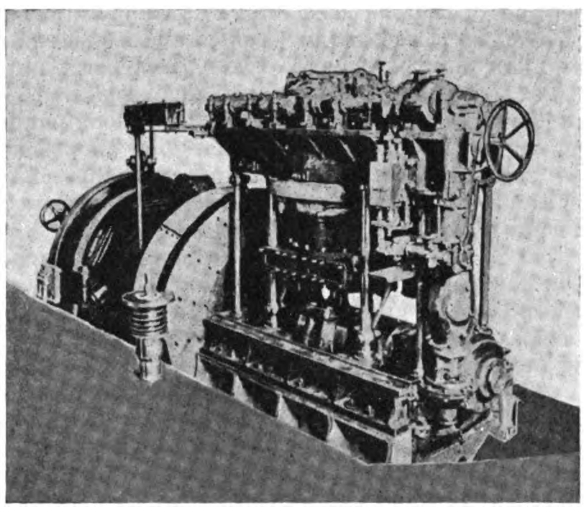
It is high time that attention be given to a most important problem, the fuel mileage obainable from a given airplane. It is unquestionably true that the average person could not afford to operate some airplanes, even though he might be able to purchase one, because of the poor mileage secured from a gallon of fuel. This is an essential consideration for commercial work, due to its effect on the profits of an operating company, and should be given study by the military authorities also, on account of the effect it has upon the quantities of fuel required in case of hostilities. This is, to our minds, the best and most obvious reason why the power requirements for aeronautical powerplants should be reduced rather than increased. It is not commercially possible to build so many power units within a given range. Airplane designers must be satisfied with fewer units, if we are to commercialize the business.

It is believed that the effect of engine dimensions on maneuverability is largely overestimated. The reason that popular comment is so often to the effect that the engine is the most important factor is the fact that there is no ready means by which the aerodynamic qualities of the airplane affecting maneuverability can be thoroughly analyzed and visualized. For similar horsepowers engine type rather than overall size will have the greatest effect on the parasite drag of the fuselage group. The efficiency of the cooling-element design for water-cooled engines is considerably better than that for air-cooled engines. Between practical limits, the effects on the performance of the airplane of variations in the values of engine weight per horsepower, of cooling efficiency, of fuel economy and of altitude performance of the engine are very pronounced. The demands of super-performance in military designs and greatest operating efficiency in commercial designs will require the development of engine types which are most favorable in these respects. The relative importance of the factors involved is governed by the particular service for which the airplane is designed.

Problems of powerplant installation are centered about the need of a close co-operation between the builders of airplanes and engines. The requirements of each system of installation can be met only be acquiring a correct knowledge of what these requirements are and satisfying them fully. A study of the engine mounting in complete detail, developing the truss system to accommodate all of the en-

gine forces involved, both static and dynamic, is a most important requirement in insuring a successful installation. Simplicity and practicality of design and the suitability of the accessory equipment used are most essential in the development of the several powerplant systems. The development of the complete powerplant installation must be made with a view to permitting the greatest possible degree of service accessibility. Only in such a way can the proper mechanical attention be assured for the powerplant. The fact must not be lost sight of that the industry is in a formative period and for this reason we must expect to spend a tremendous amount of time and money in research. We cannot standardize without the necessary knowledge, and we cannot obtain that knowledge without research.

After the presentation of the above paper, Elmer Sperry gave as a volunteer paper an outline of some development work he has been doing in the line of compound Diesel engines for automotive purposes. Just why this was inserted in the aeronautic session was not explained. Sperry referred to the fire risks connected with our present airplanes and cited accidents in the air mail service in support of his statement. He said that in his type of Diesel engine he used what he called bunker oil which actually had fire extinguishing properties. He had recently read of the use of magnesium in commercial work and obtained some samples of the metal. He expected that there was something wrong with the metal and found this to be the case, in that the chips produced in working it were apt to catch fire. Squirting water on the metal would only make matters worse, and to reduce the fire danger, in the factory in Frankfort, Germany, where they produced this metal, they supplied each of the workmen with a pail of the same grade of heavy oil which he used for engine fuel. The pail of oil hung close to the lathes and the oil was for use in smothering an outbreak of flames.



The Supercharged Compound Diesel Type Engine, Described by Sperry.

Sperry showed on the screen photographs, drawings and indicator cards of a three-cylinder compound expansion engine with two 7 by 11 inch high pressure cylinders. The low pressure cylinder is located between the two high pressure cylinders and receives the discharge from these two cylinders alternately. The lower end of the low pressure cylinder is used as a precompressor and forces into the high pressure cylinders a much greater amount of charge than could be gotten in by suction. Owing to this precompression and the resulting supercharging the compression space is not nearly so flat as in the ordinary Diesel engine, and the proportion of surface or cooling area to volume of compression space is therefore much smaller. As in the regular Diesel cycle, nothing but air is drawn into the precompressor and transferred to the compression chamber of the high pressure cylinder. When the piston in the latter reaches the top of the stroke, fuel is injected by a solid injection mechanism in the center of the cylinder head and the mixture ignites spontaneously owing to the heat of compression. The explosion pressures normally attained are in the neighborhood of 900 lbs., per sq. in. These are pressures usually associated with detonation, and Sperry claims to have solved the problem of harnessing the detonation and turning it to useful account.

In the high pressure cylinders the charge is expanded down to about 300 lbs. per sq. in., and it is then transferred to the low pressure cylinder. The two high pressure cylinders are set to explode alternately at equal intervals, working on cranks in the same plane. Using the high pressure cylinders only, Sperry stated, he obtained only 29 hp., while with the low pressure cylinder operating in addition the output was increased to 200 hp. In reply to a question by Dr. Miller as to whether any trouble was experienced from sulphur in the fuel, Mr. Sperry said that it was necessary to keep the exhaust temperature above the temperature of water condensation. Mean effective pressures of from 62 to 75 lb. per sq. in. are obtained.

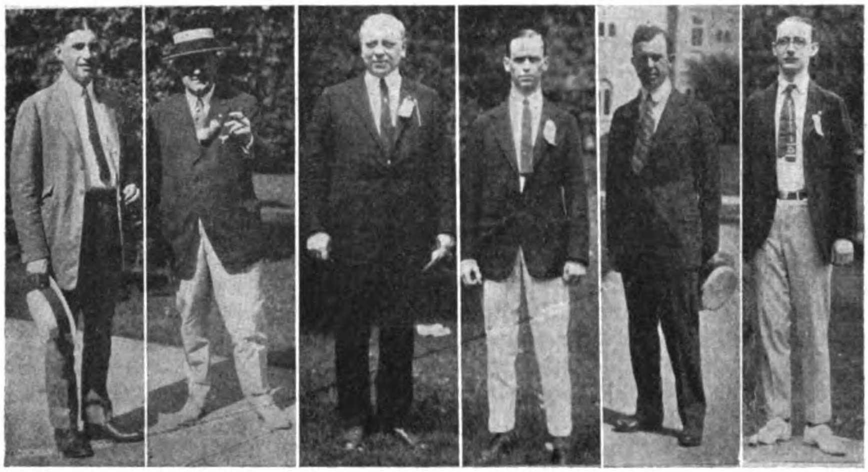
A number of indicator cards from the engine, obtained with an ordinary piston type of indicator, were thrown on the screen, and emphasis was laid on the fact that the combustion line was absolutely vertical, showing that the combustion took place very rapidly. It is thus shown that one of the objections often raised against the use of the Diesel engine in automotive practice, that the charge won't burn sufficiently rapidly, is not well founded. In the low pressure cylinder the exhaust is through a port at the lower end, which is closed some time after the piston has started on its upstroke, and the gas remaining in the cylinder is then compressed until at the end of the stroke the pressure is substantially equal to the transfer pressure of 300 lb. per sq. in., thus forming a cushion for the low pressure piston and also tending to reduce losses due to clearance in the low pressure cylinder.

Sperry had thrown on the screen a sectional and an outside view of a so-called Diesel aircraft engine built by Dr. Junkers in Germany (views already shown in AUTOMOTIVE INDUSTRIES) and remarked that there were shown two spark plugs in the cylinder wall, which proved that it was not a real Diesel engine. The compression pressure used was only about 250 lb. per sq. in. and there was, moreover, the complication of the double crankshaft. In reply to questions during the discussion Mr. Sperry said that the fuel consumption amounted to 0.42 lb. per hp.-hr. and that the maximum speed attained was 2400 r.p.m.

The engine which Sperry has built and on which the indicator tests were made was of the marine type and weighed about 27 lb. p. hp. He has now agreed with the Government to build a light engine of similar design which is not to exceed 5 lb. per hp., and he hopes to improve upon this figure.

A. D. T. Libby asked what had been the experience with regard to the increase in power by the use of two or more spark plugs in such large cylinders as discussed in the papers.

J. G. Vincent replied that he had had experience with a four valve dirigible engine of 6⅝ in. bore and 7½ in. stroke, a type of engine in which fuel economy was very important. The engine had four spark plugs per cylinder. With all four plugs in good condition the engine would run without appreciable knock, although it was impossible to go beyond a compression ratio of 5 to 1, which was ascribed to a slight variation in the distribution. If three of the plugs were cut out the engine would go nearly through the roof, and it ran about as badly on



E. M. Coe | C. S. Whitney | B. W. Brodt | W. P. Culver | E. L. Vail | M. C. Horine

Mark Smith, Bert Kelly, Lon R. Smith.

three as on two plugs. This engine operated constantly at 1400 r.p.m.

A member asked why it was that no more progress had been made in this country in the line of water-cooled radial engines which seemed to have reached a high stage of development abroad. To this L. E. Pierce replied that his company (Wright Aeronautical Corp.) is now working on the air-cooled engine problem, and after that had been solved they would take up the water cooled engine. Vincent said that air-cooled engines were made radial because of cooling requirements and not because of aircraft requirements. He also referred to Sperry's mention of the fire hazard and averred that it was not nearly so great as made out by Sperry. The pilots, as a rule, do not dread fire nearly as much as the possibility of being obliged to land in rough, restricted fields. He himself had no more fear of an airplane catching fire than of the same thing happening to an automobile. Engineers now knew how to build airplanes so as to make them practically fireproof; that is, even if a leak should develop in the fuel system the fuel would not accumulate in any place where there was a chance of igniting it. It was true that there had been some cases of fire on the planes of the air mail service, but this was due to the fact that the Post Office, owing to lack of sufficient funds, was compelled to make use of obsolete equipment.

John McGeorge pointed out that while at McCook Field the previous week he observed that the fuel joints on some of the engines there were poorly made, and that this might be one of the explanations of the occasional burning up of planes. It was not a matter of poor design but merely of poor workmanship. Vincent said it had to be remembered that at the Field they got engines for test from all over and that some of these naturally were somewhat crudely built. But before they were put into planes they were always given extended block tests.

Mr. Caldwell said that what we wished to commercialize was not so much the art of flying as the aircraft industry. If it were possible to develop a good pleasure airplane it should not be difficult to find an extensive market for it. He referred to the possibilities of the helicopter, which does not require a big field to start from and land in, can rise to a considerable altitude in a few minutes and is much less unwieldly than a plane. The French were doing development work on helicopters, but had not to date achieved any very notable results. Col. Clark, the author of one of the papers of the morning, later said that he did not think highly of the possibilities of the helicopter. Its stability must of necessity be rather uncertain, not much speed in a horizontal direction could be expected, and there would always be a considerable element of danger if the engine should stop accidentally while the helicopter is in flight.

In Col. Clark's paper the possibilities of getting capital to seek investment in aeronautic enterprises were discussed and it was shown that the prospects were not very rosy. This point was taken up by Fred Moscovics, who said that capitalists should be appealed to to help the movement along on patriotic grounds without any particular view to profits. It had been the fact throughout history that those nations which had the most advanced system of transportation also led in culture and in civilization. He had spent the winter on the Pacific Coast, where there was more flying than in any other part of the country, and he gave some figures as to the time that could be saved by the use of airplanes over different routes. Seattle and San Francisco are 800 miles apart and the trip by railroad takes more than a day. The aerial distance is much shorter than the distance by train and the air trip can be made in about 8 hours. Vincent agreed that commercial aviation had the best chance where other means of transportation are comparatively poor.

A representative of the Air Service stated that they had recently developed a method of predetermining the static thrust of a propeller of given dimensions; that is, the thrust exerted by the propeller when the airplane is at rest and the propeller is being revolved at any given speed. It was found that there is a certain relation between the thickness of the blade and the thrust. The newly discovered method permitted of calculating in advance the horse power which a propeller will absorb at different speeds. The usual ratio between thrust and horse power was 7. The thrust varied as the square of the revolutions per minute, and by increasing the diameter of the propeller and at the same time reducing the speed of revolution to keep the strain due to centrifugal force constant, the thrust ratio could be increased to 10.5 to 1. He was of the opinion that eventually the propeller would be used in landing. In traveling over the country he had observed large districts where it would seem almost impossible to construct landing fields for airplanes, and yet birds landed there every day. When a bird lands it first comes down at considerable speed and then, just before touching the ground it flaps its wings, that is, it exerts considerable power, which enables it to land in a comparatively restricted space.

Col. Clark, referring to a statement by a previous speaker, that one of the ways of getting cities to provide landing fields was to give them an air mail service, said that he was not sure that such an inducement would have much effect. Salt Lake City, for instance, voted an ap-

(Continued on page 1161)

The Combustion Session

(Continued from page 1147)

the flame must propagate itself is greatly decreased, hence detonation velocities are not reached.

Replying to the remarks on the advantages of the Knight engine from the turbulence standpoint, he stated that he agreed in this and that there is apparently but one disadvantage to the Knight engine, and that is the location of the spark plug in the pole of revolution of the stream of turbulence and up in a chamber out of the way. The turbulence is so good, he said, in these engines that notwithstanding the low m.e.p. the fuel economy is good. The reason for this is that the turbulence makes up for the loss of compression, and in a measure acts as its equivalent.

C. A. French in presenting his paper on flame, printed in last week's issue of AUTOMOTIVE INDUSTRIES, advanced several interesting theories, some of which were accepted as a step in the development of present knowledge on this subject and others which were questioned by the members. It will be recalled that the author reached the conclusions that to burn heavy fuels with a blue flame it is desirable to 1. Thoroughly vaporize fuel. 2. Retard speed of oxidation. 3. Crack opaque vapors before ignition by use of radiant heat. 4. Raise compression and use reasonable excess of air. 5. Ionization to prevent ignition. 6. Induce great turbulence. 7. Destroy reverberatory action of combustion chamber walls. 8. Eliminate pockets in the combustion chamber. 9. Locate spark plug in exact center of combustion chamber.

A written discussion by O. B. Zimmerman made the point that we must correct our fundamental theories on what actually occurs in the combustion chamber if we are going to perfect our engines. French's paper, he said, helps us to visualize flame propagation and to realize the effects of changes in the mixture, shape of the container, etc. It will also help to bring home the point to refiners regarding the need of a more uniform liquid fuel.

He stated that we are not far short of the time when the molecular structure of the fuel can be commercially rearranged to provide us with a better fuel. Brewer added that combustion should be so rapid that it should be complete before the piston has traveled 1/10 of its stroke.

Prof. Wilson disagreed with French in his ideas of the molecular and atomic structure of the fuel and showed by models what is generally recognized as the structural form making up the molecule of fuel. Such a conception, he stated, is as necessary a fundamental to the chemist as a true working drawing is to the engineer. He stated that all atoms do not occupy the same space as French contends, but may vary in size in the proportion of 1 to 32. From past research it is known that molecules are tied together in different ways and have different structures. He showed by means of models the construction of hexane, and the benzine ring. With the straight chain construction he stated that the hydrogen burns first and the carbon on the free ends only after hydrogen is combined.

In the absence of Sir Dugald Clerk, his paper entitled Cylinder Actions in Gas and Gasoline Engines was presented in digest form by Prof. Daniel Roesch. Brewer reviewed at length the work done by Sir Dugald. He stated that in 1906 there was a marked revival in research work on internal combustion engines. The complete theory of the thermo-dynamics of internal combustion engines was largely developed in the few years around that time. Brewer stated that the United States has now outstripped Europe in automobile engine research. No discussion was given of Sir Dugald's paper. As Chairman Midgley laughingly put it, "No one felt capable of going up against Sir Dugald on these matters."

Highway Transport Session

IN the absence of H. W. Alden, the highway session was presided over by President David Beecroft. The important work of the highway engineer in developing better and more enduring roads was discussed in papers by A. T. Goldbeck of the United States Bureau of Roads, and C. J. Tilden, engineer of the Highway and Highway Transport Educational Committee, the latter paper being read by Albert Reeves of the National Automobile Chamber of Commerce. The large attendance at the meeting indicated the interest of the engineers in this subject.

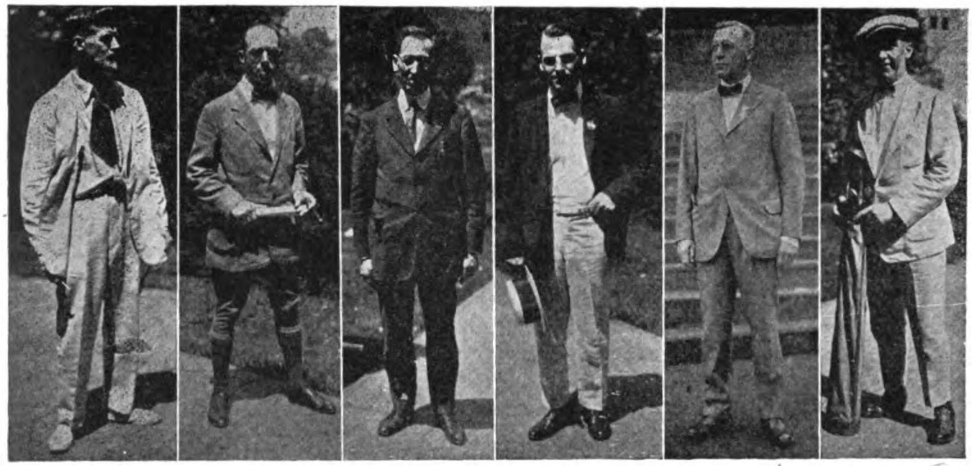
A. T. Goldbeck made the point in his paper that the ultimate consumer does not care who gets the money or how the results are accomplished as long as his transportation bill is as low as it is possible to make it. He stated that the cost of road construction and maintenance must be reduced, and his remark that there is something wrong "when roads disintegrate in two and sometimes in one year" was heartily agreed with by the engineers present.

The author made clear the point that the best highway is the one which carries the greatest amount of traffic for the least amount of money. Another point which he emphasized and dwelt upon as the main issue is that the highway and the vehicle should be mutually suited to each other. He stated that weights and speeds of vehicles are now limited because vehicle construction and road construction are not balanced to meet the requirements of one another.

Goldbeck stated that in his opinion the truck should be designed to meet the limitations of road construction in the same way that the railroad engine is designed to meet the load limitations placed on railroad track. In order to reduce the unit load on the roadbed and on the track the railroad engine has more than four wheels. In the same way the possibilities of a greater number than four wheels should be considered by the truck engineers as a real step in the way of highway conservation. Goldbeck stated that he did not wish to go on record as actually favoring the multiple-wheel vehicle, but that he did consider that the merits of this type of construction should be given very careful consideration, taking the angle of road life as one of the dominant factors.

In speaking of the actual construction of the road, the author stated that the subsoil formation is of the highest importance, as the load is really transferred to this, and when the load exceeds the capacity of the sub-base the road is sure to disintegrate, because this permits the surface to break up.

Another factor in the situation is that of tires. Goldbeck stated that as far as the sub-base for the road is concerned there is little or no difference in the solid or pneumatic tire, as the loading of the road per square inch of ground contact is about the same. In other words, relatively there is an extremely high unit load transmitted to the sub-surface, regardless whether the truck is pneumatic or solid tired, and there is a strong possibility that the multiple-wheeled vehicle will provide sufficiently decreased unit load to give a marked difference in road life.



H. C. Gibson — C. T. Myers — R. E. Northway — H. C. Buffington — E. L. Apperson — E. L. ("Casey") Jones

N. C. Cramer, Albert Champion, E. O. Christiansen

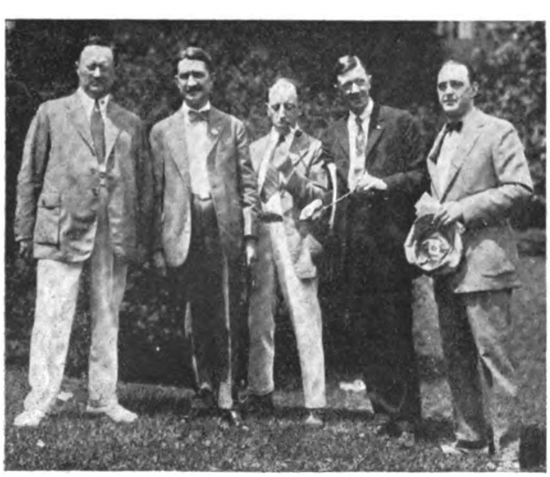
Goldbeck stated that he hoped that the engineers would co-operate with the government department in working out the problem of what is the best road and what is the best way to design a vehicle, so that combined cost of road and vehicle would result in the least possible expense to the consumer.

Russell Hoopes, in the discussion, asked what had been found to be the effect of high and low unsprung weights. In answering this the author stated that there is a slightly noticeable difference in road wear in favor of low unsprung weight, but that as far as the actual vehicle produced is concerned the difference is so slight as to be unimportant. B. B. Bachman brought up the point that trucks as now designed are for the purpose of meeting road conditions as they now exist. Better roads, he stated, would undoubtedly have a material effect on the design of trucks were these roads to be sufficiently universal to represent average conditions. The object of the truck as well as the road is moving merchandise at the lowest possible cost. In this, Bachman pointed out, the road is a considerable factor, as has been shown by tests over the roads. He stated that fuel consumption on one particular run showed a noticeable difference in the miles per gallon fuel consumption of the trip in traversing different highways. In other words, the question of getting the greatest amount of mileage per gallon per ton of product carried must be considered from the road standpoint as well as that of the truck.

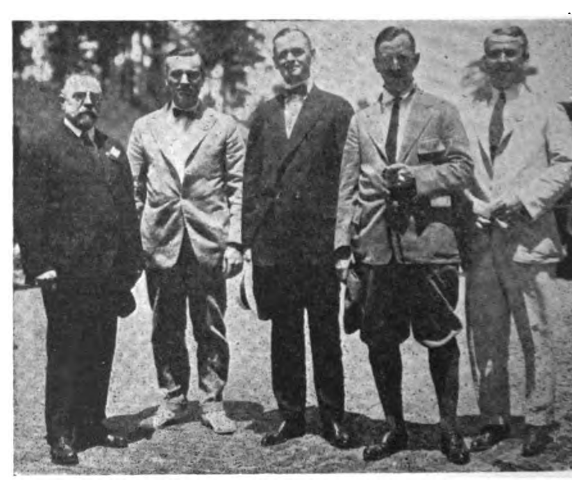
R. E. Wilson asked if the pneumatic tire did not help reduce impact on the subsoil. To this the author replied that there was no difference of importance noticeable in their observations, but that unit loads are too high on the big capacity trucks, and it is for this reason that he is looking for more careful examination and possibly for some important developments in the line of trucks with more than two driving wheels.

F. E. Moscovics stated that the suggestions of Goldbeck should be followed, and that the engineers who are members of the S. A. E. should make it their business to co-operate with government road officials to so design their trucks that the life of the road and the cost of transportation will be a minimum. At the request of President Beecroft, Moscovics put his suggestion in the form of a motion to the effect that it was the sense of the meeting that the members of the Society should co-operate with the government highway officials with a view to getting together on the design of both trucks and roads to the end that the highest possible transportation efficiency may be realized. This motion was passed unanimously, and a working committee will be appointed. In closing the discussion Goldbeck expressed his appreciation of the action taken by the Society in designating its intention of naming this committee.

"Transport Engineering Education" was the title of a paper by C. J. Tilden. In this, the necessity for educating, through our universities, men capable of intelligently spending the hundreds of millions appropriated for road construction was pointed out. Before reading the paper Reeves stated that the automobile business has two menaces to-day—unfair legislation and poor roads. He said there are 2,500,000 miles of road in the country, only 10 per cent of which are improved.



W. B. McCarthy, H. A. Brown, H. C. Rice, A. L. Clayden, O. J. Rhode.



G. L. Lavery, W. J. Bryan, J. G. Swain, C. C. Carlton, A. S. Van Halteren.

Standardization Session

THE Standards Committee session was the first of the meeting and the attendance was surprisingly good and those present stayed well until the finish. Under the direction of B. B. Bachman, chairman of the Standards Committee, the program was conducted with dispatch and the comment kept to the subjects in hand. Chairman Bachman also showed a grasp of the parliamentary difficulties that might involve the procedure and kept things moving by avoiding any pitfalls that might be hidden in the motions, rather than by untangling them later. His run of good-humored comment kept the audience interested despite the severe heat in the ball room of the hotel, which served as the meetings place.

The report of the Standards Committee, the bulk of which was published in AUTOMOTIVE INDUSTRIES for May 19, was adopted, except in certain particulars mentioned below, in the form presented. This report, in the amended form, was later approved by the Council of the Society. It will now be submitted to voting members of the Society in a letter ballot, and if favorably acted upon will become standard or recommended S. A. E. practice.

The entire truck division report incorporating recommended practice for body installation dimensions and motor truck front hubs, was unanimously adopted without discussion. This report, looked upon as the most important of the entire standards work of the year, was reserved until last. When complete silence greeted the call for discussion and a hearty unanimous aye, answered the request for a vote, the members present broke into applause. Considerable interest is being displayed in the next step along the line of recommendations for preferred practice in front hubs for passenger cars.

Clutch Release Type Thrust Ball Bearings

W. R. Strickland read the report of the Ball and Roller Bearings Division, which covered recommended practice regarding clutch release type thrust ball bearings. The dimensions standardized are the bore, width and ball diameter, the outside diameter being left open, owing to divergence in present practice and to the fact that standardization of this dimension is not very important. All the dimensions are given in inches, which is in accordance with the practice of the makers of 80 per cent of the clutch release type bearings now manufactured. The report was adopted as presented.

Roller Chains

W. F. Cole read the report of the Chain Division. This covered two items, viz., a new system of numbering for chains of different pitch, roller diameter and width, and a standard form of roller chain sprocket tooth. This section of the report was adopted as read. There was considerable discussion on the proposed new sprocket tooth form. M. C. Horine objected that the new sprocket form was still in the experimental stage, and that it should not be given the dignity of an S. A. E. standard until it had been thoroughly tried out in practice.

H. S. Pierce of the Link-Belt Co. replied that his company had used a form of sprocket tooth very closely approximating that recommended since 1908, and had found it very satisfactory. The tooth form, therefore, was not experimental. W. F. Cole of the Baldwin Chain & Mfg. Co. said that his firm had cut sprockets in substantial accordance with the form recommended, and trucks fitted with such sprockets had been run for many thousands of miles. Horine remarked that the largest manufacturer of chain-driven trucks had had no opportunity of discussing the merits of this form of sprocket, and he would like to have the report referred back. On the matter being put to a vote the recommendation was adopted.

Insulated Cable

The report of the Electrical Equipment Division was read by A. D. T. Libby, chairman. It covered general specifications of insulated cables, tests, specifications for high-tension (secondary) ignition cables, low-tension (primary) ignition cables, rubber-covered lighting and starting cables, varnished cambric insulation starting and lighting cables, armored starting and lighting cables and a revision of electrical equipment nomenclature. The 7-mm. size was recommended for all high-tension cable.

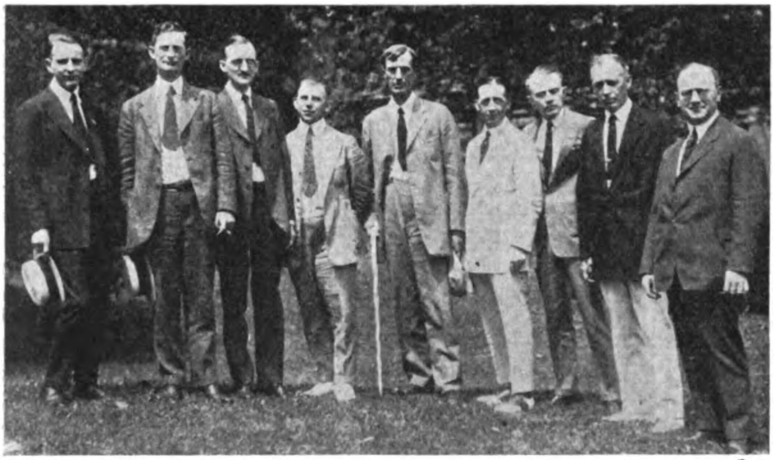
This was objected to in a communication from H. B. Burley of the Boston Insulated Wire & Cable Co., a member of the committee, who said that about one-half of the high-tension ignition cable supplied by his firm was of the 9-mm. type. The production of this cable was a matter of evolution. His firm had been called upon to supply cable for some unusually severe service, for which the 7-mm. cable was found inadequate. To this objection the reply was made that 7-mm. cable had been found satisfactory on motorcycles, which was about the severest service encountered in automotive practice. One objection to the use of more than one thickness of insulation is that all connectors and clips also have to be made in more than one size. The report was adopted as read.

That section of the report dealing with nomenclature also led to some discussion, especially as regards the proper name for that part of the ignition system which performs the functions of a circuit interrupter and a spark distributor. The report recommended timer-distributor, and this part also was adopted without change. Another recommendation of this division that was adopted was to cancel the present S. A. E. standard for magneto flexible disk couplings and insert the following note under the drawing of the standard magneto mounting: Magneto couplings shall be 2⅜ in. long and have a maximum diameter of 3¼ in.

Battery Rating Cancelled

L. S. Keilholtz presented the report of the Isolated Electric Lighting Plant Division, which related to a new proposed rating for farm lighting set storage batteries. It was recommended to cancel the present intermittent discharge rating and adopt instead a method of rating based on the number of hours' discharge capacity at a constant discharge rate of 300 watts. Mr. Keilholtz explained that he was personally much opposed to the recommendation of his division, and he moved that the report be referred back to the division for further consideration. After extensive discussion pro and con, it was voted to adopt that part of the report recommending the cancelling of the present standard rating and to refer the rest of the report back to the division. This leaves the S. A. E.—provided the action is approved by the membership's letter ballot—without a battery rating standard for isolated lighting plants.

The report of the Lighting Division was read by C. E.



Bearings Group, F. H. Lennox, H. C. Brunner, O. P. Wilson, D. P. Chambers, F. W. Gurney, Norman Bell, H. D. Rumlman, H. G. Freeland, F. M. Germane.

Godley, chairman. This covered headlamp brackets, motorcycle headlamp mounting, lamp nomenclature and bases, sockets and connectors; it was adopted.

Ball Studs Report

There was considerable opposition to the proposed recommended practice for ball studs, both from representatives of manufacturers of such studs and from representatives of car and truck manufacturers. It was claimed that on one particular size the neck dimension was too small to permit of the required angular motion of the ball in the drag link. No provision was made for running out the thread chasing tool, the type of nut which was intended to be used was not mentioned, and M. C. Horine stated that, since the ball had to engage with surfaces produced with standard reamers, the ball diameters should be slightly below the nominal sizes. A vote was taken, and it was decided to refer this part of the report of the Parts and Fittings Division back to the division.

Exhaust Pipes

Some discussion also arose over the proposal that the outside diameters of exhaust pipes extending from the engine to the muffler shall conform to the following inch sizes: 1, 1¼, 1½, 1¾, 2, 2¼, 2½, 2¾, 3, 3¼, 3½ and 4. Menges said that in stationary engine practice it was customary to use wrought iron pipe, and there was some possibility of the sizes given being mistaken for wrought iron pipe nominal sizes. The recommendation was adopted with the proviso that the wording be so amended that there can be no possibility of mistaking the scope of the recommendation.

Two other items were covered in the report of this division; namely, square shaft fittings and universal joint hubs, and both were adopted as offered. By the item on square shaft fittings the thread at the end of the shaft is changed to an S. A. E. standard thread, which brings the square fitting in line with the taper fittings.

The universal joint item specifies the hub dimension and the distance from the end of the bolt projecting from the flange to the outer face of the hub.

The report of the Engine Division, covering slight change in the thickness of cast iron carbureter flanges and extension of the disk clutch flywheel housing standard, was adopted as read.

The report of the Screw Thread Division, covering proposed recommended practice in the matter of drain cocks, was adopted as read, after some discussion, in which the use of the ⅛-in. size on radiators was criticized. It was made clear that this size was not specifically intended for use on radiators but could be used in other places; on the carbureter for example.

Social and Sport Features

THE social and sport features of the semi-annual meeting were never better handled, and despite the handicap of the weather conditions a good time was had by all who were willing to enjoy themselves.

The great atrium, or rotunda, in the center of the circular hotel building was an ideal playground for the evenings and for loitering and conversations during the showery days. Also, it supplied all of the elements of out-of-doors with a relief from the sun for those who did not care for southern Indiana spring temperatures.

In this atrium the evenings were especially gay. Without being in each other's way, there were the dancing party each evening, with just as much space as was desired; private card parties; informal receptions by those who had a large list of acquaintances among the members; family parties; playgrounds for the few children present, with plenty of floor space to spare, and had C. F. Kettering carried out his threat to come in his airplane, there would have been air space for him to have staged a stunt exposition. But there were no airplanes present—much to the regret of those who were looking forward to an aerial sport program as a part of the meeting. Kettering and his plane were both missing.

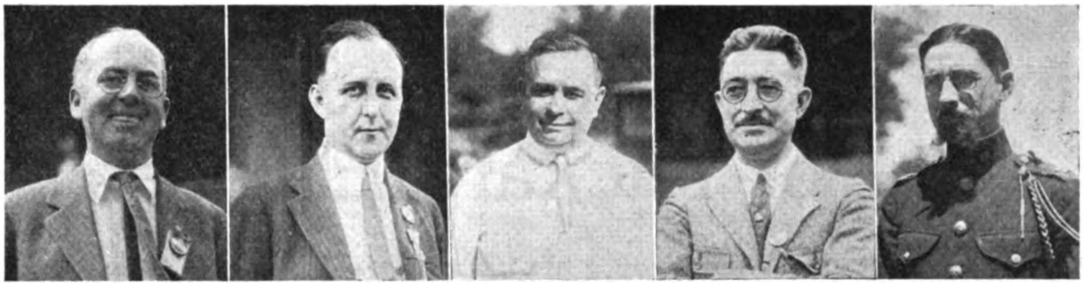
In addition to this very liberal allowance of space, there were a large office lobby of a more formal sort and great stretches of porch, an ample lawn and acres and acres of near-mountain land, on top of which was a very sporty golf course.

Indeed, it was one of the interesting features of the meeting to see golfers in their tweeds taking a taxi for a five-minute ride up the hill to the course where they would spend several hours walking on ground almost as rough as the hillside. The game completed and the score safely in the hands of the men in charge of the contests, the players again immediately forgot the benefits of physical exercise and called the taxi and rode comfortably to the hotel. While this was going on, scores of non-golfers were climbing this same hill for exercise. The golf events were especially well contested and were conducted continuously despite the showers.

The most notable feature of the sports—to judge by the scores—was the trap shooting. For each of the four days there was a score of 49 out of 50, and on more than one occasion it was necessary to shoot off ties at this score. J. A. Fesler made this score on two days and D. F. Fesler and W. H. Miller equaled his shooting.

The ladies' events on the sport programs attracted the largest crowds, and there was always something on the grounds when the weather permitted. There were many close contests, much good-natured rivalry and many new acquaintances formed here.

The tennis players had a difficult time of it. The courts



F. E. Watts nominee for second vice-president, representing motor car engineering.

Chas. S. Crawford V. G. Apple F. N. Nutt

Mark Smith, Disguised as "Capt. Merino, eminent representative of the Italian Goverment."

were the poorest part of the West Baden equipment, and the rain played havoc with the arrangements. The matches were started on Tuesday, but after two days' necessary recess a fresh start was taken Friday and a busy afternoon resulted. When dark came the matches were not completed and the winners in these events did not get to walk up before the Friday night crowd and claim their prizes. A proud moment in the lives of these champions was destroyed by the fickle Indiana rain god. So here are the results: Men's doubles—Final round, Bates and Buetner defeated Crane and Clarkson, 6—3, 0—6, 6—4. Men's singles—Final round, Clarkson defeated Buetner, 6—1, 6—1.

There were the usual stunt features, and it is no reflection on any previous program to praise them. The most pretentious was Indiana Night, staged after dinner on Wednesday evening. It was the plan that former Senator Albert Beveridge should be the speaker, but he was unable to be present. The committee was fortunate in being able to obtain former Senator Thomas Taggart, an Indiana political power, as a substitute. Taggart is the owner of the French Lick Springs Hotel, a rival to the West Baden Springs Hotel, and he gladly came from his entertainment palace to speak to the biggest convention the rival hotel has housed. His talk was on the practical side of the good roads question. It was at this meeting that a telegram from Gov. McRea of Indiana, extending the best wishes of the people of the State to the convention, was read.

After the speaking program, the annual Indiana stunt was presented. It had been quite a serious program and there was no surprise when an Italian army captain was introduced to speak on the automotive developments of the Italian engineers. He started well, explaining some highly technical lantern slides, when a considerable amount of disorder developed in one section of the dining room. When this racket continued, several of the more serious members of the society left, feeling that an eminent and worthy guest was being insulted. As they reached the hall they heard loud applause and laughter, and returned to find that the supposed scientist was really Mark Smith of Chicago. Several favors were distributed at this meeting.

On Thursday afternoon the Cleveland section staged a circus in the center of the atrium, and the quantity of peanut shells left on the floor was a strong feature of the occasion. The performers did their part well, and much amusement was experienced by those present. It is said to be a matter of record that this was the only session of the meeting at which the attendance was greater at the finish than at any other period of the meeting.

After dinner on Thursday the Metropolitan Section invited all present to come to the convention hall to hear Prof. Albert Einstein, the German scientist, explain his theory of relativity. The hall was well filled and the eccentric-looking visitor was well introduced by H. M. Crane in a talk which a portion of his audience understood and which betrayed not the slightest gleam of humor. Then came a heavy mathematical talk in an unusual German dialect which progressed nicely until by a premeditated accident it was revealed that the speaker was Cornelius T. Myers, who was quite well disguised and who had acted quite unlike himself.

The last night of the meeting was—according to precedent—designated as Ladies' Night and was quite a brilliant occasion. It brought out an unusual showing of evening gowns and the politest garments the men had brought along. The first feature of this occasion was the dancing contest, in which a dozen couples entered. The judges had quite a difficult task in the elimination, and be it said to the credit of the ladies that most of the eliminations were due to the hopping proclivities of the men.

After the dancing contest came the distribution of the prizes, and here the organization headed by Howard A. Coffin proved themselves. The usually troublesome task of distributing so many prizes went off smoothly, and was quite an interesting feature of the evening. A special vote of thanks was registered in loud tones for each person on the sport committee, with a cheer for Miss Mattle of the S. A. E. staff. The only sport disappointment was that the section baseball games and similar sports had to be abandoned.

As this was the last night of the session, the hotel management suspended the usual rule for midnight quiet, and music and dancing continued until almost breakfast time.

J. L. Yarian, S. R. Castor, C. P. Grimes

The Aeronautic Session

(*Continued from page* 1156)

propriation of $50,000 for a landing field for the Post Office airplanes but now they wanted their money back. He expected some good results from the reorganization of the Aero Club of America which up to now had been nothing more than a local organization, but now, under the leadership of Howard Coffin and of A. G. Batchelder, who had done good work in the A. A. A., it was to be made a national organization. It was planned to secure thousands of members and with nominal membership dues of, say, $5 or $10 each, there would be considerable funds available for propaganda purposes.

Routine Factory Tests and Final Inspection of Packard Engines

Operations include five hour running-in during which engine is driven by an electric motor, and two hour dynamometer test in silent room, where measurements of power developed, compression pressure of each cylinder. fuel consumption, etc., are made, and noises are located.

By J. Edward Schipper

THE final step in the routine manufacture of the Packard passenger car and truck engine is a very thorough test and inspection of each engine. After final assembly is completed, all engines are put through this same test, which is in very noteworthy detail and provides an accurate check on the condition of every engine before it leaves the factory.

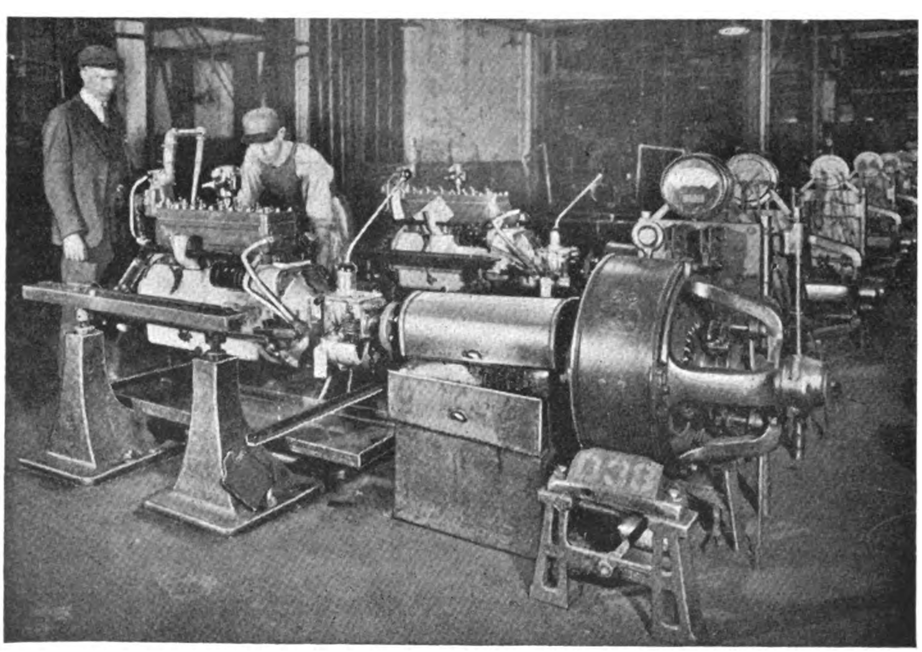
When the engines leave the final assembly department they are brought to a running-in room where they are run-in by electric motor. The transmissions are completely assembled with the engine so that the engines are run-in through their own gears. The first run is for 1 hr. in high gear. The electric motors which drive the engines are direct connected and run at a constant speed of 625 r.p.m. during this period. The amperage required is from 6 to 7 at the start of this run. Following the 1-hr. run at 625 r.p.m., the engine is given a 4-hr. run in second gear, during which the engine turns at 1000 r.p.m.

During the run the engine is gone over to locate leaks, scores and all the troubles which it would be possible to locate in an open room of this kind with several engines being run-in at the same time. When the engines are put on the running-in stand, a dynamometer inspection card is attached to the engine. This card stays with the engine during this running-in process and during the subsequent operations necessary to the completion of the inspection and tests. On this card are listed all of the probable troubles which can be detected during the running-in period as well as during the subsequent dynamometer inspection. Few notations can be expected on the card during the running-in process, which is purely a matter of working in the bearings and putting the engine in condition to run under its own power. The wattage required to run the engine or, in other words, its frictional resistance to being turned over by the electric motor is, of course, entered, as well as the number of the jacks or electric outfits employed in the running-in process. The engine is checked over for tightness of all of the nuts and bolts which can possibly become loose.

The motors used for running-in are Westinghouse direct-current type, 15 hp., 230 volts, 57 amp. The motors are operated on 220 volt, direct current, generated in the Packard plant. As soon as the 5-hr. running-in process is completed the engines are brought to a bench where the spark plugs are put in and the ignition is timed. This is set by a mark on the flywheel 1½ in. ahead of center with the spark lever in the full advanced position.

The engines are then lifted from the rack on which they were taken to the bench and rolled by means of an overhead track to the dynamometer rooms. There are 15 of these so-called "silent" rooms, each capable of handling an engine every 2 hr., or 5 per day, giving a capacity of 75 engines per day in the passenger-car department. The dynamometer equipment consists of Sprague 150-hp. dynamometers.

Including the mounting and dismounting of the engine on the dynamometer stand, there are 32 operations in the dynamometer room. These are as follows: 1. Connect engine to dynamometer stand. 2. Connect all controls and examine generator brush. 3. Check all nuts for tightness. 4. Check line-up of valves and push rods. 5. Measure and adjust carbureter spring. 6. Run engine with dynamometer. 7. Try oil level. 8. Try valves for riding. 9. Locate and stop compression leaks. 10. Start engine on own power. 11. Check generator for groan, and open circuit and see that ammeter reads

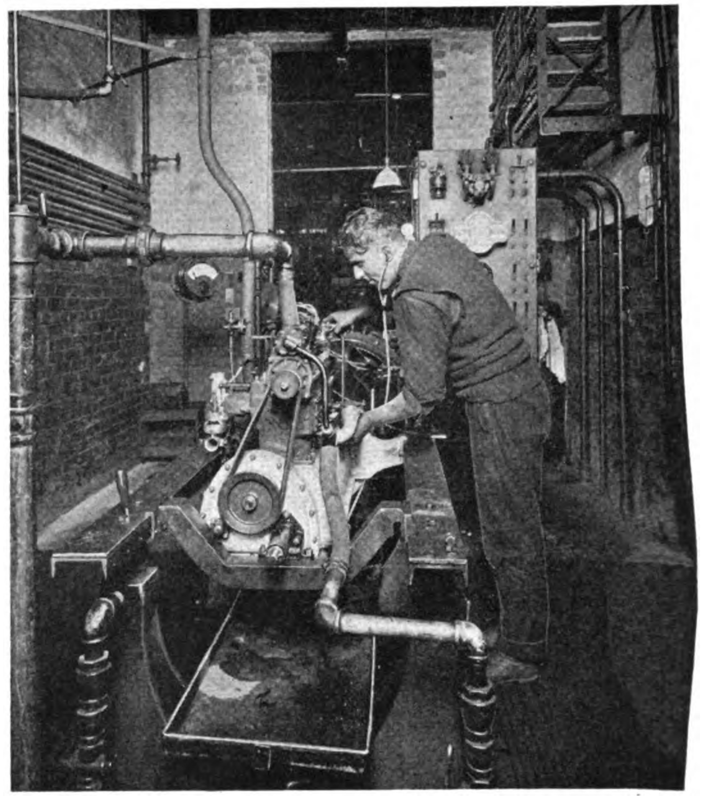


TESTING PACKARD ENGINE
Packard single-six engine on the running-in stand, where it is driven by direct connection with an electric motor.

correctly. 12. Try cylinder for knocks and scores. 13. Give engine hard run for 10 min. 14. Look over engine carefully, tighten all nuts, locate leaks, cracks and sand holes. 15. Throttle engine to observe low-speed performance. 16. Take power curve from 400 to 1800 r.p.m. 17. Check for gasoline mileage. (This is done on a special device which measures out 1/20 of a gal. The engine is set to pull 21 lb. on the dynamometer and the engine must run from 153 to 160 sec., which is equivalent to about 19.2 to 20.5 miles pei gal.) 18. Set the oil pressure. 19. Try cylinders for knocks and scores with stethoscope. This is the Locophone made by Baylis company. 20. Try the transmission at first, second and third speeds for lost motion in the shifter shaft. 21. Examine clutch for release, rough plate knocks and growls or slipping. 22. Try the tire pump. 23. Try the starter gears. 24. Try the front-end gears. 25. Try the cylinder base for oil leaks or gasoline leaks. 26. Look for exhaust and air leaks. 27. Throttle engine and try for low-speed miss, low to 100 r.p.m. 28. Check the carbureter. 29. Idle five min. for smoke. 30. Set the push rods. 31. Take compression on standard compression gage. This is the compress-o-meter made by the Brown company.

The engine, after this routine work has gone forward, is taken out of the rack the bottom taken off and washed out and the bottom screens, which have hitherto not been assembled in the engine, put in. After the bottoms have been washed out and the engine examined all over for loose nuts, loose cotter pins, flaws and defects of any kind, the bottoms are put on and the engine sent to stock.

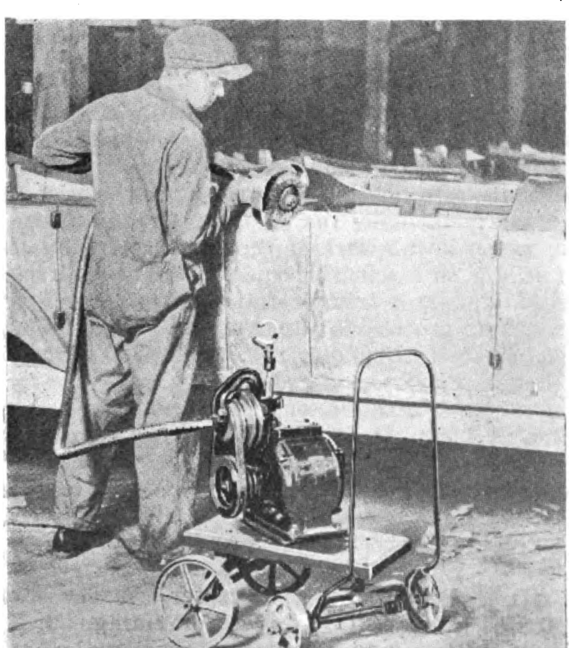
As a final inspection, the engine is sent out on the road test with a road-test card attached, as shown. The majority of troubles to be observed are, of course, not engine troubles, but this enters in. It is interesting to note that the final road test is an administrative department matter entirely and out of the hands of the factory. That is, the road testers are responsible to the president of the Packard Motor Car Co. and cannot in any way be held to factory or shop requirements. Thus, the final check-over of the car is independent of anything which may have been done as a plant operation.



Testing Packard Engine
Packard single-six engine on the dynamometer in one of the silent rooms where final inspection is given

Roughening Aluminum Body Panels

ALUMINUM sheet, as it comes from the mill, is exceedingly smooth and its surface does not hold paint well. It is therefore roughened by mechanical means before the first coat of paint is applied to the body.



Haskins equipment for roughening aluminum body sheets.

The attached cut shows a Haskins Type H-7 equipment in use in the automobile body building industry. These machines are used with a stiff wire scratch brush. The equipment consists of a 1 hp. motor, a three-speed counter shaft (giving spindle speeds of 900, 1800 and 3600 r.p.m.) and 6 ft. of Haskins flexible shafting.

Motor Car Fuel Economy Trial

THE Royal Automobile Club of England has announced its intention of holding a national fuel economy trial on Saturday, May 7 next. The object of the trial is to demonstrate the possibility of obtaining greater fuel economy in the use of a car than is at present generally the case, and it is pointed out that greater economy can be obtained by various methods, such as (a) a more economical adjustment of the carbureter, with very slight depreciation of the car's performance; (b) greater skill in driving, and (c) the fitting of auxiliary devices, such as extra air valves, the last-named method, of course, being obviously only of economic advantage when the saving achieved justifies the expense of the fitting. The trial will take the form of a fuel consumption test of not less than 40 miles and not more than 60 miles on a circular route, on the public road, and it will be open to all comers, whether members of an automobile club or not. Entries will be received from individuals only, who may each enter only one car.

Selling Trucks by Solving Transportation Problems

By specific examples and definite data, the author explains how one truck manufacturer has built up permanent customer good-will and increasing truck sales through analysis of the buyers' transportation needs. The analysis includes material handled, storehouses, and many other factors.

By N. J. Ocksreider*

THE motor truck industry has within the last two or three years entered upon a new period in its growth. The days of experiment and the days of development of manufacture are over to a large extent, although there are still many questions of detail and refinement which the producer has to solve. But we do know how to make remarkably efficient transportation machines at a reasonable cost.

This new era is the result of realization by truck men that a vehicle which is wrongly sold is a liability instead of an asset. In days gone by, too many truck salesmen sold anything they could to haul whatever was to be hauled. As a result much overloading developed trouble or underloading increased expense, and both combined to cause lack of satisfaction not only with the particular truck sold but with the truck as a transportation agent..

Manufacturers and dealers realize today that, so far as possible, they must place themselves in the position of transportation experts, competent to give sound advice on questions arising in this field. Salesmen must be employed who are capable of analyzing their prospects' requirements and these salesmen must be encouraged—they must if necessary be compelled to advise the prospect to act in his own interest even at the cost of losing the sale. It is a great credit to the industry that there are many cases on record where this attitude has been adopted and practiced.

It is obvious, of course, that the manufacturer makes trucks to sell, but it is precisely for this reason that he should see to it that his trucks are sold only where they can perform their work economically. This policy will inevitably develop repeat customers, widespread advertisement and great good will; any other policy will create enemies. The motor truck in its proper place is one of the greatest assets of modern life—misplaced it is an economic waste.

If a salesman is to be sure that his truck is properly sold be must be fully informed about the prospect's requirements and he must be capable of analyzing them honestly and intelligently. He must be able to observe analytically. He must find the truck problem as it exists and prescribe the proper answer. Often an analysis of the customer's problem shows the salesman that the vehicle he sells cannot be used. He must then so inform the buyer and advise him what equipment he should adopt if any is needed.

In the modern business world there are many problems of high class transportation which become too complicated for easy analysis. In literally thousands of cases the buyer himself does not understand his own needs and he does not even have at his command the facts which will make possible an intelligent analysis. It is cases such as this that have developed a new field in the automotive industry—that of the transportation engineer. His is the duty of studying these large and complicated problems and of finding the answer. His purpose must always be the interests of the customer, even if they seem to conflict at the moment with the interests of the selling organization. His object must be to tell the customer in what way he can handle his transportation most efficiently and economically.

It is obvious that in this problem there is involved far more than the qualities of the truck itself. Road and shipping conditions, kinds of freight, methods of packing, seasonal variations in business handled, all such matters as these must be taken into consideration. In the analyses that have been made by the transportation engineers employed by the Packard, recommendations have been brought in involving such varied matters as a new form of package, changes in the arrangement of shipping room and loading platforms, changes in the hours of work, systems for routing and dispatching traffic, and as minor a matter as bagging coal at the yards instead of at the point of delivery. All these things are at first glance outside the range of a truck salesman; actually they have all helped in the sale of trucks and have helped still more in the satisfaction which the buyer has found in the use of his equipment. The reason is that they have all helped him solve his problem and save or make money.

This work falls naturally into two divisions. The first one, which is the field of the transportation engineer, is in studying and solving the transportation problems. The second, which is the work of the truck salesman, consists in the selling on a scientific analysis whether it has been furnished him by a transportation engineer, or whether the immediate problem is so simple that he can analyze it himself. In this article only the problems of the transportation engineer are considered.

When a transportation engineer undertakes the solution of a problem his first need is facts. In instructions issued by the Packard to its engineers there are listed forty-two questions which must be answered before solution can even be attempted. The engineer starts out equipped with note book, camera and usually a large scale map of the territory in which the hauling problem is located. He begins by getting in contact with all the officials connected with the hauling problem and secures a plan of the works, to be used in handling questions of internal routing.

*Chief transportation engineer, Packard Motor Car Co.

He begins his analysis with a study of the material handled, both raw and finished, finds out what it is, how it is received and shipped, in what kind of packages and by what transportation means, whether water, rail, motor truck or team. He studies the question of storehouses and secures data on the amount and kind of material moving in and out of each shipping or receiving point.

Studying Costs

He then takes up the company's present hauling equipment, the number of trucks or horses owned or hired, particularly with reference to peak seasons. He makes a careful study of the cost of this haulage, finding out what the expense is for hiring either trucks or horses, gets the freight rates and the express and motor haulage rates and the frequency and adequacy of the existing freight express, boat or motor haulage services.

He then makes a careful study of operating costs of company owned equipment, both horses and trucks. This cost he divides into fixed and variable charges and if possible reaches ton mile costs on both types of equipment. He studies periods of idleness and the possibility of avoiding them. He takes up the quantity and cost of repair service on the company owned equipment and garage facilities. He learns whether gasoline or oil are properly bought, checked up and handled. He investigates any special equipment that has been used and determines what success it has had.

The next point taken up is the routing and scheduling of the hauling. This is done in detail, finding for what purpose each unit owned is used, and why. He follows this with a study of the road conditions for the year around, including all bridges that must be used. He finds the average and the best possible running time between all points and investigates whether there are any city ordinances which need to be taken into special consideration.

Platform Survey

A survey is also made of all shipping and receiving platforms. In doing this the engineer surveys back of each loading and receiving platform to the shipping or receiving room, watches the boxing, crating, sorting, assembling and internal routing so as to get an idea of the relationship and importance of each platform. He particularly checks up waste of time where products are taken twice over the same ground and where different goods are loaded at different times on the same truck. Where material is being shipped by freight or boat he determines whether it could be handled more economically by truck by learning from the company's records what a saving could be effected on boxing and crating.

Finally he learns the sentiment of the company toward its existing service and equipment, the reasons for desiring new equipment and the attitude of the various men involved toward the equipment that the company offers for sale.

With this material in hand the engineer is ready to start on the actual analysis. The method for this will naturally vary considerably, but in general his task is to establish two things. First, present cost of handling the necessary tonnage. Second, the best possible method for handling the necessary hauling and its cost.

To show how a typical problem of this type is worked out there follows a report made to a corporation at a town in Massachusetts which we will call Blankville, on shipments between its plant and New York City and Newark:

Blankville Analysis

The cost per week to ship merchandise from Blankville to New York City, Newark, and return, by the methods and the combination of methods that have been considered, are presented below:

FROM BLANKVILLE, MASS.:

Using the Standard Motor Express Rate, Plus 3 Per Cent for War Tax

To New York City—$1.00 per cwt. multiplied by 10.5 tons (210 cwt.) of finished product	$216.30
To New York City—$1.00 per cwt. multiplied by 1.7 tons (34 cwt.) of empty drum return	35.02
To Newark—$1.35 per cwt. multiplied by 2.5 tons (50 cwt.) of finished product	69.525
Total cost per week to ship all tonnage by standard motor express	$320.845

Using the Total Freight Rate Plus Cartage Plus 3 Per Cent of Total for War Tax

To New York City—First class L.C.L., $1.11 per cwt. multiplied by 10.5 tons of finished product	$240.09
To New York City—Fourth class L.C.L., $0.72 per cwt. multiplied by 1.7 tons of empty drum returns	25.21
To Newark—First Class L.C.L., $1.36* per cwt. multiplied by 2.5 tons of finished product	70.04
Total cost per week to ship all tonnage by freight	$335.34

*NOTE.—Cartage at Newark end estimated at New York City rates.

TO BLANKVILLE:

Using the Standard Motor Express Rate, Plus 3 Per Cent for War Tax

From New York City—$1.00 per cwt. multiplied by 9.74 tons* (195 cwt.) of raw material	$200.85
Total cost per week to ship all tonnage by standard motor express	$200.85

*NOTE.—Assuming that all phosphate is shipped from Long Island City.

Using the Total Freight Rate Plus Cartage Plus 3 Per Cent of Total for War Tax

From New York City—First class L.C.L., $1.11 per cwt. multiplied by 2.4 tons (48 cwt.) of triphenyl, acetone and miscellaneous	54.878
From New York City—Second class L.C.L., $1.00 per cwt. multiplied by 1.14 tons (22 cwt.) of castor oil and mirrors	22.66
From New York—Third class C/L*, $0.71 per cwt.† multiplied by 6.2 tons (124 cwt.) of phosphate	90.68
Total cost per week to ship all tonnage by freight	$168.218

*NOTE.—It is assumed that phosphate shipments are received in full carload lots, minimum weight 30,000 lb.
†NOTE.—It is assumed that this merchandise is loaded direct into freight cars at the plant from which it is purchased, eliminating a local charge for cartage.

It is obvious that it would not be profitable to ship all merchandise either by Standard Motor Haulage or Freight in either direction. Therefore, selecting from the above a combination of methods most suitable for your requirements, under normal flow of traffic, we have the following combination for consideration:

Merchandise Shipped by Standard Motor Haulage

Finished product from Blankville to New York City and Newark (260 cwt.)	$285.825
Raw material, castor oil, mirrors, triphenyl, acetone and miscellaneous to Blankville (70 cwt.)	72.10
Total cost per week for standard motor haulage	$357.925

Merchandise Shipped by Freight

Phosphate from New York City to Blankville (124 cwt.)	$90.68
*Empty drum return from Blankville to New York City (34 cwt.)	25.21
Total cost per week for freight	$115.89
Combined total cost per week	$473.815

*NOTE.—For the last six months these drums have been returned by standard motor haulage due to an embargo at New York City end.

We suggest the following method to improve the combination method, outlined above, in order that it will be possible to:

1. Place the shipment of both finished product and raw material between Blankville and New York City and Newark on a set schedule.
2. Place the New York office in a position so that their customers may be accommodated to a greater extent than at present.
3. Reduce the present transportation cost.

By installing a Packard size "EF" truck we believe it would be possible to put into operation the following method that would permit you to:

1. Haul the average weekly tonnage of 24.44 tons in two round trips per week at an average load efficiency of 81 per cent.

Equipping a Packard size "EF" truck with a 13 mile axle, it is believed possible to make a round trip between Blankville, Mass., and New York City in three days, each day sub-divided as follows:

Proposed Operating Schedule

Day	Max. Speed M.P.H.	Est. Aver. Speed M.P.H.	Max. Speed Min. Hours on Road	Est. Speed Aver. Hours on Road A.M.	P.M.	Distance	Leave	Time	Arrive	Time
1	13	9	10.1	7.3	7.3	132	Blankville	5:00 A.M.	New Rochelle	8:30 P.M.
2	13	9	1.3	2.0	..	18	New Rochelle	7:00 A.M.	N. Y. Office	9:00 A.M.
2	13	9	5.7	..	8.3	75	N. Y. Office	11:00 A.M.	New Haven	8:18 P.M.
3	13	9	5.6	5.5	2.6	73	New Haven	5:30 A.M.	Blankville	3:36 P.M.

*NOTE.—It is estimated that no hours will be required in New York to exchange loads and that during this interval the truck will cover 5 miles.

Summary

The present cost to ship merchandise by the selected "combination of methods" to New York City, Newark and return is as follows:

Cost per week	$473.815
Cost per day	78.969
Cost per trip	236.907
Cost per cwt.	.97

The operating cost of a size "EF" truck to do this same work is estimated to be:

Cost per week	$331.80
Cost per day	55.90
Cost per trip	165.90
Cost per cwt.	.68

This is delivered to New York City only. To this cost there should be added an additional charge for shipping 2.5 tons of finished product from New York City to Newark at a local charge of 50 cents per cwt., plus 3 per cent of total for war tax or $25 per week, making a total cost of:

Cost per week	$356.80
Cost per day	59.46
Cost per trip	178.40
Cost per cwt.	.73

Comparing the final cost of operating company owned equipment with final cost of shipping by the selected combination method the following saving is believed possible through the adoption of company owned Packard trucks.

	Saving
Per week	$117.02
Per day	23.07
Per trip	58.51
Per cwt.	.24

In a year of 288 operating days it is estimated that this would be an approximate saving of $6,644.16.

To this is attached a detailed estimate of the cost of operating the trucks, which has been summarized in the previous report. As an example of the method of making use of these estimates, there follows one submitted in a report to the New York *Globe*, when it was considering hauling its papers from the St. Lawrence River to Burlington, Vt., during the period of serious freight congestion some months ago. This gives both the basis for an individual truck, and operating nine trucks a week.

OPERATING 9 UNITS FOR A WEEK—18 ROUND TRIPS—250 TONS

OPERATING COST PER WEEK

Figured on 250 Tons

Miles	5040	miles total
Garage 9 units @ $6 per week	50.00	
Driver—8 crews for 3 fleets.	1152.00	24 men @ $8 day for 6 days
Taxes estimated	20.00	for licenses for 9 units per week
Insurance $1.66 per day per unit	89.82	for 9 units for 1 week
Sinking fund	655.20	560 miles per unit per week
Interest	53.10	
Gasoline*	756.00	for 9 units for 1 week
Lubrication**	51.39	for 9 units for 1 week
Tires $.087 per mile	438.48	for 9 units for 1 week
Maintenance and overhaul	252.00	
Total cost per day	3521.99	
Total cost per year		
Total cost per mile		

Cost of $14.10 per ton

LUBRICATION PER 1000 MILES (Includes refilling)

	Necessary Gallons	Necessary Cost	Desirable Gallons	Desirable Cost
Cylinder oil				
Heavy oil				
Grease				
Cost per mile				.0102 per unit per mile

MAINTENANCE AND OVERHAUL
Repairs per unit—6 seasons—60,000 miles—total of $3,000.00.
Maintenance and overhaul for life of truck equals $.05 per mile.

TIRES
$877.30 ÷ 10,000 miles = .087 per mile.

MISCELLANEOUS
State license ....
Garage rent per month ....
Driver's wages per day ....
Guaranteed tire mileage ....
Gasoline per gallon ....

ESTIMATED COST OPERATION TRACTOR—SEMI-TRAILER UNIT

INVESTMENT

Chassis	
Freight	
War tax	
Body, top, etc.	
Total	$8777.50 basis for computing interest
Less tire value	877.30
	$7900.20

OPERATING CONDITIONS
East Angus and Burlington.
Average 5 miles per hour.
Round trip of 280 miles = 64 hours — with allowance for delays, etc.
2 round trips per week—18 weeks = 10,000 miles—life of 6 years—60,000 miles.

INSURANCE

Fire and theft	
Collision, full coverage	
Liability	
Property damage	
Total	$500.00 per year per unit

SINKING FUND
$7900.02 ÷ 60,000 miles = $.13 per mile per unit.

INTEREST
Formula 6%—6 years—averages = { $307.02 per year per unit; 5.90 per week per unit }

GASOLINE

Miles per Gallon
Good Average Fair
2.0 at 30c. per gallon

*"Average" miles per gallon used in computation.
**"Necessary" lubrication used in computation.

Each problem naturally affords different factors and calls for a different method of solution. One of the problems recently was conditioned upon the hauling that had to be done across a bridge limited to 6 tons carrying capacity. Another was dependent upon the fact that the heavy haulage had to be done over an 8 per cent grade. In a third, that of handling ore from a Colorado mine; the answer was found by putting three trailers to each truck, so that on the haul from the mine the first function of the truck was to act as a break, while it had nearly a capacity load in returning the empty trailers to the pit mouth. Examples like this could be multiplied indefinitely.

It has been working out problems like this that convinced us of the necessity of rating the units sold to the particular job, and abandoning the old flat tonnage rating. It was clear that a truck that might carry 2 tons over an 8 per cent grade could handle 4 tons on a level.

For this reason we no longer sell the truck as of a given capacity, but after studying the hauling problems and determining how much freight should be carried we recommend the units that can do the work most efficiently.

Steel Castings and the Automotive Industry

The use of steel castings in the automotive industry is largely limited to trucks and tractors. The story of the growth of this industry tells the extent to which it has been influenced by automotive development.

THE use of steel castings has been quite extensive in certain phases of automotive construction, despite the fact that the automobile industry has not influenced the steel castings business so strongly as it has some others. Especially in the truck field has the steel casting been widely used, so that the steel foundries of the country can properly be classed as important units in the group which supplies the automotive industry.

Taken as a definite industrial unit, the steel castings industry is comparatively young. It is only during the last twenty or twenty-five years that the production of steel castings has been carried on in any large way. It is said that the first steel castings of which anything is generally known were made by the William Butcher Steel Works in July, 1867. Not until about 1896 or 1900, however, did the steel castings business assume any considerable proportions.

During the very early stages of the steel castings industry, says David McClain in *Foundry*, "great secrecy and caution were exercised in handling mixtures by those whose duty it was to oversee this part of the business, and symbols instead of names were used to specify alloys for steel mixtures."

In 1884 the first Bessemer converter devoted entirely to the manufacture of steel castings was put into operation by the Pittsburgh Steel Castings Co. The early furnaces used in steel casting manufacture, however, were short lived and unsatisfactory in many ways. The acid open-hearth furnace marked a step in advance, however, and about 1896, twenty-five years after the beginning of steel casting manufacture, the installation of a 20-ton acid open-hearth furnace determined the superiority of the open-hearth furnace over the crucible or converter.

The electric furnace is a development of recent years and marks another notable point in the growth of steel casting practice. All three methods are still in use, although the chief obstacle to the more widespread usage of the electric type seems to be that of cost.

There has been a rapid growth in the number of steel foundries during recent years. One authority attributes this to the fact that more men have been taught the technical details of steel casting manufacture, so that many employees have gone out and set up small establishments of their own. He believes that the growth was less rapid during the first decade of this century because there were so few men who really understood how to make steel castings successfully.

At the present time something like 1,000,000 tons of steel castings are produced each year in this country. A large proportion of this output is usually absorbed by the railroads, while the machine builders are also large consumers. While there has been an intimate connection between the steel castings and automobile industries during recent years, it cannot be said that the steel casting manufacturers are strongly dependent upon the automotive industry or that the automotive industry has had a very large part in causing their technical and commercial development.

There are some 250 foundries in the United States which make steel castings. About 190 are independent foundries producing castings for the trade, while about 135 are devoted exclusively to the manufacture of steel castings.

Assuming that the output of steel castings is about 1,000,000 tons a year, the distribution of this output is probably something like this:

Railroads	60%	600,000 tons
Machine Builders	25%	250,000 tons
Automotive Industry	8%	80,000 tons
Miscellaneous	7%	70,000 tons

These figures are merely approximate and are based upon the opinions of several men long connected with the industry in its broadest phases. Definite statistics are not available as regards the steel castings industry. The Steel Founders' Association, which includes the firms producing a large proportion of the total tonnage of the industry, states that it has no information available along these lines and that it is not interested in supplying material or in discussing articles designed to give to outsiders some view of the technical and commercial growth of the steel castings business. Individual members of the Society, however, have been extremely helpful in supplying information and suggestions.

The Society has about 87 members at the present time and, as stated before, these firms produce a very large percentage of the entire output of the industry. Apparently no concerted effort has been made, however, along the lines of co-operative research or tests.

Qualities

The steel casting has characteristics which make it specially adapted to certain automotive uses. Steel castings are made in three grades, generally known as hard, medium and soft. The Society of Automotive Engineers has adopted the standard specification of the American Society for Testing Materials for steel castings. The physical properties required by these specifications are as follows:

	Hard	Medium	Soft
Tensile strength, lbs. per sq. in.	80,000	70,000	60,000
Yield point, lbs. per sq. in.	36,000	31,000	27,000
Elongation in 2 in., per cent	15	18	22
Reduction in area, per cent	20	25	30

The relatively high tensile strength of the steel casting renders it specially adaptable for use on trucks. The following list comprises some of the chief qualities of the steel casting:

1. Relatively high tensile strength as compared with other castings.

2. Machining off even a considerable thickness of metal does not appreciably affect strength of casting.
3. Intricate shapes can be cast which are not at present possible by means of drop forging.

In the early days of steel casting there was a great deal of difficulty experienced in getting the proper metal mixtures to produce the best castings. Progress along this line, however, has gone so far that little trouble is now found. One prominent steel castings man said recently, "Plain carbon steel casting of to-day has been brought to a point where the problems of manufacture are purely mechanical problems. . . . It is, therefore, time to work for better physical properties than those found in low carbon castings straight annealed."

Progress has also been made in heat-treatment methods which has enabled steel casting manufacturers to raise the average tensile strength of their product well above the limits that were previously possible. There is this difference between the malleable and steel casting which is of importance in the consideration of heat treatment and annealing. The steel casting does not rely on the annealing process for the development of any new qualities or properties; the heat treatment merely adds to those properties already present in the inherent nature of the material from which the casting is made. In the malleable casting, on the other hand, the heat treatment serves a purifying purpose and imparts to the casting qualities which it did not previously possess.

It is true, however, that the heat treatment of plain carbon steel castings yields an improvement of 20 to 50 per cent in strength. One manufacturer who has had considerable contact with the automotive industry said recently that "to meet the varied requirements of the truck, tractor and machinery castings we have developed a series of steels with yields points from 30,000 lbs. up to 110,000 lbs., and have obtained higher strength without undue sacrifice of machining qualities."

There are five factors which, in a general way, affect the final quality of the steel casting. These are:

1. Steel making practice,
2. Composition,
3. Moulding practice,
4. Annealing practice,
5. Design of casting.

The automotive engineer is concerned only indirectly with the first four of these factors. It is likely to be to his advantage to understand something of the practice involved in each of them, but he cannot be expected to be thoroughly conversant with all the phases in detail. He is the vital agent, however, in making the casting design. It is because of this fact that he should either understand steel foundry practice rather well or should take advantage of the opportunity for consultation with the castings manufacturer.

This matter of co-operation has been discussed in connection with drop-forgings, die-castings and malleable castings, but bears repeating because of its importance. How important such consultation is from the standpoint of the castings maker and how far back into the process of castings manufacture the design goes is shown by this statement, made a year or so ago by a big castings producer. He said:

"The desire is to persuade the designer of castings that exchange of views is important not only in respect to the production of castings, but also in regard to the use of differing qualities of steel for various purposes."

Two of the chief difficulties, for instance, in steel castings manufacture are unequal cooling of sections of the casting and the presence of blow-holes. As regards the first of these troubles, the design is very largely responsible. Where the sections are of very unequal thickness, unequal cooling is almost sure to take place, while some sections may be too thin to be poured successfully in steel at all.

The unequal cooling can be offset to some extent by "chilling" the thick parts, but there is a definite limit to the possibilities of this method.

Blow-holes come chiefly from improperly melted metal and from wet molds. These troubles have been eliminated in most high-grade foundries at the present time by properly melting the steel and adding to it suitable percentages of silicon and manganese.

There is some indication that the steel founders recognize increased possibilities for development through contact with the automotive industry, and that efforts to increase the importance of that contact will be made at least by individual firms. Discussing the effect of the war on the steel castings business, one executive said recently that it had had two effects:

1. It improved the general quality of steel castings because the Government made large demands, but had very rigid specifications.
2. This large demand developed a very greatly increased capacity for steel castings production.

He went on to state that much of this capacity was now excess and that the big problem before the producers was to develop new fields for the use of steel castings and new markets for the utilization of this excess capacity. He pointed out the fact that even some pre-war uses do not exist now because "the inability of truck and tractor manufacturers to obtain steel castings forced them to eliminate castings and substitute stampings or replace steel with malleable of heavier section."

As regards the function of the steel casting and the drop-forging, one casting maker says, "On quantity orders of simple design it is impossible for casting to compete with forging. But in the development of new models, where production is limited and die expense must be amortized over a few hundred pieces, steel casting is the logical material to use. It is also adapted to intricate shapes which cannot be forged."

Information as Selling Basis

To successfully sell a truck or tractor means even more than putting the vehicle in the hands of the user and collecting his money for it. The development of a permanent market requires that the proper vehicle be sold to meet the special needs of the particular user, and that proper service be rendered after the sale.

The Bates Machine & Tractor Co. has adopted a plan of going direct to the farmer for information as regards the possible usefulness of a tractor to him. A letter and questionnaire is sent to the prospect. The letter states that it is the earnest desire of the company to sell their tractor only to those who can really show a profit through its use, and explains that the purpose of the questionnaire is to get information for use along this line.

The questionnaire includes such questions as these: Total number of acres, acreage under cultivation, pasture, kind and nature of soil, estimated percentage of steepest grades, number of men employed, number of horses and mules, do you use tractor now, what make, do you own an automobile or motor truck, do you operate a thresher or an ensilage cutter, do you operate a centrifugal pump, what other belt work have you, what tractors have you had experience with. who is your best local dealer

A Foreman's Thoughts of Piece-Rate Cutting

It is a common human failing to attempt to dispose of complex questions by means of a ready formula. It has been said that under a piece-rate system a man is paid in accordance with his ability to produce. This is true, and yet the statement must be qualified. This foreman discusses the matter of cutting piece rates in his own practical, "two-fisted" manner.

By Norman G. Shidle

THE question of a fundamental basis for wage payments is one of the important problems confronting industry. The piece-work system is common to automobile plants, but varies greatly as to the methods by which it is administered. The cutting of piece rates probably causes as much trouble as any other single factor of wage adjustment.

The opinions of employers vary on the subject, while that of workmen is unanimously opposed to the policy. The views of an experienced foreman on the subject should be of interest to executives, since the foreman occupies an intermediate position between employer and employee.

The foreman in question is in charge of a department of nearly 100 men in an automobile factory. The men under his supervision are all piece-workers. The opinions quoted were not expressed in a formal interview of any kind, but merely in the course of a conversation about production methods. His conversation ran something like this:

"Yes, we are getting all the kinks in production pretty well ironed out now in this department. We recently installed a lot of new equipment, and the men are just now beginning to get the maximum value from it. Then they put the whole department on piece-work a few months ago.

"Piece-work has boosted production a lot. I am getting twice the production out of here now with two-thirds as many men as I had before. That is partly due to piece-work and partly to the new equipment.

"But, say, maybe I couldn't get out a lot more production from this gang if they would take off that 75 cents an hour limit on the piece-workers. We get about 400 a day out of here at present, and if they didn't limit the piece-work earnings to 75 cents an hour, I'm sure I could jump production to 600 without turning a hair.

"I've got a good bunch working in here, but when there is a limit like that put on they simply won't turn out any more. Sure, there's a limit. No, we don't tell the men that, but you can't keep that sort of thing quiet very long. It soon gets around the shop. One of the boys was asking me yesterday if it was true that there was a 75-cent limit. I just evaded his question somehow, but he knew just the same.

"And you can't blame them for not going over the limit when they know the rate is going to be cut. I'd do the same thing and so would you; be crazy if they didn't It's wonderful how close they can hit that mark, too. I had a department in a plant up in Detroit a year or so ago. When I went in there production was down low, and all the men were making between $7.90 and $7.99 as regular as the sun rose and set. Later the rate was cut. Every man in the bunch kept on turning in between $7.90 and $7.99 a day just the same. Again I say I don't blame them. I'd do just the same way.

"You can't expect to get maximum production from a man when he knows he is going to be penalized for doing his best.

"Huh? What is the sense of having a piece rate if it has a definite limit? Why not just pay the good men that limit rate and grade the others down accordingly? Hm. Well, now I don't know just what answer you could give to that. It does seem as though a piece-rate system with a limit like that was pretty nearly the same as a day rate basis with a minimum production requirement, doesn't it?

"Well, I don't know about the theory of the thing, but I do know that the boys will hold down production as long as they know the rate is going to be cut when they boost it to a certain figure. If they'd take that 75-cent limit off in this department, I'd soon show 'em some real production. Got a good bunch in here now, and they know that jobs are scarce outside, too."

This is not the opinion of a theorist, but of a practical working foreman of considerable experience in automobile work. Harry Tipper said recently that "of all the systems for general wage payments which are being used at the present time the ones which are predicated upon the relation between the individual and the quantity and quality of his production are the most effective in their general application."

All of which merely emphasizes the necessity of administering as carefully and as fairly as possible this inadequate method which is the best available for immediate use.

A NEW company has been organized in London with the object of reclaiming stale lubricating oil. The waste oil can be bought at prices ranging up to about $100 per ton and in some cases can be had for the cost of collection. It is planned to establish immediately a plant near London with a capacity for treating 50 tons per week, which, it is believed, can be easily collected in London, and other plants in the various large cities of the kingdom. Tests of the waste oil and clean oil made by a consulting analyst are said to have shown the following changes to have been effected by the process: Appearance changed from dark brown cloudy to dark brown clear; the gravity at 60 deg. Fahr. from 0.9180 to 0.9185; the acidity from 0.61 to 0.06, and the water content from about 1 per cent to a trace.

Medical Attendance in Relation to Compensation

Labor interests have seriously opposed the present method of making it the duty of the employer to provide medical attendance in compensation cases. They believe the employee should choose his own physician. T. W. Konop of the Wisconsin Industrial Commission discusses this point here.

ALTHOUGH the movement started too late to publicly gather national force in connection with the 1921 sessions of State legislatures, the proposition of what part the employer and insurer and what part the employee should have in the choice of medical and surgical attendance in the event of injury in industry is already a real national one, and is bound to intermingle with the other big items that are up for consideration in connection with industrial relations.

This question of medical attendance in connection with workmen's compensation is more vital than the item of money indemnity for injury, considered in a broad way. Labor interests are very serious in their opposition to the universal present method of making it the duty of the employer or insurer to provide such attendance. They will make the issue as big as they can.

Interests other than those of either employer, insurer or worker are not in favor of any radical change from the present method, chiefly because they have found that self-interest alone, on the part of employer and insurer, has given the worker entirely satisfactory attendance.

These were the leading thoughts expressed on the subject of compensation for injury in industry at the fourth Wisconsin Industrial Service Conference and Wisconsin Industrial Physicians and Surgeons, held at Appleton, May 17. Wisconsin, the leading State in the introduction of compensation insurance and State control of safety in industry, now has two bills before it on the subject of choice of attendance which are the models for other states, and this formed one of the main subjects at the conference. Thomas F. Konop, former congressman from Wisconsin and a member of the Wisconsin Industrial Commission, sounded the keynote of the discussion.

"Compensation to injured workmen, under our law, comprises two things, medical and surgical attendance and weekly money indemnity of 65 per cent of the average weekly earnings," said Commissioner Konop. "These two benefits are so linked together that they are dependent on each other. The amount of the second depends largely upon the character of the first. The better and more skillful the medical treatment, the lesser the period of compensation disability. Unskillful and negligent medical and surgical treatment lengthens the period of compensation disability, makes compensation costly to the industry and many times unnecessarily makes a cripple of the employee.

"To my mind, skillful and adequate medical and surgical treatment is more important to the injured person and to the employer as well than the money indemnity provided under the law. Skillful and adequate medical and surgical treatment is absolutely essential to the restoration of an injured employee's earning capacity, and yet in nearly all of the compensation laws of the country there are limitations on this service of from two weeks to ninety days or at a cost of from $25 to $300, sometimes both.

"Under the above provision the commission has repeatedly ruled that with this duty imposed upon the employer is a corresponding right to select the physician and surgeon who shall treat the injured workmen. The employer, therefore, is given the right to select, and has been exercising that right and insisting upon its exercise in Wisconsin."

The commissioner then spoke at some length on the movement on foot to change the system and give the right of selection to the employee, although declaring that personally, and he believed the other commissioners agreed with him, he was opposed to any radical change, that he believed the present system was working satisfactorily and that the kind of medical and surgical service that is being furnished to injured workmen is of the best.

Some of the reasons given why the employer should select the physician and surgeon were: He is in a better position to select a competent, skillful physician or surgeon; he is financially interested in the speedy recovery of the injured workmen and will, therefore, furnish the best skill possible; he has to pay the expenses and, therefore, should be permitted to make the best bargain and reduce the cost of this service; where the physician is selected by the employee the treatment is prolonged, bills are padded.

On the other hand, he said, the demand for a change has been growing all over the country. Two years ago a bill to amend the law and give the injured workmen the choice of medical attendant was withdrawn after a conference, when the employers agreed to take the matter up with the insurance carriers and bring about a condition that would give the injured employee the choice of another physician or surgeon if dissatisfied with the one offered, but practically nothing has been done to carry out this agreement.

There are two bills now pending before legislative committees relating to this feature; the Schafer bill would give the injured employee the right to select his own physician or surgeon and the Huber bill gives him the right to make a selection from a list provided by the employer.

Taking up the other side of the argument, Mr. Konop said it is argued the relation between physician and patient is confidential and personal and that sometimes the company physician discloses these confidences; that the best results are obtained

when the patient has confidence in the surgeon; that the physician selected by the employer restricts the period of disability, requiring the injured employee to return to work too soon in order to lessen the indemnity payments; that the physician is too devoted to the interests of the employer; while medical men have complained of the concentration of medical and surgical work into the hands of a few.

The commissioner discussed the various arguments at some length and with absolute frankness. He cited various cases which have come to the attention of the commission to prove this or that argument. He declared the absolute choice of a physician and surgeon by the employee was liable to be detrimental rather than beneficial to the injured workmen, and that one of the first results would be that the Industrial Commission would have to fix the schedule of fees for the medical profession. He said the most skillful physicians and surgeons would object to that to such extent that they would refuse to handle such cases and the workmen would suffer in the long run.

The Future of Airplane Manufacturing

IN a statement just released C. M. Keys, president of the Curtiss Aeroplane & Motor Corporation, asserts that "it costs at least $1,900,000 to develop any airplane motor to the point of successful production." He goes on to point out that the Government idea that airplanes and even aeronautical motors should be bought only under competitive bids is not conducive to scientific progress under these circumstances. The statement continues:

"It is fairly obvious that no company can spend that amount of money and suffer the grief and disappointment of experimental labor—which is so often lost labor—only to have the product of that labor, if successful, taken up by the Government and thrown open to competitive bidding.

"It is fair to say that because of these conditions, over which the industry has no control, not only the Curtiss company, but all other forward-looking institutions in this art, have curtailed their efforts, economized their resources and foregone their ambitions for the art in order to adapt themselves to the policies of their Government."

At the end of the war the Curtiss company was operating seven plants, employing 170,000 workers. It produced 5811 complete airplanes during the war, together with over 5000 motors. The following list indicates not only the location of the various Curtiss plants, but also the various lines of development along which research and progress is being made:

Research, Experimental and Production, planes and motors
- Garden City, N. Y.
- Churchill St., Buffalo, N. Y.

Rehabilitation and Overhaul,
- Waukegan, Ill.
- Atlantic City, N. J.
- Houston, Texas.

Repair and Supply Depots
- Garden City, N. Y.
- Waukegan, Ill.
- Atlantic City, N. J.
- Houston and Dallas, Texas.
- Riverside, Cal.

Flying Schools and Fields
- Curtiss Field, Garden City,
- Curtiss Field, Buffalo,
- Curtiss Flying Station, Atlantic City.

Airport, Newport News, Va.
- Waukegan, Ill.
- Houston and Dallas, Tex.
- Riverside, Calif.

Distributors and Agencies
- Throughout the United States, Central and South America and the Philippines, thereby vastly extending the service opportunities for users of Curtiss products.

The Garden City plant covers 260 acres. In addition to the shops, this factory contains a drafting department, an aerodynamical laboratory, a 7½-foot wind tunnel, a motor laboratory, chemical and physical laboratories, etc. The Buffalo and Garden City plants take the results of the scientific research made in the other plants and translate them into actual motors and airplanes.

The Curtiss company, according to Mr. Keys, believes in the future of commercial aviation and thinks that "the Government should provide sympathetic regulation, establish airports and lay out routes, etc.," while "the industry must do its part in providing the flyers with economical equipment and good service."

Sulphide Alcohol as Motor Fuel

A GREAT deal of alcohol made from the sulphide liquor of paper manufacture has been used as motor fuel in Sweden during the past several years, and a questionnaire regarding experiences with this fuel was circulated about a year ago by Prof. C. E. L. Hubendick, at the instance of the Swedish Department of Commerce. No less than 668 replies were received. The majority of motor owners had difficulty in getting benzol and sulphite alcohol in a state of sufficient purity, and in many cases trouble was experienced from fouling of the engines and attack of some of the metallic parts. Moreover, many of the carbureters, which were designed to use gasoline, were not properly and completely adapted for the use of alcohol, which resulted in irregular operation.

Of all the reports received only 10 per cent show the alcohol engines to work satisfactorily in every respect. On the other hand, serious trouble was reported in only 4 per cent of the answers. A most serious defect is insufficient preheating of the fuel, which results in abnormal consumption of fuel and oil and also in the deposition of unvaporized fuel which washes off the lubrication oil, and therefore results in increased wear of the cylinder walls in spite of the more liberal supply of lubricant. Incorrect adjustment of the carbureter and the ignition mechanism often leads to improper mixture conditions, incomplete combustion, and, consequently, reduced output.

In many cases there was excessive wear of parts that do not come in contact with the fuel, and this can be explained only on the supposition that the oil was also of poor quality. Some wear of engine parts was undoubtedly occasioned by the iron salts which are added during the preparation of the alcohol. The most serious disadvantage was shown to be the starting difficulty. In a general way the conclusion may be drawn from the answers received to the questionnaire that if the necessary precautions are taken the use of alcohol fuel does not affect the life of the engine detrimentally and there are no serious objections to it.

Production Value of Industrial Incentives

The big labor problem is to provide incentives in industry which will induce the worker to put forth his full capacity for accomplishment. The manufacturer must be as willing to experiment in regard to industrial relations as in regard to mechanics. Changed attitude is necessary.

By Harry Tipper

THE big problem of labor is not the problem of trade unions, I. W. W. or the radicals. It is not the question of whether the demands of the workers are justified; it is not even the question of whether they are misled by their leaders. These things may or may not be. Trade unions are wrong many times. The Socialist's dream is based upon a false idea of progress, the labor leader is no less selfish than the rest of humanity and the manufacturer is frequently arbitrary and autocratic. These things are important mainly because they indicate the amount of time lost in discussion that ought to be devoted to accomplishment.

The main job of industry is to get more work done for less cost per unit of work. Whether this work is done in the factory, in the salesroom, in the accounting department or the warehouse, the work should be planned so that useless motions and waste will be reduced to a minimum.

The big labor problem, therefore, is the production of an incentive for the worker which will enable him or induce him to put forward his full capacity for accomplishment. Anything that will aid this result is important to industry, and anything which reduces this possibility is a detriment to industry.

Obviously, the worker in a majority of cases is not putting forward his full capacity toward useful industrial accomplishment. We know that he is not as interested in his work as he might be. We know that the error in its practice is larger than it should be. Furthermore, we know that these items of waste depend for their correction upon the human element and the proper consideration of the workers within the organization.

Unfortunately, opinions have been formed from circumstances and conditions on all sides, so that people who disagree with one another as to conditions and results are contented with accusing each other of being reactionary or radical, unionists or capitalists, without getting down to the main problem.

When I was selling machinery some years ago it was a part of a salesman's aim to get the engineer to discuss some technical points about the machine, so that the main point of this disagreement would be lost sight of.

Most of our discussions upon the industrial relations has been devoted to this or that system through a union or an open shop, the bonus system or straight wage, until we have almost forgotten that the main problem of industry is production, increased efficiency and speed of accomplishment without a corresponding increase in the unit cost.

If we would get back to this point and stick to it, we would find a great deal of information to be gathered by a study of fatigue and some of the real books that have been written upon the subject. If we would look upon fatigue as something to be avoided in excess because of its effect upon production cost, our consideration of hours, surroundings and other conditions of labor would be measured from the cost standpoint.

Similarly, the question of incentive, the interest secured from the work by the worker, the encouragement to the exercise of judgment would be considered in their relation to the development of production capacity and efficiency, and from that standpoint we would find a great many suggestions in the observations of men who have no industrial management and no experience in handling a factory.

If a flexible system with more responsibility upon the foreman will improve the production efficiency within the plant, the highly centralized system is out of date, and we should reanalyze in order to eliminate its deficiencies.

In these articles the statement has been made that the work must retain the interest of the worker, in addition to the pay, if the full capacity of the worker is to be exercised upon it. As the workers increase in intelligence, it is not possible to maintain their interest in their work unless the work itself offers possibilities of mental improvement and a visibility of growth.

The interest cannot be maintained unless a fair degree of confidence can be established between the supervisor and the worker and the organization system and policy is generally understood.

The suggestions in these articles have been made because they offer possibilities of improving the individual production capacity by harnessing the human incentives to the work of production. Whether these suggestions agree with present practices as generally established is unimportant. Their agreement or otherwise with specific opinions of labor leaders, sociologists or employers is equally unimportant. The sole tests by which they should be measured are those relating to the possible improvement of production capacity and meeting the problem of constantly increasing production costs.

Either it must be admitted that the worker's interest is necessary in order to secure his full capacity or not. If this is not admitted, then the present practice stands justified as the only possible practice —with all its interruptions, troubles and fluctuations in production effort.

When it is understood that human interest in the work is a necessary part of the production capacity for maximum working value, any practice that has established a larger working value per man is worth examination and analysis so that its value may be determined and further experiments developed along similar lines.

Any manufacturer who possessed a machine which was

capable of producing more effectively, more speedily and at less cost would consider himself possessed of a strong competitive advantage and his competitors would be anxious, indeed, to secure equipment of the same character.

In human affairs it is different. Three or four hundred manufacturers in this country in various lines of industry have established experiments in dealing with the human beings in their organizations; these experiments have shown a larger production value, less turnover, elimination of wastes from interruptions and strikes, or some other greater efficiency.

Other manufacturers are not anxious to secure the information of this improved practice, however, and they are very skeptical of its value or its wisdom when they are approached upon the matter. For this reason the experimental changes in the human development of organization grow very slowly. While there is a rapid adoption of machinery which possesses marked advantages, and widespread experimentation with systems that offer new possibilities, there is little disposition to approach the human problem with the same ideas in mind. The improvement of our organization from the human side proceeds very haltingly in comparison with the improvement in its mechanics.

Not long ago a manufacturer was explaining to me a system he had developed theoretically for eliminating the trouble between capital and labor. I asked him how he proposed to put it into effect. He suggested government agencies; after some discussion we eliminated that possibility, and I asked him to try again. He then suggested that the industry might get together and formulate some plan.

We speedily discarded that, and then I said, "If you knew you could secure a piece of machinery which would eliminate a lot of your mechanical troubles and inaccuracy and save a lot of the company's money, you would feel obliged to buy it in justice to the stockholders. You have outlined a plan for human relations which you believe would lead to greater production efficiency and, therefore, more money for your stockholders. Don't you think you are obligated to put it into effect?"

"Well," he said, "maybe I am, but I cannot very well do it, because——"

In other words, this manufacturer was willing to take the responsibility for the investments of the company, the system, the methods and the operations of the company, but he would not accept the responsibility for experimentation with his human organization, although that was the only thing that made the operations valuable.

So long as this attitude prevails, experimentation will be slow, and the understanding of the human necessities within the organization will be developed to an insignificant degree in comparison with the mechanical arrangements of the organization itself.

Bait for House Organs

"WHEN you go fishing it is the taste of the fish, not your personal likes, which determines the kind of bait you use. When you publish an employees' magazine or newspaper it is the taste of the workmen that should determine the sort of material which is printed." This was the statement made recently by James Melvin Lee, editor of *Administration,* in discussing news in employees' papers before a meeting of the New York State editors of such publications.

Several other simple rules of procedure were brought out by Lee which are of interest to the executive should he desire to judge in a general way how far his employees' organ is fulfilling its function. Some of these are discussed in the following paragraphs.

News is far more important feature in these publications than are editorials. News will have a greater influence in accomplishing the purpose of the editor than all the editorials he will ever write. The employees may feel that editorials are inspired propaganda, but news cannot cause such reaction. There may be a large hole in the Main Street of your town for instance, which needs to be repaired. The local paper may write many editorials without getting any action. But if it prints a series of news stories showing how a motor truck got stuck there, how a car bumping through the hole splashed the new spring dress of one of the leading society ladies, etc., the hole will probably be patched up in a few days.

The personal element should be injected into these publications to as large an extent as possible. One Boston newspaper is said to have built up a large circulation and an excellent reputation by mentioning the name of everyone in Back Bay at least twice a year. The small events, such as marriages, week-end travels, visitors, etc., are of great interest to those concerned. The degree to which the personal element is successfully injected into the paper is likely to determine the degree of success with which it accomplishes its purpose.

To make the news interesting, the editor should be able to dramatize the facts when they are presented. Nearly all news stories when analyzed will be found to center around the idea of "struggle" in one way or another. Fires, murders, international relations, industrial relations, deaths—even marriages when they get into the news—all center around the struggle idea. It is this factor which makes the news interesting and vital to the readers. More of the struggle idea should be injected into the news stories of the plant paper, and the facts should be dramatized for the benefit of the reader.

Anecdotes and short, witty stories often help out a news account to a large extent. They liven up the article and help appreciably in dramatizing the idea. In writing their material for house organs, the editors might well take a tip from O. Henry, who is said to have stated something like this: "I just sit down and write an ordinary story. Then I put a little raisin here and little raisin there; then I put a big raisin at the end. And the editors bite on those raisins." And that is just what O. Henry did; it is the little raisins throughout and the big raisin at the end that make his stories distinctive.

Regular advertising is usually out of place in employees' magazines, but a classified column might be run to great advantage. Here the employees could be allowed to advertise free of charge anything they had to sell, etc.

There is a tendency in employees' publications to lack variety. Week after week reading of many of them leaves the reader with a sense of sameness. A proper realization of the value of news, and a proper sense of news values and methods of presentation would go far toward eliminating this fault. The employees' publication is written for the employees; not for the executives.

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A Successful Convention

THE 1921 summer meeting of the Society of Automotive Engineers will go down in the history of the organization as one of the most successful ever held by the Society. Not only were the technical sessions well attended and the papers well discussed, but the meetings were handled in an alert and punctual manner which permitted of definite adherence to the schedule adopted before the meeting opened.

Those who attended the meeting were there primarily to become posted on late engineering developments and exchange information. The papers were excellent and a credit both to the Society and the authors. They furnished much data that will be used for reference purposes for years to come.

The meeting was indeed a liberal education for those who were fortunate enough to attend and will furnish much food for thought and study on the part of members who could not be present.

If any criticism is to be offered concerning the meeting it might be said that there was not quite enough time for discussion, but there was marked improvement in this direction. Some would have liked a larger proportion of papers dealing directly with design features, especially of passenger car chassis, and less leaning toward pure theory, but there was certainly no lack of interest in the subjects selected or the method by which they were treated.

The meetings committee, the S. A. E. staff, those who provided papers and discussion and others who co-operated to make the meeting so successful are to be congratulated and should receive the thanks of the membership.

The Value of Turbulence

THE idea of promoting turbulence of the mixture in an engine cylinder at the moment of ignition, discussed in the paper presented by H. L. Horning at the Society of Automotive Engineers Summer Meeting, is not a new one, but has been given far too little attention by designers and others interested in bettering the combustion conditions which obtain in automotive engines. Flame spread is greatly accelerated thereby with the result that the entire charge is burned more quickly and more efficiently. It is a well known fact that two or more spark plugs fired simultaneously at points some distance apart in the combustion chamber facilitate early completion of combustion and make possible the use of less spark advance. The same is true to an even greater extent when the flame is rapidly spread by turbulence to all parts of the charge. In this way ignition takes place at an infinite number of points almost simultaneously, and since the mixture is quickly inflamed at many points the time which elapses before the entire charge is burned is so small that the flame cannot reach the detonation velocity, and consequently the knock which would otherwise result does not occur or is much less likely to do so, at least so long as too high a compression ratio is not employed. Conversely, the greater the turbulence, other things being equal, the higher the compression ratio which can be employed and the higher the efficiency obtainable.

Mr. Horning points out two methods for obtaining turbulence and shows the advantages gained thereby. His paper is worthy of careful study and should prove instructive even to those who are already well versed in the subject.

Hub Standardization

NOW that the smoke of battle has cleared away and the adoption of the recommended practice on front truck hubs is an accomplished fact, a real panorama of the admirable way that the Standards Committee of the S. A. E. has handled a difficult problem is presented.

It will be remembered that this matter was referred back to the committee at the meeting last January after failing to carry by a very small majority. The ball bearing manufacturers, and doubtless rightly, believed that their side of the case had not had the proper consideration. Subsequent revision of the recommendations have met with the en-

tire approval of all concerned and as a result the report was carried unanimously.

AUTOMOTIVE INDUSTRIES congratulates the standards committee and members of the ball and roller-bearing industry, the axle manufacturers, wood and metal wheel manufacturers and other allied interests on the unselfish co-operation which finally made this result possible. Having vigorously pointed out in its editorial pages the economic waste through lack of uniform practice due to minor and immaterial differences, this publication looks forward to the rapid adoption of a similar report covering front hubs for passenger cars, as a real conservation measure and one which will further the welfare of the entire industry.

Scientific Research

AT the S. A. E. meeting one of the speakers made the remark that during the period of from 15 to 10 years ago a great deal of scientific research on problems connected with the operation of internal combustion engines was carried out in England by such men as Clerk, Hopkinson, Callender, Bairstow, Watson and others, while at the same time in America little attention was given to such matters; now things seemed to have changed around, for aside from the creditable work of Ricardo little research is being carried on in England, whereas in the United States the subject is being taken up with avidity. Prominent among the scientific work on gas engine phenomena being done in this country is that of the Bureau of Standards and of the Research Laboratory of the General Motors Co.

Research work, so far as it pertains to internal combustion engines, may be divided into two classes, namely, research carried on with a view to the solution of immediate practical problems and research conducted with a view to establishing broad fundamental facts without special regard to their immediate practical application. Research of the former kind has been carried on in America practically ever since the automobile industry was first established. It was often conducted with limited means and meager equipment, and the results obtained were seldom published. The making and testing of all classes of experimental devices intended as models for manufacture falls under this head. It must be realized that if a new type of carbureter, for instance, is developed, numerous experiments usually have to be made before all around satisfactory results are obtained, and this experimental work really constitutes research, although it passes more generally under the name of development work.

The work done in England by such men as Hopkinson, Bairstow and Watson was of a different character. Most of it was conducted for the Gaseous Explosions Committee of the British Association for the Advancement of Science. Among the factors determined experimentally were explosion temperatures, changes in specific heats of the products of combustion with temperature, rate of flame propagation, chemical constituents of exhaust gases, etc. These are fundamental factors in the operation of engines, and a knowledge of them undoubtedly enabled engineers to design better engines. The results then obtained are probably appreciated a great deal more now that the necessity of exceeding high speeds and of burning the heavier grades of fuel has confronted engineers with new and more difficult problems than when they were first made known to the public.

If research on internal combustion engines is lagging in England just now, we need not expect that this will remain so for any length of time. Immediately after the war a national research organization was created there for the purpose of encouraging those industries which felt that they could benefit by systematic co-operative research work and were willing to contribute the necessary funds by the grant of Government research subsidies. One of the industries that have qualified for such grants from the Treasury is the automobile industry. Naturally the result of this research work will not be published generally and will be made available only to such firms as contribute to the fund required for meeting the expenses. Also, the work will no doubt be carried on more with a view to immediate practical returns and will therefore be conducted on materially different lines from that of the Gaseous Explosions Committee.

The Individual in Industry

THE question of incentives in industry is often approached from the wrong side. Plans for making workers more enthusiastic about their jobs and consequently more efficient are likely to start by viewing workers as a mass. Actions of "Labor" are considered and the plans devised are formulated on the mass basis.

It is probably true that certain fundamental principles form the basis for human actions and reactions, but at the present time we are far from understanding what these fundamentals are. We cannot hope to understand them except through a long period of conscientious study and experiment. And the analysis of the problem must center about the individual—not about the mass.

The mass is simply the group of which the individuals form the component parts. It can never be understood until the individuals are understood. We must start our work and study with the individual. Industrial relations should be approached from this angle if permanent progress is to be made.

To study human relationships in industry by concentrating on the individual is a tremendous task. Progress is likely to be slow; but once made the progress is permanent. To attempt to solve the difficulties through formulas and mass generalities is to put the cart before the horse.

Though a slow process, the analysis of the individual is really the quicker, because it will record constant progress, while the mass approach leads backward rather than forward. And this constant progress will more than pay in production and profits, as it goes along, the expense and trouble necessary for the analysis.

Americans Sweep Indianapolis Race

Milton's Frontenac Leads Contenders

Eight of First Nine Places Go to Yankee Cars—Engineers Analyze Results

INDIANAPOLIS, May 30—A Frontenac car, piloted by Tommy Milton, won the 500 mile classic here to-day and was closely followed by three other American cars. The second car was a Duesenberg straight-8 special. Third was the Chicago Frontenac and then another Duesenberg. Only nine laps separated these cars when the winner crossed the line. The fifth car was a Sunbeam. Only nine cars completed the race. Continuing in order they were: Duesenberg, Leach special, Duesenberg and a Frontenac.

The drivers in the order in which they followed Milton across the line were Ralph Sarles, Jules Ellingboe, substituting for Percy Ford; Jimmie Murphy, Ora Haibe, Bennett Hill, Ira Vail, Albert Guyot, and Ralph Mulford. The tenth prize was distributed between the drivers finishing the race.

At the beginning of the race, De Palma made a splendid record with his Ballot special for 102 laps. He kept the time well above 93 miles an hour while he was in the running and he carried off something more than $10,000 in lap prizes.

After he went out Sarles took the lead for a time, but Milton soon came to the front and led consistently. Milton's time was 5:24:44.65. His average speed was 89.62 miles an hour, which compares with last year's average of 88.50. Both of these races were for cars of 183 cu. in. displacement.

The track record is 89.84 miles an hour, made in 1915, when 300 cu. in. was the maximum. The Frontenacs are practically the same as the Monroe, which won last year.

Duesenberg Team Work Good

Milton's victory was a reward for good driving of a good car. The Duesenberg group always had some one handy to spurt with De Palma as long as he remained on the track. It is held that De Palma was led into unwise bursts of speed by the splendid teamwork of the Duesenberg group.

While all the deserved glory goes to the victors, it is really those who fail who make the Indianapolis classic of value to the industry. Indeed, for these cars to have run and lost is far better than had they not run at all. Each broken hope, in the form of a shattered part, spells out an engineering lesson which, when interpreted, makes the Indianapolis Speedway the greatest automobile engineering school in the world.

HOW THEY FINISHED

First, Tommy Milton	Frontenac
Second, Ralph Sarles	Duesenberg
Third, Jules Ellingboe	Frontenac
Fourth, Jimmie Murphy	Duesenberg
Fifth, Ora Halbe	Sunbeam
Sixth, Bennett Hill	Duesenberg
Seventh, Ira Vail	Leach Special
Eighth, Albert Guyot	Duesenberg
Ninth, Ralph Mulford	Frontenac

Time of winner: 5:24:44.65. Average speed: 89.62 miles an hour.

When Tommy Milton piloted his Frontenac special to victory he bore out his reputation for being able to size up the staying qualities of his vehicle and his wisdom in not exceeding the pace which eventually proves to be sufficient to win. Too fast a pace was set up by others, probably in an endeavor in some conspicuous instances to win prizes for laps. Ralph De Palma won every lap prize except two up to the 110th, but this burst of speed, which was far ahead of all previous records for the distance, probably cost him the race as he went out on the 111th lap with a burned out rod.

Next to tire stops, which in spite of the hot weather were less numerous than in any previous year and mostly merely precautionary at that, burned out rods and spark plugs were the most prolific causes of trouble and equal in number, there being four cases of each.

Next in order came steering knuckles and water connections with three instances of each. Freezing brakes, valves, ignition and oiling each claimed one victim. As far as the broken rods were concerned, it is more than likely that the trouble with some of these originated in clogged or faulty oiling systems.

Those who suffered were Ralph De Palma in his Ballot special, which looked for a while like an easy winner; Howard Wilcox in the Peugeot, first out of the race; the Talbot-Darracq and one of the Junior specials.

Five Spark Plug Victims

Spark plug troubles were experienced by the Revere, Ballot, Boyer's Duesenberg, Spiel, and Murphy's Duesenberg Special. Those who had the plug troubles had many of them while the others had none at all so that it is very possible that the troubles were of design. Perhaps it was the old fault of not enough water around the plugs.

Two of the Duesenberg specials had broken steering knuckles, showing possibly a weakness in heat treating or material selection. Both cars and drivers, Murphy and Thomas, had narrow escapes as their cars went from one retaining wall to the other, creating conditions with

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Miller Encourages Loans on Car Paper

Kansas City Reserve Head Opens Way to Business—Funds Now Ample

KANSAS CITY, May 31—Two items of motor car paper, said to be paper of distributors of motor cars, submitted by member banks, were rediscounted by the Federal Reserve Bank of Kansas City, during the week of May 23.

Governor Miller of this Federal Reserve Bank sent letters to several of the member banks, announcing that high class motor paper that is solvent and eligible, was being taken.

Governor Miller's most emphatic statement, in the course of an interview with a Class Journal representative, was a declaration that the Federal Reserve Bank of Kansas City is now offering rediscount facilities on automotive paper primarily and definitely for the benefit of automotive dealers and distributors of the Tenth Federal Reserve District.

"We are hoping," said Governor Miller, "that our increased liberality toward motor paper will not cause a flood of that paper to invade the Tenth District and absorb the lending power of the leading banks as well as of the Federal Reserve Bank, which ought to be used for promotion of live stock interests. We are hoping that such automotive paper as is offered, by member banks, will be paper of firms and individuals of this district, in the automotive business, and not paper of outside automotive concerns."

In 1920 a great deal of outside motor paper from the automobile and accessory field was bought as commercial paper by Tenth District banks. Most of this was liquidated as it matured and has not been returned to Tenth District banks. None of it, of course, got into the Federal Reserve Bank. It is obviously the desire of the Federal Reserve Bank officials, that each automotive district take care of its own automotive paper.

Has $40,000,000 Reserve

Several factors, not mentioned in his address to the Motor Car Dealers' Association May 21, seem to have entered into Governor Miller's decision to relax the scrutiny of commercial paper. The Kansas City bank is $70,000,000 better off this spring than in the spring of 1920. Then, it owed $30,000,000 to other District banks; that is paid off, and the bank has accumulated a large reserve.

An important factor is the sharp contrast in the attitude of bankers gener-

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Industry Steady as Market Changes

Renewed Sales Follow Reductions in Price

No Repetition of 1920 Slump Likely—Farm and Foreign Markets Opening

(By James C. Dalton)

NEW YORK, May 31—The present decline in buying demand for automobiles is neither remarkable nor unexpected. In fact, if there had not been a falling off in sales at this time it would have been most remarkable. The business of companies which have announced definite price reduction is holding up remarkably well.

There probably are many elements responsible for slower buying. One of the most important is uncertainty in regard to prices; another is the usual seasonal slump, and another is bad weather. Spring sales began earlier than usual this year and it is only a natural sequence that they should slow up earlier. The slackening demand did not come unexpectedly to anyone in the industry who has followed the situation closely. There always has been a dull season in summer for the automotive industry. There are few industries which do not have dull seasons.

In recovering from periods of depression, industry and commerce always have ups and downs. There is no steady upward trend, with business increasing each month, nor does trade remain stationary. But business seldom slumps back as far as it did at the height of the depression, and each rebound carries it a little farther forward than the last one. That undoubtedly is what will happen now with automobiles.

Sales Pace Production

It is not likely that sales—and sales now are synonymous with production—will drop back to the low levels of the last months of 1920 and the early days of 1921. Trade will depend to a greater extent than it has since March upon general business conditions. These should show a marked improvement by early fall. Predictions in times like the present are foolhardy, but it can be said safely that there are more elements tending towards stability than there have been since deflation began a year ago.

The general buying power of the country has now approached its lowest ebb, except for those unfortunates who have been compelled to draw on their savings to meet current expenses. The outlook is brighter now than it has been in years for those with fixed incomes and for the salaried workers whose positions are secure. They are finding the purchasing power of their dollars constantly increasing. There are many thousands of families in this class who, if they are not now in a position to buy an automobile, soon will be. The difference between their earnings and their expenses is steadily widening as the cost of living slowly but surely declines. These families are the ones which make the best prospects.

Industrial Conditions Spotty

Industrial conditions throughout the country are "spotty" and they will continue to be for some time to come. There is less depression in some districts than in others, and those sections which are most prosperous naturally offer relatively the best sales territory. Intelligent sales efforts will bring results now as they always have. The wiser sales executives are not mapping out arbitrary campaigns and sticking to them. They are keeping their forces mobile and making quick, decisive raids in the districts where the most money is to be found.

Sales resistance in the great agricultural sections is slowly breaking. It cannot be said truthfully that the farmers are buying feverishly as yet, but they are displaying increasing interest in what they consider real bargains. This is shown by the greater volume of sales reported by the great mail-order houses which find their best patronage on the farms. Holdings of last year's crops gradually are being turned into cash and the outlook for the present season is most encouraging. By fall the buying appetite of the farmer should have been whetted to such an extent that he will consider purchasing the motor vehicles he sorely needs.

Domestic business is inextricably bound up in foreign trade, and in this direction there are distinctly encouraging factors. Chief of these is settlement of the German reparations question and the evident sincere desire of the present German Government to meet its obligations scrupulously. A better feeling already is apparent in Europe. The Silesian question probably will be settled without further bloodshed and the justifiably militant attitude of France has been modified to meet the Teutons half-way, if it finally is demonstrated that they intend to meet squarely the burdens imposed upon them for drenching the world in blood.

Reparation Treaty Helpful

The stabilizing effect of the reparations settlement already is apparent upon the continent, and European nations soon will be coming into the market for the purchase of American goods

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Argentina to Take Cars in September

Will Clear Present Stocks by New Season's Opening—Ford Manager Resigns

NEW YORK, May 27—Contradictory statements concerning the automotive situation in Argentina are cleared up and the promise held out that new business will be gotten under way in time for the opening of the sales season in September, in information received from M. T. Meadows, manager of the American Chamber of Commerce, Buenos Aires. This observer declares that the stocks of cars held in the Argentine on May 3, when his communication was written, represented no more than a two months' normal supply.

"I feel that I can assure you that the friendship and goodwill of the Argentine dealer and importer is not lost," Meadows states, "so that the resumption of the sale of American cars on a large scale is merely contingent upon the revival of business activity here.

"In effect the large car stocks, reported in a previous statement, are gradually being liquidated and are now figured as standing at about two months' normal supply. However, owing to the general business depression still prevailing, which is reflecting most unfavorably in the automobile market, it is probable that the present supply will carry us through the winter and very few new cars will be needed until the opening of the spring and summer selling season in the coming month of September.

"I also feel sure that our American manufacturers have shown a ready disposition to get together with their local dealers and that eventually the situation will adjust itself in a manner satisfactory to all concerned."

The resignation of E. H. Hampton, as manager of the Ford branch at Buenos Aires, also is reported, as one of the results of the change of dealership territorial rights, similar to the changes made in this country several months ago. This action in taking away the exclusive territory rights has evoked a storm of protest from the Argentine agents who number about 325. Hampton became the Ford manager at Buenos Aires in 1912, when Ford sales were 30 yearly.

COLUMBUS TIMKEN RESUMES

COLUMBUS, May 31—The Columbus branch of the Timken Roller Bearing Co. has now 260 men on its payrolls and additions are being made constantly, according to Charles N. Replogle, general manager.

Ace Truck to Sell Direct from Factory

Elimination of Dealers, Company Says, Permits Price Cuts of $455 to $655

NEWARK, OHIO, June 1.—The American Motor Truck Co., manufacturer of the Ace truck, has eliminated distributors and dealers from its selling plan and hereafter will distribute its product direct from factory to user through a system of zone offices. Coincident with the change of policy, the company has announced a reduction of $455, or 16½ per cent, on the 1½ ton model and of $655, or 23½ per cent, on the 2½ ton model. The new prices are $2295 on the 1½ ton and $2795 on the 2½ ton.

The new Ace plan, originated by C. L. Bowler, general manager, was first tried out beginning Feb. 1. In 60 days in three zones where the test was made, 396 garagemen were retained to handle the service work and these garagemen, operating on a basis whereby they will be paid $150 each for names of prospects who later buy trucks, turned in more than 1400 prospects. Up to date 14 zone managers, recruited from the ranks of factory and distributor sales representatives of various truck lines, have been appointed and it is planned now to develop the new selling system on a national scale under the direction of Glenn B. Hiller, who became general sales manager May 1. Hiller formerly was general sales manager of the Nelson Motor Truck Co. and later assistant general manager and director of sales and advertising of the Triangle Motor Truck Co.

The Ace will develop new selling zones gradually by sections throughout the country, eventually, according to the present plan, having between 200 and 300. In each will be a zone manager in charge of sales and service, a zone service supervisor and as many salesmen and traveling service men as are necessary. The zone managers and their assistants will all be factory employees, those in the sales department working on commissions with drawing accounts.

Will Have Service Depots

It is planned in each territory to have a central parts depot or two or three if necessary, and 200 or more service stations handling monthly inspections of all Ace trucks in the territory and doing necessary repair work. These service stations will also obtain prospects for new truck sales. They will be allowed $150 on each prospect who later buys and they will be permitted to get the cooperation of drivers and others to obtain prospects in which case $50 of the $150 will go to the tipster. Selling will be handled exclusively by the zone manager and his salesmen.

Service stations will make no investment in parts, obtaining these as needed from the zone parts depot, which it is expected in most cases will be not more than 25 miles distant. The zone service man will check up the service station on the quality and prices charged for repair work. For the inspection service, which includes four inspections of three hours each the first month after a truck is delivered and one of three hours each month thereafter for 11 months, the service station will receive $45 from the factory, this inspection being free to the owner. The owner carries a coupon book entitling him to the inspections which he can obtain in any garage serving as an Ace service station. Garagemen for this work will be selected preferably from those having no car or truck agencies.

The company will do no trading but through its zone managers and service stations will sell used trucks for new truck buyers on a commission basis. New trucks will be sold for 50 per cent down and the balance in six months, the American Motor Truck Co. doing its own financing. In the contract will be a provision under which the owner pays a flat rate of $150 on the 1½ ton truck and $182.50 on the 2½ ton truck for interest on the time payment over the six months period and for insurance on his truck for one year.

The company states that the reductions in its list prices were made possible through the reduction in selling cost under the new plan.

Louisiana Motors Head Temporary Receiver

SHREVEPORT, LA., May 31—Acting upon application of creditors who hold notes against the Louisiana Motor Car Co., W. F. French, president of the company, has been appointed receiver by the court according to the petition asking for receivership. The unpaid debts of the concern amount to approximately $150,000 with assets amounting to more than $900,000.

The appointment of a temporary receiver to manage the affairs of the company whose automobile factory is located at Cedargrove, near Shreveport, was agreed upon at a meeting of the board of directors. At the request of the petitioners, W. F. French, president of the company, was appointed by the court as temporary receiver. The only reason given for the request for the receivership is that the company owes debts which it has not the means available to pay. The factory has been temporarily closed down, but it is announced will resume operation soon.

DART TRUCK IN RECEIVERSHIP

WATERLOO, IOWA, June 1—To avoid complications following the death of President C. C. Wolf of the Dart Truck & Tractor Corp., who was also cashier of the State Exchange Bank, W. H. Johnson, former vice-president and general manager of the company, has been appointed Dart receiver and will continue the business. The company's inventory of materials for trucks and tractors is declared to be in excess of its obligations.

Penn Motors Names Trucks for Dealers

Applies Brand Idea to Commercial Vehicles—Will Make Passenger Car Later

PHILADELPHIA, May 28—Something distinctly new in the policy of truck manufacture is in operation at the new factory of the Penn Motors Corp., Rivington, N. J., whose headquarters for sales is in this city. Hilton W. Sofield, president of the corporation, said the corporation will manufacture Penn trucks for the dealer, this being an application of the brand tire idea to trucks.

While the product of the factory will be generally known as Penn trucks of two tons' capacity, the corporation, as a special inducement, and having in mind the benefit of the dealer, will, where the dealer prefers it, have the trucks made with his name on the radiator and rear, exactly as if they were manufactured by him, thus not only advertising the dealer, but also giving the truck for that territory an individuality. There are certain restrictions, however, where the dealer's name is used.

Already orders for more than 100 trucks have been received and it is expected that the first will be finished within six weeks. There is one large building, 80 by 220 ft., in use at the factory, with several small outbuildings. It is planned to manufacture a light delivery truck in time, and before long the matter of making a passenger car will be taken up.

Speaking of his new plan, Sofield said:

"We had in mind making it easier for the dealer, who very often, just after he has succeeded in working up a good business, is informed by the factory that he will be removed from the territory and a branch factory established at that point, 'because business seems to warrant it.' Usually this business has been made possible by the man who, in such a case, has to suffer for it, instead of being rewarded."

The officers of the Penn Motors Corp., which is incorporated under the laws of New Jersey, are: Hilton W. Sofield, president; Howard S. Sofield, treasurer, and Charles B. McGuire, secretary. The directors are the foregoing and Dr. W. W. Beveridge, L. H. Collins and George A. Small.

The authorized capital stock is $300,000.

REVERE SEEKS $1,250,000

LOGANSPORT, IND., May 31—The financial condition of the Revere Motor Co. remains almost unchanged. The necessity of selling $1,250,000 of stock for refinancing and placing the factory in production is admitted to be considerable of an undertaking. It is practically certain that the money cannot be obtained in Logansport, despite the fact that quite a few prominent Logansport men have gained control of the crippled organization.

War Gave America World's Tire Trade

British Manufacturers, Seeking Protection, Declare United States Far in Lead

LONDON, May 6 (By Mail)—Urging protection for the British tire industry, the British Rubber Tire Manufacturers Association, Ltd., has prepared a memorandum in which it outlines the precariousness of the situation caused by American imports, unfavorable exchange rates and loss of Continental markets. The memorandum says in part:

"The rubber tire manufacturing industry in Great Britain is assailed by severe foreign competition, which is having a most serious effect on the industry. A great deal of this competition is from the United States, where, owing to overproduction, the home market is overloaded with tires, and the remainder from Continental countries with a depreciated currency. It can, therefore, hardly be classified under the heading of 'dumping' in the usually accepted sense of the term. The effect of this foreign competition at home and abroad is already felt to such an alarming degree by British manufacturers, and the position is so serious, both to the employers and the workpeople engaged, that unless immediate protective steps are taken the industry will be gravely affected.

"Before the war, although subject to fairly keen competition from France and Germany, the British tire industry did not experience any serious competition from America, and, generally speaking, was able to hold its own. In motor tires particularly, a branch of the business which was then attaining large dimensions in the United States, the American manufacturers had failed to make any effect on British home and Colonial markets, and in many Continental and foreign markets where the British manufacturers had a strong hold.

"The importance of the tire industry to the nation cannot be over-estimated. Motor transport is impossible without tires, and a state of affairs in which the nation had to rely upon foreign supplies in time of war would be unthinkable.

War Service Important

"The important part played by the British tire industry during the war cannot be over-rated. Under circumstances of extreme difficulty it supplied not only the requirements of the British armies, but assisted largely in supplying those of our Allies on all fronts. Prior to the war solid tires for heavy vehicles had been almost exclusively supplied by Germany, and British tire manufacturers were, therefore, faced, on the outbreak of war, with the necessity of overcoming the technical difficulties involved in solid tire construction, and that they were successful is demonstrated by the fact that at no time was transport held up through lack of tires.

"During the war practically the whole output of the British tire manufacturers was taken by the Government. This position gave considerable advantage to American competitors, who, until the last year of the war were unfettered in any way by war restrictions and were thus enabled successfully to attack the British home and export trade in motor tires. This export trade of the British manufacturers had been secured at great effort and expense, and war conditions therefore presented American firms with the goodwill of the British tire manufacturers in the various foreign and Colonial markets. American firms who, prior to the war, exported little or nothing are now doing a considerable export trade.

Imports Rise Ten Times

"The tire imports into this country from the United States of America rose from £231,096 (for the year ending 30 June, 1914) to £2,097,215 in the year ending 30 June, 1916, while in the Colonies and eastern markets, where motoring restrictions were less marked, their success was even greater.

"It was only half way through 1917 that their progress in this country was, to some extent, checked by import and shipping restrictions, but the hold secured by the American trade means that their competition has become an after-the-war factor, which presents a very serious menace and a much greater one than any the industry was faced with in pre-war times.

"The Americans have a huge home market which is fully protected by tariffs, while, on the other hand, it is necessary for British manufacturers, with their small home requirements, to be in a position to do a large export trade, and their activities in this direction are seriously curtailed by the advantage gained by the American manufacturers at a time when the whole of the British production was required for war work.

"The rapid rise of the American rubber industry is shown by the fact that in 1914 the production of rubber goods in America was to the value of £60,000,000, and in 1919 this had risen to £240,000,000. About 75 per cent of the total production consists of tires, and, therefore, the approximate value of the output of tires produced during 1919 would be £180,000,000. This export of tires from the United States rose from £788,644 in 1913 to £4,493,316 in 1919, and the export figures available for the current year show values at the rate of £10,000,000 per annum.

Eliminate Special Taxes

"Most of the important American concerns have their own subsidiary British distributing companies, and it is understood the prices at which tires are charged to the branches in this country are so arranged that no profits are shown for income tax purposes or excess profits duty.

"There are now very large stocks of British tires abroad, foreign demands have practically fallen to nil, and British manufacturers are faced with such

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New Japanese Tax Blow to Car Sales

Fees of 1920 Increased 50 to 80 Per Cent—Opposition May Bring Decrease

SEATTLE, May 27—Prospects for the future development of the American trade in motor vehicles in Japan have been dealt a severe blow by the enactment of new prefectural and municipal tax laws on automobiles, motorcycles and motor trucks, which call for excessive fees from owners. Great opposition is developing in Japan to the new taxes and it is hoped that they will be modified.

The new taxes represent an increase of from 50 to 80 per cent on the taxes in force last year. Coming, as it does, at a time of marked business depression in Japan, it cannot fail to have an adverse effect on the automobile business.

On privately owned vehicles of from one to five horsepower the new tax totals a yearly expenditure of 135 yen ($67.50). From five to ten horsepower the total is 229 yen, ($114.50), and from 10 to 15 horsepower, 378 yen ($189).

By far the greater majority of motor cars are rated in the 15-30 horsepower class, and it is in these classes that the taxes are the heaviest. For privately owned vehicles of from 15 to 20 horsepower the tax amounts to 598 yen ($299) per annum, and from 20 to 25 horsepower the very sizable figure of 843 yen ($421).

On the average, the motorist of Japan will be obliged to pay a municipal and prefectural tax aggregating 10 per cent of the first cost of the automobile. The average car of 25 horsepower retails in Tokyo at approximately 8500 yen ($4,250) and the owner of such a car will be assessed for an annual tax of 843 yen, or approximately 10 per cent. The cost of upkeep, including tires, fuel, oil, repairs and garage hire in Japan is very high, and the addition of the new tax will render motoring well-nigh prohibitive, declare Japanese dealers.

The tax on vehicles in commercial use is smaller, but nevertheless very high, taking into consideration the work in which these vehicles are employed. From one to five horsepower, the tax is 70 yen ($35) a year; from five to ten horsepower, 78 yen ($39), and from 10 to 15 horsepower, 127 yen ($63.50).

The new tax is based entirely upon the horsepower rating of the motor vehicle, and does not take into consideration the age of the car, the first cost, or the probable re-sale value.

GERMANY CUTS PRODUCTION

NEW YORK, June 1—German automobile works are suffering a further reduction in demand, according to reports reaching here. Operations have been cut to a minimum as they have in many of the Rhenan-Westphalia iron works.

Industry Steady as Market Changes

Financing Export Sales to Help Crop Regions—Falling Market to Continue

(*Continued from page* 1177)

upon a moderate scale, provided long-term credits can be extended. This is a pre-requisite to foreign trade. Sales of goods abroad inevitably will relieve depression at home. Those companies which have cultivated foreign customers carefully and wisely soon will begin to reap the harvest of their forethought.

Arrangements are now being made for financing export sales of foodstuffs, cotton and other commodities. This will thaw out frozen credits in the South, Middle West and Northwest, thereby putting into circulation money which can be used to buy finished products. The emergency tariff, framed especially for the benefit of the farmer, probably will tend to slow up exports, but its full effect in this direction cannot be determined immediately. It is not likely its deterrent effects will be strong enough to prevent a steady increase in exports.

Haphazard sales efforts are no more advisable in foreign trade than they are at home, and the companies which study their markets carefully will get the most business. Advices from Argentina, for example, state that the large surplus stocks of automobiles in that country are being gradually liquidated and it is probable dealers will be in the market again by late fall. The same conditions undoubtedly prevail in other countries. On the other hand, there is little hope of any extensive business with England for months to come, although some of its colonial possessions are well worth cultivating.

The United States as a nation is comparatively young industrially and it has not become inured to hardships and adversity as have some of its older sisters. For that reason it is rather temperamental. It either is riding joyously on a high tide of prosperity or it is in the slough of despond. There apparently is no mental middle ground. Times are hard now, largely by contrast with the unexampled prosperity of the war period. An enormous amount of business still is being done and the present volume of employment would not have caused serious alarm in the years prior to 1914.

Deflation Hopes Ill Founded

Any hope that recovery from war inflation would be rapid was ill-founded. It is vastly easier to spend money than to save it, and it takes much less time to burn up capital than to build it. Some of the wealth destroyed in the war must be restored before there can be any real progress toward what may be considered normal conditions. This applies not only to this country but to every nation in the world.

For that simple economic reason the process of recovery will be painfully slow and it will be attended with many difficulties. The business structure of the country is gathering strength, and the gains from now on never will be quite offset by the losses, so that recovery is assured.

Business will be done on a falling market for many months to come and its stabilization will be marked by a survival of the fittest. Falling markets do not necessarily mean hard times, however, and faith in the future will be abundantly rewarded. A long period of prosperity is before the United States and there is every indication that it is approaching with all the speed that can be expected under the circumstances.

Blame Backward Spring for Sales Resistance

MILWAUKEE, May 31—Shipping instructions from distributors and dealers have assumed a more satisfactory volume, with the result that the recent accumulation of finished jobs in factory warehouses is steadily being eliminated. The operation of factories is expected to resume an upward swing momentarily. From the middle of the month to date nearly every passenger car manufacturer felt the effect of a sudden recurrence of sales resistance due principally to the backward spring, which jammed the flow of cars from producer to dealer. The arrival of seasonable temperature, however, has loosened the congestion.

The automotive parts and equipment industry in Milwaukee did not slow up to nearly the same extent as passenger car production, although some plants have noticed a tendency on the part of manufacturers to cut down delivery specifications on contracts for engines, frames, axles, etc., because smaller quantities were required currently. No perceptible reduction of working forces in parts shops has been made, although production schedules were curtailed to some extent to prevent undue accumulation at the source.

COTTON ACREAGE REDUCED

NEW YORK, June 1—Reductions in cotton acreage for 1921, together with a reduction in use of commercial fertilizer, give an estimated yield of 7,558,365 bales for 1921, according to American Cotton Association figures. This yield is still further reduced to 6,762,664 bales by allowances for abandoned acreage after planting and other minor losses. The average production for the past five years has been 11,808,389 bales. The acreage for the current year will total approximately 24,563,486, conforming very closely to the acreage planted in 1897, which totaled 24,319,584.

WILLYS LIGHT JUNIOR, $295

TOLEDO, June 1—The Willys light division of the Electric Auto-Lite Corp. is now manufacturing a small individual lighting plant for use on farms, which will be known as the Willys Light Junior. The new plant, which sells for $295, has a generator rating of 500 watts.

Chicago Bank Finds Lower Prices Needed

Process of Liquidating Inventories at High Costs Slow and Difficult

CHICAGO, June 1—While general manufacturing shows little change in the past thirty days in the Middle West section, the disposition of manufacturers being to operate on a hand to mouth basis, buying only those materials that are necessary to fill outstanding orders, there are evidences of a gradual stabilization of business conditions.

The Federal Reserve Bank of Chicago finds that "business is going through a process of 'backing and filling' as a result of the effort to liquidate stocks purchased at higher prices, and to replenish at the new market level lines of merchandise as they are exhausted."

The advent of warm weather has gone a far way toward changing the mental attitude of the farmer although the farm implement business still remains practically at a standstill. One of the large implement manufacturers has closed down virtually all of its plants; another is operating on a schedule about 35 per cent of last year and nearly all implement manufacturers have a sufficient stock of finished products on hand to meet the ordinary demand for some months in the future.

In the manufacturing centers trade continues in a surprisingly good volume with indications of a movement of merchandise in those centers where industries experienced a sharp slump around the end of the year. Collections show no uniformity, the situation seeming to turn upon the ability of business men to liquidate their inventories.

Lowering of the cost of labor and a tendency to greater efficiency are showing themselves in some of the larger cities of this section. One outstanding feature in the motor car industry, as in other lines of business, is that those who are showing courage in the conduct of their business by forging ahead and manufacturing or using up high priced materials on hand and replenishing at lower costs are finding a ready market for their products, even though it be at reduced prices; while those who have adopted a more conservative policy of manufacturing are necessarily liquidating their inventories more slowly, and consequently are experiencing more difficulty in working out of the condition in which they found themselves.

Used Car Market Limited

A factor from the dealers' standpoint is that there is a more limited market for used cars, due to unemployment and general depression. Accordingly, the dealer finds his capital tied up in these cars and is unable to make further sales, involving trade, until he has liquidated such stock. Many of the steel contracts to automobile companies contain adjustment clauses.

War Gave America World's Tire Trade

British Market Now Using 75 Per Cent Imports—Would Apply Equalizing Duty

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competition from Continental manufacturers as will necessitate the liquidation of stocks at a loss in very many cases and the closure, in due course, of such markets in Italy, France, etc.

"If the import of tires at the present rate continues they will cover 75 per cent of the total motor tire requirements of the British home market.

"In addition to the disadvantage of the currency rates the British manufacturer also suffers from the cost of his product being increased by the heavy duty on imports of tires into foreign countries. In the Canadian and American markets, where the exchange rates favor the British, it is impossible for them to take advantage of the position as in those countries a different type of motor pneumatic tire came into general use during the war, and it has not yet been possible for the British manufacturers to obtain the necessary plant to enable them to meet the demand for this type of tire owing to war restrictions.

"The following remedies are suggested for consideration:

"(a) The limitation of future imports and the treatment of foreign stocks on hand in England as 'future' imports.

"(b) The levy of a duty on future imports on the basis of the difference between wages and local expenses per article in the country of origin at the rate of exchange current from time to time and the wages and local expenses per article of the British manufacturer.

"(c) The influencing of British Dominions to investigate and confirm whether British manufacturers actually have a tariff preference over foreign manufacturers in view of the depreciation of the various currencies, and, where necessary, the adjustment of such tariffs."

Tire Cuts in Belgium Check American Sales

NEW YORK, June 1—American tire trade in Belgium has been severely affected by an unprecedented wave of price cutting entered into by many of the leading domestic manufacturers and producers in England and on the Continent. The price cut has been so extensive that one of the large American companies has recalled its agent, being unable to compete successfully under the new conditions.

The questions of credits and exchange rates have also been important factors in the problems affecting American manufacturers. Opposed to the American policy of demanding cash in advance or payment against documents is the long term credit offered by German makers and now adopted by at least one important French company. To get business in Belgium it is borne to American manufacturers that they must make every effort to meet European competition with more acceptable terms.

Good business is reported in some American brands which are being offered at prices in francs near the European level. Buyers of low price tires do not lay stress on mileage as long as the price is what they think they should pay.

MAY SALES FALL OFF; JUNE OUTLOOK DULL

NEW YORK, May 31—Automobile production for the month of May reached approximately the same figure as in April but there was a material falling off in sales in practically every section of the country.

The most notable exception was in the South where business showed an improvement for the first time in many months. This was due to gradual liquidation of the cotton crop in preparation for the sale of the new crop.

Retail business in New York and the metropolitan district remained fairly steady and approximated that for April.

Reports from the great agricultural sections show that while business in May was not as good as in April a marked improvement in sales is expected when harvesting of the crops begins.

Nearly every section of the country reports that lines which have cut prices are doing a good business and that there is every indication sales will continue brisk.

General indications are that both production and sales in June will be considerably below May. The cry of dealers everywhere is for price stabilization by definite announcements by manufacturers of what they intend to do.

AJAX BUILDS NEW TIRE

NEW YORK, May 27—Following its reduction in prices which became effective two weeks ago, the Ajax Rubber Co., Inc., is soon to bring out a new cord tire developed by William W. McMahan. The new tire is now in production at the factories in Trenton, N. J., and will be placed on the market at once.

SHERIDAN SALES UNCHANGED

REDWOOD CITY, CAL., May 27—Capt. Eddie Rickenbacker, who is here to-day supervising the preparation of the army field for his flight to Washington to-morrow morning, stated that the purchase of the Sheridan Motor Car Co. by the Durant interests would not affect the Sheridan on the Pacific Coast and he would continue active management.

Steel Tread Tires Pass Out in France

Surplus Army Stocks Factor in Swerving Former Demand—Clincher Type Favorite

PARIS, May 14 (By Mail)—Steel studded automobile tires, which only a few years ago were considered absolutely essential for safety, are rapidly passing out of use in France. It was formerly common practice to run with steel studded tires on one rear wheel and the opposite front wheel, under the impression that this combination alone gave a guarantee against skidding. In London, taxicabs are bound by law to be equipped in this way, and although there was no such legal obligation in France, the practice was generally followed by owners. Customers taking delivery of a new car claimed at least one steel studded tread.

The general practice now is to supply all new cars with rubber tread tires, the public accepting these without objection. This change is bringing France into line with American practice, with the difference, however, that non-skid chains are never used by French motorists. Michelin reports that his production of steel studded tires is 60 per cent less than before the war. Pirelli declares that he is now selling 40 per cent fewer steel studded tires than was the case two years ago. At the French factory of the Goodrich Tire Co. the production of steel studded tires, which represented 25 per cent of the total output, has been stopped altogether, owing to lack of demand.

Several causes seem to have contributed toward this rapid abandonment of the steel studded pneumatic tire. The American Army in France set an example of running its automobiles on all-rubber tread tires, which seems to have impressed French motorists. In addition, large stocks of these tires were left behind by the army and were sold when other types were almost impossible to obtain, thus initiating motorists to their use and giving them confidence in running on rubber treads.

Michelin Brings Out Cord

Michelin is also largely responsible for the change, for since the armistice he has brought out and featured a cord tire which of course has an all-rubber tread. As Michelin has by far the biggest output in France and equips at least 60 per cent of new French cars with tires his adoption of cord construction and rubber treads had an important influence.

The Goodrich company, which also has put a cord tire on the market, considers that the steel studded tread was often used because of the protection it afforded against punctures, and now that the same protection is afforded by cord construction, with longer life and lower cost, there is less reason for the use of the steel studded band. A contributory cause, it is pointed out, is the high cost

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Indiana Road Work Waits Lower Prices

Policy of Prohibiting Necessary Construction Rouses Opposition of Industry

INDIANAPOLIS, May 27—Last week Governor McCray announced simultaneously the names to complete the reorganization of the State highway commission and a new policy of the commission—not to permit construction of highways in Indiana "until prices come down."

Organized units of the automotive industry are preparing for a session with the State highway commission. The automotive organizations hold that the commission policy should not prohibit improvement where necessary for improvement of traffic conditions.

Apparently the whole political framework of the present administration which took office Jan. 1 is directed toward suspension of highway extension. The State tax board, which has authority over highway and other bond issues, announced a few days ago "that the taxpayers have an opportunity of preventing unnecessary expense" by appealing to the tax commissioners. The last legislature passed an administration measure providing that where bonds carry more than 5 per cent interest and amount to more than $5000, the whole question must be referred to the State tax commission. Two road bond issues, one from Bush County and one from Marshall County, for permanent improvement of dirt roads were disapproved by the tax commissioners last week, killing both projects. Such a settled highway policy is arousing the automotive industry of the State.

Pershing an Advocate of Highway Commission

WASHINGTON, May 28—Another method of financing highway construction throughout the country has been advocated by E. J. Adams, former member of Oregon State Highway Commission and now Secretary to Senator Stanford of Oregon, when he appeared before the Senate Committee on Postoffices and Postroads in support of the proposed Townsend bill. He suggested that Congress authorize the issuance of bonds without interest which will also be legal tender for domestic obligations. He contended that this method would provide a market for bonds because Congress could authorize receipt for bonds on deposit, making them serial bonds payable over a period of years.

In support of his plans, he asserted that state highways and county roadways built nearly all after the issuance of bonds. These bonds must have a market, he said, and the market is so congested at present that they cannot be sold. The Committee appeared quite interested in his plan and questioned him as to the costs of highways. He estimated that it would cost $15,000,000,000 to build essential highways without consideration of maintenance costs.

General Pershing appeared on the stand today and advocated a central body, such as proposed in the Townsend bill, to direct Federal expenditures for road purposes. The General discussed highway legislation only in a general way. He stated that all roads were valuable and it was necessary at all times to get farm products to shipping points as well as to the army.

Representatives of the Federal Highway Council, organized farmers and others interested in highways appeared before the Committee this week. Senator Townsend expects to conclude the testimony by June and report the bill out for consideration at the special session.

N. A. C. C. to Distribute 500 Prizes for Essays

NEW YORK, June 1—Five hundred prizes for the best essays on safety are offered to the grammar school pupils of the United States by the National Automobile Chamber of Commerce. The contest is under the direction of the Highway and Highway Transport Education Committee, a group of men from United States Government departments and other associations interested in motor transport and highways.

The essays are to be written in the fall term so that children may have ample opportunity for observation and study of traffic dangers during the vacation months. Teachers in every municipality in the country will have full details concerning the contest at the opening of the 1921-22 term which they will be asked to detail to the children.

A trip to Washington, D. C., and a gold watch will be first prize. The second national prize will be a gold loving cup, and the third, a silver loving cup. In addition to these, medals and cash prices will be distributed in all states, territories and possessions of the United States. The Highway and Highway Transport Education Committee directing the contest is headed by the United States Commissioner of Education and includes experts on highway work.

FARMERS DISCUSS UNIT BUYING

INDIANAPOLIS, May 31—Co-operative buying and pooling of motor equipment were two subjects discussed by the purchasing agents of farmers' associations of Indiana and neighboring States, who met here Tuesday and today. O. J. Stierwalt of the Ohio Farmers' Commercial Service and W. H. Wagenbreth of the Missouri Farm Bureau were the principal speakers. Some of the "doctrines" advocated by these speakers would make the purchasing bureaus of farmer organizations huge distributing centers for vehicles, implements, etc. It was plainly intimated that one large manufacturer would readily make contracts with the farm bureaus, allowing substantial discounts for exclusive markets.

Oregon Gets Results in Highway Program

Co-operation of Counties Links State With Main Routes on Coast

PORTLAND, ORE., May 31—The thirty-five counties of the State of Oregon have bonded themselves to the extent of $15,363,704 for road improvement since the advent of the automobile, practically all of the money being voted within the last three years, and considerably more than half of it still remaining unspent, according to a summary made public this week by the State Highway Commission. This is in addition to the State road money and the Federal aid money which has been provided along with county funds.

Under the Oregon system the State Highway Department stands ready to aid the various counties by putting up half the cost for improvement of the main highways. This liberal program has resulted in activity in the various counties, both in meeting the State funds for improvement of main highways and for secondary roads connecting with the main highways.

While no summary is made, it is estimated that at least half of the money obtained from county bond issues, which has been spent thus far, has gone, together with State funds, into improvement of three important roads, the Pacific highway, running north and south, and connecting with California; the Columbia River highway, the great east and west road, and the Old Oregon Trail, which connects with the Lincoln highway from the east.

Oregon is to have a second main highway into California, according to action of the State Highway Department this week in permanently establishing the location for The Dalles-California highway. The highway, which has been recognized for some time as one of the important State roads, but had not been located with a view to permanent improvement, begins at The Dalles, on the Columbia River, and runs southward through central Oregon into California. The road will be an inland route as compared with the Pacific highway, which is a coast route. Near the Oregon-California line the new highway will swing westward, joining the Pacific highway in northern California and affording an immense loop for travelers from Portland to California and return.

Locate First of New System

Location of the first 100 miles of this road, from The Dalles south, was made by the highway commission last week, and it is estimated that $1,500,000 will be required to grade the road and surface it with gravel. Work will start in 1922 and it will take several years to complete the road. In the meantime the present roads, which are narrow and have some severe grades, will be used by those desiring to make the trip to California by the eastern route.

W. R. Wilson Named Maxwell President

New Executive Was Formerly with Dodge and Studebaker—Takes Office June 15

NEW YORK, June 2—The election of William Robert Wilson as president of the Maxwell Motor Corp. was announced here to-day by Walter P. Chrysler following a meeting of the Maxwell board of directors and the reorganization committee of the company. Wilson has been a vice-president of the Irving National Bank and will sever this connection at once to assume his duties with Maxwell on June 15.

In announcing Wilson's election, Chrysler said, "I consider Mr. Wilson one of the strongest executives in the automobile business."

Wilson's introduction into the field of automobile manufacturing was with Studebaker, where he began as assistant to the manufacturing manager and rose to assistant to the general manager. On Dec. 1, 1913, he went with Dodge Brothers, where he remained five years, and then resigned to accept the vice-presidency of the Irving Bank.

In his connection with the Dodge brothers he was directly associated in the organization of their motor car business. He was credited with considerable of the responsibility for the selection of their organization and the upbuilding of their departments, whether pertaining to manufacturing, distribution or commercial phases of the work.

When he takes office Wilson will be one of the youngest executives in the industry. He is a graduate of the Armour Institute of Technology, where he received the M. E. degree in 1909.

Announcement was made by AUTOMOTIVE INDUSTRIES on Feb. 15 that the selection of Wilson was being considered by Chrysler and the reorganization committee. It was deemed advisable, however, to defer the formal announcement until transfer of the Maxwell and Chalmers properties to the new company was well under way.

Directors of Company Elected

Directors of the company elected were Walter P. Chrysler, chairman of the board; Fred T. Murphy, J. R. Harbeck, James C. Brady, C. C. Jenks, Harry Bronner, William Robert Wilson, Elton Parks, J. S. Bache, E. R. Tinker, Henry Sanderson, Carll Tucker, Allen F. Edwards, Thomas F. Dougherty and T. C. P. Martin.

Officers elected in addition to President Wilson are W. Ledyard Mitchell, Carll Tucker and A. B. Barker, vice-presidents; T. H. Thomas, controller, and Jackson B. Clark, E. W. Clark, L. W. Linaweaver and Horace Davies, assistant secretaries.

The executive committee of the company is Walter P. Chrysler, Elton Parks, Fred T. Murphy, Allen F. Edwards, Harry Bronner and C. C. Jenks.

Dealers Flood Congress with Dumping Protests

WASHINGTON, June 1—Automobile dealers throughout the country are flooding Congress with protests against the reimportation of American-made trucks. The movement is not confined to the Atlantic and Pacific seaboards where sales have been heaviest, but has extended to small communities in the Middle West. For instance, the Motor Trade Association of Riley County, Kansas, adopted a resolution urging Congress to enact legislation to prevent dumping of salvaged material from European war areas in competition with American industry. All of these protests have been filed with the Senate Committee on Finance.

The protests are rather late to bring effective action, for the anti-dumping bill has passed Congress and has been signed by the President. It was understood that its provisions might offer some relief from the reimportation menace, but persons who have studied it carefully contend that before a tax can be imposed on the difference between the exporter's sale price and the foreign market value, price discrimination against this country must be shown. It might be possible for a customs appraiser to hold up a shipment pending investigation, but as it stands now there is little prospect for real relief under the existing law.

Miller Encourages Loans on Car Paper

(*Continued from page* 1176)

ally toward borrowers, as against their attitude a year ago. Bankers are far more conservative now; they are improving their position and have plenty of excuses of their own for declining a loan, without having to fall back on the old excuse that the Federal Reserve Bank will not rediscount the paper.

Further, the motor car dealers and distributors are, it is said, in no frame of mind to take on obligations, and stocks with cars and accessories. It seems perfectly safe to offer large credit facilities, since only a small part of the facilities are likely to be asked for.

The manufacturers may want this credit, to assist toward larger production—but so far as possible the Kansas City financial resources will be conserved to care for the distributors of this district, to be available for them after factory production has prepared the supply for them.

Altogether, the announcement of Governor Miller regarding rediscounting of automotive paper, is the keynote in the portrayal of improving conditions.

FRED W. MORGAN DIES

CHICAGO, May 27—Fred W. Morgan, founder of the firm of Morgan & Wright, bicycle tire manufacturers, died at his home here yesterday of angina pectoris. Mr. Morgan was born in New York, March 30, 1854.

Seiberling Buys Newcastle Rubber

Secretary Acts as Representative —Sale Price $103,000—Held Controlling Interest

AKRON, May 28—The Newcastle Rubber Co. at New Castle, Pa., was purchased at receiver's sale yesterday by R. C. Ellsworth of Akron, who served as private secretary to former President F. A. Seiberling of the Goodyear company. Ellsworth, it is reported, bid in the plant as representative of Seiberling. Seiberling attended the sale. The plant is valued at over $500,000. The sale price was $103,500.

F. A. Seiberling is reported to have held a controlling interest in the Newcastle Rubber Co. for some time, having originally purchased the plant more than a year ago for one of his sons who since has been forced to go West for his health. Through Seiberling's financial difficulties at Goodyear, the Newcastle plant became involved and was placed in the hands of trustees. Seiberling reported that the purchase of the plant through Ellsworth does not mean that he will again become actively engaged in the rubber industry, for it is known that he has other definite plans in process of development at this time. The Newcastle plant includes two large and fully equipped factory buildings, seven and one-half acres of ground, an office building and three dwellings.

Americans Sweep Indianapolis Race

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dangerous possibilities but both escaped as well as their mechanics.

Broken water connections on the Talbot, Sunbeam and one of the Frontenacs accounted for the elimination of these cars. Where these broken connections were located technical committee reports do not make clear. Probably water pump trouble accounted for most of them.

A rather peculiar condition accounted for the elimination of Pete Henderson's Junior Special. Freezing brakes caused the wheels to skid and resulted in the car swinging into the side wall.

Joe Boyer's Duesenberg had to be pushed into the pits and withdrawn after he had driven a very pretty race and in fact had pushed De Palma very hard during the first few laps, winning the sixth. His trouble was a broken axle shaft.

A consistent race was driven by the winner. He stopped on the 77th lap for two front tires and again was flagged by his pits to come in for gas and oil on the 160th lap.

A great amount of interest was created in the Frontenac driven by Tom Alley. This was fitted with Disteel wheels and was able to carry for this reason 10 lb. additional air pressure in the tires. This car ran well, being for a large part of the race in third place and gaining on the leaders.

Many Price Reductions Announced

Quick Price Action Urged by N. A. D. A.

Stability of Market for Cars Threatened by Indecision, Declare Dealers

ST. LOUIS, May 31—In an effort to end the present unsettled condition in sales, due to continued drops in price, General Manager Harry G. Moock of the National Automobile Dealers' Association to-night wired all manufacturers of motor cars, asking them to make any contemplated reductions at once.

The appeal was prompted by a flood of letters and telegrams from dealers all over the country, urging the N. A. D. A. to do anything within its power to bring the present condition to an end. Reports from all sections state that each successive price reduction puts an additional damper on general buying of cars and indications are that if the reductions are spread over the summer the season's business will be ruined. Leading dealers, however, feel that there can be a good business this summer if the price question can be disposed of at once.

General Counsel C. A. Vane of the N. A. D. A. conferred this week in New York with General Manager Alfred Reeves of the N. A. C. C., which conference developed that the manufacturers as an organization do not care to discuss prices. With legal opinion closing this avenue of appeal the only remaining course was a request by the N. A. D. A. to each car maker individually. The telegram follows:

"Dealers all over the United States have been wiring here, asking National Automobile Dealers' Association to lend its help to stabilize the present price situation. They complain the public is refusing to buy any merchandise because of uncertainty of future prices of automobiles. May we on their behalf ask you to announce immediately whether your factory will make price reduction or adhere to present prices for a definite period. The question is not so much one of price as of stabilization. For that reason we believe an immediate declaration should be made by each manufacturer as to what his policy is going to be if we are going to reestablish a buying market."

Federal and Oldsmobile to Hold Present Prices

DETROIT, May 28—Federal Motor Truck Co. sent out a letter this week guaranteeing prices on Federal trucks to Oct. 1. The notice which was sent out by W. C. Rowley says while there has been some slight reduction in the price of steel recently, the cost of manufacture has not been affected thereby.

Olds Motor Works also has notified distributors that there will be no price reduction in the Oldsmobile line. The letter points to the introduction last December of the new four-cylinder model and says the factory could not have produced this car at this time were it not for the fact prices had been predicated on a later drop in the price of material and labor and a certainty of volume production.

Lafayette Prices Cut Ranging $750 to $950

INDIANAPOLIS, June 1—Price reductions ranging from $750 to $950, effective to-day, are announced by the Lafayette Motors Co. Prices are f.o.b. Indianapolis, including standard equipment. The new prices are: Touring car $4,850, reduced $775; roadster $4,850, reduced $775; four-door coupe $6,250, reduced $950; sedan $6,500, reduced $900; limousine $6,750, reduced $750.

LINCOLN DOWN $300 TO $800

DETROIT, June 1—Price reductions have been made effective to-day by the Lincoln Motor Co. The new prices are: Open models $4,300, reduced $300; coupe $4,950, reduced $800; sedan $5,400, reduced $600; limousine and town car $6,000, reduced $600.

HAYNES GUARANTEES TO 1922

KOKOMO, IND., June 1—Prices on Haynes cars will be guaranteed to Jan. 1, 1922, it has been officially announced by Alton G. Seiberling, president of the Haynes Automobile Co. "Our present margin of profit is so slight," he declared, "that it would be impossible for us to reduce prices."

HANDLEY GUARANTEES PRICES

KALAMAZOO, MICH., June 1—The Handley-Knight Co. has notified its distributers that their prices are guaranteed up to Jan. 1 next. The statement says the lowest prices possible to be maintained were fixed last November and were $500 less than were justified by conditions at that time.

RECEIVER TO SELL BODY PLANT

DETROIT, June 1—The property of the Detroit Weatherproof Body Corp. at Corunna, Mich., will be sold at public auction June 17 by the Security Trust Co. of this city as receiver.

HUDSON-ESSEX DOWN $150

DETROIT, June 2—Price cuts of $150, effective to-day, are announced on all models of Hudson and Essex cars.

Nash on Half Time as Sales Fall Off

Production Cut to 65 Daily Pending Developments—Price Cuts Harmful

KENOSHA, WIS., May 28—Following reduction of working schedules by the Nash Motors Co. of Kenosha, Wis., to a basis of a full half-day six days a week, due to over production, certain departments have been shut down temporarily pending improvement in the demand for cars. A statement by President Charles W. Nash says in part:

"Automobiles take up when finished an unusual amount of storage space, and the operation of an automobile factory, insofar as the completed car is concerned, is controlled almost entirely by the demand for the product. In other words, if orders suddenly cease to come in, we can run but a short space of time due to the fact that we have not the storage room. It means a severe loss to shut down a plant and allow the organization to scatter, and if for no other reason than this we do our best to run continuously.

"We decided last week that it would be better to operate a full half-day each day and make 65 cars in the half-day than it would be to try to carry this over a full day's work, due to the fact that it would be necessary to have reduced our working force materially if we attempted to operate all day; whereas if we operate a half-day we are able to keep a great many more employed.

"We have no definite date fixed when we may be compelled to close down for a short while entirely. This will be due to the condition of the business throughout the country. Our dealer body had a considerable number of cars on hand, and the extreme cold, backward weather that we have been having all spring is not conducive to selling automobiles.

"Another thing: Some companies have been able to reduce their prices materially, and this has upset in a measure the prospective buyers of Nash cars. My judgment is that if we should get some settled, warm weather, selling would take a new lease on life and business would go on to a considerable extent. However, it is impossible to tell exactly what the attitude of the public is going to be."

SHERIDAN PRICES DOWN

MUNCIE, IND., June 1—The Sheridan Motor Car Co., which went into the control of W. C. Durant last week, has cut its prices. The roadster and touring car now sell at $1485, a cut of $200; the coupé at $2265, a cut of $300, and the sedan at $2765, a cut of $300.

Cars in All Price Classes Are Cut

Studebaker Prices Down $150 to $200

Light Roadster Added to Line to Sell at $1300—Twelve Cars Reduced

NEW YORK, June 1—Price revisions covering its entire line and ranging from $150 to $200 were made by the Studebaker Corp. to-day, the new prices to take effect at once. In making the price cuts the company announces a new EJ-40 model roadster to sell at $1,300. The new and former prices follow:

	New Price	Former Price
Model EJ-40		
Roadster	$1300	New model
Special body roadster	1695	$1850
5-passenger	1335	1485
Sedan	1995	2150
Model EH-50		
Roadster	1585	1750
5-passenger	1635	1750
4-passenger	1635	1750
Coupe	2450	2650
Sedan	2550	2750
Model EG-60		
7-passenger	1985	2150
Coupe	2850	3050
Sedan	2950	3150

President Erskine of the Studebaker Corp. has announced that April sales numbered 6589 cars, as compared with 2602 of April, 1920, while May sales were 7400 against 4024 for the same month last year. Unfilled orders approximate 7000 cars. May collections exceeded $12,000,000. Profits for this quarter are expected to exceed $5,000,000 before taxes.

CHALMERS PRICES DROP

DETROIT, May 27—The following price reduction was announced by General Sales Manager A. E. Barker on Chalmers cars: 5-passenger touring, from $1,795 to $1,545; roadster, $1,795 to $1,495; 7-passenger touring, $1,945 to $1,795; 5-passenger sport, $1,995 to $1,695; coupé, $2,595 to $2,295; sedan, $2,745 to $2,445. All prices f.o.b. Detroit.

CHEVROLET CUTS ITS "FB" LINE

NEW YORK, June 1—Following its recent action in reducing the prices on its "490" line, the Chevrolet Motor Co. has cut the prices of its "FB" line. The touring car has been reduced to $1,185 from $1,345, the roadster to $1,185 from $1,320, and the sedan and coupe to $1,885 from $2,075. The prices are f.o.b. Flint.

KING TO BUIILD NEW COUPE

DETROIT, May 31—King Motor Car Co. will put a new King 8 coupe on the market with deliveries about August 1. Announcement of the new member of the King family was made by President Weber in a letter to the trade this week. The only reference to price is the statement in the letter that above everything else in the automobile to-day it must be built to meet "to-day's pocketbook."

Buick Cuts Prices Ranging $300-$660

FLINT, June 1—Price reductions on the Buick ranging from $300 to $660 went into effect to-day. Simultaneously with the reductions the Buick line assumes the serial number "1922" instead of "1921" which expired May 31. It was announced that present models will be carried through the 1922 season.

Old and new prices are as follows:

		Old Price	New Price
1922-44	Roadster	$1795	$1495
1922-45	5-passenger	1795	1525
1922-46	3-passenger	2585	2135
1922-47	5-pass. Sedan	2895	2435
1922-48	4-pass. Coupe	2985	2325
1922-49	7-pass. Touring	2065	1735
1922-50	7-pass. Sedan	3295	2635

Buick guaranteed prices to the public to May and to dealers to July 1 on the 1921 models. The guarantees are not applicable to cars bearing the 1922 serial numbers.

SENECA REDUCES PRICES

FOSTORIA, OHIO, June 2—The Seneca Motor Car Co. has reduced the prices of its two and five passenger touring cars from $1185 to $1045 and of its truck from $1160 to $1020.

TEMPLAR MAKES BIG CUT

CLEVELAND, June 2—Price reductions of $500 on open models and $600 on closed models, effective July 1, are announced by the Templar Motors Co. The two, four and five passenger touring cars have been reduced from $2885 to $2385 and the sedan and coupé from $3785 to $3185. Prices are f.o.b. Cleveland.

FRANK H. WHEELER DIES

INDIANAPOLIS, May 28—Frank H. Wheeler, 57 years old, Indianapolis millionaire, committed suicide yesterday morning by discharging the contents of both barrels of a shotgun into the left side of his head. Mr. Wheeler was one of the founders of the Indianapolis Speedway, president of the Wheeler-Schebler Carburetor Co., and was connected with the Stutz Fire Engine Co., being vice-president, and was president of the Wheeler-Langsenkamp Brass Co. It is believed his action was due to despondency over the condition of his health and also brooding over the death of Seymour Avery, an associate.

Franklin Makes New Revision in Prices

New List Approximates Scale Fixed in September Reductions of 1920

SYRACUSE, June 1—Franklin announced to-day price reductions on open cars ranging from $150 to $200 and on inclosed cars from $200 to $250, effective immediately. The reductions follow a small increase on the Franklin line made March 1, which in turn had been preceded by an increase of $100 Jan. 1 coincident with the appearance of the new hood.

The present reductions bring Franklin prices within $50 to $150 of the low level of September, 1920, when Franklin, following close on the heels of Ford, was the second manufacturer to announce a substantial post-war price cut. Franklin prices are now $400 to $750 below the high war-time levels.

A comparative summary of Franklin prices follows:

	New Price	March 1921	Sept. 1920	High war-time
Touring	$2,650	$2,800	$2,600	$3,100
Runabout	2,550	2,700	2,400	3,050
Roadster	2,550	2,750	2,500	3,100
Sedan	3,650	3,850	3,600	4,350
Brougham	3,550	3,800	3,500	4,300
Demi-coupe	2,850	2,950	2,750	3,300
Demi-sedan	3,050	3,150	(New Type)	(New Type)
Chassis	2,225	2,300	2,225	2,625

"Wages are not being cut," H. H. Franklin declared. "With our price cut last fall sales started on the upgrade, and from month to month during the early winter season held very near to factory capacity. Since December we have not had on hand at the factory on any one day more than three days' production of cars, and right now our dealers' stocks are lowest of the year.

"Reduction in the price of Franklin cars is being made without any reduction in wages. We hope that the new basis will permit the continuation of the present working force, without the contractions that are usually expected in the automobile industry in the midsummer months. Our previous price adjustment also left wages unaffected and was accompanied by a slight increase in employment."

ELGIN PRICES REDUCED

ARGO, ILL., June 1—The Elgin Motor Car Corp. announces price reductions ranging from $180 to $300, effective tomorrow. The price of the touring car has been cut from $1775 to $1595; the sedan and coupé from $2795 to $2495.

Death of Batchelder Shock to Motordom

First Became Roads Enthusiast in Bicycle Days—Tragedy Ends Noted Career

NEW YORK, June 1—A pall of grief has been cast over the entire industry by the tragic death of Amos G. Batchelder in the airplane disaster near Morgantown, Md., which cost seven lives. The universal esteem in which he was held was evidenced at his funeral to-day.

Every branch of the automobile industry in this country and abroad had representatives at the funeral. Floral tributes were received from the National Automobile Dealers Association, Motor Union of Great Britain, and from every automobile and aero club in this country and Canada. Representatives of these organizations and the Department of the Interior, Bureau of Public Roads, Chamber of Commerce of the United States, Brigadier General Mitchell of the U. S. Air Service, National Geographic Society, Aero Club of America and five past presidents of the A. A. A. were present.

Services were conducted by Rev. Ulysses G. B. Pierce, rector of All Souls Unitarian Church. Among the floral offerings was an attractive piece from the Oldtimers, an organization of automobile pioneers. Batchelder became associated with this organization during his five years' service as an editor for the Class Journal Co. He has been executive chairman of the A. A. A. for eleven consecutive years and was re-elected recently for a term of four years.

The body was taken to Buffalo where it will remain in a vault until fall and then be interred in the family plot at Attica, N. Y.

Hundreds of messages of condolence have been received by Mrs. Batchelder, who was visiting relatives in Jackson, Mich., when she received word of her husband's death.

Popular in Washington

Probably no man in the history of the automobile has been better loved than Batchelder and few have done more than he for the motor vehicle. As executive chairman of the American Automobile Association he was known personally to thousands of motorists in every section of the country, and they were fully appreciative of his ceaseless efforts to promote better highways. In no circle, however, was Batchelder more popular than in official Washington. He had stood high in the esteem of several administrations and his views on highways always commanded respect.

Back in the days of the bicycle, when most people looked upon any proposal to build roads as only another means of burdening them with taxes, Batchelder foresaw their need and their value, and he was first to recognize the importance of bringing the Federal government into highway building. When President Wilson signed the Federal Aid Road Act on July 11, 1916, thereby bringing the Government into road building after more than 75 years of a passive attitude toward highways, Batchelder all but collapsed. He had reached the goal of many years of effort and did not realize until then his weariness from the strain he had been under.

Batchelder had very clear and definite ideas on highway legislation and road building, and he lived to see his ideas generally accepted. He talked good roads incessantly, in season and out, to everyone he met, because he believed everyone should share his enthusiasm and that by incessantly talking good roads he would win more good roads advocates. He had traveled many thousands of miles into every part of the United States to speak on his favorite topic. He was to have delivered addresses on this theme in Salt Lake City, June 16 and 17. He had been one of the foremost advocates of the Townsend bill.

Never Too Tired to Boost

In spite of numberless obstacles, Batchelder never became discouraged. He never was too ill or too tired to travel to any point of the United States where he might be needed to bolster up a slipping bond issue for highway building. To him more than to any other one man the motorists of the United States owe a debt of gratitude for the charting, sign marking and improvement of the roads they use.

While promotion of highway legislation, building and maintenance always has been a large part of the work of the A. A. A., Batchelder gave generously of his own time and money to the cause in the serene belief that his work in this direction was a service to the country.

(Continued on page 1190)

BATCHELDER A POWER IN CAR DEVELOPMENT

NEW YORK, June 1—This tribute is paid to A. G. Batchelder by James Rood Doolittle in his "Romance of the Automobile Industry":

"A. G. Batchelder, chairman of the executive committee, is the commander in the field of all the armies of Three A's. He presides at the councils and for years has had more influence with the various administrations than anyone else. He edits and manages The American Motorist and, ex-officio, has a hand in nearly every activity of the organization. Mr. Batchelder was a newspaperman of prominence before entering the automobile field, and during the past ten years has developed qualities of much importance to motordom. As an executive he is conservative; as a diplomat, effective, and as a motorist, radical."

Ford Helps Detroit Show Gain in May

Increases Output 20,000 While Most Others Fall Off—Reduce Working Forces

DETROIT, June 1—Automobile production in Detroit and the State of Michigan for May totaled 144,601, as compared with 140,955 in April and 142,083 for May last year. The increase over last month was largely due to the Ford output of 101,897 cars and trucks. The April total without Ford was 50,830 and for May, 1920, without Ford was 62,085.

Decreases compared with April were shown by all factories save Ford, Buick, Hudson-Essex, Lincoln, Oakland and Packard. All factories are working short forces but full time in most instances. Dodge was down three days last week, but officials say the plant will be operated full time hereafter in spite of persistent reports that the three-day schedule would continue.

Ford announces that orders ahead of production total more than 100,000 in spite of an output of more than 90,000 in April and more than 100,000 in May. Reports that production had been cut 1000 daily were denied, and it was asserted that no such decrease was in contemplation. Ford officials said it was natural to expect a downward trend to begin late in June, but that everything now points to increasing demand.

Manufacturers See Need for Decision on Prices

NEW YORK, June 2—That every means possible should be taken to stabilize the industry, especially on the question of prices, was the general opinion of manufacturers who attended the annual meeting of the National Automobile Chamber of Commerce here today. It was felt that whatever reductions are contemplated in prices should be made at once in fairness to dealers and to the purchasing public.

W. P. G. Harding, governor of the Federal Reserve Board, addressed the members of the N. A. C. C. at noon to-day. He reiterated that there would be no discrimination against automobile paper, even in the Kansas City district, and declared that so far as finances are concerned he can see no reason for anything but optimism for the future.

The members will listen this afternoon to a debate on the problem of unit parts service, to reports on business conditions in all sections of the country and there will be a discussion of the motor truck reimportation question.

It is probable the retiring directors will be re-elected and that at the organization meeting the directors will re-elect Colonel Charles Clifton as president.

The special committee headed by J. Walter Drake which will co-operate with Secretary of Commerce Hoover, will meet with Hoover to-morrow.

Fiat Plant Reopens on Six Hour Basis

Company Successful in Imposing Work Conditions—Stinnes Not Controlling Company

TURIN, ITALY, May 20 (By Mail)—After a lock out lasting 32 days, the Fiat factory has reopened on the conditions imposed by the owners. The works are now running on a 6-hour basis, working 6 days a week. The dispute arose over the claim of the men that they should have a control in shop management and the right to decide when men should be laid off. Rather than accept this the management closed the entire factory, throwing 12,000 hands out of work, and put troops in possession of the entire establishment.

When 8000 men had signed an agreement to accept the disciplinary measure imposed by the directors, and to execute any kind of orders, whether for peace or war, it was decided to open the factory. The general elections which have just taken place completed the downfall of the socialist and communist movement, for the ringleaders who were responsible for the revolutionary outbreak last September failed to secure a majority.

Local trade is in a very depressed condition, with the result that the smaller companies, having few foreign connections, are badly hit. The bigger firms, such as Fiat, Lancia and Isotta-Fraschini, are kept busy on foreign orders. The recent automobile taxes, under which a 35 hp. car pays $3,000 a year at nominal exchange, is having its effect on the industry, and some firms having specialized on big cars up to the present are preparing to produce engines of lower power for next season.

Fiat has opened an automobile factory in Warsaw, Poland, the concern being registered under Polish laws and having a capital of five million Polish marks. Half this capital has been subscribed by Polish financiers and half by Italian interests. Cars and trucks are being produced under the technical direction of the Italian Fiat Co. Business prospects are declared to be good.

The report that Hugo Stinnes had obtained control of the Fiat Automobile Co. is officially denied by that concern, which declares that the German iron king does not hold any stock or have any connections with the leading Italian automobile company. The report seems to have got abroad when Stinnes purchased 20,000 shares in the Alpine Montan Gesselschaft, in which Fiat directors were also holders. The two concerns, however, are entirely distinct.

DIESEL AGENTS NAMED

CHICAGO, May 31—The Dalton-Elliott interests, Wrigley Building, this city, have contracted for the exclusive representation of the Export Gesellschaft fur Deutsche Fabrikate for the North American continent. This carries with it exclusive sales and purchasing representation. The organization is composed of 54 manufacturers in Germany representing practically all lines of industry. It controls a large portion of dye production and, among other products, the Diesel engine. The contract calls for the purchase of raw materials in this country.

Cars Take Second Place in Leading Industries

WASHINGTON, May 31—Automobiles ranked second in the value of products produced in 1919, according to a preliminary statement of the 1920 census of manufacturers, issued to-day. With 315 establishments reporting in 1919, the estimated value of automobiles was $2,387,833,000. This figure is supplemented by 2394 establishments producing automobile bodies and parts to the value of $673,593,000 and 15,486 establishments listed as automobile repairing with production valued at $222,596,000.

The meat packing industry led in the value of products.

These comparative figures illustrate the growth of all branches of the industry, for in 1914 there were only 971 establishments producing automobile bodies and parts with a total production of 129,601,000 and in the same year 3273 automobile repair establishments reported production valued at $29,920,000. Thirty-one establishments manufacturing airplanes, seaplanes, airships and parts in 1919 with a value of $14,373,000 as against 16 establishments in 1914 with production valued at $790,000.

FIRST DUESENBERGS BUILT

INDIANAPOLIS, May 28—The Duesenberg Automobile Co. placed on display in the plant yesterday a roadster, a chassis and a touring car, the first automobiles to be manufactured for sale by the local company, which marks the beginning of production in the first of the three units of the company. The first shipment of automobiles to agents will be made July 1. The six cars entered in the Speedway race were manufactured here, and finishing touches are being put on four racing cars to be entered in the Grand Prix race at LeMans, France, July 26.

TO SELL IMMEL PLANTS

COLUMBUS, May 31—Upon the application of Robert H. Schryver, receiver for the Immel Co., the court ordered the sale of the plant and other assets. The south plant is to be sold for $200,000; the plants on Livingston Avenue for $20,000 and $17,500, and the land at $1200 per acre. All material on hand is to be sold for cash. The preferred stockholders have perfected plans to make a substantial bid for the properties and has made arrangements with J. D. Potter, formerly vice-president of the Kilbourne & Jacobs Co., to head the organization if they secure the plants.

METAL MARKETS

WITH the normally dull period in the steel market ushered in the theme that is in the foreground of discussion is whether there will be a revival of demand in August. In past years when the steel industry suffered from extreme stagnation in the last half of the second and the beginning of the third quarter, it was always August that brought the turn. Optimists among the producers aver that by July the steel market will have reached so moribund a condition that August is certain to bring a reaction. The pessimists say that if the revival does not come in August they will abandon all hope for better conditions during the remainder of the year. Aside from the leading builder of low-priced passenger cars who continues to figure more or less in all departments of the steel market, buying for automotive account is of retail proportions and on the hand-to-mouth order. What little in the way of orders is being placed goes to those mills that have been able to maintain operations on a one-third capacity basis. The reason for this is that those mills which are in operation can make shipments within a few days, while those that are down are prevented from resuming operations until they are fortunate enough to accumulate a sufficient backlog of orders. Prices are extremely soft, and in all transactions that are even remotely representative concessions are the order of the day. Reluctance to shade the nominal quotations is confined to those producers who are not operating anyway. Those who are striving with might and main to keep at least a third of their plants going are more than ready to offer inducements whenever tonnagers and specifications are in the least attractive. The strip steel market reveals sharp cuts by individual mills apparently in an effort to determine whether these concessions will bring out any business. All of the automotive buying of sheets is for instant shipment, and most sheet mills do not know from one day to the next whether they will have enough orders on the morrow to warrant a continuance of operations.

Pig Iron.—Although production continues at famine proportions and the market, if its statistical position governed, should be more than strong, prices are pliable. Even at $23 automotive foundries seem to show little interest. All of the iron for the Ford Motor Co.'s castings is being supplied by its own furnace.

Steel.—New demand for steel bars is light and Chicago bar mills face the end of their backlog of orders...Forging quality bars are being shipped to the Ford Motor Co. by Ohio valley mills that are reported to have taken the business at concessions of $3 per ton. Cold-rolled strip steel is offered in Pittsburgh at 5c. and hot-rolled at 2.55c., compared with 5.50c. and 2.75c., respectively, supposed to be leading producers' quotation. Bolt and nut buying has died down.

Aluminum.—The market continues flat and quotably unaltered.

Copper.—A new copper contract became effective on the New York Metal Exchange June 1. It permits trading in Standard copper, by which term anything running from 96 per cent upward in purity is known. The new contract is designed on the pattern of that in vogue in London and intended to "broaden trading" in copper. If this object is attained, it will mean "outside" speculation which, at times, may bring about artifical conditions that call for extraordinary caution on the part of consuming buyers.

FINANCIAL NOTES

Fisher Body Ohio Co. paid a $2 dividend on the preferred stock May 31. This is the April 1, 1921, dividend, which was suspended until it was determined whether the common stockholders would accept or reject the share exchange offer made by the parent company. The plan was declared operative May 10.

Commonwealth Finance Corp. has declared an extra dividend of one-half of 1 per cent in addition to a quarterly dividend of 1 per cent on its common stock; also a semi-annual dividend of $3.50 a share on its preferred stock, all payable July 15 to holders of record June 30.

Pierce-Arrow Motor Car Co. directors have voted to pass the quarterly dividend on preferred stock due July 1, to conserve the assets of the company during the present period. Quarterly payments of 2 per cent have been made on this issue since Jan. 1, 1917.

Rolls-Royce, Ltd., in a balance sheet for the year ended Oct. 31, 1920, shows net profits of 202,835 pounds sterling, which compares with 192,777 pound for the previous year.

Winfield Barnes Co., Philadelphia, will be sold at receiver's sale, permission for which has been granted by Judge Thompson in United States District Court.

Milwaukee Rolling Mill Co. will increase its capitalization from $1,500,000 to $3,000,000, to provide for expansion.

Auto Car Co. has declared a regular dividend of 1½ per cent payable June 10.

INDUSTRIAL NOTES

C. H. Wheeler Mfg. Co., Philadelphia, manufacturers of pumps, condensers, etc., has opened a new branch office in Boston at 53 State Street.

Stutz Motor Car Co. has started rebuilding the units of the plant destroyed in the recent fire. Production has not been hampered seriously.

Los Angeles Trailer Co., Los Angeles, has changed its name to the Utility Trailer Mfg. Co., with no change in personnel or location.

Marion Plants Find Business Outlook Good

MARION, IND., May 31—Automotive industries of Marion are in fair condition and the future outlook, according to information this week, is for a big increase in production in the next 60 days. Reutenber Motors Corp. is just getting settled into its new plant. It is not in operation. Orders on the books and inquiries that have been received in the last few weeks indicate much new business. The plant will be in operation this fall.

Velie Motors plant, formerly the Rutenber plant, is not in production on power units. It is occupied almost entirely with experimental and laboratory work and it is understood that when production is organized for this fall, a new design of power plant will be announced.

The Indiana truck plant is going steadily on a curtailed schedule. A steady income of orders from Mexico and the Central States is causing preparations for an increased production in June. Most of the new business is coming in from Chicago, Kansas and Texas and is a decided increase over April.

On 50 per cent production now, the Western Drop Forging Co. expects to be in full production on automotive parts within 30 days if business in that time continues as through the last month.

G.M.C. Denies Report of Fusion with Austin

NEW YORK, June 1—The General Motors Corp. denied to-day reports from London that it had been instrumental in arranging a loan for the Austin Motor Co. through W. P. Bonbright & Co. The London report was that there might be a virtual fusion of the British interests with those of General Motors.

Greater credence was given the report because the assistance for Austin came from an unexpected source. It was said at General Motors headquarters, however, that the corporation had no interest in the Austin company beyond a claim for a comparatively small sum for goods furnished. There were reports in London a year ago that Austin was anxious to have General Motors acquire an interest in its business.

Weideley and Midwest Extend Engine Schedules

INDIANAPOLIS, May 28—Officials of the Weideley Motors Co. are planning a production schedule of 14,000 engines for 1921, and in order to produce engines according to the schedule, approximately 4900 tons of raw materials are to be purchased. By the end of the year the company plans to employ about 750 men, or the maximum. An export business of 2 per cent of the output was done by the company last year. The company is selling its product to 22 companies at the present time. It will continue to specialize in engines for automobiles, but intends spending some effort in the development of its tractor department.

A production schedule of 18,000 engines is being planned by officials of the Midwest Engine Co., and it is also planning to get in on the ground floor in the export end of the business. Engines for fifteen concerns are being made by the company and they are planning to have 1800 men employed by Dec. 31.

TO MAKE CAR FOR COAST

LOS ANGELES, June 1—The West Coast Automobile Mfg. Co., organized to manufacture passenger cars, trucks, tractors and trailers in this city, will first bring out an automobile in six and eight-cylinder models, to be known as the Mission. The car will be of featured design and it is proposed to distribute it exclusively on the Pacific Coast. The design of the car above the frame is covered by patents held by Augustus W. King, first vice-president, general manager and designing engineer. The company is incorporated for $1,500,000.

BANK CREDITS

Written exclusively for AUTOMOBILE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, June 2—The local money market again gave signs of firmness last week. Call money ranged from 6½ per cent to 7½ per cent, as against 6½ per cent to 7 per cent the previous week, with a ruling rate of 7 per cent, which was the renewal rate every day except Tuesday, when 6½ per cent was the renewal figure. On Thursday and Friday 7½ per cent, the highest quoted rate since Feb. 8, was reached during the trading periods. There was little activity in the time money market, where rates were also higher. Sixty and ninety days' and four months' paper were quoted at 6¾ per cent to 7 per cent, as against 6½ per cent to 6¾ per cent the previous week, while five and six months' paper were quoted at 6¼ per cent to 7 per cent, as against 6 per cent to 6½ per cent the previous week. Among the factors having a bearing on the firmer tone in the money market last week were the large Government withdrawals and the preparations for the first-of-the-month's disbursements. In addition, there were in the neighborhood of $150,000,000 in new issues during the week, of which the French 7½'s accounted for $100,000,000.

The Federal Reserve System continued to show the improvement which had been made consistently since the first of the year. The mid-week statement showed increased gold reserves of $14,041,000, and increased cash reserves of $9,098,000. Bills discounted secured by U. S. Government obligations increased $19,082,000, and total bills on hand $33,174,000. Total earning assets, however, declined $50,858,000, almost wholly as a result of decreased holdings of U. S. certificates of indebtedness. Total deposits declined $10,686,000 and Federal Reserve notes in circulation $32,611,000. As a result of these changes, the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 56.8 per cent to 57.6.

Foreign Exchange Irregular

The foreign situation is still clouded, with the exact method of the payment of the German reparations undetermined. This uncertainty was reflected in the foreign exchange market, where rates were irregular and tending to decline. The British pound dropped to more than 13 cents below the recent high for the current year. The announcement of further dividend cuts by prominent industrial corporations was probably in part responsible for the lower prices for industrial shares. Railroad shares, on the other hand, showed some resistance to the downward movement on the strength of rather favorable earnings statements for the month of April, published last week, which, taken in conjunction with the wage cuts which are expected to take effect July 1, had a bolstering effect on the market.

MEN OF THE INDUSTRY

Charles W. Churchill, until recently general manager of the Winton Co., Cleveland, has joined the sales organization of the Buick Motor Co. In his new work with Buick Churchill will be closely associated with E. T. Strong, general sales manager, with headquarters at the main office in Flint. Churchill rose from retail salesman to general manager of the Winton company. In 1904 he became identified with Winton, where he gained valuable first-hand experience in selling cars. In 1906 he was made eastern manager of the company with headquarters in New York. His success in New York was so marked that after two years' experience as a branch manager he was recalled to Cleveland to take over the direction of the entire sales force. As general sales manager, the high calibre of his judgment and executive ability was evidenced and in 1915 he was promoted to general manager of the complete Winton organization, which position he held until joining Buick. Churchill has been a director of the National Automobile Chamber of Commerce for some time and has been chairman of the membership committee as well as chairman of the patents committee.

J. S. Garlent has been named factory manager of the Auto Wheel and Gier Pressed Steel units of the Motor Wheel Corp., at Lansing. Garlent joined the organization a year and a half ago, previous to which time he was factory superintendent for the King Motor Car Co.

Le Roy J. Williams has resigned as counsel and assistant to the general manager of the Lincoln Motor Co. He had been associated with the Lelands for the past six years.

Langdon A. Smith has been appointed vice-president and director of sales for the American Motors Corp., Plainfield, N. J., manufacturers of the American car. He has been connected with Maxwell-Chalmers interests for several years, latterly being assistant director of sales for the combined companies. D. M. Kingley has been appointed manager of the American's New York branch. He was vice-president and sales manager of Holmes and before that was associated with Locomobile.

C. W. Butterfield has been appointed sales manager of the Apex Motor Corp. He was sales manager of the Herschell-Spillman Motor Co., and also served for several years as sales and service manager of the Dyneto Electric Corp., Syracuse.

E. J. Mueller has been named director of sales and advertising of the Cleveland Motorcycle Mfg. Co. He had been connected with Harley-Davidson Motor Co. for eleven years, the last five as sales manager.

H. S. Dart, advertising manager for the Paige Motor Car Co., has resigned effective immediately. He has not announced his future plans.

O. L. Weaver has resigned as sales manager of the Star Rubber Co., because of ill health, but will continue as a director and secretary. A. G. Partridge, formerly vice-president and general sales manager of Firestone, has been named vice-president and sales manager of the Star company.

John T. Bowers has been appointed commercial manager of the Columbia Motors Co., Detroit. This is his first service in the automotive field, his sales experience to date having been almost exclusively in piano merchandising.

Wilson Bailey, formerly Eastern sales manager for the Gary Motor Truck Co., Gary, Ind., is now Eastern district manager of the Trackless Transportation Corp., New York.

W. C. Sills Resigns as Chevrolet Sales Chief

NEW YORK, June 1.—The Chevrolet Motor Co. announces the resignation of W. C. Sills as general manager of sales, effective to-day. Sills began his connection with Chevrolet in 1912, when he resigned from the Buick Motor Co. as assistant New England manager and started the distribution of Chevrolet cars in Boston and New England.

He moved to New York in 1914 and assumed the general direction of sales for the Chevrolet company. He has been, in a large measure, responsible for building up the strong organization now marketing the Chevrolet product.

Sills will return to Boston on Aug. 1 and resume distribution of Chevrolet cars in New England. He will be succeeded by Colin Campbell, who has been executive assistant to the general manager of sales for more than five years.

Colonel Cardway Resigns as Packard Export Head

NEW YORK, June 1—Colonel Fred Cardway has resigned as vice-president and general manager and director of the Packard Motors Export Corp. to devote all his time to personal interests. He has been a leading factor in the upbuilding of Packard international trade and his achievements have earned him a reputation as "one of the world's great business diplomats and psychologists."

Paul D. Davis, advertising manager, who for several years has been identified with the export sales promotion and advertising activities of Packard and the Firestone Tire & Rubber Co., has also submitted his resignation, as have Charles A. Cobb, assistant sales manager, and Paul F. Mulvey, secretary to Col. Cardway.

Rice Outlines Policies at Testimonial Dinner

DETROIT, May 27—H. H. Rice, who succeeded R. H. Collins as president and general manager of the Cadillac Motor Car Co., was guest of honor last night at a dinner in the dining room of the new Cadillac plant at which 400 of his co-workers were present. The meeting was presided over by G. H. Layng, vice-president of the Cadillac, and the committee in charge of the affair included C. M. Carson, industrial manager; F. A. Tresler, office manager, and J. A. Cleary, advertising manager.

All of the administrative officials, heads of the various departments throughout the factory, as well as foremen and assistant foremen, were present. The affair took the nature of a get-acquainted, get-together dinner, and Rice took occasion to outline some of the plans that would guide him in his efforts as the head of the Cadillac company.

Receivers Are Named for Portage Rubber

AKRON, June 1—George D. Bates and J. W. McGuire have been named receivers for the Portage Rubber Co. on a petition in bankruptcy filed against it by the Wellman, Seaver Morgan Co., which has a claim for $22,266. Total liabilities are listed at $1,700,000.

The receivership follows a hitch in the refinancing plans of the company. Creditors refused to assent to a plan of readjustment. The failure is due largely to heavy inventory shrinkage on raw materials and contractual losses for fabric and rubber.

Force Reduction Causes Lafayette to Sell Homes

INDIANAPOLIS, May 31—A group of fifty-six houses built by the Lafayette Building Co. here have been placed on sale by the company. The houses were primarily built for employees of the Lafayette Motors Co., of which the building company is a subsidiary organization, but because the plant has been forced to cut its force the houses are to be offered publicly for sale.

The houses are being sold for $1000 under the actual cash price and in some instances a greater loss is being taken. It is estimated that the company has suffered a loss of about $100,000 on the entire group, but it is thought that with a colony established the company will be able to utilize the remainder of the lots for building purposes and absorb the loss on their first group of houses.

The Union City Body Co. at Union City, Ind., is planning the construction of from twenty to forty houses on a site near its factory for employees, the houses to be sold on payments. The company plans to have the houses completed by fall.

TRUCK DIRECTORS TO MEET

DETROIT, May 28—Directors of the National Association of Motor Truck Sales Managers will meet June 7 to discuss improved sales methods among motor truck dealers and outline a plan of campaign to bring about a better understanding. Fred Glover, general manager of the Timken-Detroit Axle Co., and G. W. Yoeman, vice-president of Continental Motors, will attend the meeting and address the directors. Many reports that have reached the association headquarters regarding the activities of some dealers not in accord with good business principles, resulted in the decision of the directors to make an effort to bring about betterment through persuasive methods, if possible. In the event of failure, drastic measures will be taken, it is said, to bring such practices to an end.

Calendar

SHOWS

Sept. 5-10—Indianapolis, Automobile and Accessory Show in conjunction with Indiana State Fair, conducted by Indianapolis Automobile Trade Association, John B. Orman, Mgr.

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

July 4-9 — Mackinac Island, Mich., Summer Meeting Automotive Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

Death of Batchelder Shock to Motordom

(*Continued from page* 1186)

Batchelder was born at Akron, N. Y., 52 years ago, and was educated at Attica, N. Y. He began life as a printer at Attica and one of his cherished possessions was a gold plated printer's stick. After learning his trade in Attica he went to Buffalo and became a compositor on the Buffalo *Courier*. He was an enthusiast on sports and became sporting editor of the *Courier*. His page was widely quoted and he was regarded as an expert in various branches of sport. But his chief interest was in bicycles.

He came to New York 27 years ago as a handicapper for the League of American Wheelmen. He also served as bicycle editor of the New York *American* at a time when cycling was in its heyday. Four or five years after coming to this city he was made chairman of the National Cycling Association, which controlled racing throughout the country.

Just as he had been a pioneer in the promotion of the bicycle, Batchelder became one of the first automobile enthusiasts in the days when few foresaw the future of the motor vehicle. He studied automobiles thoroughly and made the acquaintance of the men who did most to develop the industry in its early days. He was one of the first to grasp the importance of highways.

When Alfred Reeves resigned as automobile editor of the *Evening Mail* his position was taken by Batchelder, who later became editor of *The Automobile* and then took up his work with the A. A. A., which then was an infant organization.

Batchelder took with him into the development of the national association of motorists the enthusiasm which had marked his entire career. While intensely interested in every activity and development which related to motor vehicles he concentrated his major energies on highways and soon became one of the foremost exponents of this subject.

Just as Batchelder had progressed from the bicycle to the automobile, he was turning to aviation. He had visions of great national highways gridironing the country to be utilized by aviators and motorists alike. He had long contended that aviators could follow these roads and that they should be lined from coast to coast and from border to border with landing places. One of the principal speakers at the annual dinner of the A. A. A. at Washington two weeks ago was Brigadier General Mitchell of the Army Air Service who advocated the building of landing fields. It probably was the lack of a suitable field upon which to land that cost Batchelder and his companions their lives on the ill-fated flight from Washington to Langley Field in a Curtiss Eagle ambulance airplane in a terrific electrical storm.

Steel Tread Tires Pass Out in France

(*Continued from page* 1181)

of leather used for receiving the steel rivets. The curious feature is that without any publicity campaign the French motoring public should have been induced to abandon a type of tire which not long ago was considered essential.

Clincher bead tires still hold the market, with no likelihood of their immediate abandonment in favor of the straight side. Michelin, the biggest manufacturer in France, is conducting a campaign against the straight side and has circularized all his dealers to fight it. According to reliable information, however, Michelin has a straight side tire ready to be put on the market if the move is considered advisable.

At the present time this change could only be made at immense expense and with the aid of a big propaganda campaign, for the public would refuse to buy cars with straight side equipment unless assured that supplies could be obtained in all parts of the country. There was a certain possibility of straight side tires getting a footing in France by reason of American army automobiles being put on the market, together with stocks of American tires. This opportunity has been lost, however.

PACKARD AWARDS WATCHES

DETROIT, May 28—The Packard Motor Car Co. Wednesday night presented to each of its employees who had served ten years or more a gold watch, among the recipients being President Alvan Macauley.

Shippers Association Invites Automotive Men

PITTSBURGH, May 28 — Manufacturers of automobiles and automotive equipment, who make use of the public merchandise warehouse in distributing their products, will be interested in the annual meeting of the Shippers' Warehousing & Distributing Association to be held at the William Penn Hotel here on June 16 and 17.

The association was organized last June by manufacturing interests which route their goods from factory to retailer and consumer by way of the public warehouse. The warehouse industry itself has for thirty years had a national organization, the American Warehousemen's Association, but shippers who had business dealings with that industry had no organized means of adjusting differences with warehousemen. The recognized need of standardization of documents and practices in this business relationship has attracted to the shippers' body such companies as the Westinghouse Electric & Manufacturing Co., American Sugar Refining Co., Colgate & Co., Lever Brothers Co., De Laval Separator Co., Horlick's Malted Milk Co., Kellogg Toasted Corn Flake Co., Procter & Gamble Distributing Co. and others.

Automotive interests which use public warehouses are eligible to membership and their representatives will be welcomed at the convention. Information regarding the program may be obtained by addressing the association's secretary, Kent B. Stiles, editor of *Distribution and Warehousing*, 239 West 39th Street, New York.

WILLYS MOVES EXPORT OFFICE

NEW YORK, May 31—Removal of the administrative offices of the John N. Willys Export Corp. from 165 Broadway to the Willys headquarters at Toledo on June 15 was announced by the company here to-day. A branch office will be maintained at New York but the export business will be directed from Toledo by E. C. Morse, vice-president and general manager. The export corporation will be continued and will not be merged into any of the other Willys subsidiaries. The company handles foreign sales on all the products of the Willys companies.

AUTOMOTIVE INDUSTRIES
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The Stage Is Set—Now for a Selling Campaign

With practically all prices adjusted to the sentiment of the times and the cost of manufacture, the job remains to sell the public and get the business. Secretary Hoover getting ready to help. Points out importance of automotive facts to other industries.

By Clyde Jennings

TWO major events of last week indicate rather definitely the task immediately ahead of the automotive industry. The first was the unofficial expression of opinion gathered during the N. A. C. C. meeting, which was of much more importance than the meeting itself; the second was the meeting of representatives of the industry with the Secretary of Commerce. Both indicate that, now that the stage is set, it is time to quit talking troubles and to sell automobiles.

The BIG IDEA has finally got across to the automotive industry. Here, there and everywhere prices are being adjusted. There was not a man at the National Automobile Chamber of Commerce annual meeting last week who was not outspoken in the sentiment:

> **"It is up to the industry to settle the price question right now and end the feeling of uncertainty that exists in the public mind. People do not buy on a falling market and we must stabilize values immediately."**

The N. A. C. C., of course, did not discuss prices, nor did the members attempt to indicate to each other what should be done. But all of the king's horses and all of the king's men could not have stopped the conversations between the men present when they were not in meeting.

Sales (and, of course, prices) were uppermost in their minds. As far as public expression goes they were all of a mind. Some laughed at the idea that an expression from the N. A. C. C. would help the situation. Instead of favoring such action, the sentiment was about like this:

> **"The manufacturer who is not sold on the necessity of clearing the atmosphere on price questions need only consult his own sales department and get an expression from his dealers. Perhaps his competitor announces a price cut. The next morning he gets a bunch of telegrams cancelling shipping orders for his cars. The dealer knows what prospective sales are competitive and he knows which he has lost, or will be delayed. So he stops deliveries for these cars.**
>
> **"Or, if he cuts the price of his own cars, he gets telegrams asking for shipments, because the dealer knows what prospects are holding back merely because of price.**

"No matter whether the manufacturer has cut or not, he can easily get the importance of price to present day sales."

That is about the way the industry stands at present. "Cut and cut now" was the unofficial and unanimous sentiment when the leaders were together.

And the flock of price announcements that came in left no doubt but that they were acting on their best judgment.

There is, however, a second chapter to this movement that is quite as important as the price cutting.

This is to justify the present price. How many times have you read advertisements during the last few months that announced "the last, final reductions" on clothing or other commodity. It is possible that the public will still be suspicious after reading the new prices. You can't blame the public if it is. For months and months the public has been fed on information as to war profiteers, speculations that were boosting prices, news of industrial and labor organizations that were upholding purely fictitious prices, the greed of landlords and many other things. There must be some sane, honest statements to counteract the opinions left by this long siege.

These sane, honest statements can be applied to automotive vehicles. We believe that this industry is honest and that it is merchandising its products honestly. It is giving honest value and it has, in the main, written off its share of the losses.

Then why not convince the public of this?

Why not let every automotive advertisement come out strong with honest value statements?

Why be afraid to discuss the real value of the car or the truck?

All hands will have to admit now that the effort to do business on the 1920 plan failed because the attitude of the public had changed. The seller must meet the attitude of the buyer. He must convince the buyer. Foolish publicity, such as serves when the buyer meets the attitude of the seller, will not serve the purpose for this.

The entire industry needs honest, substantial publicity. Despite all that has been said and done in the last five years, there are many who dare to doubt the utility of the industry. These folk must be convinced. The individual who buys a vehicle must be convinced that he has made a good buy.

There were other happenings of the week that worked to the same conclusion that the industry has reached in the slow course of reasoning that has governed it since "FORD DID IT" last fall. The entire course of development was plain to all who wanted to study the future then. Some were reactionary; some did hasty things; now all realize that the best thing to have done then was to write off the loss.

A lot of manufacturers who wanted the public to share in the losses have found that the public was of a different mind. The public became discriminating and bought of those who made the best practical showing—and you cannot convince any man to-day that price is not a practical argument.

There is one consolation to be gained—and that is that the public apparently is sold on the honesty of manufacture of the entire industry. This is shown in the inclination of the public to follow the price, regardless of previous choice of car. If the car they wanted did not cut, then they bought the one that did.

But to get back to the other happenings.

Credit Now Ample

W. P. G. Harding, governor of the Federal Reserve Bank, spoke to the N. A. C. C. He did not say anything about the prices of automobiles in so many words, but he did say much about price trends. Also he vouched for the statement that the public held a tremendous buying power to-day. He said that the changed conditions had brought about a buyers' market in all lines, and he thought that this was a beneficial state of affairs. He frankly favored a buyers' market because it brought out the best that was in the seller, both as to methods of manufacturing and marketing. The governor reviewed the history of finance, from the banking standpoint, since the beginning of the war, and dwelt especially on the period following the war. This review is more or less familiar, but his conclusion was new. It was, in effect, as follows:

AFTER setting forth that the credit foundation had now been laid for new activities, Governor Harding in his address to N. A. C. C. members suggested the revival of the slogan: Business as usual.

He said this slogan was tried during the first days of the war, but was dropped when it was found to be impractical. Now, he suggested, was a very fine time to revive it and to let the optimists do the talking. In this connection he said:

"Just at present the pessimist is entirely too prominent. The pessimist is a very useful person. He keeps us from running away with ourselves. He should have been listened to a year or more ago. Just now he should be silenced.

"My personal objection to a pessimist is that he operates best at the wrong time."

The banks are now in excellent position to help any helpful business. They have the proper basis for extending credit and there is no reason for any discrimination between helpful industries. In some quarters business is dragging, and you automotive manufacturers should strike out boldly to push business. Your business to-day is very large; it has many ramifications, and if you will do your best to help business you have a great power for good and it will not be long before all lines of business are responding.

Meet with Secretary Hoover

The next day came another move in the same direction. It took place in Washington, where a number of automotive manufacturers met with Secretary of Commerce Hoover at the latter's invitation. J. Walter Drake acted as spokesman for the manufacturers. At the opening of the meeting the manufacturers were just a bit doubtful as to what Secretary Hoover wanted with them and how he was going to get whatever it was that he wanted.

The Secretary quickly allayed any suspicion by stating his position quite clearly. He said at the outset that he wanted only the figures that would be helpful to business, but he told the automotive manufacturers that their industry had become of such importance in the business world that other industries were asking for their figures showing the status of the industry.

The accuracy and excellence of the present automotive industrial figures were conceded by the Secretary, but he said that to other industries they would be much more valuable if they were given by price classes. He also

made it clear that he was not interested in the figures of any one factory, but in figures that were representative of the industry. He did not even care how these figures were gathered, except that the data be accurate.

In explaining his dealings with the National Automobile Chamber of Commerce, Secretary Hoover stated that he was entering upon this alliance because it was his information that this was one of the really helpful industrial organizations and is, and has been, clear of doubtful business practices. He said that some trade organizations could not be considered in this relation because their activities were chiefly in restraint of trade, rather than a promotion. He expressed his pleasure in meeting an industrial committee that comprised association members as well as non-members. He said that he was quite willing that the N. A. C. C. should be the chief agent in gathering statistics, and that he wanted such statistics as the individual manufacturers could see the benefit of. He had no desire to force figures from an industry.

It was practically agreed that the monthly shipping figures comprised the data that other industries were chiefly interested in. Drake informed the Secretary that the practice of the industry was to regard future orders, or annual sales contracts merely as a means of allotment and not as "future orders." It was Drake's thought that the shipping figures were the only informative data, and that these could be separated into price classes, also the percentage of closed cars could be given by classes.

NOT much has been said recently about the prices of trucks.. The faster moving passenger car is the center of attraction and is experiencing a revival of selling.

Here is a curious result. Early this week a truck man came to talk over the prospects and, after considerable discussion, he remarked:

"We are very much afraid someone will start a price cut on trucks."

Evidently the passenger car is faster than the trucks in other than road operating speeds.

Drake presented to the Secretary the industry's request for information from other branches of trade. He said that additional steel figures were needed, also crop statistics, figures showing the status of the meat packing, textile and shoe industries and accurate and prompt reports of railroad passenger miles and railroad freight ton-miles. The Secretary said that he thought these figures would form a part of the complete picture of business that the Department contemplated publishing, once the facilities were equal to the task that the Department had undertaken.

While discussing this question the need of more detailed export and import figures was taken up. Drake said that the manufacturer wanted to know what kind of motor cars were going to a certain country. The Secretary said that this need had early impressed him, but that to get the port figures classified properly it was necessary that this service be transferred to the Department of Commerce. This work was now under the Treasury Department. He said that some time ago **he and Secretary Mellon thought they had adjusted this phase of the work, but that the comptroller had decided that, while they might shift the labor from one department to the other, they could not shift the appropriation.** Now it was necessary to await a new comptroller. The Secretary made no further comment on this, but after the meeting had adjourned the manufacturers who were present talked it over at length as an illustration of business methods of government.

The Secretary said that in time he hoped that export figures would be classified in a way to be most helpful. He told of speeding up the compilation and publication of foreign trade figures.

Another matter of considerable importance was the naming of two men to be placed in the Department of Commerce to represent the industry while the new plans for the promotion of domestic and foreign sales were being carried forward. First the Secretary wanted as a trade advisor in the Bureau of Foreign and Domestic Commerce a broad-gage salesman who could form the plans upon which statistics were to be gathered and used both at home and abroad. This man would also help to educate the traveling agents who will go to other countries to look into trade prospects. This man, said the Secretary, must be a man who, in private life, can earn several times what the Department can pay him. He must be a very self-sacrificing individual for a period of perhaps a year while the Department is being educated. This obligation was assumed by the representatives of the industry.

Another man is wanted for the Bureau of Standards. This man, the Secretary said, should be both an engineer and production man. The idea behind this appointment was to make the Bureau of the utmost practical value to the industry. The salary in this job will be utterly out of keeping with that which the man wanted would earn in industrial employment. The manufacturers promised to suggest such a man, but said they would probably consult the Society of Automotive Engineers on this, as they had regarded the Bureau of Standards as the engineering branch. Secretary Hoover said he was quite anxious to make this Bureau of practical manufacturing value to the industry.

An interesting point was raised when the Secretary asked if it was possible to report periodically on production as a percentage of capacity. The manufacturers said they were at a loss to measure capacity and did not feel that they could make an accurate report on this.

At the conclusion of the meeting Drake offered to submit to the Secretary at once a memorandum setting forth the extent to which the industry could co-operate in the effort to broaden and stabilize business generally and what the industry needed for the same purpose. He also said he would forward suggestions for appointment to the two positions at the same time. The Secretary said that this course was satisfactory to him.

Those present were: J. Walter Drake (Hupp), Alfred H. Swayne (G. M. C.), A. T. Waterfall (Dodge), E. A. Williams, Jr. (Garford), Gaston Plaintiff (Ford), J E. Kepperley (Overland), H. S. Vance (Studebaker), R. A. Hauer (International), M. L. Hemmingway (M. A. M. A.), Pyke Johnson and John C. Long (N. A. C. C.), T. F. Cullen (Chilton Pub. Co.), Clyde Jennings (Automotive Industries).

THERE are 107 agencies for foreign cars in Holland. American manufacturers have the largest representation with 37. It is estimated that there are now about 10,000 passenger cars in use throughout Holland; 3000 American cars went into that country during 1920 alone.

New Federal Is Heavier and More Powerful Than Earlier Models

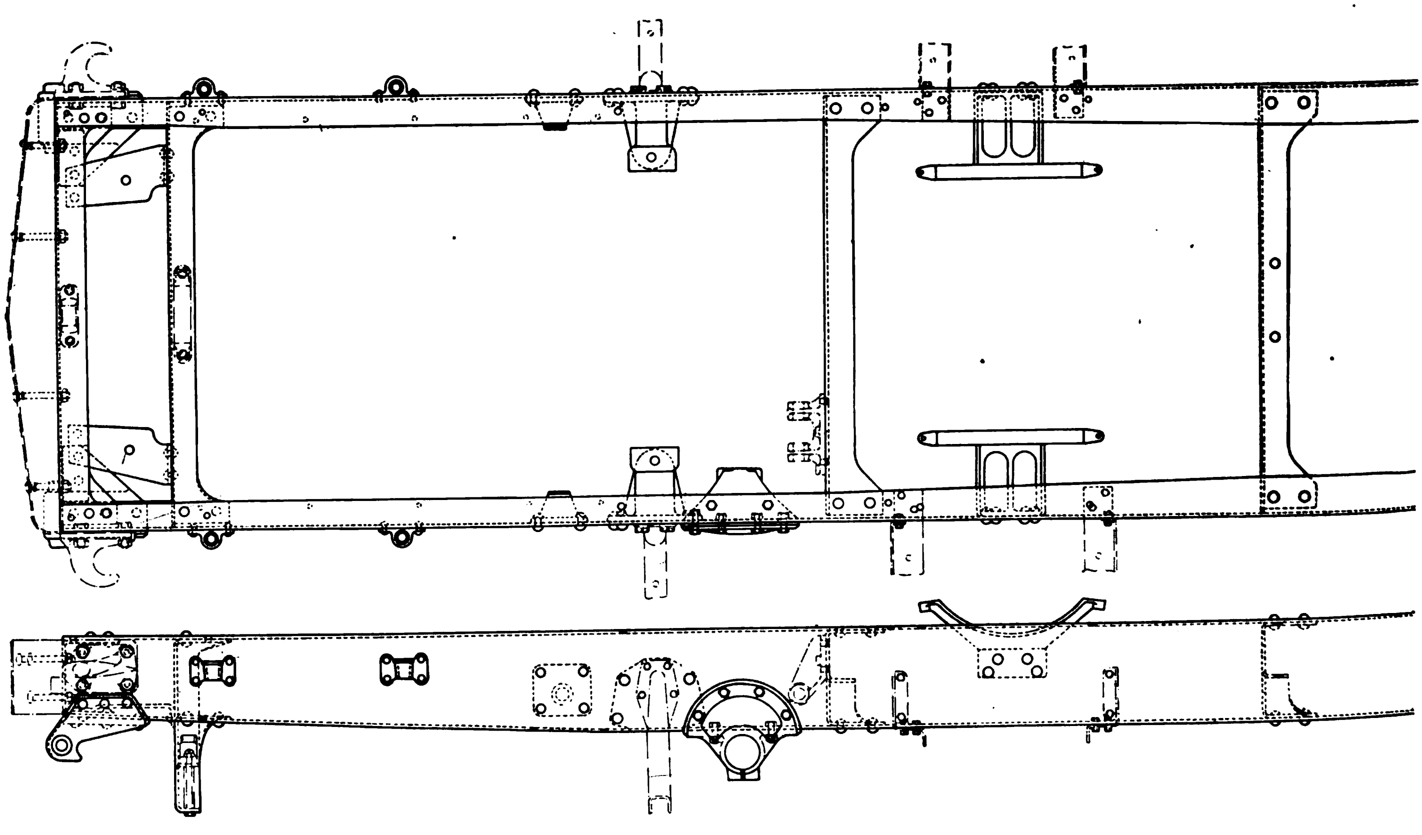
Five to six ton job is equipped with new Continental engine which develops 50 hp. at 1100 r.p.m. and has full pressure lubrication. Other equipment includes lighting generator, vacuum fuel feed, Eisemann magneto, Pharo governor, hub odometer and Alemite grease attachments.

By J. Edward Schipper

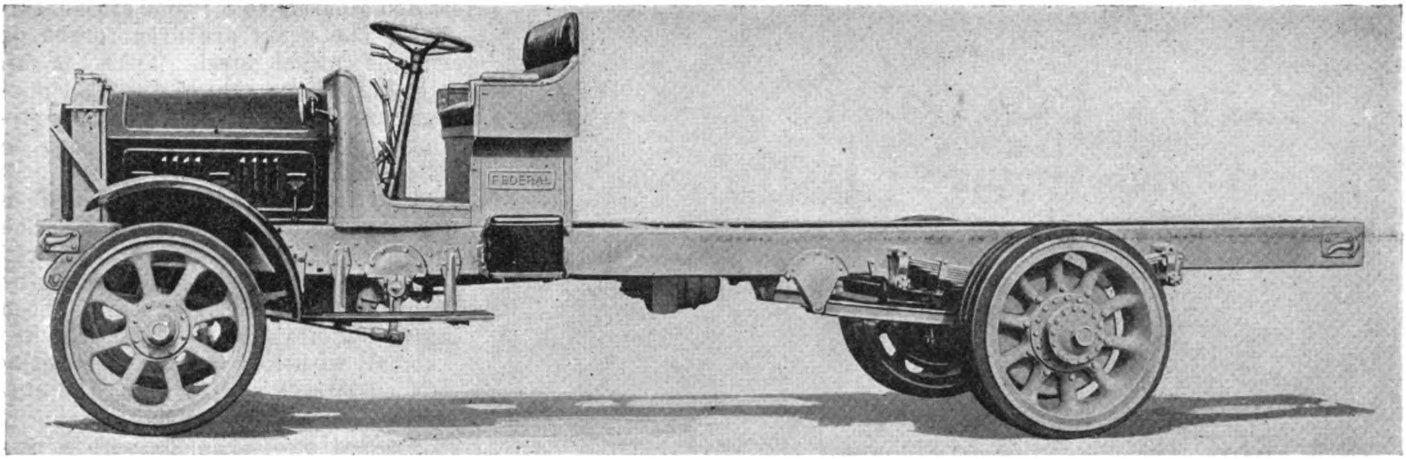
A NEW 5 to 6-ton Federal truck, incorporating a number of features of advanced design, is about ready for the market. As compared with the older 5-ton Federal, the new truck has a larger engine, the displacement being 425 instead of 350 cu. in. This engine has a removable instead of a fixed cylinder head, larger crankshaft bearings and full pressure oil feed instead of circulating splash. Electric lights and horn are furnished in place of oil lamps and a hand horn, and provision is made for an electric starter. The truck has a 14-in. instead of a 12-in. clutch, a larger propeller shaft, a heavier frame and a heavier transmission, with less reduction in the rear axle and increased reduction in the transmission, thereby attaining greater speeds in high gear without sacrifice of power in the lower gears. The new truck also comes with better equipment, being provided with four towing hooks, vacuum feed in place of gravity, and a hub-odometer.

The engine used is a new Continental model. It has been designed particularly for heavy work, being a four-cylinder, 4¾ by 5 in. design, developing 50 hp. at 1100 r.p.m. The cylinders are cast in pairs with removable heads. One of the features of the cylinder castings is the exceptionally large water jacket, the depth of which is even noticeable from the outside, giving a rather fully rounded casting. The crankcase is of aluminum, and the aluminum oil pan is bolted to it. The flywheel housing is cast integral with the crankcase and oil pan. The engine has a three-bearing crankshaft, 2⅝ in. in diameter. The end thrust of the crankshaft is taken on the front bearing and an adjustment for end play is provided. The reciprocating parts are completely machined for balance, and both the pistons and connecting rods are of extra length to reduce side thrust per unit of bearing surface on the cylinder wall. Each piston is equipped with four ¼ in. piston rings.

The gear train at the front end of the engine consists of four instead of the conventional three gears. The



Plan and side view of frame



New Federal 5-6 ton truck, which is generally heavier and more powerful than the former 5-ton Federal.

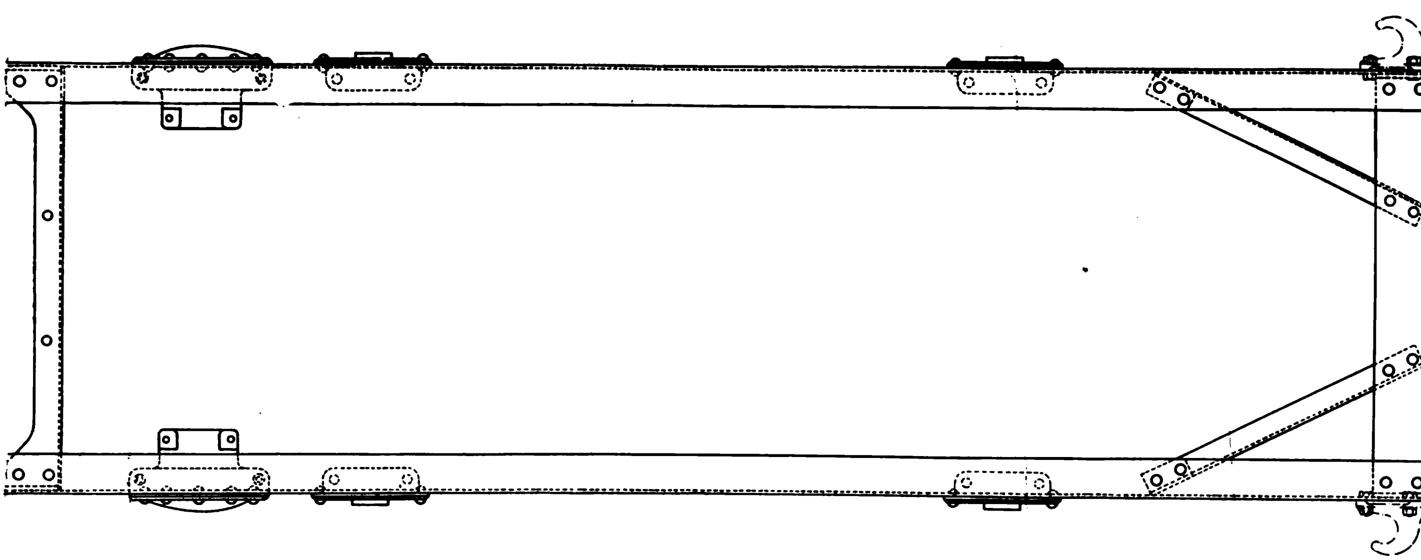
use of an idler gear between the cam and pump gears and the crank gear makes it possible to distribute the accessories, such as the pump, generator and magneto, so that they can be accessibly installed. Three bearings are employed for the crankshaft, which is 1¼ in. in diameter between the cams. It is machined and ground on special machines and the diameter of the camshaft at the bearing is greater than the height of the cam, to permit the removal of the shaft without disturbing the bearings. The valves are on the right side of the engine and are 2 1/32 in. in diameter. The valve stem diameter is 7/16 in.

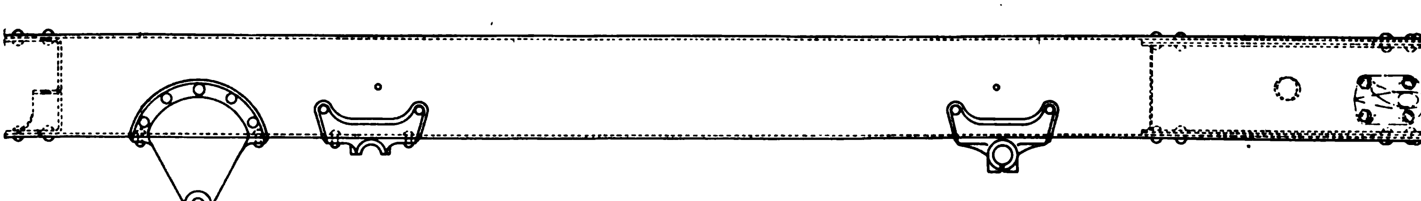
Cooling is provided for by centrifugal water pump so mounted that there is ample room for taking up and replacing shaft packings. The pump is on the left side of the engine on the water pump and magneto shaft, which are driven off the same gear which supplies the drive to the fan pulley.

Full pressure feed oiling is secured by a gear pump, driven by spiral gears from the camshaft. The oil pump draws oil through a strainer in the oil pan. From this pump oil leads run to all the main bearings and the timing gear case. The crankshaft is drilled to supply oil to the connecting rod bearings, and an oil duct carries the oil from the lower end of the connecting rod to the piston pin bearing.

An oil pressure adjusting valve is built into the engine and the oil level in the pan is determined by the use of the conventional bayonet or stick type of gage. A pressure gage located on the dash of the truck indicates the pressure under which the oil is circulating. The oil which feeds the pump is strained by a non-clogging type of strainer which is carried in the oil pan.

The fuel system comprises a pressed steel tank of two pieces electrically welded together and tinned to make it rustproof. It rests in a malleable iron saddle held by straps. Gasoline is fed from this to the engine by means of the Stewart vacuum system. The carburetor is a Zenith 1½-in. model L-6. Ignition is by an Eisemann magneto Model G4, mounted on a bracket on the crankcase and driven through the pump shaft. An impulse starter is stock equipment. The governor is the





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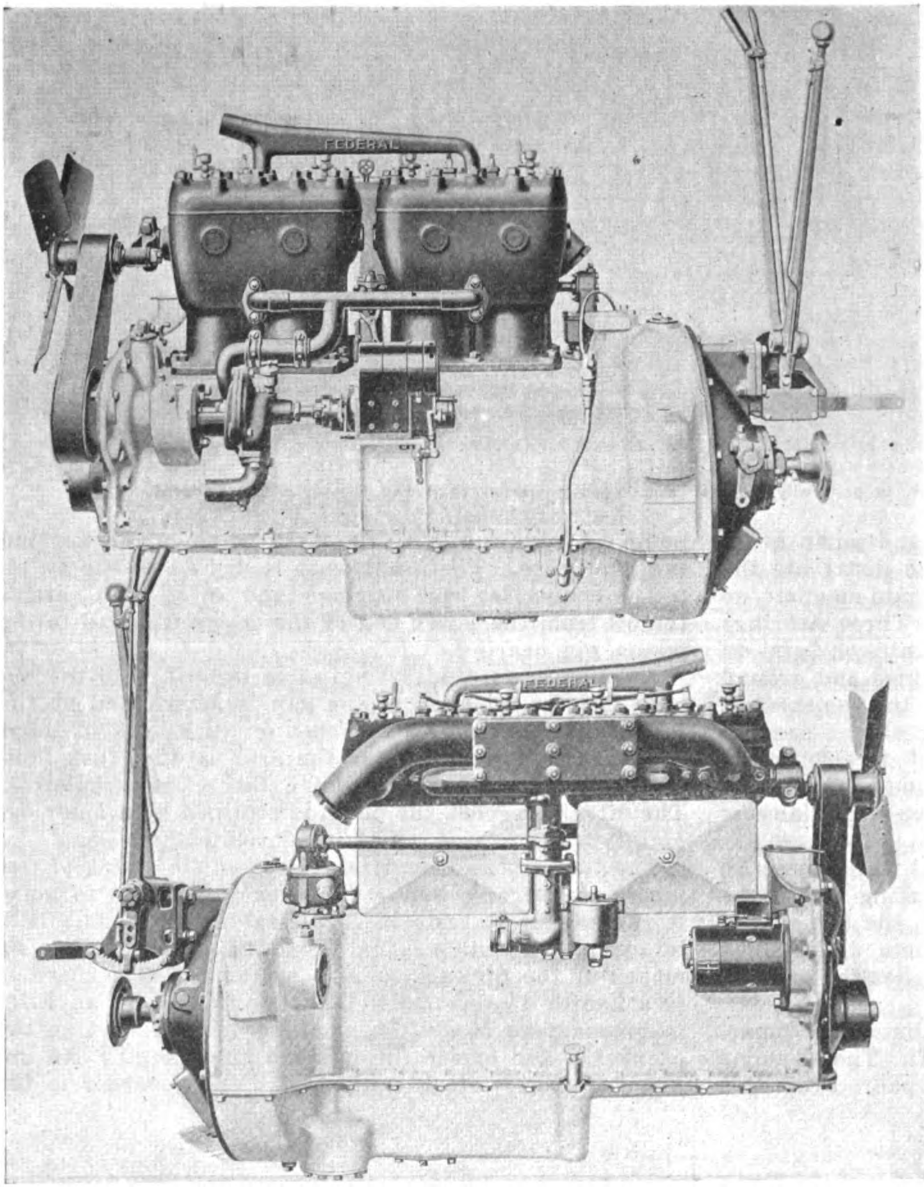


Two views of the new Continental 4-4¾ x 5 in. truck engine fitted to the new Federal truck.

Pharo, a centrifugal device using oil as the medium subjected to centrifugal force. The pressure of the oil raises a piston, which closes a butterfly valve in the intake pipe.

Three-point suspension is used for the engine, the front end being supported by a circular trunnion cast integral with the timing gear case and resting in a saddle bolted to a cross member. The two rear engine arms are supported on brackets riveted to the frame members. One of the rear arms is flexibly mounted by means of a coiled spring used in connection with the hanger bolt.

A Borg & Beck clutch 14 in. in diameter is fitted. The clutch shaft is 1¾ in. in diameter and is milled with 10 splines. Throw-out thrust is taken by a ball thrust bearing. The clutch shaft is mounted on two ball bearings and lubrication of these bearings and the throwout sleeve is provided for by a drilled clutch shaft through which grease is forced to the bearings.

The four forward and one reverse speed ratios of the transmission are as follows: High, 1 to 1, third, 1.75 to 1; second, 3.22 to 1; first, 5.85 to 1, reverse, 6.8 to 1. The gearset is mounted amidships and is supported at three points, two in the rear and one at the front. The front support is flexible, while the two rear supports are bolted securely to a frame cross-member. The gears are drop forged of chrome nickel steel. There is an opening on the side of the transmission case, through which, by removing a plug, the transmission can be filled with oil.

Provision for a power take-off is made on both sides of the case. The drive shaft between the clutch and transmission and that between the transmission and rear axle, both carry two universals. The shafts are tubular, with forged stubs electrically welded to each end to which the universal joints are attached.

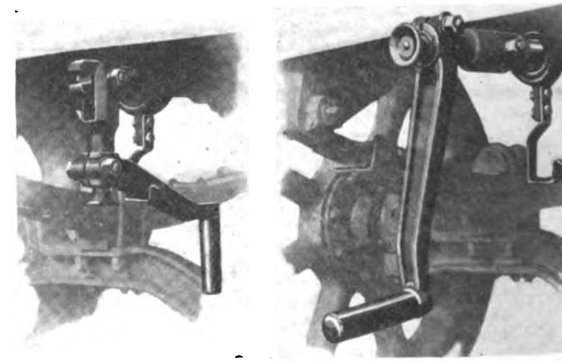
Pressed steel channels with a section 9 in. deep by 9/32 in. thick are employed for the frame. The latter is reinforced at all corners and at the junction of the frame cross-members is provided with heavy gusset plates. The frame is hot riveted and all the rivet holes are drilled. The truck is made in three chassis lengths with wheelbases of 163 in. on two of them and 187 on the third. The two with the 163-in. wheelbase have loading spaces of 130 in. and 154 in. respectively. The 187-in. wheelbase chassis had 190-in. loading space. These trucks all have the same over-all length of the frame, 222 in.

A Gemmer steering gear is employed and the control levers for the spark and throttle are mounted on the steering post. The steering gear, clutch, pedal and service brake pedal are on the left side. The gear shift lever and the emergency brake lever are mounted in the center.

The 5 to 6-ton model is equipped with generator, 6-volt battery, two side lamps with diffusing lenses and a tail lamp. A feature of the equipment is the mounting of the tail lamp in a recess of the rear frame member and of the license plate on the rear frame in such a way that it is illuminated by the tail light.

The axles are Timken type, mounted on roller bearings throughout. The rear eye of the front spring is slightly lower than the front eye, thus providing a caster effect. The rear axle is a full floating worm type,

(*Continued on page* 1205)



Folding starting crank on Federal truck, in folded and operating positions.

A Possible Explanation of Airplane Accidents Attributed to Engine Trouble

Formation and collection of snow in inlet manifold is known to cause throttling and erratic engine action. The trouble can be remedied by slightly heating the incoming charge with but slight loss in power.

By Stanwood W. Sparrow*

WHEN the daily paper tells that a plane has crashed, and states a definite cause such as the fracture of a fuel line or the collapse of a wing, public confidence in the safety of aviation is shaken. It is easy to believe, however, that defects so glaringly revealed will be corrected at once. The real blow to aviation comes when no satisfactory explanation for the accident is forthcoming. Knowledge of what is wrong must precede any intelligent effort to make a thing right. A wrecked plane bearing mute testimony to the existence of a fault and a confession of ignorance as to the nature of the fault tends to contradict assertions that aviation has outgrown the experimental stage. To bring attention to one possible cause of such unexplained accidents this note has been prepared for the National Advisory Committee for Aeronautics.

In testing airplane engines at the Bureau of Standards it has happened frequently that engine performance became erratic when the temperature of the air entering the carbureter was between 0 deg. C. (32 deg. Fahr.) and 20 deg. C. (68 deg. Fahr). Investigation revealed the trouble to have been caused by the formation and collection of snow somewhere between the entrance to the carbureter and the manifold, probably at the throttle. Experiments in the carbureter test plant had shown the possibility of this trouble. In fact, a glass portion of the induction system made it possible for one actually to see the snow as it collected.

Proof scarcely less convincing was obtained during engine tests. That something was wrong became apparent from a drop in power. The manifold depression, the difference between atmospheric pressure and the pressure in the manifold, was greater than that usually obtained at full throttle at this speed. At the same time, measurements showed the rate of air flow to be lower than usual. Inasmuch as both of these effects would be produced by throttling the engine, they gave a clue to the source of trouble. In some cases the snow would continue to collect until it shut the engine down, while at other times after it had effected a decrease in power of from 25 to 50 per cent a portion would become dislodged and the engine would speed up. The test apparatus is arranged so that the air on its way to the engine passes over heating grids. If, while the power was still low, sufficient heat was applied to increase the air temperature 20 deg. C. (36 deg. Fahr.) the power, manifold depression and air flow would soon regain their normal values. A few rather violent fluctuations of speed usually accompanied this period and can be attributed to the water passing into the combustion chamber as the snow melted.

*Of the Automotive Powerplant Section of the Bureau of Standards. This paper is issued as Technical Note No. 55 of the National Advisory Committee for Aeronautics.

Granting this trouble to be caused by the condensation of moisture from the air and the subsequent formation of snow, the removal of the moisture should prove as effective a cure as an increase in temperature. Fortunately it was possible to do this and thus check the validity of this supposition as to the origin of the trouble. The engine test apparatus includes refrigerating coils which enable all the air taken by the engine to be cooled to below —20 deg. C. (—4 deg. Fahr.). This air is then reheated to the desired temperature. Air when cooled to —20 deg. C. (—4 deg. Fahr.) contains almost no moisture and no opportunity is offered for it to collect any during its passage from the heating grids to the engine. Under these conditions, the engine operated satisfactorily at these temperatures at which difficulty was experienced with the air from which the moisture had not been removed.

The more serious the manifestations of this trouble, the more difficult it becomes to secure accurate data for record. Fluctuations of speed are violent and a stalled engine is usually the final result. A record of a few instances where it was possible to hold the speed reasonably constant are given as examples of the trouble in its milder stages. On Feb. 14, 1921, with the engine operating at part throttle at 1800 r.p.m. it was noted that the power was decreasing. At 1:06 p. m. readings of carbureter air temperature and manifold depression showed the former to be 10 deg. C. (50 deg. Fahr.) and the latter 25.0 cm. (9.84 in.) of mercury. Heat was applied and at 1:08 p. m. the air temperature had risen to 38 deg. C. (100 deg. Fahr.) and the manifold depression had dropped to 6.8 cm. (2.68 in.). Again the temperature of the air was allowed to drop and again a drop in power and increase in manifold depression resulted. With the speed maintained at 1800 r.p.m., the throttle was opened wide and readings taken showing the air temperature to be 10 deg. C. (50 deg. Fahr.), the manifold depression 11.1 cm. (4.37 in.) and the brake horsepower 86. Within two minutes, the application of heat had resulted in dropping the manifold depression to 5.6 cm. (2.20 in.) and in raising the brake horsepower to 185. The foregoing results were all obtained at air densities corresponding to ground level. Similar conditions were found on Feb. 23, at an air density corresponding to an altitude of 5000 ft. with the engine operating at full throttle at 1600 r.p.m. With the air at a temperature of 30 deg. C. (86 deg. Fahr.), the manifold depression was 2.9 cm. (1.14 in.) and the brake horsepower was 156. Eight minutes after the heating was discontinued, the air temperature had become 8 deg. C. (46 deg. Fahr.), the manifold depression 5.1 cm. (2.01 in.) and the brake horsepower 120.

While in all of these instances it was a change in weight of charge that caused the drop in power, the mag-

nitude of the decrease may have been influenced by another factor, a change in mixture ratio. If a carbureter does not maintain the air-fuel ratio constant at reduced loads, any unintentional throttling involves a departure from the desired mixture quality as well as a reduction in mixture quantity. To the reader familiar with carbureters in which changes in the area of a small passage between the float chamber and throat effect the mixture ratio changes, still another source of danger has doubtless suggested itself. This danger is that a collection of snow may block the connecting passage and cause a serious change in air-fuel ratio.

Discussion thus far may have emphasized unduly loss of power instead of what is probably the more serious effect, excessive fluctuations in power. Under these conditions a pilot is in exactly the same position as though his engine were controlled by a lunatic, opening and closing the throttle at will. Yet, in case of an accident, before an examination could be made the snow would have melted, leaving no evidence to confirm the pilot's report of trouble.

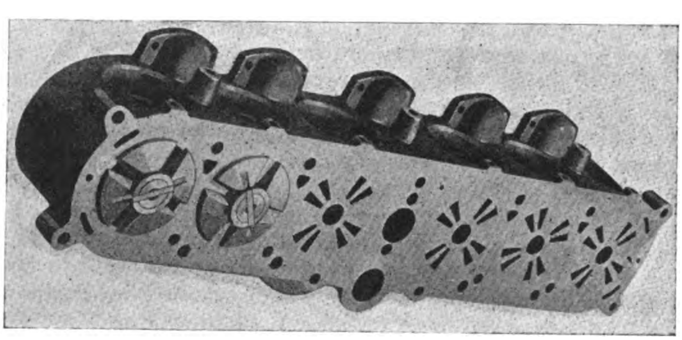
It is hardly worth while to attempt to predict from theoretical considerations at what temperature the trouble from snow formation will be most pronounced. It does seem desirable, however, to consider how much additional external heating is necessary to give reasonable assurance that the trouble will not occur. The weight of water vapor that a unit volume of air can contain decreases with decrease in temperature and the surplus condenses. Obviously if the drop in temperature be prevented there can be no condensation. The problem is to supply sufficient heat to completely vaporize the fuel so that no heat for this purpose need be withdrawn from the mixture. If the heat of vaporization of aviation gasoline be 75 cal. per gram (135 B.t.u. per pound)* complete vaporization will produce a drop in mixture temperature of 26 deg. C. (47 deg. Fahr.) with an air-fuel ratio of 10 to 1 and a drop of about 14 deg. C. (25 deg. Fahr.) with an air-fuel ratio of 20 to 1. It is safe to assume that the mixture ratio used will fall within these limits. The above calculation assumes all the fuel vaporized and all the heat used in vaporizing the fuel to be supplied by the mixture, while usually a portion of this heat is supplied externally. From these considerations it appears that the addition of an amount of heat sufficient to increase the mixture temperature 25 deg. C. (45 deg. Fahr.) should prove a reasonable guarantee of immunity from this trouble. The power loss that this would entail should not exceed 5 per cent.

This note is not intended as a sweeping recommendation of additional air heating for every airplane engine. Such a course would be akin to prescribing medicine for a patient without first being assured that he was really sick. The aim is to call attention to a "disease" to which aviation engines are subject, to describe its symptoms, and to emphasize its seriousness. Methods of prevention or cure can be consigned with safety to those vitally concerned.

*Ricardo, *Automobile Engineer*, February, 1921.

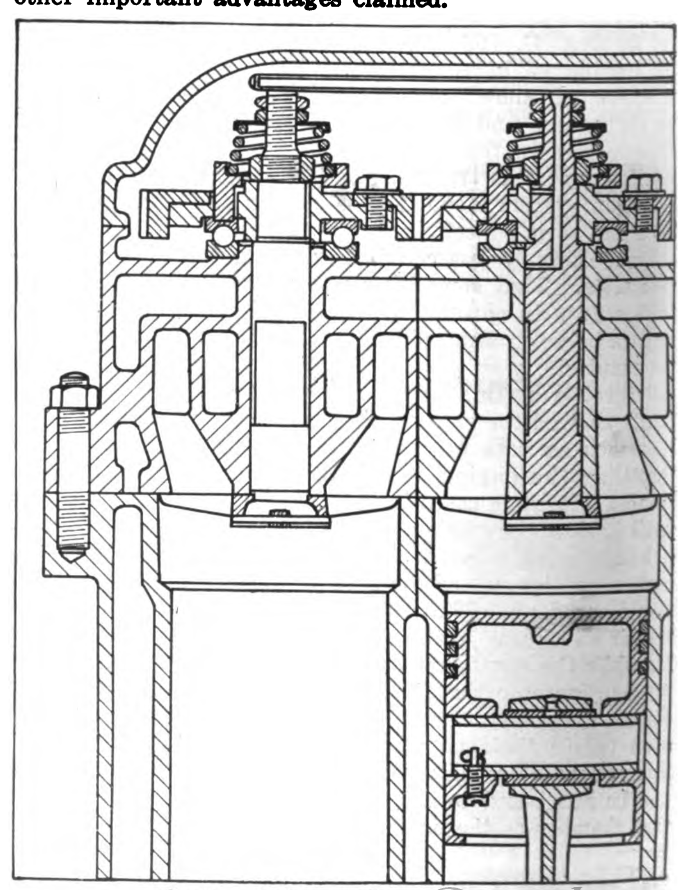
Disk Valve Engine Used in New Car

ONE of the passenger cars marketed for the first time this year is known as the Ace, and the principal feature of this car is the Guy rotary disk valve engine. The disk is located in the combustion chamber. It bears against the cylinder head and is provided with four radial, rectangular slots forming ports. In the cylinder head there are four corresponding inlet and four exhaust ports. As the inlet ports, for instance, are opened every time the slots in the valve disk register with the inlet ports in the cylinder heads, which happens four times during one revolution of the disk, and as they need to be opened only once every two revolutions of the crankshaft, the disks revolve at only one-eighth the crankshaft speed. This low speed of rotation seems to be the chief novelty. The inlet and exhaust ports are located adjacent to each other. Inlet and exhaust ports lead to two concentric passages with outlets on opposite sides of the cylinder head.



Head of Ace engine, showing Guy rotary disk valve

The claims made for this valve are that it insures better scavenging, gives a high low-speed torque, is self-cleaning and that lubrication is positive. It is said that a Guy disk valve used in an engine which was driven more than 50,000 miles showed less than 0.001 in. wear on the valve surfaces. Silent operation and freedom from warpage are other important advantages claimed.



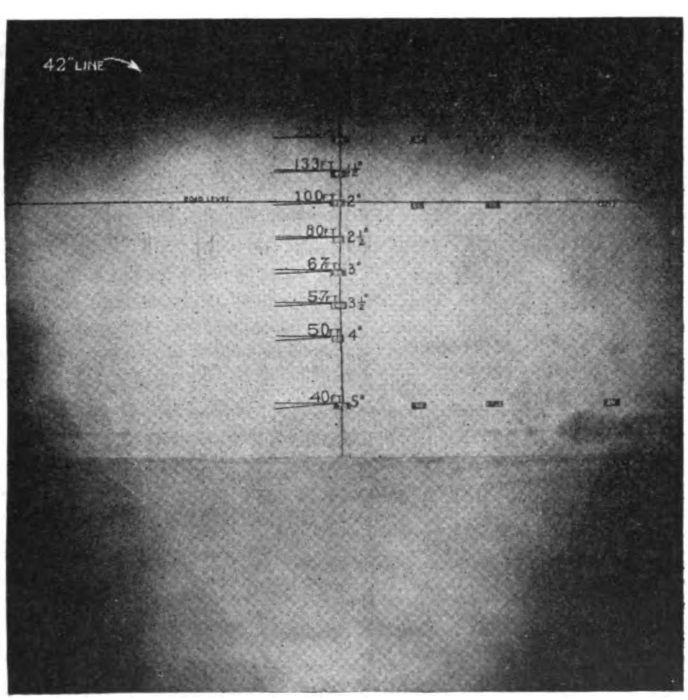
Sectional view of Guy disk valve

Devices for Controlling Headlight Glare

Specially shaped reflector designed to keep beam of light below eye level requires no special lens. Ford cars are now being regularly equipped with green visor lenses and device for focusing the bulb.

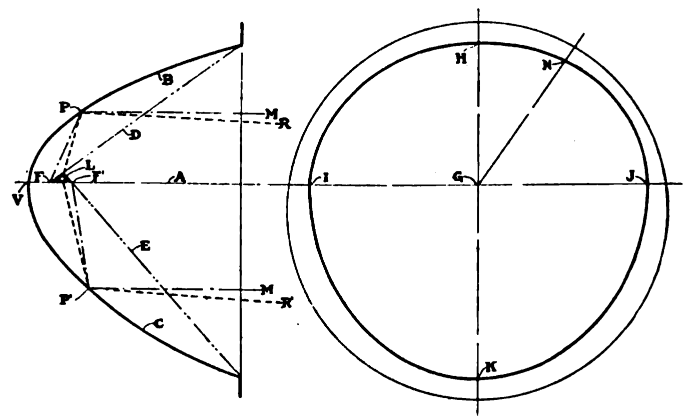
THE problem of controlling headlamp illumination so as to effect efficient lighting of the road ahead of the car and yet prevent annoyance by glare to people traveling in the opposite direction is still with us. Almost every conceivable means of attack has been made use of since the glare problem first became serious, about 1910. At first absorbing media, such as amber colored lenses, were used to quite an extent. Later came lenses of such formation as to break up or disperse the light beam, and finally it was decided that the proper principle to use was to control the direction of the beam of light, so it falls upon the road surface at a reasonable distance ahead of the car, but does not rise to a sufficient height to reach the eyes of the approaching pedestrian or vehicle driver. Use of the dispersion principle does not seem logical, for we first place behind and around the luminous source a carefully made reflector to gather the rays into a parallel beam and then place in front of the source a lens which breaks the beam up again before it has accomplished any useful purpose. The eyes of other users of the highway are always above the level of the headlights and the most logical plan seems to be to direct all the rays from the source downwardly. This can be done by use of lenses of prismatic form; it can also be done by giving the reflector a suitable shape, and this is perhaps the simplest method.

C. W. and C. H. Crockett have developed a reflector which permits of this desirable control of the beam of light. This reflector is in the form of one smooth continuous surface, but within the concavity of the reflector there is a space, in which the source of light may be placed, such that, when the light source is wholly in the space, all of the light falling on the reflector will be reflected either horizontally or in a downward direction.



Photograph of surface illuminated by beam from Crockett reflector.

The surface of the reflector is generated by revolving, about its horizontal axis, a parabolic arc whose parameter



Crockett head lamp reflector.

gradually increases as the arc is revolved through 180 deg. from its upper vertical to its lower vertical position. Referring to the drawings, the plane *GH*, through the axis *A* and on one side thereof, will cut the reflector in a parabolic arc *B*; and any other plane *GN* through the axis *A* and on one side thereof, will cut the reflector in a parabolic arc having a parameter greater than that of the arc cut by the plane *GH*; and the parameter of the section will increase as the cutting plane passes from the position *GH* to the position *GK*, where the parameter of such an axial section will have its greatest value, the corresponding section of the surface being the parabolic arc *C*. Thus the sections of the surface, made by planes through axis *A*, are parabolic arcs, all having the common axis *A* and the common vertex *V*, the focus of each arc being situated on the axis *A* between *F*, which is the focus of the parabolic arc *B* and which is the focus nearest the vertex *V*, and *F'*, which is the focus of the parabolic arc *C* and which is the focus farthest from the vertex *V*.

The sections made by planes perpendicular to the axis *A* and in the form *IHJK*, which consists of two semi-ellipses, *IHJ* and *IKJ*, having a common center *G* and a common axis *IJ*, *GH* being less than *GI*, while *GK* is greater than *GI*.

If the reflecting surface is a right parabolic cylinder, whose intersection with the vertical plane through the axis *A* is shown in the curves *B* and *C*, and if a point of light *L* is placed above the horizontal axis *A*, and in the vertical plane through *A*, and forward of the line *D* drawn from the focus *F* to a point on the parabolic arc *B* which corresponds to the upper forward edge of the reflector, none of the rays of light falling on the upper portion of the surface will be reflected in an upward direction; for, if a point of light is situated at the focus *F*, any ray *FP* will be reflected in the direction *PM* parallel to the axis, and there-

fore any ray *LP* from the light *L* will be reflected in the direction *PR*—downward. Again, if a point of light *L* is placed above the axis *A*, and in the vertical plane through *A*, and to the rear of the line *E* intersecting the focus *F′* and extending to a point on the parabolic arc *C* which corresponds to the lower forward edge of the reflector, none of the rays of light falling on the lower portion of the surface will be reflected in an upward direction; for, if a point of light is situated at the focus *F′*, any ray *F′P′* will be reflected in the direction *P′M′* parallel to the axis, and therefore any ray *LP′* from the light *L* will be reflected in the direction *P′R′*—downward. Hence, if a point of light *L* is placed above the axis, and in the vertical plane through the axis and forward of the line *D* and to the rear of the line *E*, that is, if it is placed in the shaded triangle whose base is *FF′*, none of the light falling on any portion of the surface will be reflected in an upward direction. But there will be upward reflection if any part of the source of light is outside of this triangle.

When the surface is one of double curvature, as it is in all reflectors, the direction of the reflected ray is not easily determined, but somewhat similar conclusions are true for the Crockett reflector. There is a limited space, projected in the shaded triangle bounded by the lines *D*, *E* and *A*, such that, if the source of light is contained entirely within this space, none of the rays of light will be reflected in an upward direction. But there will be some upward reflection if any part of the light source is outside of this space.

A test of this reflector was made by the Electrical Testing Laboratories of New York City using a Mazda B headlamp bulb of 18 spherical candle-power. The maximum beam candle-power was 11,000. The photographic record of this test is reproduced herewith, and it will be seen that there is no light above the 42 in. line. The reflector is said to meet the anti-glare provisions of the laws of New York, New Jersey and Massachusetts. With a reflector of this type a plain glass lens can be used, and it is believed that this reflector affords the least expensive means of dealing with the troublesome glare.

Ford Green Visor Lens

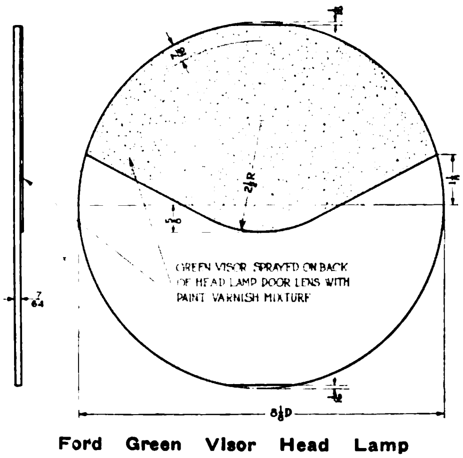
FORD cars are now coming through regularly equipped with non-glaring head lights known as the Ford green visor head lamps, installation of these head lamps having started in March. The Ford company has also placed on sale replacement lenses for the cars already in use. The new head lamp has been tested and approved in the states of Connecticut, New York, Pennsylvania, Maryland and Wisconsin, in the District of Columbia and in the city of Detroit, and tests are at present being conducted in California.

According to the Ford Motor Co., this device has been adopted in an effort to provide a head lamp which will give ample light for driving and at the same time eliminate glare.

The diagram herewith shows the illumination obtained in the New York tests and indicates that the equipment complies with both the light and anti-glare requirements. The new lamp comprises the standard Ford parabolic reflector of 1⅜ in. focal length. The lens has the upper part painted green. The visor extends ⅝ in. below the center of the lens and is tapered back to a distance of 1⅛ in. above the center line at each side. A special double filament bulb is supplied carrying a helical major filament, closely wound and 7/32 in. in length. This filament is specially focused with the filament drawn back of the focal center of the reflector until the front end of the filament is at the focus. The tip of the filament being at the focal center gives the direct beam required, while the remainder of the filament behind the center distributes light to the sides of the lamp.

Standard adjusting directions have been supplied all dealers. A shop layout for focusing and aligning the lamps is shown in the sketch herewith. The empty car is put on a level surface in front of a white wall or screen 25 ft. from the front of the head lamps. This wall must be in semi-darkness or sufficiently shielded from direct light to enable the light spots upon it from the head lamps to be clearly seen. The bright lights are turned on and the lamps focused by means of the screw at the back of the lamps, first one lamp and then the other, drawing the bulb filament slightly back of the focal center of the reflector until a semi-circular spot of light is obtained on the wall, with the flat side up and with a concentrated circular central portion. In focusing the bulb is drawn back to obtain as wide a spread as possible and still maintain the approximately flat top line and the concentrated central portion. In general, the spot of light when properly focused will measure about 5 or 6 ft. across the top.

In aligning the head lamps the brackets are bent so that the top lines of the bright spots on the wall are set at a line 28 in. above the level of the surface on which the car stands. The half cone of light from each head lamp is to extend straight forward; that is, the centers of the concentrated circular portions must be 28 in. apart. In assembling at the Ford plant, this is the last step taken before the cars leave the line.



Ford Green Visor Head Lamp showing dimensions and location of visor.

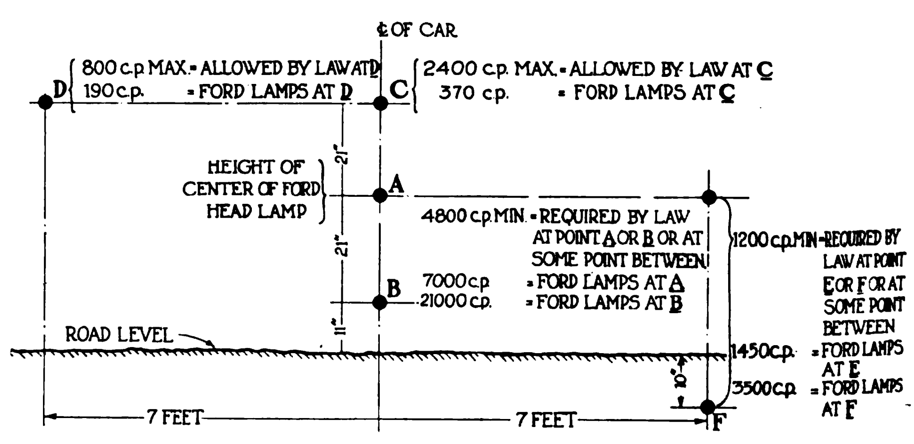


Diagram of Ford Head Lamp Illumination.

An Analysis of Elements Which Govern Automobile Fuel Economy

Part I

A paper containing much useful information in regard to the factors which determine rolling resistance, frictional and other losses which are encountered in converting the heat in fuel burned in the engine into tractive effort at the periphery of the driving tires.

By W. S. James*

AN attempt has been made, first, to analyze and state the factors effecting the power requirements of cars; second, to analyze and state the factors affecting the amount of power supplied the car as fuel to produce at the road the power required for transportation.

The power required to propel rubber-tired vehicles over roads is delivered to the road by the wheels as thrust or tractive force which is used (*a*) to overcome wind resistance, (*b*) to overcome the resistance to the rolling of rubber-tired vehicles, (*c*) to produce linear acceleration of the car masses and angular acceleration of the wheels and (*d*) to overcome gravity deceleration when climbing hills.

The thrust or tractive force required to overcome wind resistance is proportional to the projected frontal area of the car and to the square of the velocity of the car relative to the air.

$$F = CAV^2$$

where A = area in sq. ft., C constant of proportionality, F = force in lb. and V = velocity in miles per hr.

The constant of proportionality C varies with the type of body and no reliable information seems to be available on the effect of changes in body shape on this figure. Values of C vary from 0.0030 to 0.0042 according to various authorities. The measurement of the projected frontal area of 17 different representative makes of car gave an average value of 26 sq. ft., the minimum being 24 and the maximum 30 sq. ft.

The thrust or tractive force required to overcome the road resistance to rolling of rubber-tired vehicles is nearly independent of speed (see Table 1) and depends on (*a*) the weight of the vehicle, (*b*) the character of the road surface, (*c*) the construction of the tires, (*d*) the inflation pressure of pneumatic tires and (*e*) on the type of wheel bearings. The rolling resistance of rubber-tired vehicles over different types and conditions of road surface varies widely. Values of this resistance according to various authorities run from 9 to 19 lb. per 1000 lb. of car weight on hard smooth concrete asphalt, wood or macadam, and may reach 150 to 250 lb. in sand. There is little information available as to the effect of tire construction on rolling resistance. For a given car weight the variation in road surface resistance is by far the most important item to consider in the reduction of rolling resistances.

*Associate physicist at the Bureau of Standards, Washington, D. C. Condensed from a paper presented at the Semi-Annual Meeting of the Society of Automotive Engineers.

The tractive force required to give a linear acceleration to the mass of the car and an angular acceleration to the wheels is directly proportional to the weight of the car and the weight and moment of inertia of the wheels. The force required to accelerate the wheels is about 2 to 4 per cent of the total tractive force and can be neglected.

TABLE 1—RESISTANCE TO ROLLING OF PNEUMATIC-TIRED VEHICLES AT VARIOUS SPEEDS

Wheel Resistance per 1000 Lb. Car Weight Lb.

Speed, M.P.H.	Front Total	Front Tires	Front Windage	Rear, Total	Total for Car
		30-Hp. Renault			
6.2	5.4	4.5	0.9	...	...
12.4	5.4	4.5	0.9	17.9	23.3
18.7	5.7	4.5	1.2	16.7	22.4
24.9	6.1	4.5	1.6	14.3	20.4
31.1	6.3	4.5	1.8	12.9	19.2
37.3	6.8	4.6	2.2	14.5	21.3
43.6	7.4	4.6	2.8	17.1	24.5
		40-Hp. Daimler			
6.2	6.4	5.6	0.8	...	...
12.4	6.4	5.6	0.8	...	...
18.7	7.0	5.9	1.1	16.6	23.6
24.9	7.3	5.7	1.6	17.3	24.6
31.1	7.7	5.8	1.9	17.4	25.1
37.3	7.8	5.4	2.4	18.0	25.8
43.6	8.6	5.8	2.8	18.9	27.5
49.7	9.0	5.8	3.2	18.3	27.3
		Mercedes Electric			
6.2	7.4	..	..	14.5	21.9
12.4	7.9	..	..	14.7	22.6
18.7	8.4	..	..	15.8	24.2
24.9	8.9	..	..	17.9	26.8
31.1	9.2	..	..	21.5	30.7
		45-Hp. Bussing Motor Truck			
6.2	3.8	..	..	13.7	17.5
9.3	4.8	..	..	13.3	18.1
12.4	5.3	..	..	13.7	19.0
15.5	5.9	..	..	14.4	20.8
		100-Hp. Benz Racing Car			
31.1	7.1	..	..	24.0	31.1
43.6	7.6	..	..	30.0	37.6
55.9	5.9	..	..	31.0	36.0
68.4	10.4	..	..	31.0	41.4
80.7	13.6	..	..	31.0	44.6
93.3	14.0	..	..	29.0	43.0
		75-Hp. Adler Racing Car			
24.9	10.7	..	..	34.7	45.4
37.3	10.7	..	..	35.6	46.3
49.7	10.7	..	..	38.7	49.4
62.1	12.8	..	..	36.3	49.1
74.7	10.7	..	..	36.5	47.2

Tires	Inflation-Pressure, Lb. per Sq. In.	Speed, M.P.H.	Rolling Resistance of Front Wheels per 1000 Lb. of Car Weight, Lb.
Car A—32x4 Silvertown Cord	60	20	10.4
		30	10.4
		40	12.3
Car B—32x4 Plain Fabric	55	21	21.1
		27	21.8
		34	20.5
		41	21.3
Car C—35x5	60	21	15.7
		27	16.0
		34	16.3
		41	16.1

An acceleration of from 3 to 4 ft. per sec. per sec. is usually demanded in good performance, but accelerations as high as 5 and 6 ft. per sec. per sec. are very uncomfortable for passengers. The tractive force required per 1000 lb. of car weight for several rates of acceleration, including an additional force of 3 per cent for wheel accelerations, is given in Table 2.

TABLE 2—TRACTIVE FORCE REQUIRED FOR ACCELERATION

Acceleration, ft. per sec. per sec.	Tractive Force, per 1000 Lb. of Car-Weight, lb.*
0.5	16
1.0	32
1.5	48
2.0	64
2.5	80
3.0	96
3.5	112
4.0	124

*An additional 3 per cent is assumed for wheel acceleration.

The tractive effort required to overcome grades is equal to the product of the car weight, gravity acceleration and the sine of the angle of grade. For grades less than 14 per cent the per cent grade can be used in place of the sine of the angle with an inaccuracy of only 1 per cent. In cities the grades are kept below 10 per cent unless extraordinary conditions must be met. Tractive force per 1000 lb. of car weight for grades up to 14 per cent is given in Table 3.

TABLE 3—TRACTIVE FORCE REQUIRED TO OVERCOME GRADES

Grade, per cent	Tractive Force per 1000 Lb. of Car-Weight, lb.
1	10.0
2	20.0
3	30.0
4	40.0
5	50.0
6	59.9
7	69.8
8	79.7
9	89.7
10	99.6
11	109.4
12	119.3
13	128.5
14	138.6
15	148.0

The power or tractive effort required for acceleration and hill-climbing are performance requirements independent of the road surface and wind-resistance. They can be considered as one power-demand interchangeable in application as both are essential accelerations and seldom demanded at the same time. The only point of difference lies in the fact that hill-climbing does not necessarily involve wheel acceleration. This item is small and for the purposes of this illustration can be neglected.

To illustrate the relation existing between the three major power demands, wind resistance, road rolling resistance and acceleration, the characteristics of the average 1921 American car have been computed and the results are given in Table 4. It will be noticed that the tractive force available to overcome wind and road resistance and produce acceleration varies less than 4 per cent over the driving range of speeds from 10 to 35 m.p.h.; that the tractive force available to overcome rolling resistance and produce acceleration varies more than 25 per cent over the same range of speeds; and further that grades of from 9 to 4.5 per cent can be negotiated at speeds from 20 to 35 m.p.h., dependent on the road resistance to rolling. If the car characteristics chosen are representative of the present American product meeting the demands of the driving public, the performance demands of the public are in no way unreasonable with our roads as they are to-day.

Fuel conservation from the point of view of power demands of the car would be greatly furthered by a sound, far-sighted good roads program. The power demands to overcome grade and high average rolling resistance would not only be reduced but, more important still, car weights could be reduced without any sacrifice of constructional sturdiness. Any reduction in car weight means an almost proportionate decrease in the power required and therefore in the fuel to supply the power.

The processes involved in the production of power at the rear wheel rims from fuel supplied the engine may be divided into four main groups; (*a*) the preparation of an explosive mixture of fuel and air, (*b*) the transformation of the chemical energy latent in the explosive mixture into gas pressure, (*c*) the transformation of the gas pressure produced into crankshaft torque and (*d*) the transformation of crankshaft torque to thrust at the road surface.

The preparation of an explosive mixture of air and fuel involves three major factors; (*a*) proportioning the proper weight of air to a given quantity of fuel, (*b*) mixing the fuel and air as intimately as possible, and (*c*) controlling the weight of combustible mixture used in a unit of time.

In proportioning the air and fuel it is important to know the limiting values of the ratios of weight of air to weight of fuel which will explode under cylinder conditions. There are some data available on this subject but they are inadequate.

TABLE 5—EXPLOSIVE RANGE OF MIXTURES OF GASOLINE VAPOR AND AIR

Initial Temperature, deg. fahr.	Lean Explosive Limit
73	23 to 25
392	25 to 27
572	30 to 31
752	31 to 37

TABLE 4—ROAD CHARACTERISTICS OF THE AVERAGE 1921 AMERICAN CAR

Car Speed, M.P.H.	Available Engine Effort[1] per 1000 Lb. of Car-Weight, Lb.	Air-Resistance[2] per 1000 Lb. of Car-Weight, Lb.	Thrust Available[3] for Road-Resistance and Acceleration per 1000 Lb. of Car-Weight, Lb.	Thrust Available for Acceleration with Road-Resistances per 1000 Lb. of Car-Weight of		
				10 Lb.	20 Lb.	30 Lb.
15	107.3	4.9	102.4	92	83	70
16	105.2	1.8	103.4	93	83	73
20	107.6	8.8	98.8	89	79	69
25	106.0	13.4	92.6	83	73	63
30	103.9	19.2	84.7	75	65	55
35	101.2	26.0	75.2	65	55	45
40	98.0	34.1	64.9	55	45	35
45	94.1	43.4	50.7	41	31	21
50	86.8	53.8	33.0	22	12	2

[1]The data used in this computation were a maximum of 33 hp. at 2270 r.p.m.; a transmission and rear-axle efficiency of 85 per cent; the torque-speed curve was proportional to that given in a paper by A. L. Nelson, published in AUTOMOTIVE INDUSTRIES for Jan. 27, 1921; 32-in. tires; a rear-axle ratio of 4.42 to 1; a car-weight of 3096 lb. without any load and a passenger weight of 750 lb.

[2]Projected frontal area of car 26 sq. ft. The division of the total car resistance by the car-weight does not mean that the air-resistance varies with the car-weight. It was done for ease of comparison with the available thrust and road-resistance for 1000 lb. of car-weight.

[3]Ten pounds tractive force per 1000 lb. of car-weight is nearly equivalent to the tractive force required to move 1000 lb. up a 1 per cent grade.

In an engine cylinder the explosive charge is diluted by the products of combustion from the previous working stroke. At the end of the exhaust stroke there remains in the clearance volume an almost constant weight of exhaust gas irrespective of the engine speed and load. As the weight of unburned charge taken in decreases with any decrease in the load, the percentage of exhaust gas dilution increases. The effect of inert gas dilution on explosive range of gasoline-air mixtures has not been extensively investigated. Fig. 1 is drawn from admittedly meager data on this subject. It indicates that the less the stratification or the greater the turbulence of the cylinder contents, the richer the leanest mixture which will fire regularly must be. From the viewpoint of fuel economy, the lean explosive limit of the mixture of air, fuel and exhaust gases in the cylinder at ignition sets a maximum limit of leanness and, therefore, thermal efficiency unless charge "stratification" is resorted to.

Within the explosive proportion limits there are two mixture proportions which are interesting from the point of view of internal combustion engines and one from an academic viewpoint. These are (*a*) maximum economy mixtures, (*b*) maximum power mixtures and (*c*) chemically "correct" mixtures. Excellent experimental work has been done by several observers on maximum economy mixtures, and it is concluded that the mixture for maximum economy is the leanest mixture on which the engine will fire regularly, usually about 16 to 1. Mixture ratios for maximum power development have also been carefully studied, and found to be practically independent of speed and load and to vary from 11 to 1 to 13 to 1.

Effect of Mixture Proportions

If equal proportions of each of the 10 compounds of the paraffin series be mixed in a single fuel and chemically correct mixture ratio of the average would be incorrect for the lightest or heaviest component by only 1.2 per cent. Similarly such a mixture for the aromatics would be incorrect by 3.5 per cent, for the acetylenes 1.3 per cent and always correct for the olefines.

It will be noticed that the maximum economy mixtures are leaner and the maximum power mixtures are richer than the chemically correct mixtures. The presence of exhaust gases, the law of mass action and the limited time available for the completion of the reaction would explain why all three mixtures are not the same. At the present time our knowledge of the relations between these factors is insufficient. In a cylinder of fixed dimensions, as the oxygen occupies a greater volume than the fuel vapor it must be entirely consumed to obtain the maximum power. To accomplish this in the shortest possible time an excess of vapor must be present. In the same way when all the fuel is to be consumed as in the case of maximum economy mixtures, excess air must be present.

To indicate what the variation in the mixture ratio with changes in the speed and the load is with present carbureters, several makes of stock carbureters, representing at least 60 per cent of the total number of carbureters in use to-day, have been tested in the carbureter test plant at the Bureau of Standards. The results show that there is little agreement among carbureter manufacturers as to the variation of mixture ratio requirements with changing loads and speeds.

The average mixture ratio, computed from exhaust gas analysis, supplied the engines of 23 average cars tested under winter conditions by the Bureau of Mines,* varied from 12 to 13.5, corresponding more nearly to maximum power than maximum economy.

*See Gasoline Losses Due to Incomplete Combustion in Motor Vehicles, by A. C. Fieldner, A. A. Straub and G. W. Jones, published in *Journal of Industrial and Engineering Chemistry*, vol. 13, p. 51.

Mixing and Vaporization

Insuffcient fuel and air mixing is probably the source of the greatest fuel waste to-day. Poor distribution among cylinders and the need for over-rich mixtures when starting and accelerations are the result of insufficient mixing. Minute and thorough subdivision of the fuel is the solution of the mixing problem. The difficulties involved in attaining thorough mixing are realized when it is appreciated that (*a*) when liquid gasoline is injected into an airstream probably not more than a small percentage is ever vaporized before entering the engine cylinder except when the air in the manifold is heated; (*b*) a cube of liquid gasoline 0.1 in. on a side is all that is required to be mixed with a cube of air 2.1 in. on a side; (*c*) when the cube of gasoline is evaporated the vapor occupies a cube 0.6 in. on a side; and (*d*) from 0.1 to 1.0 sec. elapses from the time the liquid fuel leaves the carbureter jet until it is ignited within the cylinder. Subdivision of the fuel may be accomplished in two ways, (*a*) by vaporization or change in state, and (*b*) by minute subdivision of the liquid or atomization.

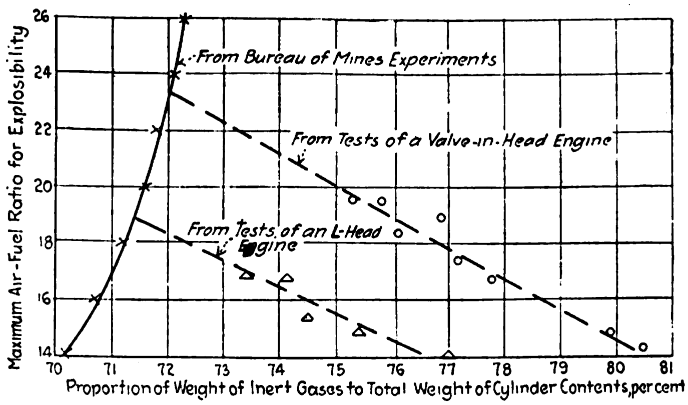


Fig. 1—Effect of an increase in the weight of the inlet gases on the maximum air-fuel ratio for explosibility.

Vaporization of the liquid fuel gives the most minute subdivision attainable. To vaporize the fuel a definite quantity of heat must be supplied per pound. The latent heat of vaporization and specific heats of the liquid for gasolines and some pure compounds found in liquid fuels are given in the series of articles by Ricardo published in recent issues of AUTOMOTIVE INDUSTRIES. Variation in the latent heat values are to be expected from the known variation in the composition of gasolines. Vaporized fuel occupies over 200 times the volume of the liquid fuel before vaporization, and in an explosive mixture the vapor volume represents from 1 to 2.5 per cent of the total volume of the charge.

Complete vaporization of the fuel would decrease the volume of air which could be admitted to a fixed cylinder; hence, the power of the engine by about 2 per cent. On the other hand, the cooling of the charge caused by such evaporation, if no heat were supplied the air from external sources, would contract the air by some 7 per cent, thus increasing the power output by this amount. Thus vaporization of the fuel causes a net increase in the power output, and the heating of the charge in the manifold, a decrease. The temperature required for complete vaporization is at least equal to the temperature at which the vapor pressure of the fuel equals its partial pressure in the explosive mixture. If this is more than about 20 deg. Fahr. above that of the entering air, a net loss of air volume will result.

Sufficiently fine atomization of the liquid fuel at the carbureter jet and subsequent vaporization within the cylinder during compression would accomplish the same

result as vaporization without the attendant loss of air volume and power output.

Charge Quantity Control

Three methods have been used to control the quantity of explosive charge used, namely, reducing (*a*) the manifold pressure but not the volume of the charge drawn from it which is the usual throttle control; (*b*) the effective time interval of inlet valve opening; but not the manifold pressure or what is known as variable inlet valve timing; and (*c*) the weight of the *combustible* charge but not the cylinder charge weight or the stratification and direct fuel injection method. In the first method the power required to pump the cylinder charge from the manifold to the exhaust pressure increases with a reduced load, thus reducing the economy with the load. At 20 per cent full load the loss in economy may amount to about 20 per cent. Exhaust gas dilution also increases with a reduction in the load and thus reduces the leanness of the mixtures which will explode. When variable inlet valve timing is used there is no increase in the "pumping loss" with a reduction in the load, and the exhaust gas dilution increases with a reduction in the load in the same manner as when charge throttling is used. However, mechanical complications are introduced. Results on a test of an engine using a late closing inlet valve show that at a little less than half load the fuel consumption was about 50 per cent less than that attained when using fixed valve timing and the usual throttle control. In the case where charge stratification is relied on entirely, "pumping loss" is entirely eliminated. As yet no commercial application of direct injection engines has been made to automobiles. Mr. Ricardo gives results from tests of an engine using stratified charge and fuel throttling for reduced loads. The results show a remarkably constant thermal efficiency of from 30 to 35 per cent from full load to about 0.15 load.

The chemical energy of the explosive mixture supplied the cylinder is transformed into gas pressure by (*a*) an increase in temperature of the gases within the cylinder resulting from heat added during combustion and (*b*) a difference in specific volume of the gases before and after combustion, due to a change in the number of molecules during combustion.

The voltage necessary to produce an ignition spark varies from about 2000 to 15,000 volts, increasing with increase in density of the charge and length of spark gap at constant temperatures of the electrodes. Recently it has been found that an increase in the temperature of the spark plug electrodes decreases materially the sparking voltage required. This decrease may amount to as much as 50 per cent. It has been shown that when a truly explosive charge surrounds the spark gap any spark passing the gap will ignite the charge. It has not been shown, however, that this is true if the explosive charge be near the limit of inflammability, from either incomplete vaporization or dilution. The results of the experiments on the explosive limits of mixtures indicate that the character of the spark discharge has a decided effect on ignition. The effect of spark characteristics on the ignition of poor mixtures needs further attention.

Mention should be made of "spontaneous" or "autoignition" temperatures. Spontaneous ignition temperature is usually thought of as the temperature at which a given mixture ignites without ignition being supplied at any point from an outside source. Spontaneous ignition may occur in an engine cylinder with certain fuels and compression ratios. When an engine is operating certain metal parts, such as spark splug electrodes and valves, or carbon deposits, remain at a higher temperature than the average temperature of the charge. If the temperature of any of these surfaces is sufficiently above the ignition point of the fuel so that it can supply enough heat to raise a portion of the charge to the spontaneous ignition temperature, ignition will take place even though the average temperature of the gas is below its spontaneous ignition temperature. The lower the ignition temperature of the gas, the smaller the rise in temperature necessary to be produced in this way. Hence, ignition of this sort will occur in the engine at average mixture temperatures lower than the spontaneous ignition temperatures of the fuel, but these average mixture temperatures will vary under the same cylinder conditions with different fuels in much the same manner as the true spontaneous ignition temperatures of the fuels. It has been shown that the spontaneous ignition temperature for hydrogen at least is materially raised by the dilution of the explosive mixture by an inert gas.

Assuming the usual pressure volume and temperature relations, the increase in the average gas temperature, and therefore the cylinder pressure, is limited by four factors, (*a*) the amount of heat liberated by the combustion of the fuel per unit volume of combustible mixture, allowing for heat absorbed in the dissociation of the products of the combustion, (*b*) the heat capacity of the gases contained in the cylinder at the end of the preceding exhaust stroke, (*c*) the rate of heat loss from the hot gases, and (*d*) the rate at which the mixture burns.

Heat of Combustion

The heats of combustion of nearly all of the constituents of gasoline have been measured. (Some values for these heats of combustion were given in the article by Ricardo printed in AUTOMOTIVE INDUSTRIES for April 14, 1921.)

The rate of heat loss from the gases during combustion to the cylinder walls is not known. It is probably very high but of short duration. Measurements of the amount of heat entering the jacket water are of little value for this purpose. There is very little reliable information on the rate at which energy is liberated from a combustible mixture. This rate is not necessarily that with which the flame passes through a mixture.

The number of factors believed to affect the rate of burning is large, probably because we know so little about it and cannot as yet separate the important from the unimportant factors. Some of these will be enumerated but not discussed because of lack of information. They are (*a*) temperature and pressure at ignition, (*b*) point of stroke at which ignition occurs, (*c*) number of points of ignition, (*d*) mixture ratio, (*e*) shape of combustion chamber, (*f*) fuel, (*g*) turbulence, (*h*) auto-ignition temperature of fuel and (*i*) detonation tendency.

The cylinder pressures after combustion will be increased by an amount proportional to the increase in specific volume of the gears. This increase in pressure due to the presence of a greater number of molecules increases with the molecular weight of the fuel.

Gas Pressure Transformation Loss

The transformation of gas pressures into crankshaft torque in a cylinder, reciprocating piston and crank mechanism is fundamentally an intermittent process. It is made continuous either by the use of a reservoir of energy such as a flywheel or by the multiplication of elements acting intermittently, that is, the addition of working cylinders. There are four sources of loss in this mechanism: (*a*) incomplete expansion, (*b*) heat transfer from the gases under pressure, (*c*) work of filling and exhausting the cylinder and (*d*) mechanical friction of the moving parts. The loss from incomplete expansion is

usually given in terms of air as a working fluid and is one minus the so-called air cycle efficiency. The usual computation of the air cycle efficiency involves the assumptions that (*a*) the last three sources of loss mentioned earlier in this paragraph are zero, (*b*) the combustion is instantaneous, (*c*) the specific heat at constant volume is independent of both temperature and pressure, (*d*) the specific volume of the working fluid after combustion is the same as it is before combustion, (*e*) the ratio of specific heats of the unburned charge is the same as that for the burned charge and both are independent of temperature and pressure and (*f*) there is no dissociation of the products of combustion. Any loss incurred through incomplete expansion is directly due to the imperfection of the mechanism, because it is impracticable to increase the expansion without an excessive increase in the weight and size of the engine. This loss, however, should not be altered by the losses or gains resulting from the last five assumptions just made, nor should it be altered by assuming constants for a working fluid other than that which it is actually possible to use. Losses or gains due to these assumptions should be charged to the fuel and working fluid used. To be sure, our present knowledge of the effect of these assumptions is incomplete, but it is sufficient to tell us that none of them is negligible. The relationships involved in each can and should be determined in order that the status of any process of combustion under pressure can be truly interpreted. Some recent preliminary determinations of the ratio of specific heats at atmospheric temperature and pressure of a particular sample of explosive mixture taken from an engine, gave a value of 1.36 and a particular sample of exhaust gas gave 1.34. Corrections for the higher temperatures of the exhaust gases would probably reduce the latter figure below 1.30.

The loss due to the heat transferred from the working fluid to the cylinder walls is directly chargeable to the type of mechanism used. No good values of this loss have been determined but they may range from 15 to 25 per cent of the total heat in the fuel. The work lost in filling and exhausting the cylinder includes (*a*) a direst loss, negative piston pressures as given by the lower loop of the indicator card, and (*b*) an indirect loss, the loss in the weight of the cylinder charge due to throttling, gas heating, etc., usually included under the term volumetric efficiency, which is one of the factors governing the size of the engine used to give a definite performance, or the maximum power output of a given engine. Any reduction in the maximum power with a constant mechanical loss involves a loss in brake efficiency, and if a larger engine is required to produce the same power, both the mechanical losses and the power required to carry the engine are increased as the size of the engine is increased. The losses due to negative piston pressures increase with reduction in load. Losses due to a reduction of the cylinder charge vary with valve timing, valve design and engine speed. They may vary from 50 to less than 5 per cent. The losses due to mechanical friction of the moving parts vary from 10 to 40 per cent with different engines and increase so materially with speed as to raise some doubt as to the possible fuel economy of small high speed engines.

Power Transmission Efficiency

The transformation of crankshaft torque into thrust at the rear wheels involves three factors; (*a*) transmission efficiency, (*b*) universal-joint efficiency, and (*c*) rear-end efficiency. All of these factors are affected to a marked degree by the kind of lubricant used and its method of application.

Considering the system as a unit the efficiencies may vary from 50 to 85 per cent according to Riedler. The value given by the Automobile Engineer's Handbook, 1920, London, is 85 per cent. Lewis P. Kalb considers 90 per cent to be a closer value. Universal joint efficiencies, according to C. W. Spicer, range from about 92 to nearly 100 per cent when transmitting power in excess of 5 hp. At lower powers the efficiency may drop as low as 80 per cent. These data include results with angles of from 2 to 12 deg. with forks in the same plane and at 90 deg. Mr. Spicer makes the following statement:

> Between 10 and 100 per cent of full load, the efficiency is above 99 per cent for all angles less than 7 deg.

The efficiency of the gearbox according to tests made by Worby Beaumont is from 70 to 90 per cent on direct drive. C. M. Allen finds that the efficiency of a worm gear axle varies from 70 to 85 per cent with power inputs of from 2 to 8 hp. reaching 90 per cent for higher inputs. With a bevel gear axle the efficiencies ranged from 95 to 98 per cent with inputs of from 2 to 8 hp. and were above 98 per cent for higher inputs.

From the point of view of the power requirements of cars it is believed that (*a*) the car performance demanded by the average driver is not unreasonable and (*b*) greater fuel economy could be attained by a sound far-sighted good roads program through possible reduction of car weight and also road resistance.

From the point of view of power development and its delivery to the road it is believed that (*a*) the greatest gain in fuel economy would result from an effort spent on the preparation of the unburned charge under all conditions of temperature, engine speed and load, first from a thorough mixing of the air and fuel and second from a correct variation of the fuel and air proportions; (*b*) the reduction of the mechanical friction losses, possibly through a change of engine speed and size, will increase the fuel economy at part throttle without any sacrifice in performance and (*c*) the closer study of the processes of combustion will make possible a rational basis for the statement of the ultimate engine efficiency and a clearer conception of the value of different fuels.

Some of the most valuable information presented in this paper was contained in six appendices written by other members of the Bureau of Standards staff. These will be published in condensed form in a later issue.

The New Federal Is Heavier

(*Continued from page* 1196)

with a ratio of 10¼ to 1 as standard. The standard tire equipment comprises 36 by 6 front, and 40 by 6 dual rear, solid tires. Forty by 12-in. giant pneumatics can be provided at extra price. The wheels are steel, with hollow cast spokes, but webbed internally for strength. Among the items of standard equipment are towing or pintle hooks at the front of the frame; a hub-odometer and Alemite greasing attachments on all bearings.

A LONDON-AMSTERDAM aerial service was started on April 14 by the Koninklijke Luchtvaart Maatschappij with a Fokker Type F-111 monoplane. The machine is fitted with 230-hp. Siddeley-Puma engines and has a cabin seating five passengers, of which three face forward and two aft. The driver's seat is at the side of the engine, much like in the latest type of London motor bus. The first regular trip started from London at 10:15 a. m. and ended at Amsterdam at 2 p. m. the same day. A quarter of an hour after the arrival of the first machine in Amsterdam the second machine left the latter city for Croydon, where it arrived at 6 p. m.

How to Lighten Front Axle Sections Without Decreasing Strength

Narrower outside draft angle is entirely practicable and permits better disposition of metal. In one case slight changes in section made possible a saving of over 6 lbs. per axle without material decrease in strength.

By Herbert S. Jandus

IN the past, the design of front axle sections was arrived at by the rule of "present practice." The usual procedure was to collect all possible data on current designs which had been in service for a period of time, make such changes as the record indicated, check up the section modulus and let it go at that.

Of course experience is fundamentally the biggest factor in successful design, but for economical reasons it is advisable to combine that experience with a reasonable amount of theoretical practice and check the results obtained so as to determine whether the section is the most suitable and economical one that could be devised.

Obviously the most economical section is that having the bulk of its area disposed at the greatest practicable distance from the neutral axis of the section. Structural rolled I-beam shapes represent, perhaps, the most economical sections in use to-day. The outside of their flanges being flat and without draft, and only a slight draft being necessary on the inside of the flanges, the resulting section is one in which the metal is advantageously placed for minimum area and maximum strength.

While it is possible and practicable to roll sections with thin webs and flat flanges, it is not practicable to forge them thus. On forgings draft is necessary both on the outside and the inside of the flanges, and the thickness of metal cannot be reduced beyond the point at which the metal will readily flow to the required depth in the die. It is, however, both possible and practicable to improve considerably on the present average design and for a given strength increase the "efficiency" as defined below from 5 to 10 per cent.

The usual draft angle for forged axle sections is 10 deg., this angle being advocated by the forge shops as best adapted to quantity production, as it obviates sticking in the dies due to the contraction of the forging in the die-block. Since the contraction of the forging in cooling is responsible for this difficulty, it is apparent that the inside faces of the flanges are the surfaces that tend to grip the die-block, while the outside faces tend to draw away from the die.

It seems, therefore, that a reduction of the draft angle on the outside of the flange would not only be practicable from the forging standpoint but would result in a more advantageous disposition of the metal of the section. Upon taking this matter up with the forge shops it was found that 7 deg. was a perfectly practicable draft angle for the outside of the flange and even 5 deg. could be used without difficulty.

Figs. 1, 2, and 3 show axle sections having outside draft angles of 10, 7 and 5 deg. respectively, while Fig. 4 represents an ideal condition with no outside draft. Taking Fig. 4 as an arbitrary standard for comparison and calling it 100 per cent, the "efficiencies" of Figs. 1, 2 and 3 are 93.4 per cent, 95.3 per cent and 96.8 per cent respectively, these "efficiency" values being based on the ratio of the radius of gyration to one-half the total depth of the section. The inside draft angle of the above sections is 10 deg. in all cases.

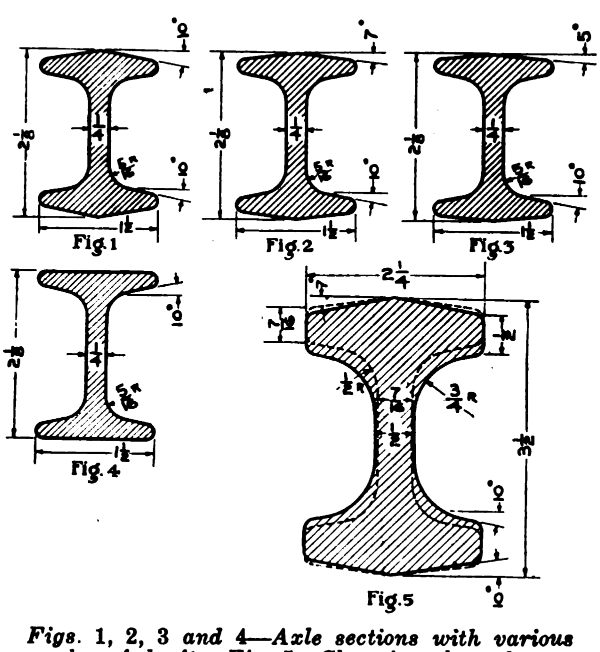
Since the strength of any section varies directly as the cube of its depth while the area varies directly as the first power of the depth, it is evident that the ratio of the moment of inertia to the area would not represent a constant ratio for different sizes and shapes of sections. In order to allow for this variation and express a true relation of strength to area which is independent of the size or shape of section under consideration, it is necessary to use a first power function of the moment of inertia. The radius of gyration fulfills this requirement as follows:

$$r \text{ (radius of gyration)} = \sqrt{\frac{I}{A}}$$

in which

I = moment of inertia,
A = area of section.

Now I is a function of the fourth degree while A is a function of the second degree. The radius of gyration, therefore, is a first power function and represents a distance from the neutral axis at which the total area of the section may be considered as concentrated. It follows that for sections of the same area regardless of shape, that one having the greatest radius of gyration has the greatest "efficiency," or to put the expression in another form, the more closely the radius of gyration approximates the distance of the outermost fiber from the neutral axis, the



Figs. 1, 2, 3 and 4—Axle sections with various angles of draft. Fig. 5—Changing the axle section shown in heavy lines to conform to dotted lines decreased axle weight 6¾ lb. without material decrease in strength

more "efficient" the section.

The ratio of the radius of gyration to one-half the depth of the section may be designated the "efficiency factor," and represented by the symbol e, thus:

$$e = \frac{r}{d}$$

The values of e for the different sections shown are as follows:

Fig. 1—10 degrees draft—$e = .700$
Fig. 2— 7 degrees draft—$e = .715$
Fig. 3— 5 degrees draft—$e = .726$
Fig. 4— 0 degrees draft—$e = .750$

In order to show a practical application of the above principles as applied to an actual axle section, attention is directed to Fig. 5. This section is one in actual use to-day and has a 10 deg. outside and inside flange draft. The properties of this section are as follows:

$I = 5.830$
$A = 4.350$ sq.in.
$r = 1.157$
$e = .661$

The "efficiency factor" value of .661 corresponds to an "efficiency" of 88.7 per cent based on the arbitrary standard section above referred to.

The dotted outlines in Fig. 5 indicate a substitute trial section having a 7 deg. outside draft and a flange and web thickness of 7/16 in. instead of ½ in. as in the original. The properties of this revised section are as follows:

$I = 5.760$
$A = 3.776$
$r = 1.234$
$e = .706$

This value of e corresponds to a relative "efficiency" of 94.75 per cent and represents a gain of 6 per cent. It should be noted that the above revised dimensions were held within the limits prescribed by the original section and this necessarily limits the possible increase in efficiency. An increase in the width of the flanges would, of course, place more metal away from the neutral axis with a corresponding gain in "efficiency."

In the particular case above cited, the axle bed is approximately 43 in. long from outside to outside of the spring pads. The saving in area is .574 sq. in. or, for the total length above named, 24.1 cu. in. At 0.28 lb. per cu. in. of steel, this corresponds to a saving in weight per axle bed of 6¾ lb., an item of no small importance when large production costs are considered.

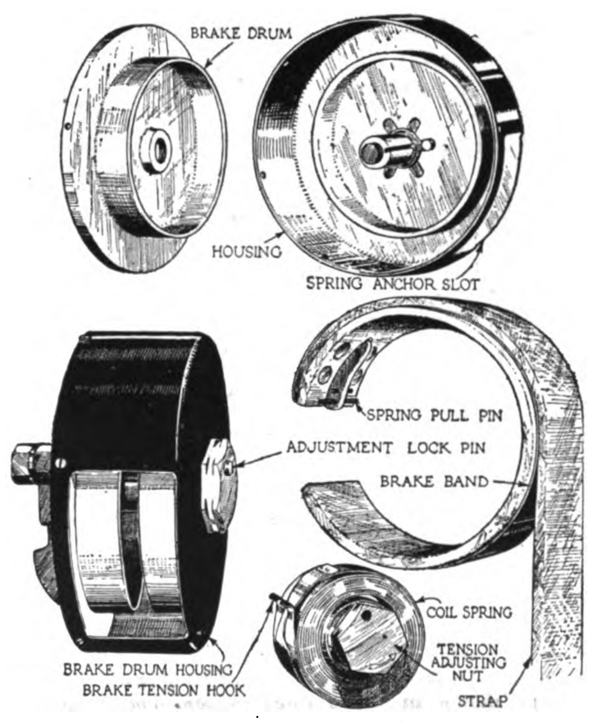
By the observance of the above principles and a little care in the design and proportions of an axle section it is possible to produce practical sections having a relative "efficiency" as high as 97.0 per cent.

A New Type of Shock Absorber

A NEW type of shock absorber in which the resistance to spring action at the normal position of the spring is very slight and which increases as the spring deflection increases, has been put out by the Watson Company. The new shock absorber known as the stabilator depends on friction for its operation, the friction being secured between a brake band and shoe, which is so mounted and designed as to afford varying degrees of friction, depending on the location of the spring.

The illustration herewith shows the parts of the shock absorber. The brake drum and housing are stationary. Surrounding the drum is a brake band, around part of the circumference of which is a pull strap which is connected with the axle members. The tension on the brake band is regulated by a coil spring which is held at its inner end by a slot in the hub of the shock absorber. At the outer end there is a hook which engages with the end of the brake shoe. As the spring takes up its normal position under the ordinary load of the car, the brake band is unwrapped from the shoe to such a position that very little friction occurs, because of the fact that there is only slight engagement between the brake band and shoe. This unwrapping is done against the tension of the spring. When an obstruction in the road is struck, causing the axle to lift off the ground, the spring tension causes the brake band to warp around the drum just as rapidly as the pull on the strap is released, due to the flexure of the spring. The friction between the band and drum prevents the rapid rebound which would ordinarily occur, due to the potential energy in the leaf spring. As a result, the spring is allowed to return slowly to normal position, the resistance to its action tapering off gradually, as the amount of contact between the brake band and drum decreases.

Due to the length of the coil spring, no flexure of the leaf spring is so rapid that the movement of the brake band cannot keep pace with it. The result is that the shock absorber is ready to function on the instant that the spring tends to return to normal. Due to the wrapping action of the brake band around the drum, which increases with the amount of spring flexure, the action of the shock absorber is practically proportional to the action of the leaf spring. The tension of the spring is adjustable by turning a nut on the outside of the housing, thus winding the spring more tightly, or releasing it to some extent. All of the parts are given a Parker rustproof finish and the brake band material is a special quality designed to endure the life of the car.



Parts of the Watson "stabilator"

Fifty million citizens are made happier, healthier and better by the automobile.

Can you imagine a city without automobiles? Think about it.

Material Flows Steadily With Efficient Intra-Plant Trucking

An analysis of trucking methods in any plant may reveal opportunity for reducing costs and eliminating interruptions from the flow of material. In the big factory discussed here, practically no hand trucking is necessary. Planning and supervision achieve the results described.

By Norman G. Shidle

TO operate a plant comprising nearly a million and a half square feet of active working space, and to move all the material required for this task without the use of a hand truck is a notable achievement in the design and operation of production equipment and methods. Theoretically this has been accomplished at the Studebaker light six factory; practically it has been so nearly accomplished as to render the achievement no less noteworthy.

The elimination of hand trucking means not only reduced labor costs,. but also the reduction of confusion to a minimum, the lessening of delays and interruptions, and a continuously high standard of efficiency in the handling of material. Two factors are responsible for the accomplishment of this end.

1. The layout of buildings and equipment, together with the installation of conveyors and other mechanical labor-saving equipment in every possible instance.
2. The effective routing and handling of power-trucking equipment.

The degree to which the first factor is developed will determine to a large extent the difficulty of handling the second. But even under the best conditions, a great deal of careful planning and intelligent administration is necessary to get the best results from a minimum of trucking equipment.

The completeness of the conveyor and labor saving equipment and the efficient way in which it has been placed and utilized at this plant cannot be adequately treated in a brief article. In making all the parts for and assembling a large number of cars each day, however, it is obvious that there must be a movement of material between buildings and sections that cannot be handled in any way except by trucking. And it is apparent that the continuous flow of material through the various departments is dependent fundamentally upon the efficiency of the trucking system. In fact, the very completeness of the conveyor equipment within the various departments renders more necessary than ever an efficient trucking system, since a break in the flow of material means that much expensive equipment is idle.

Moreover, the problem cannot be solved simply by a multiplicity of trucks of various kinds. The larger the number of trucks and operators or laborers, the greater the need for supervision and direction, the greater the chance for confusion and inaccuracies and the greater the investment in trucking labor and equipment. In other words, the only solution to the problem lies in applying to the matter of intra-plant transportation the same methods of careful analysis, intelligent routing, and close supervision that are exercised in connection with other phases of the production system.

There are more opportunities for waste in an inefficient trucking system than are generally realized. Some of these have been pointed out. A description of the trucking methods used at this Studebaker plant serve to show how trucking costs can be reduced through intel-

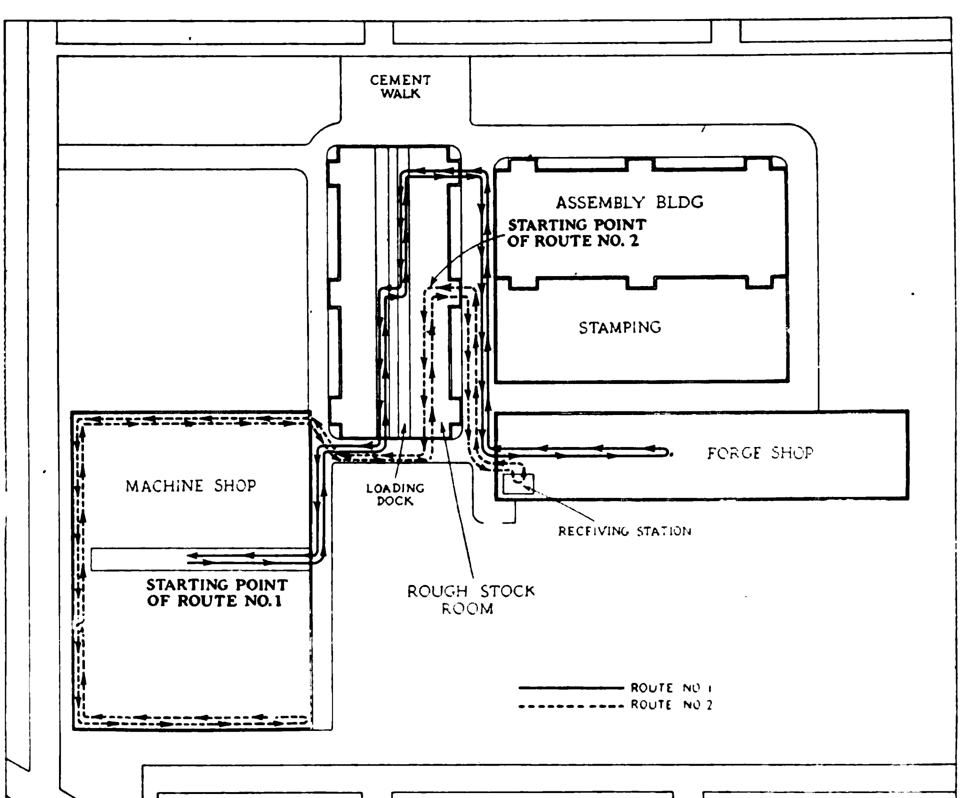


Fig. 1. Ground plan of Studebaker light six plant, showing relative position of various buildings, together with truck routes

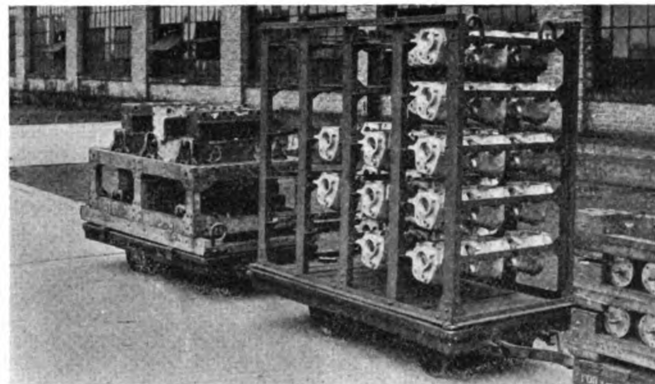


Fig. 2 (Above)—Type of special trucks used for carrying transmissions and cylinders
Fig. 3 (Below)—Type of special truck used for carrying crankshafts

ligent planning and routing, and how important is this phase of production activity.

All of the parts of this car are manufactured within the limits of the plant, with the exception of the foundry work, which is located at some distance away. The accompanying plan, Fig. 1, shows clearly the various units of manufacture and their relative location. On the basis of this plan it is possible to discuss definitely the various aspects of the trucking system. Samples of these special trucks are shown in Figs. 2 and 3. Fig. 2 shows the type of truck used for carrying transmissions and the type used for cylinders, while the crankshaft truck is shown in Fig. 3.

As stated previously, there is practically no hand trucking done in the plant. The equipment for moving material from one department to another consists of several Mercury electric industrial trucks and a large number of small box trucks and special built trucks or racks for specific parts. The box and special trucks are hauled in trains by the Mercurys, each Mercury having a special route and a definite task to perform.

Run Number 1 and Run Number 2 operate on a schedule as do railroad trains, making certain definite stops at definite times, and for a definite purpose. Run Number 1 begins at the machine shop inspection bay, as indicated on the drawing. It should be explained in passing that the finished production of the machine shop feeds directly into this inspection bay from both sides. Here the finished machined parts are inspected and loaded on the box and special trucks. The trucks are then made up in trains.

The Mercury comes to the inspection bay, hitches on to this train of finished parts and carries it out of the inspection bay along the route traced on the map to the shipping and receiving dock which bisects the sub-assembly building. Various platforms protruding from the different floors are adjacent to the various sub-assembly stock rooms, in which are stored the finished parts for sub-assemblies.

At this receiving dock the Mercury drops from its train the trucks filled with finished parts ready for the sub-assemblies. The big traveling crane then picks up the trucks and distributes them to the proper platforms.

From here the Mercury train goes on to the assembly building where it drops more trucks. The trucks contain certain parts which go directly from the machine shop to the final assembly line. From this point the train goes on to the forge shop where it makes its last stop. Here it drops the finished parts which are to be heat treated.

Having left the last of its full trucks, the Mercury picks up the empty forge shop trucks, and starts on the return trip, picking up empties at the various stopping points of the backward journey. The entire round-trip for this run comprises a distance of about .7 of a mile. The Mercury train runs on a thirty-minute schedule, leaving the machine shop inspection bay every thirty minutes throughout the day. A view of Run Number 1 Mercury train leaving the machine shop inspection bay is shown in Fig. 4.

The driver punches a time clock at the beginning of each trip, the first trip being at 7:15 a.m., according to the usual schedule. An examination of a number of time cards picked at random from this run indicate that it has proved possible to adhere to the schedule with surprising regularity. Everyone with any actual experience in attempting to regulate similar trucks, realizes the many petty delays and difficulties which tend to throw the schedule out.

A careful planning of the route, however, together with thorough instructions to the drivers concerning their duties and routine, has made it possible here to eliminate a large proportion of these inefficiencies. The trains are made up for the driver at each station, so that he has to leave the truck only to attach the train to the Mercury. As an indication of how well it has been possible to work out this system, the following times are given from a time card of the driver on this run. The card was chosen at random, only the times for the afternoon runs are given, but will be sufficient to illustrate the point:

P. M.: 0.18, 0.90, 1.40, 1.72, 2.20, 2.67, 3.17, 3.65, 4.13, 4.65.

Run Number 2 is the longest, requiring 50 minutes to complete a round trip. Not only is this run of considerable length, but it includes a number of stopping points.

The run begins in the rough stock room, where the Mercury starts out with a train of trucks loaded with rough stock destined for the forge shop. It carries this train to the forge shop, drops it, and brings back finished forgings to the rough stock room. It then takes a train of rough stock parts to the machine shop, by the route indicated on the drawing.

As it enters the machine shop at the end nearest the sub-assembly building, the Mercury drops off its train at an inspection desk, where all of the parts are counted. While this load of rough parts is being counted and inspected, the Mercury picks up the train which it brought on the previous trip and which has subsequently been counted. This it takes around the outside aisle of the machine shop, dropping off at each of the various departments, the rough parts which are to be machined there.

The machine shop is so arranged that with one or two exceptions, the first operation on every part is done on a machine adjacent to this outside aisle. Thus no hand trucking is necessary to bring the stock to the machine. The Mercury simply drops the truck load and the stock is practically in position for the operator to take the pieces and place them in the machine for the first operation.

When the Mercury has thus disposed of all of its train, it turns in its tracks, and picks up empties on the way back. It carries this load of empties back to the rough stock department and is ready to begin another round trip.

It will be noted, as indicated previously, that the machining operations are so arranged that the last operation on each piece feeds into the machine shop inspection bay, out of which the finished parts are carried by the Mercury on Run Number 1 as described. Thus with the first operation placed so as to receive the parts directly from the Mer-

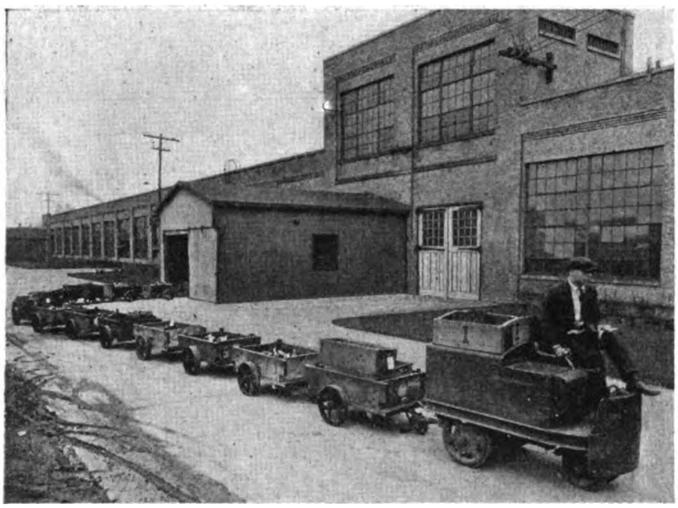


Fig. 4. Truck train leaving machine shop receiving bay on Run Number 1

cury on Run Number 2, no hand trucking or manual labor of that kind is necessary.

The driver on this Number 2 run also punches a time clock, 50 minutes being the time required for a round trip, as stated before. In this case, however, he punches a clock at several points on his journey. Fig. 5 shows the card used for this purpose, the points at which he checks himself, and the times of the trips for one morning.

Run Number 3 is not operated on a definite time schedule, but the driver has a set program which must be followed out. The program is such that it is impossible for him to have any idle time, though the run is such that a time schedule is not feasible.

This driver operates on the second, third, and fourth floors of the sub-assembly building and on the second floor of the final assembly building. The various sub-assemblies, including front and rear axle, transmission, wiring and small parts, motor, etc., are concentrated in the one building, which is connected by a bridge to the final assembly building.

As these various sub-assemblies are completed, they are placed upon specially constructed trucks. The Mercury on Run Number 3 then comes along and carries those truck loads to the final assembly stock room on the second floor of the final assembly building.

While the actual ground covered by this driver is not so great, his speed is diminished by the necessity for going up and down on the elevator. Upon him depends the supply of finished parts for the final assembly line, and he is kept continually making his regular round.

Run Number 4 covers the stamping building. The man on this route takes the finished stampings to the stamping inspection department, located in the same building, and plies between the stamping building and the final assembly building. His route consists of a large number of very short runs, so that a time schedule again is not feasible. It should be noted, however, that in this, as in every other case, the driver has a definite restricted territory and specific duties to be performed.

Even in the "best regulated families" every action or operation cannot always be fitted into a groove. So with this efficient trucking system. To care for the different trucking needs not covered by the specific routes, the Mercury on Run Number 4 performs miscellaneous service. This does not mean, however, that it runs aimlessly about the plant at the beck and call of everyone. It works only on written orders from the trucking foreman.

The Run Number 4 driver gives two hours each day to the oil stores department, two hours to the receiving dock, and about five hours to miscellaneous dies and haul needs.

The other regular run consists of carrying scrap to the salvage department from the various departments of the plant. One extra Mercury is held in reserve, to take the place of any other Mercury which may have to be laid up temporarily for repairs.

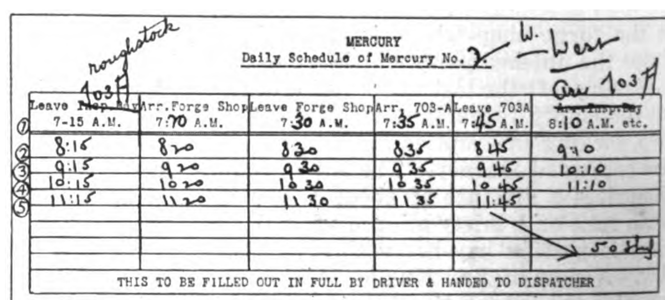
On Run Number 1 and Run Number 2 very long trains are usually carried, averaging between 20 to 35 trucks. The length of the trains is limited rather by the possibilities of speed, and safe and efficient handling than by the ability of the Mercurys to pull the loads. On Run Number 3, for instance, long trains of this kind cannot be pulled because of the necessity of using the elevators.

By these systematic methods of truck operation the material is handled almost twice as rapidly and efficiently as before the methods were installed. The transportation foreman has a definite check on every train, knows approximately where it should be at any given time, and is able to check up very closely on any loitering or inefficiency on the part of the drivers.

At one time helpers were sent along with the driver of each Mercury, but experience has shown that far better results are obtained through the present method. The truck trains are made ready for the Mercurys, so that the driver does not need a helper. It is found that there is less loitering, horse-play, etc., under this system, while less time is actually spent in preparing the trains and getting them under way.

Before the present system was installed, there was considerable delay in the distribution of material, although three more men were engaged in the work of taking it about. Material is reaching its destination on time, and the flow of work through the plant is thereby accelerated materially.

Even under a system of close supervision, however, a good deal depends upon the men who are actually driving the Mercurys, according to the transportation foreman. Where the driver is intelligent as well as interested in his job, he can facilitate the movement of material to a great extent; he can readily meet the small difficulties which must constantly arise in any such job; and he can act effectively without having to delay proceedings for minor instructions. Although the pay for the Mercury drivers is not high, the job offers certain opportunities which appeal to some wide-awake young fellows. It takes them around to the different departments of the plant and allows them



roughstock 703A

MERCURY
Daily Schedule of Mercury No. 7 W. Werr

Arr 703A

	Leave ~~Insp. Bay~~ 703A 7-15 A.M.	Arr. Forge Shop 7:20 A.M.	Leave Forge Shop 7:30 A.M.	Arr. 703-A 7:35 A.M.	Leave 703A 7:45 A.M.	~~Arr. Insp. Bay~~ 8:10 A.M. etc.
2	8:15	820	830	835	845	910
3	9:15	920	930	935	945	10:10
4	10:15	1020	1030	1035	1045	11:10
5	11:15	1120	1130	1135	11:45	
						50 Bldg

THIS TO BE FILLED OUT IN FULL BY DRIVER & HANDED TO DISPATCHER

Fig. 5. Sample card and time schedule used for Run Number 2

to learn a great deal about the general manufacturing processes, if they have a desire to learn. It enables them to see and understand a large number of jobs, and perhaps to choose some better job or trade into which they would like to go at a later time.

The results achieved by a close analysis of the intraplant trucking problem at Studebaker indicates that money can be saved and production speeded up at the same time through a careful study and operation of this phase of material distribution. It is a factor of the production problem that has not been studied as closely as some others and in many plants offers opportunities for improvement.

Economical Forming of Storage Batteries

Installation of boosters at the Prest-O-Lite plant permits batteries which are undergoing forming operations to be discharged back into the line thus saving much energy and reducing cost of manufacture.

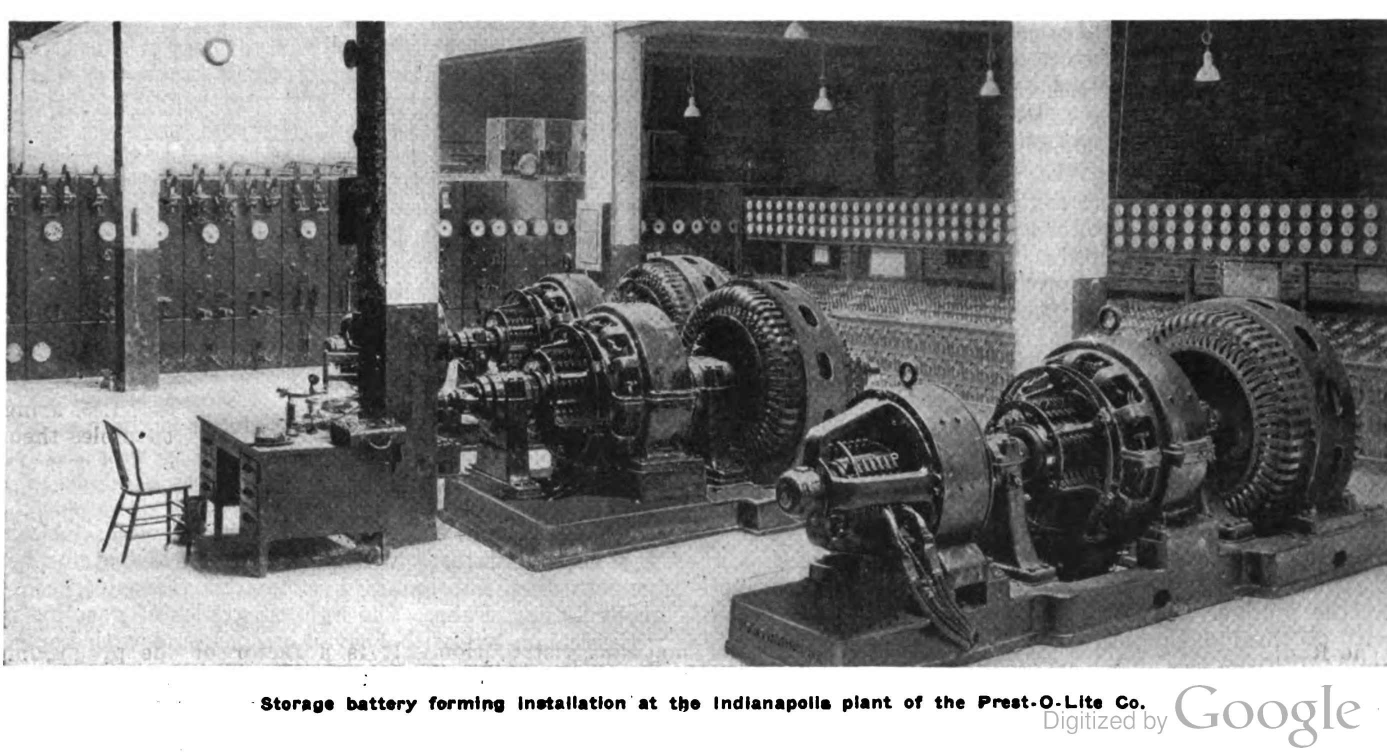
STORAGE batteries, before they are ready to leave the factory, are subjected to a number of long charges and discharges in order to properly form the plates, after which they are given a final charge. This requires a considerable amount of energy and usually forms an important item in the cost of manufacture of the batteries.

At the Indianapolis plant of the Prest-O-Lite Co. this energy is furnished through synchronous motor generator sets converting the energy from 4100-volt 3-phase alternating current to 250-volt direct current. In the photograph are shown two 625-hp. and 450-hp. machines. An 875-hp. machine will be installed shortly. The feature of this equipment is the use of three units for each machine, the third unit being used as a booster to allow the storage batteries to be discharged directly back into line.

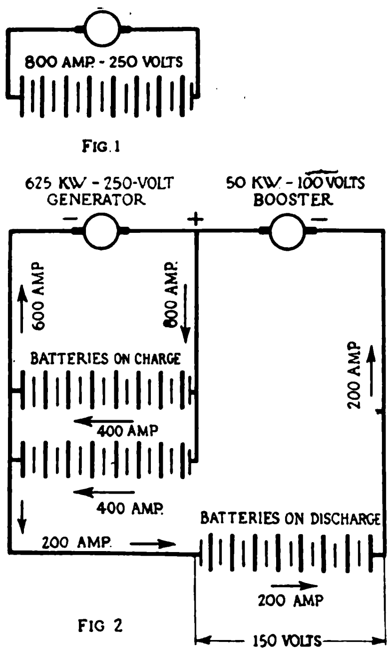
The method of accomplishing this is shown in the accompanying diagram of connections, and can be understood by an explanation of operating conditions. For charging, batteries are connected across the 250-volt generator in the regular manner, the generator (Fig. 1) delivering 800 amp. for charging various batteries, each having a suitable charging rheostat connected in series therewith. If several other batteries are connected to the discharge circuit, the conditions shown in Fig. 2 exist. These batteries are connected in series with a booster which composes the third unit of the converting apparatus, it being a 100-volt direct-current machine. Assuming that the batteries on discharge deliver 200 ampères through rheostat to the negative terminal of the booster and the voltage is thereby raised 100 volts, the batteries on discharge will develop approximately 150 volts, which with the 100 volts developed by the booster, causes the discharge circuit to pump 200 amp. into the 250-volt bus. Therefore, with a current of 800 amp. flowing through the batteries on charge, only 600 amp. is delivered by the main generator because the discharge current is delivering 200 amp. to the charging circuit.

The main object of this booster is to increase the capacity of the charging equipment. That is—with a standard motor-generator set, the number of batteries which could be charged at one time would be limited to the capacity of the motor-generator set. With the addition of the boosting generator on the same shaft the effect is obtained of increased generator capacity. For instance, in Fig. 1 the 250-volt generator is delivering 800 amp. for charging or is producing 200 kw. Now, if a 200-amp. 150-volt battery is placed on discharge, 30 kw. are available. In this case, the generator will be required to deliver only 600 amp. or 150 kw. However, to raise the voltage of the discharging circuit to 250, 200 amp. at 100 volts must be produced at the booster machine. This amounts to 20 kw. Therefore the same number of batteries are charged with only 170 kw. being taken from the main source of supply neglecting the losses in the machines.

In this plant, the facilities for charging the batteries are comprehensive in principle but simple in operation. Each battery circuit is controlled through bench board panels equipped with knife switches, rheostat handles



Storage battery forming installation at the Indianapolis plant of the Prest-O-Lite Co.



Figs. 1 and 2—Diagram of connections of battery forming plant

and ammeters. On one side of the room there are 288 of these circuits and on the other side there are 180 circuits. Two operators can easily handle all of these circuits and thereby charge and discharge a great number of batteries at the same time. One of the interesting features of this charging equipment is the method of mounting the grid rheostats. On the side shown in the photographs, these rheostats are mounted nine in a row directly behind and on a level with the board. On the other side, however, there was not enough space for this kind of mounting so that some of the resistance had to be mounted above the top panel. This type of mounting precludes accessibility but as in two years of operation there has been no need of repairs on the 288 circuits, such facilities are thought unnecessary.

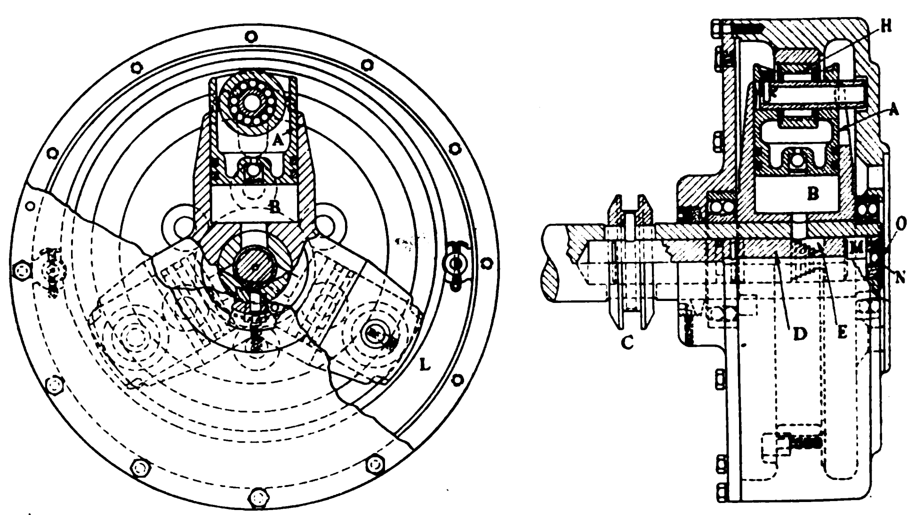
At the end of the room is the switchboard controlling the motor-generator sets. The 4100-volt energy enters through an oil switch and then goes to the main bus. The motors of the machines are connected directly to this bus through separate oil switches. No starting apparatus is necessary because the motors are designed to start as induction machines.

On this switchboard are also contained the panels controlling the power circuits for the rest of the plant.

A Hydraulic Type of Clutch

A CLUTCH which is claimed to afford the desirable feature of easy engagement and positive driving lock has been developed. The feature of this clutch is that it can be engaged with any degree of slippage so that the power of the engine can be developed as desired and yet smoothly and evenly transmitted to the rear wheels at extremely low vehicle speeds. When disengaged the clutch functions in reality as hydraulic transmission.

The clutch is built inside the flywheel in the usual way and is inclosed. It runs in a bath of oil. In the sectional illustration the pistons are shown at A. Oil is imprisoned above these pistons in the cylinders B and can be by-passed from one chamber to another above the pistons by moving plunger D to open the by-pass shown at E. The three pistons A ride on roller bearings H against the eccentric ring L, which is ½ in. off center, thus allowing the pistons to make a 1-in. stroke. When the clutch is released the continuous by-passing of oil from the three chambers B through E maintains a constant equalization of pressure above these pistons so that the roller bearings are in idling action against eccentric ring L, and the pistons are in constant pumping action.



The Hubbard Oil Clutch.

When the clutch is engaged plunger D moves forward to close by-pass E, thus locking the pistons A against the eccentric ring L. This locking action results from closing the by-pass from oil-filled chamber B, the oil remaining under each piston. It is impossible to drop the clutch into sudden engagement, for at the end of the plunger D is a space M which acts as a dash-pot. As the plunger D is pulled back, this space M is filled with oil through the ball valve N. If the foot is released suddenly from the clutch pedal the oil within this dash-pot M flows out gradually through the by-pass O, this causing smooth gradual engagement of the clutch.

It is evident with the hardened steel roller bearings which are rotating about the contact ring during slippage of the clutch that there are no parts in the clutch which can be worn by slippage and consequently the driver is free to slip the clutch as much and as often as he pleases, thereby giving him additional traffic control without in any way damaging the clutch.

The pressure required to release the clutch is equal to the tension of a spring only strong enough to hold the weight of the clutch pedal. The clutch is the product of the Hubbard Clutch Co.

BENZOL and alcohol are readily miscible. Alcohol-benzol mixtures will not freeze at low atmospheric temperatures, but unmixed commercial benzol freezes at about 23 deg. Fahr. The lightest grades of gasoline mix with alcohol, but with heavier grades, and with kerosene separation occurs. Separation is prevented by addition of a mutually miscible solvent such as benzol.

Human Study a Necessary Factor in Automotive Sales

Now that it is necessary to discover merchandising in the automotive field, the question is uppermost as to the proper place to look. Most searchers have turned to statistical tables. Here is a suggestion for another field.

By Harry Tipper*

I WAS in Detroit last week visiting with some of the people who are at the center of the automotive manufacturing, attempting to discover what the conditions were from the production standpoint. They are better than we could expect in view of conditions.

The manufacturers are moving forward in production further than we had any idea of at the beginning of the year, and those manufacturers who have maintained their product on a basis of stability and their organizations on a basis of fair efficiency are moving ahead a little faster than the average. The orders up to June show a very surprising volume. In the replacement business the cars and trucks that are in use are apparently beginning to absorb their usual quantity of replacement materials. Stocks in the case of jobbers are beginning to move once more and they expect to keep them to a normal basis during the rest of the season. So the outlook is better. We had a rather severe shock but the possibilities are that we shall have sufficient business to take care of on the basis of present industrial conditions.

We have to discover merchandising in the automotive field now. We have not had to do it heretofore. The entry of a new convenience of that kind into the world's possibilities required no particular merchandising. It required only more or less effective production in order to bring it into use. At no time have conveniences of communication or transportation required very much merchandising to sell them; they have been seized upon, always, with avidity by the world's population because progress depends entirely on communication and the ease of transportation itself. The automobile offered a flexible unit of transportation, under the control of the individual, and this opened up an entirely new field of social and industrial possibilities to the individual and the community. It was seized upon just as fast as we could turn it out—people desired to have it and we have not yet fulfilled the desires.

The future of the business depends on our intelligence in knowing the conditions and not on any supposed saturation point or limiting point in the possibilities of use. As a matter of fact, we are entirely too prone to view industry from a static standpoint, as though we could take a stationary and fixed view of it. We talk about economic conditions of the country as being against the possibility of consuming more or less of this or that material, but we forget that the economic conditions of the country depend upon our productivity, on the increase of our population, the growth of our wealth and a number of factors that are not stationary in themselves but are constantly moving. Any view we take of industry must agree with the dynamic character of the industry itself. It is always moving and the automobile business has not moved in the volume that it must approach.

It might be worth while to spend just a minute on that point because the thing has grown so fast that we are a little doubtful if there is not some magician's trick in it that will leave us in the lurch later on.

In the passenger car business, we have established so far that a car on the present basis of production and efficiency will last a little more than five years and on that basis we shall have replacement requirements, at the end of five years, of about 1,700,000 automobiles merely to keep the present number going. We have exported a few cars in a single year abroad, but we have a market there that we have not yet touched. We must supply cars to the great foreign countries of the world, because there is no competing country manufacturing on a mass production basis in automobiles. For medium low-priced cars and even high-priced cars there is no corresponding value in the largely hand-work or individual production of the other manufacturing countries. There is no possibility of getting the volume out of those countries.

We talk as though mass production could be gained in a few months by putting a little machinery in the plant, but it has taken the automobile business ten or fifteen years to standardize for mass production. They have not begun to standardize the work in European countries. They have ten or fifteen years of standardization work before them. Organization cannot be planned in a few months unless the elements have been established and these other countries have not established organization for mass production. The call came to us all last year in our office from people all over the world, importers, distributors, dealers in cars and trucks and tractors wanting to know about the American product, claiming it the only thing they could get in a reasonable time and in reasonable quantity. This offers a foreign market two or three times as large as at present and in itself is enough to make the outlook somewhat inspiring. The matter of the possibilities is not a discouraging one and the only discouragement we can get is from our lack of analysis of the situation. The reason for our lack of analysis is the fact that we have not been obliged to analyze heretofore. We have not had to know why automobiles were bought. We are ignorant of many of the merchandising necessities. We must now discover what these necessities are and I wanted to suggest a few things that enter into this.

First of all merchandising is a human matter. Our

*An address by the Business Manager of AUTOMOTIVE INDUSTRIES before the Advertising Club of the Brooklyn Chamber of Commerce.

market statistics are of no value unless they tell us a human story. After all, buying is done by human beings and because of human reactions. It is affected by tradition and association just as much as it is by economics. The desire to buy a single product may rest in the mind for years before the possibility of buying comes along, but when the money is there the spending of that money is influenced by the long controlled desire. We must understand the human reaction if we are to understand the market conditions.

What we are trying to do in merchandising is to produce a favorable reaction toward us on the part of every individual and have that result in agreement for the exchange of a product. We have been too much inclined to consider markets as based upon statistics and economics. As a matter of fact, the statistics and economics are the outcome of the previous condition of the market and all they can do is to give us a general idea of the flow and ebb of human actions in connection with industry and merchandising.

We have not studied human reaction very far in the automotive business. Along in last August when the drop began to come, I was asked by some of the manufacturers what would be the probable return and I made the statement then **that the social buying of passenger cars would begin before the industrial buying of trucks —long before any business buying—and I based it upon the fact that the social buying would come first from those people who had had a long desire to own a car and found it impossible for one reason or another to do so.** Among the individuals in the population there is always money to be spent, even when money is scarce in the general sense.

I know in my own travels of certain general classes who had been out of the buying of cars all through the war but who had never lost the desire for a car, who were beginning to get in shape for the buying of cars. That is what happened. The volume of production in passenger cars to-day is much larger than the production of the truck, simply because the human reaction is different and the desire to buy on the part of the individual is more insistent than the necessity for buying on the part of business.

That is something we have not paid much attention to in the marketing of automobiles. Similarly we have not paid much attention to why the thing is bought. The sales reasons which you give for a car or any other product are frequently not the reasons why people buy at all. You have insisted on the technique as well as the details of the car to a degree which might have been all right in the beginning but is no longer necessary. You have neglected the insistence upon a lot of other details which are absolutely necessary for a favorable reaction on the part of many buyers.

I watched in the shows last year and this year and heard the conversation between the people who wanted to buy and the people who were selling. A lot of information was displayed on the part of customers about the technical details, but the reaction after they left the booth, the conversation among themselves, did not go much on the technical details. It went upon the conveniences of the car, of the shift lever, on the room in the front seats and the character of the upholstery, upon the feel of the tonneau seats and of the probability of its riding easily and matters of that kind connected with the immediate comfort of the passengers, but I did not notice the insistence on those points in the booths.

We do not study quite sufficiently people who buy. It is a curious thing. I was talking to Mr. Clark at lunch and he found it rather extraordinary, that in an investigation made not long ago not one of the owners approached knew what tires he had on the car previous to the last two that he bought, and a great many of them did not know what tires they had on the car at all. That seemed extraordinary and he felt there must be some mistake, but it was a very careful investigation. There are many reasons for that, but one of the important reasons is that the buyer does not buy tires for the reason that the manufacturer thinks he does. Many tires are bought because they are recommended by a neighbor or the dealer and many tires are bought because they justify themselves among the neighbors or to the dealers. Many buyers refuse to purchase tires because they think a great deal of luck enters into them. They find that they vary considerably in mileage and they think it is more luck than the manufacture when they get a good set.

I might run down a number of products and show you that the buyer of products reacts toward the product in an entirely different way from what we suppose.

We are too much engrossed by the technique of our business to know what the other fellow thinks about it and our sales approach and how merchandising arguments are affected by that fact.

Then we have been merchandising cars and trucks without having divided the buyers up into their ordinary groupings and know how they are affected in their purchasing by those groupings. It is interesting to me to know how many trucks are used in the different lines of industry, but I am sorry to say that I am unable to find from the truck manufacturers themselves any who knew which was the biggest market and the next, and the next, and the number of trucks that entered into each market. They are unable to divide their market up and consequently they do not know how to approach that market.

Then we have not determined how the division of the market affects the product itself; how much people are willing to spend and what they demand in the way of individual differences for the expenditure. There are a large number of small concerns building a few trucks a year. They are doing a successful business because they are building the bodies of the trucks to suit the individual requirements of the individual customer and building the service to suit the requirements of its customers. We have not measured how much the divisional groupings of the market require a change in the product to meet those conditions, because we have not studied the probable reactions of the buyer sufficiently.

Similarly, we have not measured the channels of distribution. I was mentioning again at luncheon to Mr. Clark the subject of branch houses for the tire people and I mentioned the fact that very few of the tire manufacturers know that the branch house came into the rubber business long before the tire was a real factor, it being the mechanical goods that they originally carried. Tires were simply added later on to those other lines.

We have not understood what are the normal channels and what are the abnormal channels of distribution. We think we can talk about eliminating the jobber and going to the dealer, eliminating the distributor and going to the jobber and going to the consumer as if it were a matter of decision. These lines of distribution have been worn deep by custom and tradition and habit of buying. We cannot simply break down those banks and put the stream in any other channel by a mere decision. We have not learned why certain lines of goods were

distributed in one way and why some others had found another channel.

Furthermore, in the automotive buying or merchandising we have not yet determined the relative importance of standardizing lines or of individualizing them. Every merchandising effort is an attempt to take your product out of competition and give it an individual character. You wish to take it out of the general acquaintance and put it into a personal friendship; that is, take it out of the competition or comparison and put it into an individual place for itself. So that every merchandising effort is to individualize the product. Time after time when the problem comes up to us in the shop, a manufacturer wants to duplicate what the other man is doing, he wants to make a package of about the same character, he wants to make a product of about the same character, and wants to go through the same methods of sale organization without determining the fact that he must attempt to individualize his work. That individualizing will rest upon certain points of difference.

Instead of attempting to differentiate himself from the others he attempts to classify himself with the others and makes it more difficult to overcome the sales resistance. We have not measured the value of standardized practice and the value of individual methods in merchandising. We have been largely impressed by the value of standardized practice in production and suppose that the same thing operated in sales.

Finally, we have had no basis for measuring the value of merchandising operations outside of the personal salesman. We know how to measure the personal salesman because we look at his order book and the credits at the end of the year. We know what he has done—what we have delivered—and we can measure his value upon that basis. In advertising—that is the mass salesman—sales promotion of various kinds, we have no means of measuring their value. We do not know how much our advertising has contributed to the sales; we do not know how much our sales promotion work has actually increased value, and we are frequently without any information which would indicate the extent of service we can allow and the character of that service. We have no basis of measurement of these points and, consequently, we are always experimenting, hoping to arrive at some groundwork, without any analysis being made and always arrive with no basis of measurement in the end.

So long as times are good we will accept the expense for advertising and the requirements of the service and O.K. them, without any understanding as to why they are in that shape, but when times are bad we ruthlessly cut them in two and cut off one-third without any understanding of the reasons. Why? There is value in all these methods, but most of the value lies in the human reaction and not in the statistical information. Out of a thousand things that pass your vision to-day, you record one on your consciousness. Out of a thousand things that are put before your eyes, pass your eyes, in advertising, out of a thousand sounds that hit your ears you select one or two to be remembered or recorded. It is automatic. How do we know that the advertisement we are putting out to-day will be one of the thousands that will be rejected or one of the few that is remembered? On what basis do we measure that?

We simply go blindly into the market and throw out our advertising matter just as if I threw it out of the window here, in the hope that people would pick it up as they go along the street. For this reason we waste a tremendous amount of effort in our sales promotion and sales work. We do not know why people act and, therefore, we cannot arrange our methods to agree with their reactions.

As a matter of observation and effect in advertising, in the mass sales work, people react to very few things. If you will think back and analyze yourself from day to day you know that there are very few things that interest you, very few; your business, certain portions of your business, not all of it in detail, your surroundings at home, certain things about it, certain things about your social life; there are very few that you examine in detail or are interested in. You probably look at half a dozen things and you are through. That is the extent of your examination and interest.

Now those interests govern your reactions very closely and if I wanted to have you react pleasantly and favorably to me I must know your interests and apply my own interests to those interests, and not only that, but also at the time you are interested in them.

There is no use for me to get you interested in the details of your business when you are wondering if you will make the put on the ninth green.

There is no use of me trying to get you interested in reference to details about church work when you are just stretching for the seventh inning.

The associations that you have are separated very carefully into compartments. The interests that you have are differentiated so that you will take up one interest where it belongs at the time that you are working on that.

If I want to advertise to you, impress you and get the recording of my impression on your consciousness, I must suit my interest to yours.

We do not do that very often. We have so large an amount of technique, without fundamentals, in our work that most of our work is scattered all along the surface, whether it touches our customers or not.

We presuppose that other people are interested in the things we are interested in. I am presupposing you are interested in this address—the chances are you are interested in a small part of it and probably will not remember more than one thing. You will forget all but a sentence or two. But personally I am apt to presuppose you are interested, because I am interested. All through life we are conducting our business on the presupposition that other people are interested in the things we are doing. We go ahead blithely telling about our production without knowing the other man's interest. Frankly, before we get very far in merchandising, we must be able to step outside our own interest and watch the people objectively so that we will not be submerged in our own technique when we approach the other fellow. Merchandising in the automotive field is no different from any other.

The merchandising outlook is good provided we have the intelligence to tell the people that we will meet their problem and can give them what they desire. They desire automobiles—they desire automobiles to run. They expect to have them continue to run and if we intelligently work out our problem I do not think we shall have any fear of the business.

A NEW rust-proofing process, which has been successfully used for bicycle parts, has been evolved in the research laboratory of Rudge-Whitworth, Ltd. This consists in boiling the articles to be treated in a solution of hydric-phosphate of iron which produces a dark gray finish practically immune from the attack of rust. It is said to be very much more rapid than Coslettizing and has no effect upon either the strength or temper.

What You May Expect From Foreign Advertising

Again it is said here that foreign advertising, and we might add merchandising, is not distinctly a different problem. Advertising and selling, like the people, are not vastly different because of the lines on maps.

By A. B. Cole*

FOREIGN advertising is an investment to insure sales, and when it ceases to be an asset it is time for the liability to be wiped out. Many concerns have treated their foreign advertising as a side issue, and carry it as a heavy liability, owing to the lack of proper co-ordinated sales and advertising effort behind a set campaign or advertising program. It is natural to expect just as much from your advertising appropriation as from any plant investment. A certain investment in advertising can be made to produce returns that will parallel, if not exceed, any other investment of equal amount.

It can be made to—

Add to sales directly,
Add to sales indirectly,
Create good will for manufacturer and commodity,
Change living conditions,
Analyze markets,
Discover demands for products when none appears to exist,
Open channels of distribution,
Successfully counteract resistances both active and passive.

It is gratifying to observe that there are many large organizations using foreign advertising to search out the markets of the world. However, we need a more universal revision of our sales organizations on the part of the medium sized and small manufacturers in this country. Many of these companies are doing 25-, 50-, 100-, and in some instances a few hundred thousand dollars' worth of business a year, and were the executives of many of these companies to take a greater interest in their foreign trade and rightly use the experience in what has made them what they are to-day, co-operate with their sales and advertising departments, their foreign trade would increase rapidly. This rightly applied will place their export trade on a permanent basis. Some small manufacturers are doing a large foreign business, and in every instance it will be found that they are conducting their foreign trade along fairly practical lines—in other words they are thinking internationally.

Then, again, there are larger interests that should be selling their products in every country on the earth, who are practically doing nothing. Their foreign sales promotion and advertising methods are haphazard, they are not concentrating on this commerce of the highest order. On account of the wonderful experience some companies have passed through during the last few years, they have overlooked the greater factor that makes any industry worth while—that of business building for the future—that great insurance which not only sells service, but causes one to point to a particular concern as a great international institution.

A plan is essential; know first what is desired to be accomplished; then as a general would deploy his armies, divine available forces to overcome obstacles. These forces must be used in their proper relation to each other, and, speaking of forces, international salesmanship in its broadest sense is meant.

Generally speaking, there are two kinds of selling: making use of existing markets, or being an opportunist; and making markets and using creative salesmanship.

ADVERTISING is nothing more than creative selling; and sales promotion in its final analysis consists of the use of three mediums:

Space—this includes from newspapers to motion pictures,
Direct-by-mail merchandising,
Salesman.

The foregoing media must be used; some or all, according to the necessity of the products or scope of the company.

After all, building up a foreign trade is nothing more than creative selling.

The foreign field is looked upon by many as a mystery. Certain localisms influence the judgment out of all proportion, owing to the lack of an international mind. Because toast has never been used as a food in Japan is no proof that a market cannot be built up for electric toaster stoves—educational work may be necessary first.

Advertising in its true sense can be used, and will produce a pre-determined result, provided proper analysis has been made of fields to be covered.

Like investing in anything, consideration must be given to the question, "Will the returns warrant the expense?" It is surprising what can be done with a limited appropriation—if care is taken to be sure every part is co-ordinated.

Human nature is very much the same the world over. Under the skin we are similar. There are certain appeals which apply to all of us and if these appeals ring with sincerity they are just as effective in Brazil as they are in China or the United States. Speaking of appeals, we mean those which affect the emotions—fear—comfort—gain—fight or pride.

Granted, the general physical conditions of a race must be considered. The so-called Latin does not like to be hurried, consequently "pep" copy lacking dignity would not pull as well as good descriptive sincerely logical copy with, perhaps, the pride appeal. Of course, the "copy" would depend upon the commodity and the locality.

*Director of Publicity, Westinghouse Electric International Co. Paper read at the Eighth National Foreign Trade Convention.

If we consider the underlying emotions common to all, the problem of foreign trade is not nearly so complicated in its fundamentals. True there is naturally, due to the wide field, a mass of detail, but this after all can be classified until it becomes mere routine.

If you have a product of merit, the thing to do is go out and sell it. First, find out how great a resistance you have, perhaps using advertising to determine this; marshaling the means available so that each and every one does its full complement of work, eliminating everything that does not help in the plan. If it does not help, it is a hindrance.

Creative salesmanship, energized by the master force visualization, sells the goods. This is true, but visions and products of the imagination, while wonderful are merely idle dreams until will power and hard work put foundations under them, after which they become realities. And the tool with which to build the foundation of any business, whether it be a corner grocery or international company, in "character" is advertising. However, it must be employed with as much care and common sense as in the buying and selling of any commodity. Return on investment in advertising should be in proportion.

Customs change overnight; they are after all only the surface. Some ten years ago all the Chinese wore queues. They were gone almost overnight. The advisability of catering to customs should not be discounted; they are an entering wedge.

We think of the customs of a country. We hear much of it these days, but in the essence what is selling anyway, but the changing of customs, the changing of another mind to conform with your ideas? It matters not whether the idea is good or bad.

Being specific, as to what may be expected from a foreign advertising appropriation, one of the primal results should be a world-wide or a country-wide acquaintance with the manufacturer, large or small, wherever advertised, namely, institutional advertising. Although many do not agree as to the value of institutional advertising, in many instances remarkable results will be obtained from a well planned campaign of this nature. Particularly gratifying results are obtainable from native mediums and with such a campaign, followed by a definite consumer campaign of commodities, a good foundation is laid.

It is highly essential that all advertising activities be properly supported by appropriate window trimmings where possible, and by well planned, and executed, dealer and consumer literature.

In export merchandising, the returns from this angle of advertising are in proportion to the aggressiveness with which the field organization as well as the home organization works. You can lead a horse to water, but you can't make him drink. So it is with the heavy machinery salesman. While he may occupy a prominent position in his own little sphere, his gross sales could be increased many times were he to analyze and dig deep into the desires and requirements of the merchants around him. Proper merchandising should always be sold with a resale feature in view. Thus, many times the aggregate of a salesman's efforts in selling merchandising lines is often greater than heavy machinery sales, on account of the duplicate mail or repeat order.

There is one advantage that we must remember in relation to our foreign competitor, and that is, the foreign house does not help his dealer move the goods off his shelves as we do. He does not feel obligated to furnish all the dealer helps that are prevalent among our up-to-the-minute advertising and sales organizations.

The Latin-American, particularly, is fast becoming cognizant of our business methods, and it is gratifying to say these methods are being favorably received. If you can show a merchant how by better merchandising he can turn over his investment several times per year instead of once, he is not going to forget the favor; and your advertising backed by such sales promotion efforts will more than pay out handsomely.

Above all, the foreign advertising appropriation should produce confidence in customers, stimulate consumer demand and keep goods sold.

As a facility for handling foreign advertising, the great importance of using a first class foreign advertising agency must not be overlooked. In this connection these points must be duly considered:

1. A foreign advertising agency is a prime essential for any extensive export operation. However, this agency must have had world-wide merchandising experience.

2. The advertising manager of a manufacturing company can obtain the best results if he does not overlook the fact that it is highly essential that the agency have his utmost co-operation in order that it may become conversant with the technicalities of his marketing problems. It stands to reason that an outside organization, being retained to assist any manufacturer, should not be expected to be any more than space brokers if the advertising manager does not assist the agency from all standpoints. If co-operation for the ultimate success of an undertaking is required, it is certainly the case in this particular relation.

3. In many instances, foreign advertising of a manufacturer depends on what the manufacturer is to-day. Too many manufacturers treat this subject as one totally foreign to their business, while in reality it is the domestic business told in another way.

4. Practical experience must be injected into foreign advertising.

The foreign agency should be treated in the same way as the domestic agency—such procedure is imperative.

The success of an advertising appropriation does not depend wholly upon media and copy, but the whole plan affects the net result.

American manufacturers must extend this world-wide facility—trade, and this can be obtained only through the co-operation of all the departments from the president to the various committees, down to the shipping clerk.

Who of you have considered these factors in order that proper analysis of your foreign advertising might be assured?

Here we have some of the factors that insure success in foreign advertising campaigns.

All efforts must be closely allied with the local advertising and trade paper compaigns in the particular countries through the assistance of the field organization.

The field organization must be completely sold as you proceed to unfold this profit-sharing method of advertising. Bear in mind that you must make advertising profit-sharing if you would succeed. It is hardly necessary to elaborate on the different forms of advertising, so similar in many cases as that adhered to in this country, such as local advertising in newspapers, trade papers, and bill posters, all of which you are familiar with; and then there is general advertising literature, specially printed matter designed for dealers' use; circular letter campaigns, and all these that I have enumerated, you realize the value of these campaigns. Why we do not adopt these methods more nearly universally in foreign trade is a great conundrum. The common procedure, if put into effect, should place us in a position that we are bound to succeed beyond all expectations.

Recording results from advertising is a real asset—

is a key to the future progress in the development of foreign trade. The most efficient way is the card system, with a practical follow-up plan. The inquiry that you received six months ago may have cost you 35 cents or $35. Perhaps it can be turned into a substantial order if you will review the hidden information within your business. I believe that the loss from neglect, improperly following up of prospects and proper handling of correspondence, has cost our country millions of dollars and much prestige in foreign trade. You may have had a remarkable sales organization; the new era of things will demand that you become as familiar with the facilities of your agents and branches in Hongkong, Buenos Aires, and Melbourne, as in the instance of your Chicago, Cleveland and New York organizations. An agent or a branch of a manufacturer abroad is an integral part of the successful advertising campaign.

The expression "foreign trade" covers a vast amount of territory and one is prone not to analyze intensively the changing conditions of the factors that make up the whole undertaking.

"What I May Expect from My Foreign Advertising Appropriation," gentlemen, is exactly the mission set forth by my company for establishing its policy.

1. We expect that the Westinghouse Electric International Company shall be known favorably throughout the world.
2. We expect that the foreign buyers of the commodities which we make shall know us to be a fair and honest house.
3. We expect that the salesmen representing us in foreign countries shall be proud of the fact that they are working for such a company as ours that is backing them up in every way possible in giving them the entrée, and in assisting them in sales, that the business in their territory be increased and that the great godsend to humanity, the uses of electricity, shall be known all over the world.
4. We expect the dealers and distributors who are handling Westinghouse products to be as proud, as the agency for our goods, as we are proud to have them for our agents.
5. We expect that every dollar that we are expending for foreign advertising to-day will be planting seed of such productivity that it will come back to us in manifold increased sales.
6. We expect that the good word which we are spreading of our company and products shall last for all time to come, so that the name of the Westinghouse Electric International Company shall be the paragon for a good fair company which sells the best kind of goods it knows how to make.

Our foreign organization operates through the arteries of all civilized countries of the globe, covering a wide range of products, 300,000, touching over 500 industries, thus including anything electrical from a giant railroad locomotive to milady's curling iron and baby's milk-warmer.

We are offering engineering advice to many peoples on the earth. This is the world-wide vision that American manufacturers must inaugurate. It is this method of capitalizing the dollar that pays dividends. It is the contribution of this service that will give the world a more convenient "to-morrow."

It is this service that industry must render the world's commerce—one of the greatest missionaries for good, and, gentlemen, the effort that you put forth in behalf of foreign trade is going to make you and your industry bigger to-morrow. And remember that international trade affects every fireside in our great country. It is one of the serious problems with which we are confronted. The great manufacturing institutions of this land realize it. They propose to render this universal service to the world, and it is only through service that any institution has the right to exist.

The company with which I have the honor to be associated has always taken a broad viewpoint of the commerce of the world, like similar institutions unselfishly placing its huge organization at the command of the trade at great cost, along lines that are not prefixed with a dollar sign but basically having in mind the duty to help others, and thereby lessen the burdens of the peoples of the earth.

Automobiles in Japan

THE following extract from a recent issue of the London *Times* gives some interesting data on the status of the automobile and truck in Japan.

"The use of motor vehicles in Japan greatly increased during the war. In 1914 Japan possessed 353 motor cars and trucks for hire, while 713 were privately owned; in 1915 there were 419 of these vehicles for hire and 825 privately owned; in 1916 the numbers were 566 and 1082; in 1917, 1291 and 1381, and in 1918, 2473 and 2060.

"The registrations of motor cars, cycles and trucks show that these vehicles are chiefly used in the larger cities and towns. The country roads are not adapted for motor traffic, although this defect is in course of being remedied. In December, 1918, 1975 motor cars and cycles and 104 motor trucks were registered in Tokyo; 423 and 5 in Yokohama; 421 and 32 in Osaka; 263 in Hyogo (Kobe); 184 and 4 in Kyoto; 146 and 14 in Aichi (Nagoya), and 918 and 50 in other towns. On Sept. 8, 1919, 968 motor cars and cycles and 119 trucks were registered for hire and 1153 cars and cycles and 119 trucks for private use; in Tokyo an increase of 280 vehicles; while in Yokohama, 252 cars and cycles were registered for hire, and 286, with 8 trucks, for private purposes, showing an increase of 93.

Since March, 1918, the Japanese Government has attempted to stimulate Japanese manufacture of motor trucks by giving a bounty for each truck built in the Empire according to military specifications. These trucks may be used only in Japan, and must have a capacity of one ton or upward. The bounty paid does not exceed 400 yen (£40 at normal rate of exchange) per truck, but an additional sum of about 100 yen is granted for trucks used or hired out by a manufacturer. The owner of a truck receives a bounty of 200 yen, and is granted 60 yen per annum for five years toward its upkeep. Owners of imported trucks also receive some 200 yen per truck, and an annual grant of 60 yen for upkeep; these bounties are, however, paid only to Japanese subjects.

"The narrow crowd-thronged streets are prejudicial to the use of motor trucks, especially those required for speedy delivery of goods. Tokio, Yokohama and Osaka will probably be the chief market for motor vehicles until roads and bridges are improved in the smaller towns.

"More cars are required for purposes of hire than for private use, and the demand for taxicabs exceeds the available supply. There are motor omnibuses in Tokio which charge lower fares and render better service than the electric street cars. Small or medium types of passenger cars are generally preferred. There is a big demand for closed private cars on account of the dusty condition of the roads."

Prominent at S. A. E. Summer Meeting

(1) J. A. Edwards, (2) L. R. Davis, (3) C. I. Bradley, (4) C. S. Morrison, (5) C. D. Cramp, (6) E. B. Reeser, (7) J. H. Wogenhorst, (8) J. M. Heald, (9) A Tennis Match, (10) Standing Broad Jump, (11) The Presidential Nominee in an Unofficial Pose, (12) J. C. Long, R. H. De Mott, C. R. Mabley, E. B. Taylor, H. E. Brunnel, (13) S. Barin, N. Mac Coul, (14) F. R. Pleasonton, (15) L. W. Wainwright, (16) Victor Pagé, (17) J. A. Green, (18) Wm. B. Stout, (19) Wm. E. Williams

The FORUM

Hub and Wheel Standards

Editor, AUTOMOTIVE INDUSTRIES:

The articles by John Younger, published in AUTOMOTIVE INDUSTRIES of March 10, and W. J. P. Moore, published in the April 28 issue, have been read with considerable interest, and it is apparent that there are several other viewpoints on this subject of wheel and hub standards which have not been expressed in either of the above letters.

These articles would give the impression that the automotive industry exists primarily to furnish employment to certain classes of workers of which one is the automobile engineer. This is evidenced by the phrase, "there is a lurking suspicion in the back of my mind that such a standard may lead to loss of individuality." It is undoubtedly true that standardization may result in a certain loss of individuality to the engineer.

However, the industry must face this fact: The American public has let it be known in a most emphatic manner that less expensive automotive transportation is demanded. The problem of the engineer, therefore, resolves itself into the question of how best to discover the method whereby the decreased cost of automotive apparatus can be given to the public.

If this decreased cost can be obtained through the multiplicity of designs and through the free expression of the various idiosyncrasies of designers as exemplified in the 257 odd motor truck hubs and wheels which we now have, in place of the 10 or 15 necessary to fill the field—then no change need be made in our present practices.

If, on the other hand, we are to exhaust every avenue looking toward the production of more economical motor transportation, then serious consideration must be given to the reduction of the multiplicity of designs, and this invariably leads toward standardization.

This standardization is bound to come about whether under the auspices of automotive engineers or under the control of some one manufacturer or group of manufacturers. We already have one-half of the passenger automobiles made by one manufacturer. Certainly, this one-half is standardized. This brings up the question as to whether the cost of motor truck transportation will be reduced by standardization or by any other available means, or will some manufacturer develop who, through economical design and production, takes over one-half the motor truck industry as has already been done in the passenger car field.

Certainly, a standard that involves 10 hub castings, with the corresponding hub designs on complete wheel castings, and which does the work of 257 designs in the range from 1½ to 7-ton capacities, promises a maximum economy in front wheel production. Economies should certainly be expected from the steel wheel maker, the wood wheel maker and the bearing supplier and the axle maker.

The economy in direct cost of the motor truck need not stop as a result of this standardization but would extend also to the maintenance of motor trucks. One of the serious complaints of motor truck operators is the excessive cost of repairs and the loss of time represented by idle trucks while making repairs. The adoption of a standard front hub and spindle design will operate toward more economical truck maintenance for the reason that if the service department of the "A" truck does not have the requisite parts, the owner of the "A" truck can, in all probability, obtain service from the "B" truck agency.

In addition to the above economies, competition between the manufacturers and agencies should lead to reduced cost of service to owners which in the last analysis would be beneficial to the motor truck industry.

A word as to the economic side of motor truck development as affecting standardization should be of interest. The motor truck as it stands to-day is the development of many years' work—the almost life work of many engineers—in bringing the motor truck to its present stage of development. It therefore represents what the automotive engineering profession considers as essential in motor truck construction as evidenced by its approval of existing designs and on the basis of these designs, we have certain necessary selling prices, which prices are based on the most economical present day production costs.

This is the problem on the one hand. On the other hand we have the great American public which, within the past nine months has rendered its verdict to the effect that motor truck costs are too high and must be reduced. The new problems for the automotive engineer, therefore, is to comply with these insistent demands and develop motor truck apparatus that can be sold and operated at a considerable reduction in cost. If these premises be granted, it follows that the motor truck manufacturer in the immediate future is going to be successful in direct proportion to his success in meeting these new demands of the public for motor truck transportation.

The article of April 28 goes into detail as to the type of bearing that should be used on standardized wheel equipment for motor trucks and brings forward the statement that the ball bearing is the recognized world standard in every civilized country of the world outside of the United States. We do not know whether we are to infer from this that the good old United States is backward as regards its civilization, as evidenced by its quite general use of the tapered roller bearing in motor truck wheels. We do not believe the writer intended to convey that impression, but he evidently overlooks entirely the fact that the tapered roller bearing has now been adopted by some 66 European manufacturers of automobiles, and as regards world-wide distribution, it should be of further interest to note that it is available in the great distributing centers of the world, and that bearings of the one standard are manufactured in two plants in America and one plant each in England and France.

There should be no hesitancy, therefore, on the part of the American engineers in using the type of bearing that has made itself by service the recognized standard for motor truck front wheels, as this bearing is available for production and for service practically the world over.

The article of April 28 goes into much detail as to the standardization of other parts of automotive apparatus, much of which has not yet been brought before the

Standards Committee. It is our firm belief that as regards the type of axle for rear wheels, the best sections for tires, the method of attaching tires, it will be found when these matters are studied closely that many of these problems have already standardized themselves and the work of the Standards Committee will consist largely in discovering these "natural" standards and presenting them in a condition to be of greatest benefit to the automotive industry.

It is far from the writer's intention to go into detail on such matters as tire standards which have already received attention from, and is in the hands of, recognized specialists on this particular subject.

T. V. BUCKWALTER, Chief Engineer,
The Timken Roller Bearing Co.

Vital Importance of Mr. Tipper's Articles

Editor AUTOMOTIVE INDUSTRIES:

The articles in AUTOMOTIVE INDUSTRIES by Mr. Harry Tipper have been a source of great satisfaction to me, and I have been frequently tempted to write, congratulating you on the manner in which you are giving publicity in a proper place to facts which are of such vital importance and yet are so generally ignored by those who should give them greatest consideration.

As a member of the engineering organization in various corporations I have had ample opportunity to observe the losses both to corporation and factory workers from lack of sincere regard by the management for the workers. I have also had opportunities to try the opposite treatment on a moderate scale and have had the pleasure of seeing the men respond with far greater effectiveness than I had reason to expect.

Lacking the ability myself for such publicity work as Mr. Tipper is doing, I take great pleasure and satisfaction in reading his articles and in the knowledge that the work is being effectively and persistently carried on.

THOMAS S. KEMBLE.

Cleveland, Ohio.

Non-Corrosive Hard Metal Wanted

Editor, AUTOMOTIVE INDUSTRIES:

We are interested in securing information from concerns who can supply a non-corrosive metal as hard as steel and of 60 scleroscope test, to withstand the action of copper sulphate; probably a material that is high in nickel and copper. This material must be capable of being machined, hardened and of taking a high polish.

We wish to exclude stellite, monel, duriron and stainless, as for various reasons these materials do not satisfy the conditions as observed by tests.

DIAMANT TOOL & MFG. CO., INC.

Army's Interest in Highway Transport

HOW intensely the Army is interested in the work of the Highway and Highway Transport Education Committee was well stated recently by Col. Mason M. Patrick, in an address at one of the public meetings of this committee. After describing in some detail the army's transport problems in France, Col. Patrick said:

"Now, just a word concerning what the army itself is doing to further the highway and highway transportation movement. You have no doubt heard of the opportunities which are being given to men to learn while they are soldiers, to train themselves in order that they may be better citizens when they return to civil life after their brief service with the colors, and it is in just such schools that we are trying to fit them for real, useful work in connection with the enormous problem of road building, of traffic control, and of motor transportation.

"There are open to all these men numerous courses, for any of which they are encouraged to volunteer, and there have been engaged men as teachers who really know their jobs. It will be understood that we are taking a large number of young men who would never have any college or university training and many of whom lacked even the advantages of high school training. While we have no ambition, desire or intention of turning them out as college graduates, we do believe that in their three years' term of service we can make them better men, better able to earn their living, and with a sense of respect for law and order, which is a wondrous asset when possessed by the citizens of any country, and the lack of which may prove a country's undoing.

"In these army schools there are now enrolled 40,000 men, and they are taking courses according to their own likings, carefully guided, of course, but still leaving to them a large measure of choice in subjects as varied as music, stenography, dramatic art, blacksmithing, automotive trades, etc. Among these courses we hope to incorporate some which will fit many of these men to take minor positions with State, county or other organizations which are engaged in developing their highway systems. We hope to have given these men practical courses which will familiarize them with the materials employed, which will fit them to be foremen, or to operate any of the machines which are employed in highway building.

"Others will be given instruction in the management of motor transport, particularly with a view to fitting them to become what, for want of a better term, we may call fleet managers, men who will be capable of conducting numbers of motor trucks running between different points and transporting goods. To my mind this is one of the problems we now have to face and for which we must find a solution.

"Nearly two years ago, in writing to a young man asking advice as to the course of study he should follow to fit himself for his life work, I suggested this idea. It seemed to me then, and I think it is more apparent now, that in the future vast quantities of materials will be carried on our highways in these vehicles, and in order that this may be done most efficiently and most economically, it is essential not only that there should be men who know how to conduct them individually, but others who know how to combine them into large or small fleets and to manage such combinations in a way which will prevent delays, which will hasten the journey and which will do this without danger to other users of the road.

"The army's highway transport problem is to be assured that the roads over which it must operate are suitable, that they are sufficient in number, that they are properly located, and that the motor vehicles which we can procure will likewise be suited for army use. That this problem is solved aright is of importance not alone to the army but to the entire country, and we wish to assure all those who are as concerned as we with the prosperity and with the welfare of our country that the army will aid in this movement by giving all of the encouragement and help it can afford and by furnishing all of the information it has acquired concerning roads and motor transport."

Importance of Human Wastes in Industry

It is easy to recognize difference in economy between two machines. It is more difficult to determine causes of labor waste in producing these machines. Human waste can be determined only after the production effort. We have no method of measuring human capacity to produce.

By Harry Tipper

DR. GRIMSHAW, in an address upon economic matters, at a meeting of the faculty at the New York University some years ago, pointed out that labor was the only value. Nothing is of any value until labor has been put upon it, and its value is in proportion to the amount of labor required for its discovery and fabrication.

When industry is measured from the finding of the material to the use of the product, there is no value except the value of the time and effort which is required to bring it into usefulness. In the average individual establishment, the importance of the labor cost is understood but the elements of labor waste do not receive the same study. The direct labor used in fabricating the product is only a portion of the amount going to make the cost of doing business. Indirectly, of course, we are paying for labor when we pay for raw materials, buildings, machinery, printed matter and everything else that enters into the cost. Capital itself is only the product of previous labor stored in convenient form for use in providing future production.

When the matter is pursued logically to its final outcome, Dr. Grimshaw is right; there is no other measure of value except labor and all costs are outgrowths of labor costs. Without knowing the economics of it most of us are sufficiently aware of this to apply prices to labor cost automatically. The discussion of costs among individuals, in newspapers and in other public prints begins and ends with the labor question.. Whether we regard it as a problem or not, the question of labor is the paramount question at all times in industry, and the future of industry depends entirely upon progress in the direction of labor efficiency.

Labor cost must be measured in time. There are other factors entering into it, of course, but these also are questions of time. The rarity of the skill demands a greater payment because the time is limited and such skill can exercise itself only during that limited time.

A physician who is able to perform an unusual operation with success is paid an unusual amount because his individual skill is rare and he can only work the length of the day. He cannot duplicate his own skill. Similarly men who can organize their own work and organize the work for others receive more money, because that capacity is not usual and the exercise of it is worth a great deal of unorganized labor in the elimination of time and effort.

When all the modifications are considered, however, the problem of production is the problem of the amount of time required to do a piece of work at a given cost per unit of time. Even in the case of piece-work, it is the time which counts and payment by the number of pieces is an endeavor to secure a larger number of pieces for a given time.

The most important wastes in industry are the wastes of human endeavor. We have been very capable of measuring those wastes when they have been translated into materials, machinery, buildings and other tangible products. It is easy to recognize the differences in economy of two machines for a certain piece of work. It is much harder to determine the causes of the labor waste in producing these machines.

Limited as we are by mechanical measurements, we find it impossible to apply any measurements at all to the human being, and, therefore, our labor wastes are only determined after the production effort has been made and not before. When the man has produced his piece of work we can measure with fair accuracy the comparative value of the product. We have no means of measuring his capacity to produce nor the elements upon which that capacity depends in harnessing it to useful work.

While we recognize therefore the fundamental importance of labor, our discussions regarding it are arbitrary and without any sound basis of consideration. We cannot compare labor capacity and waste because we do not know either the possibility of practical improvement or the factors which will bring it into practical result.

In organizing the present work of industry, we have arrived at the point where the mechanical organization is sufficiently complete to be improved only with decreased speeds. So much past effort in the form of capital has gone toward the making of equipment which we use, so much ingenuity has been expressed in its improvement and it has become so large in its proportions that a measurable addition in the efficiency of any of its details can affect the total result but slightly.

This improvement may be lost through a slight decrease in the human efficiency or the mistakes of our organization from the human standpoint. Already in some instances, this difficulty is showing up so that within the next few years it will have a real influence upon the cost.

In the endeavor to secure accuracy from workers who do not understand the value of that accuracy, we have added to the supervision with systems of inspection handled by men who are themselves igno-

rant of the real importance of the work which they do. In some large industries, this centralization has gone so far that the improved machinery has not increased the accuracy materially in the last few years.

In some instances of effective organizations grown to an enormous size, the percentage of spoiled work has not decreased with the improvement of the equipment and the increase in the supervision.

The time of labor scarcity preceding the present depression showed the effect of decreased human efficiency upon costs and the great variation in human efficiency existing in plants of the same character drawing their labor from the same local market. This variation is the most important point of examination in considering organization changes calculated to increase the human efficiency.

As soon as the scarcity of the labor period was passed the human efficiency increased in many lines of industry within a few weeks, twenty or twenty-five per cent. Between plants in the same line of business and in the same locality, the difference in the human efficiency of labor ran as high as fifty per cent. Such variations in cost are too important to be neglected, they involve the whole economic position of the establishment. The reasons for the differences are worth examination and organization changes should not be frowned at where they offer a reasonable basis of increased efficiency, even though it may take some time to establish them.

One of the faults of the present mechanical system of organization has been the centralized control. It became easy to centralize all planning and all developments in the hands of a few executives as the systems of communication and transportation grew more rapid and more complete. These centralized systems reduced many of the supervisors to the position of the worker in their capacity to understand and their ability to conduct their operations in the business.

In many of these centralized systems we have endeavored to secure an understanding from the top over a large group of thousands of men, instead of securing it with the individual and in the small group. The responsibility has been limited to such a degree that few men have developed either an understanding or a capacity for decision in connection with their work.

These are elements which reduce the human efficiency or prevent it from developing. Inasmuch as labor cost is the important cost in industry, increased labor efficiency is the important problem of industry and future organization changes must be based very largely upon their ability to improve the human efficiency of the plant.

Health Service in Industry

A RESEARCH service financed and supported by employers is pretty certain to investigate and discuss questions of practical and immediate value to the production and organization problems of its subscribers. For this reason special interest attaches to the bulletin on "Health Service in Industry" recently issued by the National Industrial Conference Board. Aside from the carefully gathered and well-presented information which the pamphlet gives, the mere fact of its presentation indicates a growing realization of the importance of industrial medical work along with the other human factors related chiefly to a study of and attention to the individual.

The purpose of the bulletin is "to present a survey of what has been accomplished in the development of . . . the Medical Department, and to discuss methods of procedure which have been applied in individual establishments." It is based on material gathered by investigators and from questionnaires.

Much of the general material presented is worth the attention of every executive, although a number of pages are devoted to extremely detailed data concerning physical examination standards, etc., and will interest only the active medical worker.

Some of the most interesting paragraphs relate to the function of the physician in industry. After discussing the gradual development of medical work in industry, the bulletin says of the modern industrial physician: "The physician who confines his activities to the four walls of the plant dispensary is found to be of but limited value to the industry with which he is associated. It is only as his influence reaches out into the operating departments that his full possibility of service is realized." Some of the chief functions of the plant physician discussed are as follows:

1. Curative and preventive activities. This is simply the work that every plant doctor does.
2. Seeing to it that only men physically qualified for certain kinds of work are placed and allowed to continue in that work.
3. Physical examination of workers.
4. Place employees in work for which they are best fitted from physical standpoint.
5. Study the degree of hazard in different production operations and suggest protective measures to meet each situation.
6. Care of health of executives.
7. Care of hygienic conditions about the plant; such matters as proper lighting, heating, ventilation, toilet facilities, fatigue work, etc.
8. Assist in proper adjustment of disturbing factors in home life of employees.

This is a summary of the chief factors discussed in this connection. Many persons will differ with some of the conclusions arrived at, as well as with some of the functions included in the list. The discussion is interesting, however, as much to bring out points of difference as to provide information and instruction.

Other factors discussed include statistics concerning the extent and character of health supervision activities in a large number of New England industries, proper methods of staff organization for the medical department, the equipment necessary to meet ordinary plant dispensary needs, methods and types of first-aid work, uses and methods of making physical examinations of employees and the value of medical records. The entire pamphlet is well worth attention, although certain minor points may meet with considerable question.

ACCORDING to one authority about 75 per cent of the gasoline produced in the United States is obtained by direct distillation from the crude. About 10 per cent comes from natural and casinghead gas, while only 15 per cent is produced by cracking processes.

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Secretary Hoover's Attitude

THE recent meeting between Secretary of Commerce Hoover and the committee representing the automotive industry was doubtless much like the similar conferences that had preceded it. The manufacturers present were frankly doubtful when they entered the meeting. They left with the firm conviction that Mr. Hoover had no other idea than to help business in any and every way possible. Also the visitors left the conference convinced that Mr. Hoover well understood the broad fundamentals of business.

It was something new to the automotive manufacturers to have it called to their attention that their business status was of vital interest to other industries. At first the members of the committee were exceedingly cautious in promising figures. After Mr. Hoover had made it clear that he personally was not at all curious about these figures; that he was interested in them only as they contributed to the general picture of business, the manufacturers got a better grasp of his plans and came forward with an offer to contribute their part to this general picture.

It was especially interesting to hear Mr. Hoover say that he did not desire to force any figures from any industry. He wanted all figures to come to him voluntarily. This attitude has done much to disarm those who have been in doubt as to his real object in gathering business data.

Need for Simple Tests of Lubricants

AT the recent meeting of the Society of Automotive Engineers one point emphasized was the need for simple tests calculated to determine the value of lubricants. A large proportion of the oils used in motor vehicles to-day are sold through garages and service stations, most of which have only the haziest notion about the real value of the lubricants they buy and sell. It would seem that simple apparatus for measuring viscosity and determining the presence by means of emulsion tests or otherwise of sulphur compounds could be readily devised, and with advantage to all concerned be placed in the hands of oil retailers, if not of the actual consumer.

There are, of course, other tests for lubricants which can be made only by trained laboratory men, but the foregoing tests are not so difficult to perform, providing a simple and inexpensive apparatus were available, with sufficient accuracy to give a reasonably fair test that would exclude or relegate to their proper place some of the poorer grades.

In many other lines enlightened advertising and selling policies have been employed to acquaint consumers with the real merits of the products they buy. Far too little has been done in this direction by oil producers with the result that the public as well as the engineer who knows more or less about lubricants distrusts the vendor. Unfortunately purchase by brand rarely assures uniformity in the lubricant, while even very large wholesale purchasers are without means for making intelligent selection of brands in the first instance. The whole situation is one which demands study and intelligent education. We believe that such education should be furnished by motor vehicle manufacturers if it is not forthcoming from the oil producer. Whoever undertakes it conscientiously will, we believe, benefit thereby.

Enlightened Self-Interest

AN automobile plant would not consciously increase the cost of parts which it buys on the outside unless there were some distinct advantage to be gained. It naturally desires to get those parts as cheaply as is consistent with the quality desired. Yet a too rigorous inspection of unimportant parts of pieces, especially if suddenly enforced, may have just that effect. Intelligence as well as rule is essential to efficient inspection work.

A parts maker said the other day that one firm had rejected a number of the parts which he was supplying that would undoubtedly have been used had they been made in the firm's own shop. This parts

maker believes that the manufacturer often rejects purchased pieces because he feels that it costs him nothing. In the case of parts produced within the manufacturer's plant, however, the manufacturer realizes directly the loss involved. He loses just the same in dealing with outside firms, nevertheless, since these firms naturally take these things into account when quoting on the next order.

In the case under discussion the rejected pieces were not defective in any essential way. Many were rejected because of slight abrasions on unexposed surfaces. To produce them without these slight abrasions and similar unimportant defects would have cost nearly double the price quoted.

In the same way, lack of knowledge on the part of the design engineer regarding practice in related industries may cause increased costs.

Both of these situations indicate the benefits that might be derived from a closer co-operation between manufacturers and contributory industries. The question is not one of lowering inspection standards; that would be undesirable. It is, rather, a matter of understanding the interdependent nature of the units of modern industry and of utilizing more fully the possibilities of enlightened self-interest.

Relation of Roads to Vehicles

ONE of the speakers at the Highway Transport Session of the S. A. E. Summer meeting dwelt on the inter-relation between the character of the roads in any locality and the general demand for automotive vehicles. His reasoning was absolutely sound, but when he proceeded to illustrate the point made by a specific example he was rather unfortunate in his choice. He said that on the Pacific Coast, where the roads in general are quite excellent, the sales of automobiles during recent months had been fair, whereas in Iowa, the poor roads of which state were well known, the automobile business had been flat.

We presume that the statements as to business conditions in the two districts are based on reports of dealers and have no reason to doubt their correctness. But when the speaker ascribed the mildness of the slump on the Pacific Coast to the good roads and its severity in Iowa to the bad roads of that State, he certainly was not very logical. It is known that Iowa for a number of years has been the banner automobile State, and if we take a period of three or four years previous to Jan. 1 last, Iowa bought more automobiles in proportion to its population than almost any other State. The roads in Iowa were no better during that period than they are to-day. This would even seem to disprove the contention that good roads influence the sale of automobiles favorably, but it does not. The point is that good roads are only one of several factors affecting demand for vehicles.

The check to automobile sales in Iowa is not particularly hard to explain. According to the latest available statistics, the State had one automobile to every 5.5 of the population, an equipment with which it ought to be able to worry along for some time in case of a pinch. Now, this pinch arrived when corn dropped in price from $1.80 a bushel to 45 cents and other agricultural products almost in proportion. Corn is Iowa's chief product and this drop goes a long way toward explaining the stagnation in the automobile trade in that State.

Getting Right with the Public

IT has been particularly gratifying during the last few days to note the number of automotive manufacturing concerns that have adjusted prices to suit the temper of the possible buyers. It is high time that this price question was settled. For a long time it has been a point of discussion wherever you went. Up hill and down dale and in the parlor one heard that automobile prices had not been adjusted and "soon you can buy at a lot less money."

This topic of conversation became popular months ago, when other prices began falling. It gained volume when Ford made his first big cut. It has been an increasing topic of conversation and rumors since. Manufacturers ignored it; dealers were confused. Selling was more or less demoralized.

Now there is the gratifying movement on the part of the manufacturers to end this price discussion. Most manufacturers have cut their prices and those who have not are explaining in their advertising why they will not cut. If the manufacturers will justify their prices, end the demoralization and get busy on a settled program, there is no reason why the motor car business should not go forward with a rush.

Scavenging and Charge Dilution with Exhaust Gases

IN the early days of the gas engine considerable attention was given to the principle of complete scavenging, and many engines embodying this principle were built. The aim then was—as it is now to a certain extent—to get the greatest possible power from an engine of given cylinder dimensions, and it was obvious that if the compression chamber could be completely swept clear of spent gases, so that the cylinder contained nothing but fresh charge at the end of the suction stroke, an increase in power could be obtained. With no change in the compression ratio, the effective ratio of expansion was decreased and a lessening in fuel economy might be looked for.

Complete scavenging has never found any application in the automotive field, no doubt because the apparatus required is too heavy and cumbersome to make it practical. On the other hand, some designers have recently even resorted to the opposite practice of introducing into the combustion chamber more dead gas than naturally remains there from one stroke to another. This reversal in practice is largely due to a change in the character of fuel employed, our present fuel having a much greater tendency to detonate than the gasoline of the earlier days. It may also be ascribed to a greater appreciation of the value of an adequate compression pressure. An admixture of spent gases with the fresh charge tends to prevent detonation and thus permits of higher compression being used, with consequent gain in economy.

Ford Makes Second Slash in Prices

Before War Basis Now Within Reach

Chassis $12 Higher Than in 1917 —Truck at $495 Is $105 Cheaper

DETROIT, June 7—Another cut in prices was announced to-day by the Ford Motor Co. It is effective immediately. The reductions are not nearly as large as those last fall which started the automobile price decline, but they mark a considerable step toward bringing Ford models back to the levels which prevailed before the war. The cuts range from $15 on the stripped chassis to $50 on the coupe and truck. The following table shows the changes:

CARS	Old Price	New Price
Chassis	$360	$345
Roadster	395	370
Roadster, with electric starter	465	465
Touring	440	415
Touring, with electric starter	510	510
Sedan (starting system and demountable rims)	795	760
Coupe (starting system and demountable rims)	745	695
TRUCKS		
Chassis	545	495

The following statement was made in announcing the price cut:

"The big reductions last fall were made in anticipation of lower raw material costs of which we are now getting the benefit, and this fact, together with increased manufacturing efficiency and an unprecedented demand for Ford cars, particularly during the last three months, permitting maximum production, have made possible another price reduction immediately.

Sales at Highest Point

"Ford business in April and May was greater by 56,633 cars and trucks than for the same two months last year. In fact the demand was even greater than the supply, so that output has been limited, not by unfilled orders, but by manufacturing facilities. During May we produced 101,500 cars for sale in the United States alone, making it the biggest month in the history of our company and our factories and assembly plants now are working on a 4000 car daily schedule for June.

"The Fordson tractor still is being sold at less than the cost of production on account of the recent big price reduction and it is impossible therefore to make any other cut in the price.

The announcement also was made that the wages of Ford workmen will not be reduced as the result of the price cut.

While the latest Ford cut was not so unexpected as that made last fall, other manufacturers had not expected price readjustments for a month or two yet.

In supplementing the statement in connection with the price cuts and denying reports that the plant will close, Henry Ford said:

"It has been the custom of the plant to release men during harvest time so grain could be cared for, but since there is an abundance of farm hands this year, this will not be necessary."

Ford said the plant was running far behind orders and that he expected to keep up the present production schedules indefinitely.

The Ford Motor Co. of Canada has announced a price cut of $65 on open cars and roadsters and $110 on closed cars. This makes the price of the touring car, without starter, $710.

TABLE SHOWING RANGE OF PRICES ON FORD

	Aug. 1 1917	Sept. 21 1917	Oct. 16 1917	Feb. 25 1918	Aug. 16 1918	Mar. 4 1920	Sept. 21 1920	June 7 1921
Touring	360	365	365	450	525	575	440	415
Roadster	345	350	350	435	500	550	395	370
Chassis	333	338	338	400	475	525	360	345
Coupelet	505	510	560	560	650	...	...	...
Coupe	...	...	...	...	...	*850	*745	695
Town Car	595	600	640	640	...	...	...	...
Sedan	645	650	695	695	775	*975	*795	760
Truck	600	600	600	600	550	600	545	495

*Includes starter and demountable rims.

Paige Reduces Prices on Complete Line

DETROIT, June 7—Price reductions were announced to-day by the Paige-Detroit Motor Car Co. They have been expected for several days. The reductions range from $20 to $160. The following table shows the new and old prices on the various models:

	Old Price	New Price
Glenbrook touring car	$1795	$1635
Ardmore Sport	2015	1925
Lenox Roadster, 2 passenger	1795	1635
Four passenger Coupe	2600	2450
Sedan	2720	2570
Lakewood, 7 passenger touring	2895	2875
Larchmont Sport	2995	2975
Five passenger Coupe	3775	3755
Seven passenger Sedan	3850	3820
Limousine	4060	4030

Price Changes Continued on Page 1233

Price Fluctuations Hold May Sales Low

Buying in New York District Spasmodic During Changes —Dealers Prosperous

NEW YORK, June 4—The automobile market in the Metropolitan territory is feeling keenly the swift succession of price reductions and sales are below standard on practically all lines, even including some of those which cut a month ago. With each succeeding reduction, the distributor handling the car reduced has a spurt of sales lasting a week or two, when somebody else comes along with a reduction and gets the attention of the public and some of its money, for the time being.

As a result of these reductions, sales for May, when they are fully compiled, apparently will show a smaller total than for April. One well known line sold a few less than half as many cars in May as in April and a good many others, except those which have benefited by heavy reductions, have had similar experiences.

Sales Surpass Former Years

However, the majority of distributors are making money. One large house which had May sales running something like 50 per cent of those of April, still made a profit in May, which the distributor declared "would have tickled me to death five years ago." He made a point that profits of the past two years are being continually used as a basis of comparison by dealers who are having about as much trouble as business in general in getting back to normal.

The Row presents a striking, if not an attractive, appearance, with a large number of salesrooms bearing flaring cloth signs announcing price reductions.

The used car situation is rather chaotic because of frequent reductions made necessary by reductions in new car prices, but the demand is fully as good as for new cars.

Caution Marks June Factory Plans

Parts Makers Find Trade Outlook Poor

Price Revisions Keep Cars Moving—Five Companies to Increase Output

NEW YORK, June 7—A large part of the automotive industry is starting June with no very definite idea of its destination. On the surface, at least, conditions are more uncertain than they have been at any time since January. Forecasts of production for the month are extremely hazardous.

Manufacturers of parts and accessories, whose plants have been operating for two months on an approximate 50 per cent basis, have less business booked for June than for any month since February. Many releases which were given in May for this month have been countermanded and there are few reports of new business.

It is difficult to reconcile this authoritative statement of conditions among the parts manufacturers with largely increased sales in passenger car lines which have made substantial price cuts. The companies which have made price readjustments assert without exception that largely increased sales followed their announcements and investigation shows there is no reason to doubt the truth of this statement.

Since retail sales of automobiles are increasing while the business of parts manufacturers is at a standstill, the only explanation is that most companies had accumulated a considerable surplus of cars which must be liquidated before production is resumed on the scale which prevailed in April and May. There is every indication, on the other hand, that retail sales for June will equal or exceed those of May, which averaged probably 25 per cent less than for April. Reports to the National Automobile Chamber of Commerce showed a gain for May of 13 per cent over April.

July Shutdown Unlikely

Detroit is pessimistic over the outlook for the immediate future, but it is not at all unlikely manufacturers there will be more cheerful before the close of the month. There is much talk in Michigan of a general shut down in the industry July 1, but unless retail sales conditions become much worse than they are now as June progresses, there is little probability of such drastic action being taken. At the present rate of sales in most lines the present surplus soon will be absorbed and factory operations then will be expanded.

Analysis of the situation does not indicate that it is as black as it is painted in Detroit. Nearly all the large production companies have taken their stand on prices and the situation in this respect is more stable than it has been in some time. Prospective buyers can go into the market with a reasonable certainty that there will be no more cuts for several months to come in the lines which have announced their attitude.

NEXT NEW YORK SHOW AT MADISON SQUARE

NEW YORK, June 3—The members of the National Automobile Chamber of Commerce at their annual meeting here yesterday decided to hold the next New York Automobile Show in Madison Square Garden because the Grand Central Palace is no longer available for such expositions. Arrangements will be made whereby there will be space at the Garden for exhibits by all members.

It was the unanimous belief that every effort should be exerted to make the show next January one of the most successful ever held. One of the leading factors in the selection of the Garden was its central location, making it more readily accessible in this respect, which is more desirable than the Palace.

The Chicago show will be held in the Coliseum as usual.

Ford Leads Factories in Schedules for June

DETROIT, June 6—Definite production schedules for June have been fixed by only seven automobile factories in Michigan and in only five of these are increases planned over May output. Ford is going over 100,000 for June while Lincoln, which built 425 in May, will cut to 400 this month. Both Cadillac and Packard announce increased June schedules, while Chevrolet will step up about 1400 if the schedule is maintained, and Studebaker approximately 1000. June estimates in those plants are 4400 and 8335 respectively. Packard plans to build 1000 single sixes and Cadillac announces 1600 against 1400 in May.

Dodge Brothers officials declined to say what schedule would be maintained as to working days beyond the statement that they expected to continue on an uninterrupted daily schedule hereafter.

All executives are disposed to move cautiously as regards production, and it is evident, save in those factories announcing definite schedules that the out-

(*Continued on page 1232*)

Price Cooperation Promised by Makers

Recognize Need for Quick Stabilization of Market—To Study Truck Dumping

NEW YORK, June 3—Real appreciation of the need of immediate action on whatever price adjustments are to be made was displayed by the members of the National Automobile Chamber of Commerce at their annual meeting here yesterday. It was felt that price changes might better have been made two months earlier or two months later but since they have been begun, manufacturers owe it to their dealers and to the public to take a definite stand which will aid in stabilizing the situation. Desire of bankers for further liquidation was blamed in some quarters for precipitation of readjustments in the automotive field which has been more prosperous than almost any line for the past four months.

The N. A. C. C. received a telegram from Harry G. Moock, general manager of the National Automobile Dealers' Association, urging on behalf of the dealers that car makers decide at once whether or not they intend to change their prices. A reply was sent stating that the N. A. C. C. was in entire accord with this view of the situation and felt the warmest sympathy for the dealers in the difficulties they are having to face.

Reports on retail business conditions in all sections of the country were submitted to the members. They showed that there was a decline in sales in May over April i almost every district except the South, where there was some improvement for the first time in many months. The best showing was made by lines which had reduced prices.

Expect Drop in June

It was the general opinion that June business would not equal that of May but that it would be of substantial proportions and that there was no occasion for pessimism.

Little change was reported in the commercial vehicle division of the industry. A few companies are doing a good business and some others have slightly increased their production. Reports are coming from dealers with increasing frequency, especially in the Metropolitan district, that they are finding great difficulty in competing with persons selling American made trucks of high grade reimported from England and France. Service on these vehicles is guaranteed and they are put on the market for 50 per cent of their list price. The Fiat

(*Continued on page 1232*)

Durant Speeds Up Production Plans

Experimental "Four" to Sell Under $900 Pleases Engineers—To Have Four Lines

NEW YORK, June 7—Important announcements by W. C. Durant regarding the future of Durant Motors, Inc., are expected in the near future. They will relate not only to production and personnel but to finances.

Plans for production are rapidly taking form. The experimental Durant cars have been completed and are satisfactory to the engineers in every respect. The "Four," which will sell for less than $900, is reported by those who have seen it to be a high grade job. It has many refinements not found ordinarily in low priced cars.

Provision now has been made for three lines. One of them will be the Durant, another the Collins, which will be produced in the old Cadillac factory in Detroit, and the third the Sheridan. A fourth line will be added, it is understood. Durant promised the people of Flint, Mich., in January, that one of his plants would be located in that city. He will keep his word in this respect and it is expected the fourth division of his company will be located there. Chassis models will be limited under the present plans, but there will be several body models. The Sheridan will be converted into a six-cylinder job and the Collins will be an eight.

Preliminary steps for the building up of a dealer organization now are being taken and it is understood several contracts already have been signed. It probably will be the policy of Durant Motors, Inc., to have its dealers handle all the affiliated lines. In this respect its program will differ from that of General Motors.

Michigan Gives Approval to Durant Stock Sale

DETROIT, June 6—Stock of Durant Motors, Inc., has been admitted to the Detroit Stock Exchange following approval by the Michigan Securities Commission and authorization for sale of 200,000 shares of common. Authorization was for sale at a price to be governed by market quotations and the stock now is listed on the exchange at 22 7/8. The company, under the commission order, is allowed to sell stock for cash or upon reliable payment plan on application to commission.

The officers are W. C. Durant, president; Carroll Downes, vice-president; Harry F. Hebermann, secretary, and W. W. Murphy, treasurer. These with E. Healy of New York compose the directorate of the company, incorporated under Delaware laws with offices in New York and Flint, Mich. The stock issue is asked to secure working capital and the declaration recites that the business of the company will be to manufacture automobiles, trucks, parts and accessories, and to hold securities of allied and affiliated companies. In the application for listing on the exchange, the company declares it has authorized 1,000,000 shares of no par value common stock of which 507,057 shares were outstanding May 1.

Poertner Gets Durant in New York Territory

NEW YORK, June 6—The Poertner Motor Car Co., distributor in the New York territory of the National and Scripps-Booth, has been appointed distributor in the Metropolitan area for Durant Motors, Inc. Poertner, who is one of the veterans in the automobile business, has had the National Scripps-Booth for several years, his territory including New York City and parts of New Jersey and Connecticut. He was formerly president of the New York Automobile Dealers Association.

It is learned that the Durant will probably sell for $890. It will have a four cylinder overhead valve engine and will be particularly well appointed, it is said, for a car of its price. At the start there will be three models, touring car, sedan and coupé.

G. M. Truck Resumes on Full Time Schedule

DETROIT, June 6—All departments of the General Motors Truck Co. resumed operations to-day and a full time schedule will be maintained indefinitely, according to W. L. Day, general manager. The fact that the machine shop and assembly department were down last week gave rise to a report that the plant would be closed entirely.

"We got ahead a bit on production, but the report that we closed down or would close was wrong," said Day. "We held up work in the machine shop and assembly for a week, but other departments were going right along and the plant opened in all departments to-day."

Day said the company had been having good business throughout the spring until the middle of May when there was a noticeable slump. This, however, he declared, he thought would be only temporary and looked for a gradual increase during the summer.

AMERICAN BUSHING SPEEDS UP

DETROIT, June 6—The American Bushing Corp. of Marysville, Mich., which is manufacturing bushings for the American and Canadian Ford companies, has increased production to 20,000 daily. Important changes in production methods devised by President J. W. Leighton permit the production increase.

MINNEAPOLIS S. A. E. ELECTS

MINNEAPOLIS, June 6—The Minneapolis section of the S. A. E. has elected officers as follows: President, W. G. Clark; vice-president, C. E. Moody; secretary, C. T. Stevens; treasurer, J. S. Clapper.

Cleveland Industry Shows Further Gain

Increased Employment 3.6 Per Cent in May—Other Businesses Report Additions

CLEVELAND, June 3—The automobile industry in Cleveland continued on the up-grade during the month of May according to a survey made by the Committee on Labor Relations of the Cleveland Chamber of Commerce for the U. S. Department of Labor.

The twelve companies in the automobile industry in this city were surveyed and the number of employees on the payrolls of the companies May 30 was 3.6 per cent greater than the record for April 30. On April 30 these companies employed 9949 persons, while on May 30 the number had increased to 10,310.

These reports have been issued by the Committee on Labor Relations since the first of the year and the automobile industry sets the pace for all other industries in the matter of recovery. The report discloses that general conditions in Cleveland are improving for ninety-nine establishments that were surveyed had increased the number of employees May 30 over April 30 1.8 per cent. The total number of employees on May 30 was 62,956 as compared to 61,847 a month ago.

The building trades workers have been on a strike here for a month and there was a decrease of 43.8 per cent in the number of employees in this industry in the last month. Metal products other than iron and steel made a big advance toward normal conditions in the last month with an increase of 14.1 per cent in the number of employees. The automobile industry is held responsible largely for this increase.

The other increases reported are as follows: Food and kindred products, 7 per cent; textiles and their products, 5.2 per cent; iron and steel and their products, 4.6 per cent; paper and printing, 5.8 per cent; chemicals and allied products, 2.7 per cent.

COURT ORDERS JOHNSON SALE

INDIANAPOLIS, June 3—Authority was given recently by the St. Joseph Superior Court for the sale of the Johnson Motor Wheel Co. of South Bend, Ind. Following financial difficulties the company was placed in the hands of a receiver. The company conducted a stock selling campaign a short time ago and hundreds of persons in the northern part of the State invested their savings.

KNOX PROPERTY REVERTS

SPRINGFIELD, MASS., June 4—Knox Motors property which has been occupied by the Sinclair Motors Co. has reverted to the Knox Motors interests under a mortgagee's sale of the real estate. The property was bid in for $250,000 by H. G. Fisk, president of Knox Motors.

Toledo Factories Increase Schedules

Overland to Double Production in June—Parts Plants Gain Steadily

TOLEDO, June 6—A substantial improvement in the automobile industry is shown in the announcement of June schedules by several factories here.

Willys-Overland output this month will be more than doubled, with enough orders already received to take up the whole month's production. The notice was sent out Saturday that no closed car models could be delivered now before June 20. The price cut has greatly stimulated the business.

The production of automobile equipment at the plant of the Electric Auto-Lite Corp. will be increased by 20 per cent in June, Clement O. Miniger, president, announced. The May production at the plant was 20 per cent greater than in April. There are now 1027 employees at the Auto-Lite plant, which compares favorably with a normal force of about 3000.

President Miniger says that orders received during the last week from many companies which have cut prices on their cars shows that the lowering costs are stimulating business beyond the expectations of the manufacturers. He doesn't expect the usual summer sag to come this year at all.

George D. Moore, general manager of the Toledo Chevrolet plant, said that nearly 200 employees had been brought back into the plant here in the last week and that the force is to be doubled this week. This is largely on the strength of the increased volume of business which Chevrolet distributors have noticed since the announcement of price reductions.

The Chevrolet company manufactures only differentials and transmissions here. The company has had a large stock of these parts on hand in various of its assembling plants and in the hands of agents so that necessarily the local plant has not been speeded up as much as the actual production would indicate.

There were nearly 1200 employees at work in the Chevrolet plant here in the peak periods.

Daily Driveaways 100 to 150

The daily drive-aways of 100 to 150 cars from the Overland plant has recalled to many of the employees the prewar days. There are also many carloads leaving the city by rail every day to more distant points of distribution. Several boatloads have gone to Buffalo in the last few weeks for the eastern States' demands.

The June production is to be at its maximum speed by June 10, according to Vice-President Charles B. Wilson, at the plant here. He says the actual output of cars for June is to be 112 per cent over the number produced in May. The plant payroll will be increased by about one-third so that there will be 8500 employees at work the last week in June.

One of the most difficult problems for the factory to face at the present time is the task of getting the materials delivered here in time to keep up with production. Supplies have been coming so slowly for several months that in many cases it is difficult to get the necessary speed up in short notice.

The factory has also gone into full time operation. For several weeks it has been on a four-day week basis, but now the output of every man every day is needed to keep up with the orders. The employment office here has indicated that practically every old Overland employee who could be located has been recalled into the service of the company and that from now on the positions will be open for new men.

Northway Pushes Sales in Eastern Territory

BOSTON, June 4—Northway Motors Sales Co. has launched an active truck merchandising campaign in the territory covered by its thirteen factory branches in New England and Middle Atlantic States. Fifty new salesmen have been placed in the field who will operate under the new sales organization headed by Joseph Husson, general sales and advertising manager, formerly editor of The Commercial Vehicle. His associates are W. E. Downs, assistant sales manager; H. F. Flugge, general service manager; F. L. Ortla, assistant service manager; R. B. Sill, branch sales manager; H. W. Pierce, manager of dealer sales, and Richard A. Magee, who is in direc charge of advertising.

Springfield Body Adds Unit to Meet New Sales

SPRINGFIELD, MASS., June 3—Plant capacity of the Smith-Springfield Body Co. is to be increased 50 per cent and 100 additional men are to be employed. Construction of a new unit, 90 x 320 ft., was begun four weeks ago and will be completed June 15. Completion of this building will double the size of the plant.

The company has recently obtained contracts for closed-car construction from the Wills Sainte-Claire and Mercedes companies. It has been making closed and touring type bodies for Rolls-Royce of America, Inc., Stevens Duryea, Marmon, Lincoln and the Citroen company.

TEXAS BUSINESS IMPROVED

DETROIT, June 6—Walter Zimmermann, special representative of Olds Motor Works, Lansing, has returned from an extended trip to the cotton states with the report that business conditions are greatly improved in some sections of the South. This is true particularly in Texas, Zimmermann said. With more stable government in Mexico that country is beginning to buy in Texas and cotton growers are optimistic.

Oakland Officials Resign Positions

Masten, Young and Hamilton Leave and May Join Durant —Other Changes

DETROIT, June 4—Changes in personnel have been coming with increasing frequency within the last two or three days, prominent among which was the departure of W. H. Masten and J. W. Young, assistants to the general manager of the Oakland Motor Car Co. and A. G. Hamilton, chief engineer, whose resignations became effective May 31. No successors have been named to Masten's or Young's positions by General Manager G. H. Hannum, but Benjamin Jerome, formerly assistant to Hamilton, succeeds to the position of chief engineer.

Masten had been with Oakland a long time and was regarded as one of the leading figures in the organization. No information regarding the plans of any of the three officials could be ascertained, though persistent reports are that they will join W. C. Durant, R. H. Collins and Edward Ver Linden in the new Durant organization.

Announcement of resignations of Frank G. Eastman, advertising manager of the Lincoln Motor Co. and H. S. Dart, advertising manager of the Paige Motor Car Co., both of which became effective within the last two days created much surprise in local automotive circles. Dart and Eastman were regarded as firmly entrenched and were considered among the leaders in that branch of the business. Their resignation came suddenly, and no information regarding the details could be secured either from factory officials or from Dart or Eastman.

Dart will be succeeded by W. K. Towers, at present advertising manager of the Reo Motor Car Co. Towers will assume his duties with Paige June 13, but no successor to Towers has been named by Reo. Dart has several connections under contemplation but is not yet ready to make an announcement. Officials of the Lincoln Motor Co. have announced no successor to Eastman and the latter has made no future plans.

H. M. Chadwick, formerly sales manager of the Insulating Materials Co. of Detroit, and prior to that with the Packard Motor Car Co. has taken over the sales and advertising end of the Michigan Crown Fender Co. products. The Crown Fender factory is located at Ypsilanti and manufactures fenders and other automobile parts.

IMMEL STOCKHOLDERS TO BID

COLUMBUS, June 6—While no definite date for the sale of the plant and other assets of the Immel Co. has been set it is announced it will be within the next 40 days. Receiver R. H. Schryver has been authorized by the court to sell the plant and all of the assets. A committee of preferred stockholders is being organized to bid on the plant.

Buying Power Large Says Reserve Head

Financial Situation Reaches New Strength—Anxious to Aid Legitimate Business

NEW YORK, June 3—"The emergency of 1920 has definitely passed," said W. P. G. Harding, Governor of the Federal Reserve System, speaking before the annual meeting of the National Automobile Chamber of Commerce yesterday. "There is nothing as far as the financial condition of the country is concerned as affected by the Federal Reserve Banks that causes any other feeling than one of optimism."

Availability of credit, the fact that automobile shipments for the past two months equalled 67 per cent of the same months of last year, the feeling that prices have reached a new stable level, and Governor Harding's statement that "the public has a great deal of buying power left" were major points of the meeting.

Governor Harding pointed out that the financial situation of the Federal Reserve system is stronger than at any time since the third Liberty Loan and that the banks are anxious to lend to legitimate business.

"We want to get the public out of the idea that things are constantly going lower and lower and lower," said Governor Harding, "and we should get some stability into the situation." It was the opinion at the meeting that the new low price levels now reached would probably be stabilized on the present basis as almost all the motor companies have readjusted their prices. The consensus of opinion brought out that motor car and truck companies have anticipated the lower levels of raw materials and have priced their product on the new basis.

Cars Keep Steel Moving

"The public has a great deal of buying power left," said Governor Harding, "and buying power begets buying power. You start up one industry and you automatically start up another. It is amazing when you consider the automobile industry to find how many things are dependent upon its prosperity. It affects the purchases of steel and all the processes of steel manufacture. See how much employment that gives to labor."

The automobile market is a leader in return of buying, reports at the meeting brought out. The May shipments exceeded April by 13 per cent and April and May shipments were 67 per cent of the same months of last year, comparing favorably with the steel market, with pig iron which is on a 50 per cent basis, and with rail transportation which is on a 60 per cent basis.

"The Federal Reserve Banks," said Governor Harding, "which are the ultimate resource of all member banks, and through them, of the public are in a position now better than ever before to extend to all legitimate business all assistance needed and are not only in position to do that but are anxious for business to avail itself of it.

"The Federal Reserve System has no desire other than to be a help to business, and all paper which is eligible under the Federal Reserve Act—that is notes, drafts and bills of exchange issued or drawn for commercial, agricultural or industrial purposes—is eligible for rediscount at any Federal Reserve Bank upon the endorsement of a member bank. There are no discriminations in the Federal Reserve System against any class of paper which is eligible and all applications for rediscount will be considered in a businesslike way upon their merits."

Central Ohio Finds Sales Outlook Better

COLUMBUS, June 6—With more price reductions announced and a better feeling developing in industrial circles, the sale of automobiles in Columbus and central Ohio territory is gradually increasing. This is the statement of practically all of the Columbus agents and also from some in the territory immediately surrounding the Buckeye Capital. The passenger car business is especially stronger, although some increase in demand is reported for commercial vehicles.

Farming communities are showing an increase in the demand for passenger cars. This is seen in the corn raising sections when the crops are now planted and farmers have a little time to look around. There are excellent prospects for a big wheat crop and this has the effect of stimulating sales of cars. In the farming sections there is also an increase in the demand for trucks and small tractors.

TIMBER SUPPLY PLENTIFUL

DETROIT, June 6—Emil Brock of Weis-Lesh Mfg. Co. of Memphis, Tenn., logging and spoke manufacturing unit of the Motor Wheel Corp., declares there is a timber supply sufficient for the next 50 years under control of his organization. Brock has been in Lansing for a conference with H. F. Harper, general manager of the Wheel Corp., and other officials. He said the Memphis unit has a large supply of raw material for shipment to the wheel plant in Lansing. The mills, however, are running on a curtailed production schedule.

MUTUAL INSURANCE URGED

NEW YORK, June 3—Increases in automobile insurance rates during the past few months have again directed the attention of automobile manufacturers and dealers to the need for a mutual insurance company to care for motor cars and motor trucks, similar to the one launched four years ago. It is asserted by the National Automobile Chamber of Commerce that loose methods of accepting risks without due regard to the moral hazard and excessive overhead expenses have resulted in the imposition of rates from which the only relief lies in mutual companies.

Harding Visit Stirs Kansas City Action

Dealers Line Up Sources of Credit—Southwest Nearing Normal Buying Move

KANSAS CITY, June 6—The visit of Governor Harding of the Federal Reserve Board, and the announcement of relaxation of restrictions as to rediscounting, which followed that visit, are beginning to show results in Kansas City territory. The immediate results are rather the sifting out of bankers, than the promotion of motor car sales.

Motor car dealers are no longer put off with the defense against loans, that the Federal Reserve will not rediscount the paper. Since the bankers have to give the real reasons for refusal, the motor car dealers are better able to judge what their next step should be. In some cases, this step is the finding of another banker. The motor car dealer who has his books in good shape, whatever they show, can confidently visit another banker and talk with him.

It is evident that many banks have not reached the satisfactory condition in relation of loans to reserves, of the Federal Reserve Banks. It is said that the country banks are less able to extend credit facilities than some of the larger city banks—the liquidation of the past few months being heavier with the city banks, whereas the country banker still has to carry agricultural loans. But the activity of the motor car dealers in ascertaining facts, is equalizing the service, so that the banks that can extend facilities will have opportunity to do so.

Perhaps the most important result of the visit of Governor Harding has been in the stiffening of the morale of the dealer. He now has the courage of his industry. Gradually this brighter tone is being infused into the territory, into bankers, and business men, as well as into the dealers themselves.

Trade Trip Dispels Gloom

Another incident that has helped mightily to bolster the optimism of Kansas Citians is the trade trip of the Chamber of Commerce through Kansas, Oklahoma, Texas, Arkansas and Missouri. The hundred Kansas Citians started on the trip dubiously, fearing to be deadly depressed by the sad condition of the Southwest and the lugubriousness of its business men. But they found that the Southwest is recovering.

"There is business in the Southwest waiting for us to go after it," said one of the men who made the trip. "The trouble with us is that we have listened to the gloomy stories of our travelers who have been convinced by the refusal of merchants to 'buy now,' and who have assumed that the merchants were never going to buy. The Southwest is past the turn, and is going strong. Stocks are reduced and merchants will be in the market close to normal very soon."

Commonwealth Sells Car Finance Business

Commercial Investment Trust Takes Over Clientele and Paper Now on Books

NEW YORK, June 7—The Commercial Investment Trust, 347 Madison Avenue, New York City, has acquired the automobile business of the Commonwealth Finance Corp. Under the arrangement the C. I. T. has taken over automobile paper on the books of the Commonwealth. In addition to acquiring business already on the books, the C. I. T. will continue to serve Commonwealth clients. Samuel S. Mattison, former sales manager of Commonwealth, has accepted a similar position with the C. I. T. and will have with him as district managers, B. J. Hall, Baltimore territory; W. W. Thomas, Buffalo territory; Elmer P. Yost, Pittsburgh territory; J. E. Parker, Philadelphia territory; W. H. Billings, Boston territory, and W. A. Gilroy and M. R. Sanborne in the New York and New Jersey territory. The Commonwealth company will transfer its activities to other fields in which its broad charter permits it to operate. It already has taken up real estate and mortgages, not so much in the metropolitan district as in other places. Its plans in this direction have not been definitely worked out.

The assets of the corporation have been transferred from the original South Dakota corporation to a new corporation formed in Delaware. This action was approved, it is stated, by approximately 90 per cent of the stockholders. The litigation which has kept the affairs of the corporation in the courts for the past two years has been settled and all the suits have been withdrawn. It is understood as a preliminary to discontinuance of the suits a substantial sum was paid to Ormsby McHarg and his associates by Henry D. Tudor, president of the company, and the faction which has stood with him in the controversy.

Tudor and his friends never lost control of the affairs of the Commonwealth and the receivers appointed both in South Dakota and in New York never obtained possession of the assets. They were successfully barred out by a series of restraining orders.

TIRE SERVICE CHARGE URGED

NEW YORK, June 4—The executive committee of the tire manufacturers division of the Rubber Association of America has recommended to all members that a service charge based upon a percentage of the invoice cost of the returned goods, plus return freight charges, be charged all purchasers who return tires and accessories to manufacturers for repairs. This custom on the part of motor car owners has given rise to many difficulties and it has been deemed advisable to handle the business in a uniform way.

The publicity department of the Rubber Association will devote considerable attention to educational work covering load carrying capacities of pneumatic truck tires. The attention of truck manufacturers and users will be called to the fact that the load carrying capacities specified in the schedule of maximum loads are the actual maximums and that in respect to overloading, consideration should be given to the necessity for a factor of safety by the use of larger equipment.

Would Liquidate Stocks Stored in South America

NEW YORK, June 4—Proposals for the formation of a co-operative liquidating corporation to handle all excess stocks of American merchandise unclaimed in the customs houses of South America were made to-day at a joint meeting of the Argentine-American Chamber of Commerce, Brazilian-American Chamber of Commerce, American Manufacturers' Export Association and the Pan-American Advertisers Association. The meeting was attended principally by local export managers and considered the liquidation of all classes of goods without reference to automotive lines. Estimates placed the value of these unclaimed goods at Buenos Aires as $25,000,000.

Reports from various cities in Latin-America recently received indicate that liquidation is proceeding on all automotive products and consequently there is some doubt as to the part the industry might take in the proposed corporation. Its purpose would be to clear all unclaimed goods through the customs houses so that storage penalties would not accrue, and so that they would not be auctioned off for charges. The corporation then would endeavor to market the goods in the various countries, endeavoring to do so to the best interest of all business.

The proposals were made by **Max W.** Boley of Buenos Aires, who was the delegate of the Chamber of Commerce of the United States in the Argentine, and J. W. Finch, an exporter to Brazil and Argentina. The plan will be studied by a committee composed of two members from each of the organizations participating in the meeting.

DECLARE PRACTICES UNFAIR

NEW YORK, June 6—The National Vigilance Committee of the Associated Advertising Clubs of the World has sent out a statement warning against what are characterized as unfair practices of the Franklin Tire & Rubber Co., 34 West Lake St., Chicago. It is asserted that this company, which originally called itself the Racine Tire & Rubber Co. of Chicago, solicited dealers to handle tires called "Racine quality tires." Dealers confused the Chicago company with the Racine Rubber Co. of Racine, Wis., makers of standard tires. Use of the word Racine finally was discontinued by the Franklin Co. They now offer, howver, "special racing tires."

Horsemen Belittle Tractor-Horse Test

Declare Demonstration Purely to Focus Attention on Tractors —Sanction Withheld

CHICAGO, June 6—The Horse Association of America has issued a statement asserting that it has not sanctioned the demonstration by tractors and horses in field operations which has been arranged by the National Implement & Vehicle Association. The first of these tests will be held at Fargo, N. D., June 28 to 30. The statement says use of the name of the Horse Association of America in telling of the proposed contests was unauthorized. The plan is characterized as "purely one by the tractor interests calculated to focus attention upon their national demonstrations. No horsemen have been consulted in respect to the demonstration or rules." The statement says:

"The situation is this: Tractor sales have fallen away to practically nothing, due to awakening consciousness on the part of the farmers that horses and mules furnish the most reliable, efficient and economical power on the farm, when farm profits over a period of years are taken as the test. In a desperate effort to do something to stimulate tractor sales, a group of men in charge of this particular problem have hit upon this plan in the hope that such a demonstration would show that more can be done in a few hours with tractors than with horses and thus create sentiment favorable to tractor sales."

Select Dakota Site for Tractor Trials

FARGO N. D., June 6—The Haggert 640-acre farm on the Red River road six miles west of here has been selected for the truck, roadmaking and ditching demonstrations to be made June 28-30 under the auspices of the National Tractor Farming Demonstration and Show. Chairman J. B. Bartholomew of Peoria, Ill., announces horse show in connection. E. E. Whaley is general manager. Each tractor or horse-drawn outfit will be assigned a definite section in which to work, based on the number of bottoms. The horse outfits will be in competition only with each other. Trucks will start from various points to reach the farm overland in time for the contest. They will be judged on their records to the finish.

BODY BUILDERS MEET JUNE 16

NEW YORK, June 6—A special mid-year convention of the Automobile Body Builders' Association will be held at Detroit, June 16 and 17, "to consider ways and means of overcoming the difficulties confronting the industry." Attendance will not be limited to members of the association but will be open to all manufacturers of automobile bodies.

Price Cooperation Promised by Makers

Recognize Need for Quick Stabilization of Market—To Study Truck Dumping

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company also is making a strong bid for business with its trucks.

The truck manufacturers discussed seriously the question of what could be done to make less serious the competition of reimported trucks. Some of them felt that if Congress enacted a permanent anti-dumping law which would cover the situation it would result in retaliatory action, especially by England and France, which would interfere with American sales in those countries. Others took the position that there was little probability of business with these countries for a long time to come under even the most favorable conditions.

No action on the subject was taken by the truck committee but it was decided to investigate the subject further and it was deemed advisable to attempt to have a clause inserted in the permanent tariff bill which would protect the industry from this competition.

The unit parts service question was discussed at the afternoon session. The viewpoint of parts manufacturers who have established chains of stations at which their products can be purchased was presented by E. H. Broadwell, president of the Motor and Accessory Manufacturers' Association. M. L. Pulcher, vice-president and general manager of the Federal Motor Truck Co., represented the manufacturers of assembled trucks and strongly opposed the parts makers' service plan. The dealers were not represented in the discussion and no vote was taken. There was evident a wide difference of opinion on the part of the members of the N. A. C. C. Broadwell declared the manufacturers he represented would do whatever was best for the industry.

Have Time Now for Service

One section of the manufacturers contends that conditions are different now than they were a year or two ago when owners of motor vehicles were clamoring for parts and the dealers were so busy selling cars and trucks that they paid little attention to their servicing. The situation now has changed radically and everyone is out fighting for business. It is easy to get men and materials. It was felt that a general discussion of the question would be helpful and lead to great reforms in respect to overcharges.

The tax committee reported the action it had taken at Washington in appearing before the Senate Finance Committee in opposition to the "stigma taxes" imposed on the industry. Activity on the tax question will be continued. Everyone interested is expected to make his position plain to his representatives in Congress.

A general meeting of all the interests advocating the passage of the Townsend highway bill was held Wednesday night and a program was outlined for work in advocacy of this measure. At the meeting were representatives of the N. A. C. C. the M. A. M. A., the Rubber Association of America and the N. A. D. A. Chief opposition to the Townsend bill comes from the American Federation of Farm Bureaus.

Officers and Directors Re-elected by N.A.C.C.

NEW YORK, June 3—Members of the National Automobile Chamber of Commerce at their annual meeting yesterday re-elected five directors whose terms had expired. They were: A. J. Brosseau, president of the International Motor Truck Corp., A. R. Erskine, president of the Studebaker Corp., Alvan Macauley, president of the Packard Motor Car Co., W. E. Metzger, vice-president of the Columbia Motors Co., and R. E. Olds, president Reo Motor Car Co.

At their reorganization meeting the directors re-elected the following officers: President, Charles Clifton, Pierce-Arrow Motor Car Co.; vice-president, Roy D. Chapin, Hudson Motor Car Co.; second vice-president, passenger car division, C. C. Hanch, H. C. S. Motor Car Co.; second vice-president, motor truck division, Windsor T. White, White Motor Co.; secretary, A. J. Brosseau; treasurer, H. H. Rice, Cadillac Motor Car Co.; general manager, Alfred Reeves.

Ford Leads Factories in Schedules for June

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put will be based wholly upon current sales demand. In spite of figures announced, a cereful check of all factories indicates that total production this month, exclusive of Ford, will not be more than 60 per cent of May figures.

Hupp now is building from 75 to 80 cars daily, but Hupp officials frankly admit that as soon as production equals current demand, the plant will slow up and perhaps close down temporarily until sales justify resumption. Buick officials express the hope of topping May production figures.

The Timken Detroit Axle Co. will close July 1 for one month and executives will take vacations simultaneously. Continental Motors is laying off men in its sales and other departments, indicating a general slowing up. The Liberty Starter Co. is cancelling deliveries.

PART TIME WORK GROWS

DETROIT, June 6—Employers' Association figures for the week ending May 31 show a decrease in the number of employees over the previous week of 3103 and an increase in employees working part time of 2371. Total employed was 113,456 against 116,564 the previous week. The figures are from 79 factories including practically all automobile plants.

Most Factories Take Position on Prices

N. A. D. A. Gets Replies from Fifty Manufacturers—Twenty-two Stand Pat

ST. LOUIS, June 4—Automobile manufacturers are pretty well agreed that the best way to stabilize the market is by a definite determination of price according to replies received by Harry G. Moock to his telegram May 31 to the manufacturers asking them to determine whether they were going to reduce, raise or stand pat and let the public know exactly what might be expected. Replies have been received from more than 50 manufacturers.

"I want to emphasize at this time," Moock said, "that my telegram of June 2 was not a request to manufacturers to reduce their prices. That's a matter that the factories only can determine, but the important thing which I sought to bring out in that request was that the public must be made to understand the situation. If a manufacturer is going to cut, let him cut now. If he is going to raise, let him raise. If he is going to stand pat, let him stand pat. But tell the public what you are going to do and stick to it, was the tenor of my message.

"Manufacturers who announced that they would maintain present prices are Haynes, Milburn, Rausch-Lang, Briscoe, Commonwealth, Cadillac, Maibohm, Daniels, Grant, Brewster, Pilot, Cox, Cunningham, Chandler, Detroit Electric, Apperson, R. and V. Knight, Dorris, Mercer, Locomobile, Crow-Elkhart and Auburn.

"From the following replies were received that just as soon as an announcement was practicable it would be made: Sayers, Roamer and Stutz."

TO MERGE FORD OHIO PLANTS

COLUMBUS, June 3—Information made public recently indicates that the Columbus assembling plant of the Ford Motor Co. will probably be discontinued when the new large assembling plant, planned at Hamilton, Ohio, is completed. The Hamilton plant will be started soon and will cost $400,000. It will have a capacity of 30,000 cars yearly. In the event that no changes are made in the plans both the Columbus and Cincinnati plants will be merged into the one at Hamilton.

W. C. SERAN UNDER CHARGES

BLOOMINGTON, ILL., June 6—W. C. Seran, president of the defunct Federal Auto Supply Co., has been charged with violation of the Illinois Securities Act in an information filed in court upon complaint of W. M. Conger, who invested $1000 in the firm. It is charged that the stock was not marked "speculative" and that other requirements of the act were not complied with by Seran. The company went into bankruptcy when a court judgment for $90,000 was secured.

MORE COMPANIES CUT PRICES

Drastic Price Cut Is Made by Dodge

$300 Slash on Open Models and More on Closed—Ads Withhold Figures

DETROIT, June 8—Dealers were notified to-day by Dodge Bros. factory officials that sharp reductions in prices would become effective immediately. It had been expected that some action on prices would be taken soon, but the cuts were deeper than dealers anticipated. Following are the old and new prices:

	Old Price	New Price
Touring car	$1285	$985
Roadster	1235	935
Coupe	1900	1585
Sedan	2150	1785
Screen side express wagon	1270	1085
Panel delivery wagon	1350	1135

The price of the touring car at the beginning of 1917 was $785, the coupe $950 and the sedan $1,185.

The decision to cut prices was not unanimously approved within the Dodge organization, and the widows of John and Horace Dodge are said to have cast the deciding vote in favor of the reduction. It is understood that price readjustment had been virtually agreed upon late in April, but the announcement was deferred more than a month.

Liberal space was used to-day by Dodge dealers throughout the country in advertising the price reductions, but in one respect the advertisements differed from those of other companies. No figures were given and the only way in which prospective purchasers could get the new prices was to communicate with the dealers. The underlying theory back of this plan appeared to be it would result in bringing more prospects into the salesroom and thereby increase sales.

DIXIE FLYER DOWN $150-$275

LOUISVILLE, KY., June 6—The Kentucky Wagon Mfg. Co., maker of the Dixie Flyer, announced price reductions ranging from $150 to $275 on its models. The touring car and roadster are reduced from $1595 to $1445, the coupé from $2570 to $2295 and the sedan from $2570 to $2345.

BREWSTER MAKES BIG CUT

NEW YORK, June 9—Brewster & Co., Long Island City, has reduced prices on the roadster and 5-passenger models to $7,000. The cars formerly were listed at $7,900 and $9,000 respectively. No change is made in the inclosed car prices.

Norwalk Motor Car Co., Inc., of Martinsburg, W. Va., makers of the Norwalk car, has reduced the price on its 5-passenger model from $1,285 to $1,135.

Raleigh Motors Corp., Bridgeton, N. J., has reduced prices on its 3 and 5-passenger models from $2,750 to $2,250; on the coupé from $3,600 to $3,100, and on the sedan from $3,700 to $3,200.

Birch Motor Cars, Chicago, has reduced prices on its roadster and 5-passenger models from $1,689 to $1,595.

British Factories Cut Prices to New Levels

LONDON, May 24 (by Mail)—Automobile trade in England is at a standstill. This applies to trucks as well as passenger cars, although it was expected that the miners' strike would give some impetus to sales of commercial vehicles.

Failure of this hope to materialize probably is due to the general slump in all lines of industry.

Prices on practically all British cars except Rolls-Royce and Napier have been substantially reduced and there is sharp competition for whatever business there is. With an improvement in exchange rates, American exporters will have an excellent opportunity to get a better grip than ever before on the British market.

Kissel Reduces $500 on Standard Models

HARTFORD, WIS., June 8—Price reductions of $500 have been made by the Kissel Motor Car Co. on the coupé and sedan of the Standard model line, bringing the new price to $3,775. The 7-passenger touring and the roadster remains at $2,775 and $2,975 respectively. No price change is made on the De Luxe line with regular equipment. The one-ton truck chassis is reduced from $2,175 to $1,585.

AMERICAN CUTS $200 TO $345

NEW YORK, June 9—Price reductions ranging from $200 to $345 have been made by the American Motors Corp., Plainfield, N. J., manufacturers of the American Balanced Six. The new prices are: Sedan $3150, 4-pass. sport $2350, 7-pass. touring $2275, 5-pass. touring $2195, roadster $2195. Former prices on each of these models were $3495, $2595, $2475, $2395, $2395. The new prices are guaranteed until Jan. 1, 1922.

COLUMBIA MAKES $350 CUT

DETROIT, June 9—Columbia Motor Car Co. has announced a price reduction on all models averaging $350. The new prices are to take effect at once.

CANADIAN FORD DIVIDEND

WINDSOR, ONT., June 8—The Ford Motor Co. of Canada has declared its regular annual dividend of 15 per cent.

Excise Tax to Stay, Washington Believes

Protests Considered Vain Unless Drastic Changes Are Made in Government Plans

WASHINGTON, June 3—Though the House Committee on Ways and Means has not taken up the question of internal tax revision, it is believed that the automobile industry will be accorded little relief from the present tax burden. The Senate Committee on Finance has closed hearings on the tax revision but has not indicated its opinion on the various proposals submitted by the automotive and other industries. The opinion prevails that the excess-profits tax will be abolished and possibly a 15 per cent tax on corporations substituted, the excise tax retained but not increased, for a year or two at least, the surtaxes lowered and certain minor taxes abolished because of the expense attached to their collection.

The views of the National Automobile Chamber of Commerce, the National Automobile Dealers' Association, Motor and Accessory Manufacturers' Association, and other automobile organizations which were presented to the Senate, will be submitted to the House Committee on Ways and Means at an early date as part of the Senate testimony. Nobody is willing to believe that the House committee will adopt proposals of the former Secretary of the Treasury that a horse-power and gasoline tax should be levied as additional source of revenue.

Unless drastic changes are made in the conduct of the Government, the excise tax will be retained, despite all protest, because it has, in the opinion of the Treasury, proven a reliable and satisfactory means of income. Frankly, Congress is particularly desirous of enacting revenue legislation which has no political boomerang.

The Senate has practically closed all hearings on internal revenue revision. There have been strong indications of their opposition to the sales tax plan and, in fact, it is generally believed that there is no hope for the sales tax at this session.

Tariff to Arouse Haggling

The introduction of the permanent tariff in the House probably will be a signal for almost interminable controversy. It could not be otherwise. It is the duty of the House Committee on Ways and Means to originate internal revenue measures, but it is doubtful if the committee can give its full time and consideration to these proposals for several weeks. If the permanent tariff is presented by June 15, practically every minute of the committee's time will be taken with defense and explanation of the schedules. The haggling over rates will not permit the tariff framers to devote time to tax hearings.

The Senate cannot take any action on the tariff until it passes the House.

Hoover to Arrange Statistics Service

Exchange of Information for Mutual Benefit Outlined at Committee Meeting

WASHINGTON, June 3—A tentative arrangement was made here to-day for the compilation of more comprehensive automotive production figures to be published for the information of other lines of business. Steps to this end were taken at a meeting of Secretary of Commerce Hoover with a committee representing the industry.

Secretary Hoover discussed quite frankly with the committee his object in asking that representative production figures be supplied to him monthly. He said that other industries had asked for these figures, representing to him that their business depended upon some knowledge of the number of vehicles produced. He added that the automotive industry had become such a power in the business world that other business needed to know something of its activities, just as the iron and steel and railroad figures were an index to activity.

J. Walter Drake, spokesman for the committee, discussed figures that would be helpful to the industry. He said that better crop figures were needed and that the industry could use to advantage more specific figures on steel, income taxes, railroad freight ton miles, railroad passenger miles, totals of business done by the textile, shoe and meat industries. He said that most of these figures were available too late to be of best use and that their sources were widely scattered.

In the conclusion, Drake proposed that the industry submit a written memorandum of the figures that could be supplied through the National Automobile Chamber of Commerce. He said he did not doubt but that monthly figures on factory sales (practically equal to production) could be supplied, separated into certain price classes. Secretary Hoover was quite positive that figures must be so separated to be of best use.

Seeks General Outline

Drake demurred at supplying figures indicating the activity as compared with capacity. He said that capacity was a doubtful proposition. Secretary Hoover made it very plain that he did not want figures that would in any way embarrass the industry, nor was he interested in the individual factory activity. He wanted only a picture of the industry as a whole. Secretary Hoover also said that he would work out a price classification of exports by prices as soon as the clerical labor could be arranged.

Drake will also submit a memorandum of what figures the industry wants. Secretary Hoover said these would be available in the near future, if they were as already outlined.

The Secretary asked that the industry recommend some person to be a representative of the industry on his staff. He wanted a broad gauge salesman with a statistical turn of mind. This person is to plan the information gathering campaign, both in this country and abroad and for a period will be on the Department of Commerce staff. Also he wanted suggestions for a man to serve as a connecting link between the Bureau of Standards and the industry. This man, he said, should be an engineer with production ideas.

Those present at the conference were: J. Walter Drake (Hupp), Percy Owen (Liberty), Alfred H. Swayne (G. M. C.), A. T. Waterfall (Dodge), E. A. Williams (Garford), Gaston Plaintiff (Ford), J. E. Kepperley (Overland), H. S. Vance (Studebaker), R. A. Hauer (International), M. L. Hemmingway (M. A. M. A.), Pyke Johnson and John C. Long (N. A. C. C.), T. F. Cullen (Chilton Pub. Co.), Clyde Jennings (Class Journal Co.)

Motor and Accessory Business for Four Months Shows Big Sales Gain and Drop in Past Due Bills

NEW YORK, June 8—Information gathered by the credit department of the Motor & Accessory Manufacturers Association regarding actual sales and credit conditions for the first four months of the year shows an amazing increase in business from January through April and a surprising decline in past due accounts. The figures, compiled from reports made by members of the association, follow:

Month	Total Purchases	Per cent Change	Total Past Due	Per cent Change	Total Notes Outst'g	Per cent Change
January ..	$6,264,587		$8,099,727		$4,359,871	
February .	10,408,962	66.15 Inc.	6,717,165	17.07 Dec.	6,063,118	39.08 Inc.
March	20,120,386	93.30 Inc.	5.603,992	16.57 Dec.	5,069,877	16.38 Dec.
April	26,746,580	32.93 Inc.	5,352,271	4.49 Dec.	5,371,086	5.94 Inc.

Main Will Supervise Purchases in G. M. C.

DETROIT, June 8—J. H. Main, for 10 years purchasing agent for the Cadillac Motor Car Co., has been appointed director of the purchasing section of the Advisory Board of the General Motors Corp., with offices here. He will be succeeded by D. F. Holgrave, who has been an employee of Cadillac for 13 years and for the last three years assistant to Main.

Main is considered one of the best informed men in the purchasing end of the industry and is an authority on iron and steel.

Sloan and Raskob Leave to Study Export Field

NEW YORK, June 9—Alfred P. Sloan, Jr., vice-president of the General Motors Corp., in charge of operations, and John J. Raskob, chairman of the finance committee of the corporation, will sail on the Aquitania, June 14, for a month in England and the Continent.

While their trip is primarily in the nature of a vacation, they will take advantage of the opportunity to determine matters of general policy pertaining to the General Motors Export Co. and study business conditions with special reference to the export situation for American cars.

South Bend Honors Studebaker Leader

Charles M. Schwab Principal Speaker at Testimonial to A. R. Erskine

SOUTH BEND, June 6—Citizens of South Bend gave a testimonial dinner to A. R. Erskine, president of the Studebaker Corp., tonight at which a magnificent silver service was presented to him. Charles M. Schwab, president of the Bethlehem Steel Corp., was principal speaker. He declared the present industrial depression was the best thing that could happen to the country at this time, and that through this depression business would get back to a real basis of economy.

"We have not been economical but we are going to be soon," he said.

Schwab had just returned from a study of conditions in Europe and regarding this said that it was his opinion that Germany would reap the real benefits of the war unless the United States got back to a solid foundation. He said the United States could compete with any nation of the world, but declared capital and labor must work hand in hand to insure a prosperous future.

In speaking of the Studebaker plant after an inspection trip he said he could find no place where he could suggest improvement. He believed this to be the greatest age of all time, that all should be of good cheer and optimistic. Among other speakers were Governor McCray of Indiana, Waddell Catchings, New York banker, and Walter C. Alien, president of the Yale & Towne Lock Co.

International Declares Regular July Dividend

NEW YORK, June 8—Directors of the International Motor Truck Co. at a meeting yesterday declared the regular quarterly dividend of $1.75 a share on the first and second preferred. The dividend is payable July 1 to stockholders of record June 21. International Motors has done a substantial business during the entire period of depression and its cash position is very strong.

Six Moore Officials Convicted of Fraud

Jury Returns Verdict After Four Weeks' Trial—Seek Disposition of Funds

ST. LOUIS, June 6—Five former officers and a former stock salesman of the Moore Motor Vehicle Co., Danville, Ill., have been found guilty of using the mails to defraud by a jury in the East St. Louis Federal Court. The charge resulted from sales of stock in the Moore company. The convicted men are: George L. Moore, Los Angeles; Edward K. Gallagher, Minneapolis; Albert C. Leonard, Denver; John K. Bichl, Chicago; James H. Vickers, Harvard, Ill., and J. W. Patt, Salt Lake City. The latter was the stock salesman. A motion for a new trial was made.

The story of the Moore company, from its inception in a village in Minnesota to a $5,000,000 corporation, was revealed during the progress of the trial. A salesman of the Ford car, his home in the wilds of Minnesota, George W. Moore came into possession of $4,700 worth of used cars taken by a country bank as security for a bad debt. It is asserted by the Federal authorities that Moore gave his unsecured note to the bank for the possession of the cars, and upon this basis organized the corporation of five millions and sold $1,600,000 worth of stock, built many motor cars and went broke, all within four years. The Federal authorities are endeavoring to learn where the money went.

Moore and his associates are charged by the Government with misrepresentation in their efforts to dispose of stock and that the salesmen they employed made impossible allegations. It is further charged that Moore, after he had decided to launch his company, appointed A. C. Leonard, a clerk, and Edward K. Gallagher, a chauffeur, as officers of his company.

From $50,000 to $5,000,000

They first incorporated for $50,000 in Minnesota and later for $5,000,000 in North Dakota, sold the first company to the second company and then launched a campaign of stock selling which assigned 500,000 shares at $10 each in order to capitalize the company to a paid-up basis, and known as "common stock"; $2,000,000 of preferred stock, and $500,000 as "voting" stock, apportioned among the officers and their friends. George Wilson was appointed stock salesman and received 35 per cent of all sold. He died recently. It was alleged at the hearing that Wilson sold the stock at any price he could secure for it, ranging from $3 to $10 per share.

It was asserted that from the time the company was first formed, little effort was made to manufacture cars, the principal business being, apparently, to sell stock. The "voting" stock was restricted to certain persons, as it had ten times the voting power of the common and preferred stock issued to the public in general. The money rolled in so rapidly that Moore became tired of receiving it and delegated this task to a stenographer. He is quoted as saying:

"It was the first time that I knew that a piece of paper could be sold for $10."

Not long after the company began to turn out cars, the operations appeared to show a loss and the stockholders forced a receivership in the hope of recovering their money. Clarence C. Smith, former auditor, testified that the company experienced a loss of $150 upon each car produced. In all 612 cars were marketed.

Employed 30 Stenographers

At one time thirty stenographers were employed whose duties were to send out literature during the stock selling campaign. Louis Platt, former mayor of Danville, testified that the Association of Commerce of that city subscribed to $20,000 worth of stock of the Moore company as an inducement for them to locate. A. Baenger, a consulting engineer of Minneapolis, was sent to Danville to make an appraisal of the Moore plant and fixed the value at $200,000 in 1918. He declined to make any estimate upon the value of the goodwill, due to lack of reliable information.

The plant of the Moore company at Danville is now owned by the American Building Association of Danville, purchase being made for $54,000 when the receiver placed the property upon the market. This money goes to the stockholders after receiver and court costs and various other obligations are satisfied. The indications are that the stockholders will receive but little unless the Federal authorities have better success than the receiver in locating the millions said to have been secured from the sale of stock.

File Petition Against St. Louis Supply Company

ST. LOUIS, June 6—An involuntary petition in bankruptcy has been filed in United States District Court against the American Automobile & Supply Co., this city, by three alleged creditors, whose claims aggregate $1,172.35. It is asserted that during the past three months the defendant has committed acts of bankruptcy by making preferred payments to creditors.

In connection with the action, Luke A. Pryor, now a farmer at West Point, Ark., has been arrested under an indictment charging him with obtaining $55,000 in property and securities under false pretences in selling the automobile company to E. Mason Roberts.

TIRE RECEIVER APPOINTED

NEW HAVEN, CONN., June 6—The City National Bank of Bridgeport has been appointed temporary receiver of the Kelly Tire & Rubber Co. upon application of the Martin Tire & Rubber Co. The receiver is authorized to carry on in such manner as he sees fit and has authority to borrow $10,000.

Goodyear Abolishes Board of Control

Duties of Members Taken Over by New Comptroller—S. A. Falor Resigns

AKRON, June 7—Under the Goodyear Tire & Rubber Co. refinancing and reorganization, the new financial management has abolished the board of control, transferring its duties to the supervision of George E. Einbecker of Milwaukee, who assumes charge of the newly created office of comptroller. This change has resulted in the resignation of Shelby A. Falor, for four years a member of the board of control and formerly in charge of motorcycle and bicycle tire sales. Falor leaves Goodyear to become president of the Universal Drug Co. of Akron, operating a chain of drug stores.

Other members of the board of control who remain with the company but who are assigned other duties are W. D. Shiltz, now assistant secretary of the company, H. B. Hamlen, and W. D. Oburn.

Reports Assets, $198,000,000

AKRON, June 3—"With net tangible assets of $135,000,000, with net quick assets of $63,000,000 and with a total provision of nearly $43,000,000 for adjustment of inventories and for raw materials not yet delivered, the Goodyear Tire & Rubber Co. will be in an exceptionally strong position and looks forward with full confidence to a future of steadily expanding and profitable business, says a statement issued Tuesday by the new management of Goodyear, in connection with the issuance of a new balance sheet as of Feb. 28, 1921.

The company's estimate of net income for interest and taxes for the 12 months to Feb. 28, 1922, is $10,600,000. Net income for the past five fiscal years, after deduction of the inventory adjustment, averaged $12,575,269, the statement reads, or approximately two and three-quarter times the combined annual interest.

The balance sheet shows provision made amounting to $24,000,000 including an additional $8,850,000 for loss on raw materials under contract but not yet received.

Total assets in the new balance sheet are listed at $177,228,515.88. These include property and equipment at Akron of $58,396,088 less depreciation of $11,329,918; the Sumatra rubber plantation at $5,489,828 and branch equipment and automobiles at $1,696,051. In the Oct. 31 balance sheet the Akron plant was listed at $57,913,143, the Sumatra plantation at $5,003,541 and branch equipment and automobiles at $2,393,891. Current assets under the new balance sheet total $42,201,915, including $1,298,838 for work in process and $19,622,250 in finished product. The company has $11,176,095 cash on hand and $19,332,995 in notes and trade acceptance and other assets of $12,500,000.

Colombian Business Due for Quick Boom

Temporary Slump Occasioned by Financial Pinch Passes—Open Up Oil Resources

NEW YORK, June 3—The expectation that business with Colombia will shortly return to normal was expressed in statements just received here from the American Chamber of Commerce of Colombia, Barranquilla, Colombia, the chief port of that rich country. Writing under date of May 18, R. L. Parrish, the acting secretary, declared:

"The business situation in Colombia has at no time been as acute as in other countries. Colombia has no national or municipal debts to speak of. The balance of trade for many years until the last two had been continually in Colombia's favor, which resulted in a substantial accumulation of wealth in individual hands. The sudden slump in prices in 1920 caught a good many importers who had been overbuying and they individually lost some money. The foreign business here was mostly through the American banks. When they shut down suddenly under orders from the United States, the situation was serious and business has not yet recovered its normal tone and volume.

"However, it seems that the situation is growing more tolerable and, in my opinion, Colombia is due for a boom. The foreign trade of Colombia in 1920 approximated $140,000,000, of which considerably more than $100,000,000 was with the United States. The greatest present activity is in the development of the oil resources, mostly by American companies, who are spending large amounts in that line."

Exports of passenger cars to Colombia in 1920 totalled 962, valued at $1,247,976, a striking increase from the 1919 total of 253 with a value of $298,383. Truck exports jumped from 38 in 1919 to 275 last year and parts purchases tripled, the 1920 total being $216,772.

Colombia Starts Roads As Lower Prices Arrive

WASHINGTON, June 3—Road and pavement building has been resumed in Colombia along with a general resumption of construction work on buildings and other public projects. This, according to reports received by the Bureau of Foreign and Domestic Commerce, is due to lowered cost of materials and labor and has resulted in many projects being started which necessarily were halted while prices were high.

Road interest has manifested itself in various parts of the country. In addition to improvements made on roads to outlying towns in the vicinity of Barranquilla, work is continuing on the road being constructed between Barranquilla and Cartagena. This 99 kilometer stretch has been under construction about six years and at present the part from Barranquilla to Sabanalarga and Manati is now in use. The Department of Cauca is also undertaking road construction.

The problem of street paving in Barranquilla is an important one and, according to estimates, will involve an expenditure of about $3,000,000. Plans for the financing of this project were discussed at a municipal meeting attended by the principal merchants.

Americans Monopolize Maltese Car Market

WASHINGTON, June 3 — Consul Carl R. Loop, at Valetta, Malta, has reported to the Bureau of Foreign and Domestic Commerce that according to the register of licensed motor vehicles, the most popular makes of foreign automobiles are English and Italian, and of foreign trucks, English. However, the current market is almost entirely monopolized by United States passenger cars, and no new trucks, other than those of United States make, are being offered for sale at the time the report was made.

During the war, the military forces imported lorries and ambulances in considerable numbers and such vehicles are now being sold to private concerns. The list prices at which passenger cars are being sold in Malta vary from £220 to £2600, or, at the then current rate of exchange, $858 to $10,140, the most popular makes selling at £365—$1424—and £410—$1599. The list price of an Italian machine is £450—$1755—and £1080—$4212, respectively. Discounts to distributors are usually 20 and 2½ per cent, but in one case of United States cars and trucks the terms are cash against documents. An Italian company allows its distributors 60 days, and similar terms are the rule with English and French cars.

The four-cylinder car is more popular than the six, for the reason that it is considered to be more economical. The one or two-ton truck is the most popular, as distances are short, the streets and roads narrow, and winding, and business is not sufficiently heavy or congested to require large trucks. According to the official register, 237 passenger cars were licensed in 1920 and 93 trucks.

CRANKCASE DILUTION GAGE

TRENTON, N. J., June 3—E. S. Lea has developed an instrument which when applied to the crankcase of an internal combustion engine indicates to the operator when his crankcase oil has become so much diluted with gasoline or kerosene that it should be replaced. It consists of a float chamber with overflow through which the crankcase oil is circulated by the pump of the lubricating system. When the oil gets too thin a red signal attached to the float shows behind a window. The signal is also out of sight when the oil is not circulating, and the instrument therefore also serves as a circulation indicator. For automobile use the instrument can be applied to the instrument board.

Exports and Imports Fall Off in England

Percentage of Reduction Heaviest on Import Trade—Labor Dispute Harmful

LONDON, May 13 (By Mail)—Official statistics for April's British import and export trade at large reflect very clearly the setback caused by labor disputes culminating in the hold up of manufacturing industries and shipping to an increased extent.

Britain imported in April 399 cars against 1914 in April, 1920, 209 trucks against 1139 in April, 1920, and 274 chassis against 1295 in April, 1920. The value of the chassis parts imported was roughly $1,017,200 against $3,606,700 in April, 1920.

Motorcycles imported were 71 against 475 in April, 1920, but curiously there was a bigger import value of parts, the respective values being for April, 1921, $63,020, and April, 1920, $61,665. The import value of tires fell from $2,506,970 April, 1920, to $817,810 April, 1921, which is a fair criterion of the state of the industry.

The export of British cars was 179 in April, 1921, as against 202 in April, 1920, and their destinations were respectively—British India 28, New Zealand 12, other countries (not specified) 139. The month's export of chassis was 102 against 155 in April, 1920, as follows: South Africa, 5, and other countries (not specified), 97. The month's export of trucks was 88, as against 78 in April, 1920, as follows: British India 33, New Zealand 4, other countries (not specified) 51.

The export value of British tires fell from $1,260,980 April, 1920, to $929,985 April, 1921. These rates are taken at the nominal rate of exchange, viz., $5 to a British £1.

Fiat Polish Factory Starts Work at Warsaw

NEW YORK, June 6—Poland's first motor car factory has been opened at Warsaw, under the title of Spolka Akcyjna Samochodow Polski Fiat, with a capital of five million Polish marks. The new concern, which is most generally described under the abbreviated title of the Polish Fiat, is an offshoot of the big Italian Fiat Co. of Turin, one-half of its capital having been subscribed by Polish financiers, and the rest being of Italian origin.

The Polski Fiat has a modern factory and garages at Warsaw, with a branch at Lodz and representatives at Lublin, Posnan and Leopol. The works are now in full production under the technical direction of the Italian Fiat Co., for the Polski Fiat car is still dependent on the home factory for many of its components. Business conditions are reported to be very promising, the firm having important orders in hand.

Berliet Deficiency 3,000,000 Francs

Stock in Trade Shown as 65,-444,021 Francs—To Operate Under Receiver

PARIS, May 28 (By Mail)—The Berliet Automobile Co., having been allowed to take advantage of the French law providing for a transactional arrangement with creditors, under which the payment of debts will be spread over a number of years, a statement has been published covering the financial situation of this concern.

Land, buildings and material are valued at 64,190,117 francs; deposits in the bank are 733,375 francs; government bonds represent 1,039,580 francs; outstanding accounts 17,499,710 francs, and general stock in trade 65,444,021, making a credit total of roughly 149 million francs.

The debit account shows 50 million francs in shares, 25 millions in bonds; 4 millions in various provisions, and 73,368,789 owing to various creditors, making a total of just over 152 million francs. The most important trade creditors are Dinin Storage Battery Co., 407,296 francs; Paul Girod Steel Works, 1,446,050 francs; Michelin Tire Co., 1,310,754 francs; Bergougnan Tire Co., 2,254,812 francs; Nilmelior Magneto Co., 680,075 francs.

The Berliet company is continuing in operation under the control of the government receiver appointed to protect the interests of creditors. A popular 16 hp. automobile on American lines is being produced; trucks are also being manufactured, but the present demand is low.

Poor Crop Prices Hurt Porto Rican Market

SAN JUAN, P. R., May 28 (By Mail)—There are now in Porto Rico over 7000 automobiles. Ford leads with a percentage of 33, Buick second with 17 per cent, and then follow Dodge, Hudson, Chandler, Studebaker, etc.

The roads throughout the Island, owing to the heavy rains, are in very poor shape, this condition being heightened by the operation of truck trains, while the railroad strike is on. For the past week all freight has been carried by truck.

Dealers report business dull, owing to the price of sugar and coffee in the main. Tobacco is hardly worth the marketing, while for a whole year the American Tobacco Co. has had a strike on its hands.

There are at present over 50 passenger buses or as they are known here, "Guaguas," in operation between San Juan and Santurco. A new line of passenger buses called the "Blue Line" has been established between San Juan and Ponco. They are 24 passenger White buses, make the run in about six hours and are meeting with great success.

The firm of Cerecedo & Co. of San Juan has sold its business to F. U. Wells & Co., Inc., including Exide, for which it was distributor. By this purchase and including the large stock of batteries already carried by F. U. Wells & Co., it places them greatly in the forefront in the storage battery field in Porto Rico. They also ship to Santo Domingo, St. Thomas, and other islands.

The P. R. R. R. Co. has adopted wheels for Ford cars, by which they can use the railroad tracks, and are using them as work and inspection cars.

Territories Withdrawn by Ford in Argentina

NEW YORK, June 3—Confirmation that changes are being made in the operation of the foreign business of the Ford Motor Co. has followed the announcement from Buenos Aires of the resignation of E. H. Hampton, manager of the Ford Argentina plant. Advices from Detroit quote W. A. Ryan, the Ford general sales manager, as admitting that the changes are being made in all territories, but he would give no details. Ryan confirmed the resignation of Hampton, whose successor has not been named.

The resignation of Hampton was one of the results, according to reports, of the withdrawal of the exclusive territory to the 325 Ford dealers in Argentina.

R. I. Roberge, manager of Ford foreign sales, has removed his office from New York to Detroit. It is stated that he will handle the major problems of Ford sales from there.

Engine Production Grows Six Times in Five Years

WASHINGTON, June 4—Statistics of engines produced in 1919 as compiled by the Bureau of Census, show that gasoline automobile engines produced in that year were valued at $58,548,000, as compared with $10,122,000 in 1914. Other internal combustion engines, including aviation, were valued at $13,-185,000 in 1919; marine, $10,153,000; gasoline stationary, $37,243,000; gas stationary, $10,571,000; portable gasoline engines, $1,127,000, and all other gasoline engines, $1,882,000. Traction engines for farm, military, road and other purposes produced in 1919 were valued at $124,546,000 and in 1914 $4,209,000. Automobile engines listed as steam engines and others were valued at $3,004,-000 in 1919. The census reported 199 establishments making internal combustion engines and 85 traction engines.

DAVIS SALES LEAD 1920

RICHMOND, IND., June 3—The George M. Davis Motor Car Co. produced and sold more cars in April, 1921, than in April, 1920, according to Walter C. Davis, secretary and sales manager. Production this year exceeds that for the same month last year by 9 per cent, and the factory is working at its full production schedule. The new cars have met with a gratifying reception.

METAL MARKETS

THERE is no longer any doubt that once the present period of intensive dullness in the steel market shows signs of waning radical reductions in the price schedule of the leading market interest may be looked for. Developments so far have been absolutely in line with those which preceded the previous announcement of cuts in the United States Steel Corp's prices. Then as now it was the American Steel & Wire Co. which led the other subsidiaries of the corporation in the downward revision of prices. That a general reduction in the prices of steel products will be proclaimed by the chief producer at the first sign of a reawakening of representative demand is the belief of conservative market observers. Those who are more radical profess to see in the American Steel & Wire Co.'s announcement indications of a price war or at least of carte blanche given by the corporation to its sundry subsidiaries to meet all price cuts by independent producers. Some characterize the present condition as a "wide-open market." There is, however, very little likelihood of any alteration in the orthodox manner in which steel prices have now been made for many years. Here and there a voice in the "independents'" camp will be heard to the effect that they made a mistake when they raised their prices to bring them up to the levels of the corporation following the latter's last price revision. But in spite of the vicissitudes through which the steel industry is passing sentiment is overwhelmingly in favor of a continuance of the present market generalship. For the present no fault will be found with any producer if he can garner in business that will keep part of his plant running, even though he has to cut way under the corporation's levels. If perchance much business of this character should materialize it will make readjustment or more permanent levels much easier. The automotive industry continues to figure prominently in shipments, but very little in the way of new orders from that source is reported. Reports current in the Youngstown district that the leading maker of low-priced passenger cars contemplated a shutdown of his plants on July 1 were followed on the heel by others that said passenger car builder would enter the market for another tonnage of sheets this week.

Pig Iron.—Manufacturers of automotive engine castings in the Middle West who have been buying on a modest scale during May are curtailing their shipping orders. Although the nominal quotation for No. 2 foundry remains at $23 valley, and for malleable on a like basis, concessions are not difficult to obtain.

Steel.—The sheet tonnage placed by the leading manufacturer of low-priced passenger cars in the last few weeks with mills in Ohio (outside of the valley) and in Pennsylvania, is said to amount to 10,000 tons. A valley producer took 500 tons on a release at 4 cents with extras, the original price having been 8 cents. Canton, Mansfield and Connellsville mills are working on sheets for this consumer. In Youngstown predictions are freely made that sheets will sell on a basis of 3 cents for the black and at proportionate prices for blue annealed and galvanized before the summer is over. Rumors that German sheet bars have been bought at $34 laid down in New York are generally scoffed at in the trade. Laid down at sheet mills the price of these sheet bars would be such that it would be unattractive. Cold-drawn bars are in light demand with a small tonnage on its way to the Cadillac Motor Co. from Pittsburgh district mills.

FINANCIAL NOTES

Maxwell Motor Corp. one, two and three year notes and stock certificates are ready for delivery at the office of the Central Union Trust Co., New York. Holders of certificates of deposit for notes and claims already approved will be entitled to receive cash and notes in the amounts provided in the reorganization plan. Holders of subscription warrants fully paid will be entitled to receive the shares of stock called for by the warrants. Holders of certificates of deposit for stock will get the new stock in accordance with the terms of the plan.

Chandler Motor Car Co. directors have reduced quarterly dividend payments from $2.50 to $1.50 and have declared the usual quarterly payment at the new rate. The $2.50 rate had been paid since October, 1919, when the old stock of $100 par was exchanged for the current shares of no par. This action by Chandler had been expected in the financial community and had been discounted by the recent break of 20 points in the stock.

McCord Mfg. Co. will be back on its feet by August, declares a banker interested in the readjustment of the company. The Detroit plant, which makes radiators, did enough business to offset the slack in other departments without any new money. The company has nearly $500,000 cash on hand, liquidation of inventory is proceeding satisfactorily, payables are being rapidly reduced and quick assets increasing.

United Auto Stores, Inc., directors have authorized a stock increase from $1,000,000 preferred and 40,000 no-par common shares to $5,000,000 8 per cent cumulative preferred (par $100), and 200,000 no-par common shares. Preferred and common stockholders of record June 10 will receive a dividend of 20 per cent in common stock.

International Harvester Co. directors have voted to reduce the dividend rate on the common stock from 7 to 5 per cent and voted a stock dividend of 2 per cent payable July 25. The quarterly cash dividend is payable July 15. Stock outstanding totals $92,000,000. No further reduction in the dividend rate is probable, the directors said.

Burdick Tire & Rubber Co., Noblesville, Ind., has mortgaged its factory for $250,000 to the First Dearborn Savings & Trust Co., Chicago, as trustee, and James S. McClellan, Chicago, as co-trustee. The mortgage runs 10 years and draws 8 per cent interest.

Lee Rubber & Tire Corp. reports sales for the first four months of 1921 exceeded $2,137,000, or 75 per cent of the corresponding period in 1920. April, 1921, sales established a new record at 34,333 casings. Output was reported exceeding 1700 casings daily.

Electric Storage Battery Co. has declared the regular quarterly dividend of $3 on the common stock and the regular quarterly dividend of $3 on the preferred stock, both payable July 1.

Advance Rumely Co. has declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable July 1.

INDUSTRIAL NOTES

Paul Rubber Co., Salisbury, N. C., is erecting a plant for the manufacture of tires. The company expects to be manufacturing tires in 90 days' time. The company is now operating a factory in Chicago, with C. T. Brown as sales manager. When the Salisbury plant is completed it will be made the main factory and the entire organization will move to Salisbury.

Atwater Mfg. Co., Southington, Conn., employing about 250 in the manufacture of drop forgings, has closed down for an indefinite period. It has been operating on a two-shift schedule of eight hours each for the past month. The factory had a large rush order for the Ford Motor Co., which it filled this week.

Altenberg Tire Equipment Co., Davenport, Iowa, has been reorganized with V. D. Sears, president and sales manager, and Ralph T. Hayes, production manager for Moline Plow Co., vice-president and general manager.

Goodyear Tire & Rubber Co. announces that the shutdown of the plant from June 25 to July 5 will not be occasioned by business conditions, but will be solely for the purpose of taking the regular annual inventory.

Rainier Motor Corp. has removed its New York headquarters to 235-7 West Fiftieth Street, where it will have an entire building for sales and services.

Arvac Mfg. Co., manufacturer of accessories at Anderson, Ind., will increase its output May 31 and has notified workers formerly laid off to report.

New Departure Mfg. Co. has removed its Chicago sales and engineering offices to the Peoples Gas Building, 122 South Michigan Avenue.

Gray & Davis, though reducing operations to the plane of current business demands, will continue manufacturing on a substantial scale.

Rome Wire Co. has opened New York sales offices at 50 Church Street under the direction of H. A. Hammond, district manager.

Milburn Capital Stock Increased to Million

TOLEDO, June 6—At a meeting of the officers and directors of the Milburn Wagon Co. it was unanimously decided to increase the common stock of the company from $625,000 to $1,000,000 for the purpose of absorbing the accumulated surplus.

The company will put on about 600 men this month in order to bring its production of bodies for the Olds Motor Co. up to schedule. There are now 220 men employed in the production of Milburn electrics. The schedule calls for about four cars a day.

Officers of the company elected for the year are: Horace Suydam, president; Otto Marx, vice-president; Frank D. Suydam, Jr., secretary, and F. H. Dodge, treasurer.

Maibohm Sues Chamber for Breach of Contract

TOLEDO, June 6—The suit of the Maibohm Motors Co. of Sandusky against the Sandusky Chamber of Commerce for $100,000 for alleged breach of contract will be heard before Judge Harvey Platt, of Tiffin, of the Common Pleas Court.

The motor company brought the suit for damages, charging that the Chamber of Commerce refused to fulfill its part of a contract when the company moved its plant to Sandusky from Racine, Wis., two years ago.

It is expected the trial will begin in the next two weeks.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, June 9—The money market during the past week was characterized by a decided firmness which carried over into the present week. On Thursday call money reached 8 per cent, the highest rate since Feb. 8. The range for the week was 7 per cent to 8 per cent as against 6½ per cent to 7½ per cent in the previous week. Most of the transactions were put through at 7½ per cent. Time money showed tendencies similar to those for call money. Rates for all maturities from 60 days to 6 months were 6¾ per cent to 7 per cent as against 6¾-7 per cent for 60-90 days' and 4 months' paper and 6¼-7 per cent for the longer maturities the week before. Funds were scarce and the supply apparently small, judging by the amount which a 7 per cent bid drew forth. The present firmness is not, it appears, consistent with the usual movement following the meeting of first-of-the-month requirements. There were, however, some Government withdrawals during the week, and a fair amount of new financing.

For the second time in the current year, and for the first time since Feb. 25, 1921, Federal Reserve note circulation of the Reserve System showed an increase. At $2,751,299,000 the Federal Reserve notes in circulation marked an increase for the week of $16,495,000, but are still about $653,632,000 below the peak figures of December 23, 1920. Total gold reserves increased $15,706,000 and total cash reserves $10,598,000.

While the bank statements give evidence of the fundamental improvement which has taken place in the banking situation, there are still signs that the general readjustment has not been completed. Ford has just announced a further cut in the price of his cars, following similar recent announcements by about thirty other automobile manufacturers. Crude oil prices have reached the lowest level in several years, while the steel trade is as yet showing no signs of revival.

It has been estimated that the steel industry is now working at about 25 per cent of capacity as contrasted with about 55 per cent in January and about 80 per cent in the first nine months of 1920. The financial markets have reflected these conditions. In view of further dividend cuts by a number of industrial companies and other unfavorable factors, the stock market declined steadily all week. On Tuesday of the present week many industrial shares reached new levels for the year.

The bond market has been lethargic and gives evidences of needing a respite from the flood of new issues. It was in the foreign exchange market, however, that the most spectacular break came, Sterling declined to $3.76¼ while the French franc broke below 8 cents to 7.88½. Practically all foreign currencies declined on the New York market.

MEN OF THE INDUSTRY

L. D. Maxson has tendered his resignation as purchasing agent of Olds Motor Works at Lansing, Mich., to join Edward Ver Linden, former president of Olds, with the Ver Linden division of the Durant organization. Maxson had been with Olds Motor Works about sixteen years. He will have charge of purchases of all material to be used in the new plant as well as mechanical equipment.

Richard Harfst has been made general manager of the Detroit branch of the Cadillac Motor Car Co., succeeding W. H. Collins, who has joined his father, R. H. Collins, in the latter's new project. For the last year Harfst has been in the office of the president of the General Motors Corp. in New York, from which position he resigned to join Cadillac.

R. E. Wolcott, assistant credit manager, and R. H. Watterman, purchasing agent, of the Miller Rubber Co., have resigned under the company's program of retrenchment of office personnel. The Miller plant is now on a production basis of 3000 tires a day, and expects to continue this program until October.

H. C. Bradfield of Detroit has been appointed director of sales and advertising for the Yellow Cab Mfg. Co., Chicago. Associated with Bradfield as sales manager of the taxicab division is J. B. Dub, who was formerly associated with Bradfield in the former Premier Motor Car Co. of Indianapolis.

A. G. Partridge, who resigned several months ago as vice-president and sales manager of the Firestone Tire & Rubber Co. of Akron, has been appointed sales manager of the Star Rubber Co. He succeeds O. L. Weaver, who it is announced retires on account of ill health.

Sir Henry McGowan, chairman of Nobel's Explosive Co., London, and representative of the British Explosives Trades, Ltd., interests on the General Motors Corp. board, has arrived in New York to attend the stockholders meeting of General Motors the latter part of June.

William C. Williams, production manager of the Chevrolet factory in Fort Worth, has been transferred to the Oakland plant, it was announced here today. Williams came here at the opening of this plant, four years ago. His successor in Fort Worth has not been named.

A. K. McLuney, who left Buick Motor Co. 10 years ago to become Detroit manager of the Studebaker branch and later was a Buick dealer at Utica, N. Y., has returned to Buick, where he is connected with the sales department at the factory.

Hugh W. Stilwell has joined the organization of the Clark-Turner Piston Co., Los Angeles, to take charge of and develop the advertising department. He was formerly connected with the Miner Advertising Agency of Los Angeles.

William J. Wickes, president of the Wickes Boiler Co., Saginaw, Mich., has been made vice-president of the new Ruggles Motor Truck Co., which has taken over the plant of the Saginaw Shipbuilding Co., Saginaw, for its factory.

Fred M. Hoblitt has been appointed general sales manager of the Ajax Rubber Co., to take the place of Fred E. Dayton, who has resigned to become connected with the real estate firm of Cross & Brown in New York.

Paul Andree has been made secretary-treasurer and manager of the Cincinnati office of the R. & V. Engineering Co. He was formerly superintendent in the East Moline factory.

E. P. Mickelberry of Champaign, Ill., has purchased the Bradley Motor Co. business here for $60,000. He will continue the Bradley line agencies with no change in office personnel.

Verne E. Burnett, who has been assistant to Cliff Knoble, advertising manager of the Liberty Motor Car Co., has resigned to join the advertising staff of the Cadillac.

Hays McFarland has been appointed sales manager of the Bassick Mfg. Co., Chicago, manufacturers of lubricating systems.

D. E. Kirk has resigned from the Green, Fulton. Cunningham Advertising Co. to join the Evans-Ayres company.

J. Henry Smith has been appointed vice-president of the Sheet Steel Products Co., Michigan City, Ind.

Goodrich Retrenchment Makes Changes in Staff

AKRON, June 7—Changes in personnel incident to office force readjustments under the B. F. Goodrich Co.'s policy of retrenchment have resulted in the resignations of E. C. Tibbetts as Goodrich advertising manager, James O'Mara, director of publicity; E. P. Rowen, in charge of Diamond tire sales; R. E. Hackenger, assistant advertising manager, and Milton Fassnacht, in charge of tire adjustments.

Tibbetts and Rowen were two of the oldest Goodrich officials, each having been with the company over 15 years. Rowen was formerly with the Diamond Tire Co., joining Goodrich with consolidation of the two companies in 1904. Tibbetts has been with Goodrich for over 25 years.

In addition to office personnel cuts, the Goodrich company has enforced a program of salary readjustments and has limited all vacations this year to one week.

Preston Motors Assigns Cuban Distributorship

BIRMINGHAM, ALA., June 3—J. T. Driver, vice-president and general sales manager of the Preston Motors Corp., announces the initial steps of his concern to go after export business. E. I. Matthews, formerly with the State auditing department of Florida, has been assigned as distributer for that State and Cuba. Matthews expects to leave for Cuba in the near future to perfect his sales and distribution organization for that territory and to launch an extensive advertising campaign.

"Mr. Matthews, being located in Florida, which is just a stone's throw from Cuba, knows Cuba and its marketing conditions, and is going to make us an excellent representative," Driver said. "It is the first step we have taken toward going after foreign business by establishing a direct distributer. However, we are planning an export advertising campaign at the present time and expect to be doing a good export business by next winter. We are going to impress upon the foreign buyer the wonderful location of Birmingham, our direct water route with gulf ports and our excellent shipping facilities."

Court Gives Verdict for Engineering Error

PARIS, May 28 (By Mail—French civil courts have condemned the Automobile Club of France to pay Alexandre Anzani, aviation engine manufacturer, a sum of $2,000 as damages for wrong awards in an aviation engine competition held in 1913. In this competition, which included all the leading French manufacturers of aviation engines for the period, the first prize was given to the Gnome company for its rotary type engine. Considering that there had been a mistake, Anzani had all the figures verified and brought forth definite proof that the engineers of the Automobile Club of France had made errors in their calculations As the club refused to recognize its mistake or to publish any correction in its official bulletin, Anzani brought the matter before the civil courts, with the result stated above.

Leach Biltwell Buys Miller Engine Works

LOS ANGELES, June 3—The Leach Biltwell Motor Co., which has been incorporated with a capital of $5,000,000, has acquired the Miller Engine & Foundry Works of this city. M. A. Leach, president and founder of the motor company, becomes president of the new corporation.

The Miller works were owned by Harry A. Miller, builder of motors for automobile racers, who controlled patents for a new motor which will be constructed especially for the Leach cars. Miller becomes a director and second vice-president of the new company and will superintend the building of the motor. Other officers of the new corporation are John T. Dye, first vice-president; Grey M. Skidmore, treasurer, and James H. Faircloth, secretary.

ALLEGE FALSE STOCK SALES

ROCKFORD, ILL., June 6—Jack Felch of this city has filed information in Belvidere, Wis., against five officers and a salesman of the Prudential Tire & Rubber Co., alleging sales of stock under false pretenses. He claimed that representation was made that the Prudential company, which had leased the Boone Tire & Rubber Co. plant, had taken over its business and on this basis was exchanging $300 stock in the Boone company for $200 stock in the Prudential company and $100 cash. The Boone company still maintains its properties

Calendar

SHOWS

Sept. 5-10—Indianapolis, Automobile and Accessory Show in conjunction with Indiana State Fair, conducted by Indianapolis Automobile Trade Association, John B. Orman, Mgr.

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

July 4-9 — Mackinac Island, Mich., Summer Meeting Automotive Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

Pintle Hook Mounting Standardized by N.A.C.C.

NEW YORK, June 6—The Truck Standards Committee of the National Automobile Chamber of Commerce has adopted the following recommendation: Where a pintle hook is attached to a motor truck or tractor frame, the hook itself shall be of the U. S. Government type. This hook shall be so mounted that the axis of the drawbar head shall be located both vertically and horizontally approximately in the center of the frame of the chassis. A means shall be provided for fastening one end of the safety chain to the rear end of the motor truck chassis frame. The clevis is to be located directly under the axis of the drawbar head or as near to this position as possible.

The Trailer Manufacturers' Association of America has suggested that it is not necessary for the truck manufacturer to place a spring behind the drawbar head or pintle hook on motor trucks. They state that trailers made by reputable trailer manufacturers have a starting and stopping spring in the drawbar or trailer head, which is or should be of proper length and strength so that any additional spring furnished by the truck manufacturer would give too much spring action, causing the trailers to jerk and bump the truck. Nevertheless the N. A. C. C. Truck Standards Committee recommends that wherever possible truck manufacturers equip their drawbar heads with springs for the better protection of the truck frame and driving mechanism.

Dort First and Third in Argentine Road Race

FLINT, MICH., June 6—Establishing a new South American long-distance record for reliable performance as well as fast time, a Dort car won the annual Argentine classic, held this year at Rafaela, northern Argentina. In a field of 16 entries, among which were one Vauxhall, two Fiats and three Dodge cars, the Dort came home the winner.

This annual cross country run covered a distance of 392 kilometers, or 244 miles, over all sorts of roads, which taxed the entries to the utmost. Of the 16 models lined up for the start, only four finished, among which were two Dorts, taking first and third places. The time was 4 hours and 41 minutes, an average of 84 kilometers per hour. This establishes a new South American long-distance speed record and also wins the special prize offered by the Automobile Club of Argentina for regularity in performance.

Progress of Industry to Be Shown in Chicago

CHICAGO, June 3—C. R. Richards, dean and director of the engineering experiment station at the University of Illinois, is making plans for a comprehensive exhibit of the automotive industries during the Pageant of Progress Exposition on the Municipal Pier here, July 30 to August 14. There will be displayed everything that goes to make up an automobile, a motorcycle or an airship with exhibits in this division of the oldest styles of cars and airplanes to the most modern. There will be model factories and actual working exhibits.

Development of the mechanism of automobiles and trucks will be shown inclusive of types of engines, exhibits of early engines, the trend of design in the development of the engine with its cooling and lubricating system, the carbureter, gasoline tank and methods of starting; the transmission system, electric system and the development of tires. This latter exhibit will include a comprehensive display of various types of wheel construction, demountable rims, and strides made in the manufacture of pneumatic and solid tires. An electric dynamometer with some form of modern automobile engine mounted on it and operated will be one of the interesting features of the exhibit.

SUE ON INTERLOCKING STOCK

AKRON, June 7—Seventy-two individual actions have been initiated in the Common Pleas Courts of Summit County at Akron by Elihu Harpham, receiver of the defunct Interlocking Cord Tire Co., against as many stockholders of the company demanding payment of unpaid amounts due on stock subscriptions. The amount involved aggregates $15,432. Recently Harpham filed 36 similar suits.

Speed Limits Lifted on French Highways

PARIS, May 20 (By Mail)—No official speed limit now exists in France, but motorists will be held responsible for the accidents they cause by reason of negligence or incompetence. The wiping out of the speed limit is in accordance with public sentiment, which has long recognized that an arbitrary limit was no protection to users of the road, while often being an arm for the persecution of motorists.

This change has been made in an entirely new set of national laws covering all phases of road travel and abolishing the local and often arbitrary and antiquated regulations in force in various parts of the country. The right hand rule of the road is maintained, despite an agitation in favor of the English or left hand rule. Traffic on national highways has the right of way, and when two roads of equal importance cross drivers must give way to vehicles approaching on their right.

The speed limit is maintained for trucks and passenger carrying vehicles weighing 3 tons. The Government driving license, granted after a practical examination, also has been maintained. Under the new laws all vehicles must carry lights, but dazzling headlights cannot be employed in towns or cities. Animals allowed to wander on the road will do so at their owners' risk.

Quality Tire Creditors File Bankruptcy Appeal

INDIANAPOLIS, June 4—A creditors' petition in bankruptcy has been filed against the Quality Tire & Rubber Co. of Anderson, Ind., in Federal Court yesterday by the Great Falls Mfg. Co., the Marlboro Cotton Mills and the Katzenbach & Bullock Co. In their petition they allege that the tire company is insolvent and sought recently to transfer a portion of its property to certain of its creditors. They also sought to obtain back salary of $215.93 for its president, H. C. Yauky. The Great Falls Mfg. Co. places its account against the tire company at $70,000, the Marlboro Cotton Mills at $112,000 and the Katzenbach & Bullock Co. at $92.

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Where Are We Getting in Efforts to Solve the Fuel Problem?

A review of research and development work covering results of tests and improvements in design made public during the past year, together with comments on future developments that appear to be promising.

By Herbert Chase

SO much has been said and written regarding the fuel problem and its solution that the situation is more or less confused in the minds of some persons. It therefore seems worth while to attempt to render an accounting of the present situation in order to determine what has been done and if possible what remains to be done in order to reach a solution of the problem.

It is quite generally agreed that the supply of petroleum known to exist in this country, if not in the world, will, if the present rate of consumption continues to increase, at least approach exhaustion within the present generation. Since our present civilization is largely dependent upon this source of fuel supply, it is evident that careful consideration must be given to the conservation and use of petroleum products of all kinds, and in particular those elements available for use in internal combustion engines.

So far as the automotive industry is concerned efforts at the present time naturally and properly center around means for better utilizing fuels in automotive engines. Efforts are also being made to better the character of fuel available, since the efficiency with which fuel can be used, especially in the present prevailing type of engine, is dependent to considerable degree upon the volatility and molecular structure of the fuel.

Looking at the present day car makes it evident that conditions are, in the average case, better than they were a few years ago when the importance of the fuel problem first began to receive wide recognition. Far more remains to be done than has already been accomplished, but it will be evident from examination of the attached chart and the literature on the subject that the work already accomplished is of considerable importance and that the near future holds possibilities of much greater progress.

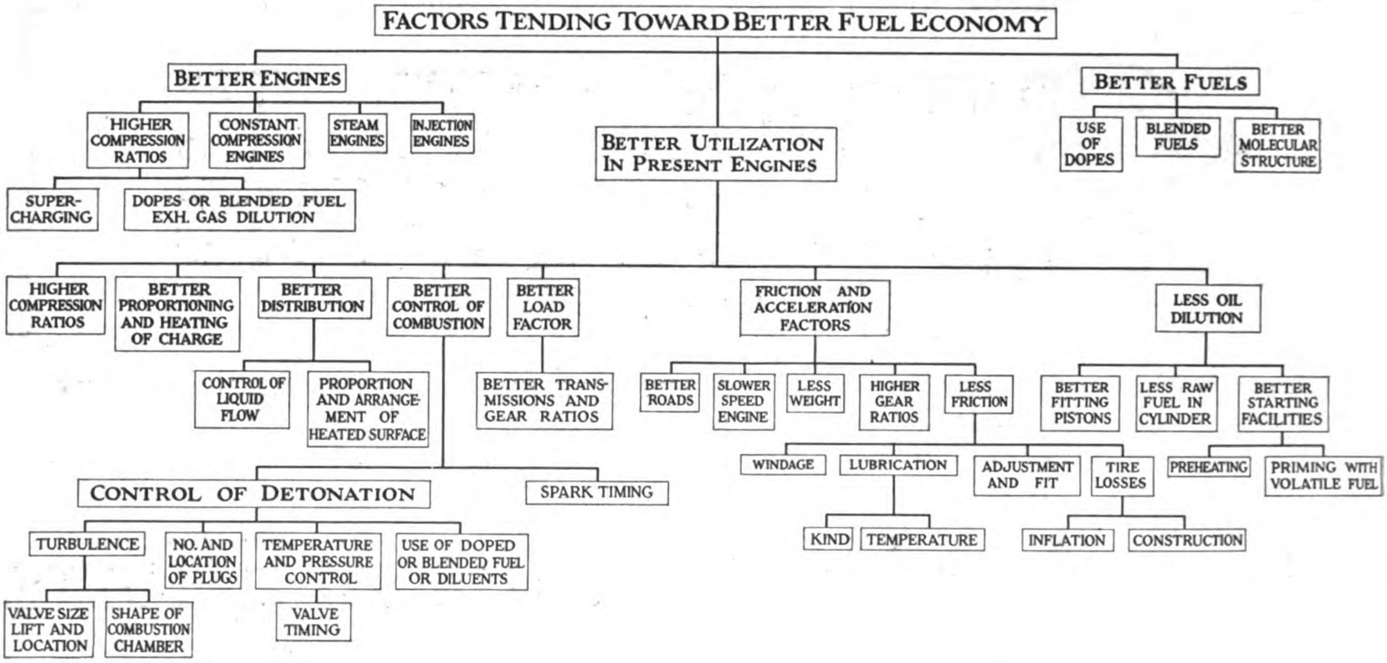
It will be seen from the chart that better fuel economy is to be expected in three main directions as follows:

1. Developing the better engines.
2. Better utilization of fuel in present engines.
3. Development of better fuel.

The work done to date and developments which are in progress or seem promising will be considered under these three heads.

Development of Better Engines

In the chart developments of better engines are classed under four main heads. The first two apply primarily to improvements in the present type of constant volume or so-called Otto cycle engines, while the second apply to other types in less extensive use. The effect of compression ratio on efficiency is illustrated in Fig. 1 from which it will be seen that if it



were possible to use a seven to one compression ratio in a constant volume engine the thermal efficiency would be as high as that of any engine now in commercial use. The chief reason why these high compression ratios are not now employed is the fact that they cannot be used with present fuels without detonation or too early ignition with consequent serious results covered later under another head. High compression ratios have been used in experimental engines with results which have been published by Ricardo* and others. They have been made possible by the use of blended or doped fuels, considered under another head below.

Ricard's super-charging engine has given a brake mean effective pressure as high as 140 lb. per sq. in. This engine gave a brake thermal efficiency of 34 per cent, equivalent to a fuel consumption of 0.461 lb. of fuel per bhp. hr. This was accomplished by the use of cooled exhaust gas as a diluent to prevent detonation.

*Nearly all the papers and reports of tests referred to in this artic'e have been printed in issues of AUTOMOTIVE INDUSTRIES or of the Journal of the Society of Automotive Engineers published since June 1, 1920, and are listed under the author's name in the indices to these publications.

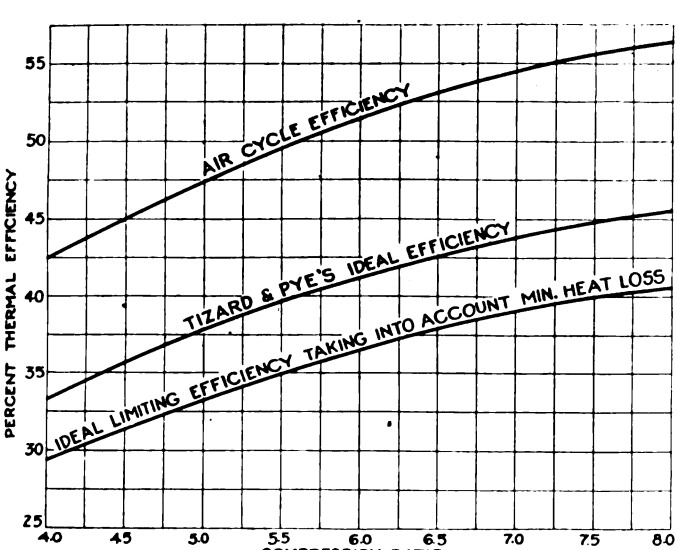


Fig. 1—Curves showing theoretical efficiency obtained with various compression ratios

Constant Compression Engines

One of the inherent disadvantages of the conventional constant volume engine as now generally applied is the fact that when throttled and running at part load its efficiency as compared to full load operation falls off rapidly. It has long been appreciated that if the throttle could be eliminated and the compression held constant while variations in loads are met by changing the quantity of fuel used the efficiency would remain good even though the load is light. This effect is realized to a certain extent in the ordinary two-cycle engine which runs with a practically constant compression and is more efficient at a low load than the ordinary throttled four-cycle constant volume engine. With the ordinary two-cycle engine, however, dilution with exhaust gas at low load is excessive, so that richer mixtures than are otherwise necessary have to be employed. To overcome this disadvantage E. C. Newcomb has long been experimenting with a type of engine illustrated diagrammatically in Fig. 2. This is a two-cycle engine using crankcase compression, but the charge is transferred through a valve in an L chamber in the head. The spark plug is located at the end of the L at a point where a portion of the fresh undiluted portion of the charge always exists at the instant of ignition. The quantity of charge can be regulated by a throttle, but the compression remains constant for the volume of exhaust expelled is determined by the volume of charge admitted, the sum of the two being substantially constant. This engine is said to show a fuel economy of 0.7 lb. per hp. hr. at full load, and slightly less than 0.7 lb. at one-third load. When fitted in a car weighing with passengers about 2000 lb. from 50 to 85 miles per gal. can be covered. This performance is due largely to the fact that the engine is relatively very efficient at part loads, which are the loads obtaining during a large portion of the time, in passenger car operation.

Other experimenters have built engines of the constant compression type operating on a four-stroke cycle. One of these, designed by Ricardo, is illustrated diagrammatically in Fig. 3. This is similar in principle to conventional four-stroke engines except that an extra valve operated by the suction of the engine is provided in a bulb attached to the head of the engine and communicating with the main clearance space through a

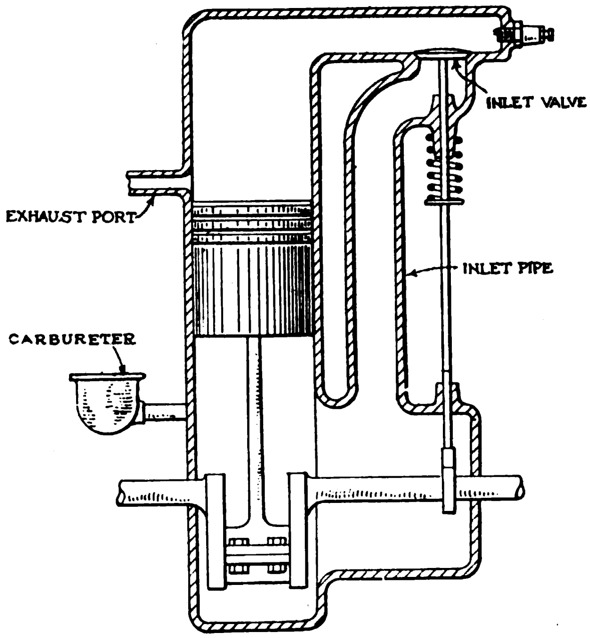


Fig. 2—Diagrammatic view of Newcomb two-cycle constant compression engine.

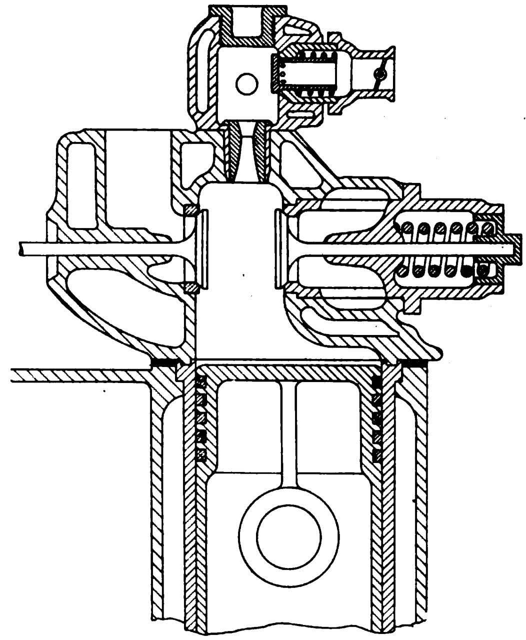
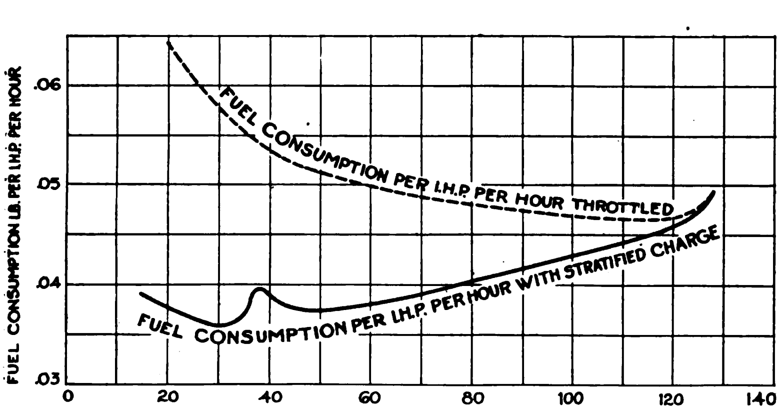


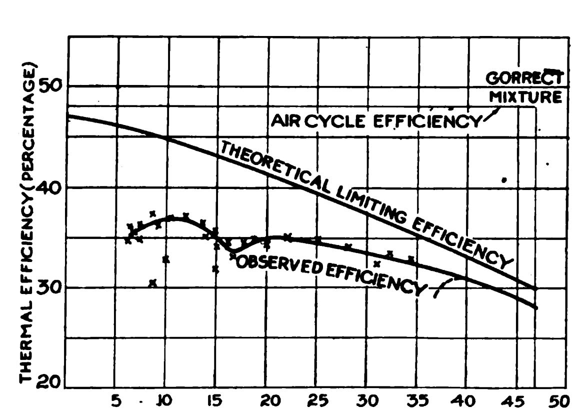
Fig. 3—Diagrammatic view of Ricardo four-cycle constant compression engine

Venturi tube. Gas or rich mixture only enters the bulb on the suction stroke, and this mixture remains in contact with the spark plug in the bulb. Air only is admitted through the usual inlet valve which opens later than the suction operated valve. The rich mixture only is throttled. The air entering through the normal inlet valve fills the remaining space not filled by the mixture of exhaust gases remaining in the clearance space, so that the compression remains constant. On the compression stroke air is forced through the Venturi tube and mixes with the rich gas in the bulb, causing considerable turbulence therein. With this arrangement a localized or stratified charge is obtained. Control is effected entirely by varying the quantity of mixture admitted.

This principle was tried by Ricardo in a single cylinder experimental engine of 5-in. bore and 6-in. stroke. He reports the following interesting results: The engine started easily even in the coldest weather. When running light with an indicated mean pressure of 14 lb. per sq. in. the exhaust, though perfectly free, was almost inaudible. The cylinder barrel remained quite cool and it was possible to bear the hand on any part of a cylinder head or exhaust pipe after an hour's running at no load. So long as the admission of fuel was not altered the speed of the engine remained absolutely uniform. The engine accelerated immediately from a speed of 120 r.p.m. on increasing the quantity of fuel admitted. The violent turbulence resulted in extraordinary rapidity of combustion. Fixed ignition 3 deg. before dead center sufficed for all speeds and loads and invariably gave a vertical line of pressure rise on the indicator diagram. The average of several hundred readings of fuel consumption at all loads from light to full load were taken. The mean results of these are given in Fig. 4 which shows the fuel consumption obtained with indicated mean pressures ranging from 14 to 120 lb. per sq. in. Fig. 5 shows the indicated thermal efficiency actually obtained, the theoretical limiting efficiency and the air cycling efficiency. On full load the running of the engine was in every respect normal.

Subsequent experiments on larger engines could not always be repeated and much further experimental work is necessary before this type of control is rendered generally applicable. Attempts to adapt the principle of operating by stratification alone over the whole range of load to existing engines have not been entirely successful, but have at least been proven that a sufficient degree of stratification can be maintained at the same time with sufficient turbulence to insure rapid combustion, although the two conditions may not at first sight appear compatible. Ricardo proved to his own satisfaction that under these conditions a very marked re-





Performance of Ricardo engine using localized charge. Fig. 4, at left, showing fuel consumption, and Fig. 5, at right, showing ideal indicated thermal efficiency and actual observed efficiency

duction in maximum temperature and a corresponding gain in efficiency could be obtained.

Other experimenters have employed other means for building constant compression engines which do not use the bulb and automatic valve employed by Ricardo. One method of doing this is to make provision whereby the first part of the charge of air entering the cylinder is not mixed with fuel at part loads, the portion of the charge entering later carrying sufficient fuel to meet the load condition imposed. One means for accomplishing this result is illustrated diagrammatically in Fig. 6. This design is due to James A. Charter. A small air pump driven by the engine is arranged to deliver air under pressure to the cylindrical valve driven in timed relation to the engine. By means of the valve and suitable piping air is delivered in the quantity and at the time desired to nozzles placed in the inlet ports of the engine. These air nozzles are so directed as to cause flow of fuel from a fuel jet placed adjacent to the air jet, as shown. The fuel is maintained under constant head by a float mechanism and is fed into the main air stream entering the engine, at the time and in the quantity desired by suitable control of the air passing the air jet, but is not affected by other air entering the cylinder. This control is obtained by axial motion of the distributor valve, which it will be noted has triangular ports. The ports are so proportioned as to feed air through the entire suction stroke at full load or through the latter portion of the stroke only at part load. The charge of fuel is independent of the total quantity of air entering the cylinder, which is substantially constant, but is in direct proportion to the quantity of air fed through the distributing valve and air nozzles. The spark plug is so placed as to be in contact with the carbureted portion of the charge.

Tests of this device are said to have shown considerable saving in fuel both at part and full load as compared with operation with the ordinary carbureter.

Steam Engines

Difficulties involved in adapting present day fuels to use in internal combustion engines has led some investigators to consider further development of the steam engine for automotive use. Newcomb and Scott, among others, have secured commendable results in this direction, and others are experimenting with steam engines. especially for truck and tractor applications. C. A. Norman, who has investigated the possibilities of improved power plants using both steam and internal combustion engines, states that the steam plant, by its ability to handle almost any kind of fuel, its economy at reduced load and its superior maneuvering qualities seems, in many ways, to meet the present fuel situation better than the gas engine.

Injection Engines

One means of realizing the high efficiency obtainable with high compression engines is to utilize fuel injection. The efficiency of this type of engine has long been appreciated and has been realized in practice in the Diesel and other types, but none of these have been extensively utilized to date for automotive purposes, although they are capable of handling low grade fuels. One difficulty with this type has been that involved in handling with precision the extremely minute quantities of liquid fuel required per working stroke in a cylinder of suitable size for automotive use. Practically all engines of this type built to date have been of large size and of very heavy construction. They are also relatively low speed engines, but W. G. Gernandt stated recently that he has developed a single cylinder two-stroke engine of 2¾-in. bore which burns gasoline, kerosene, distillate or fuel oil and can be operated at speeds varying from 225 to 2250 r.p.m. without missing by simply varying the quantity of fuel injected.

Development in the heavy oil engine is continuing and some expect that it will ultimately be adapted to automotive use. The maximum pressures developed even with 500 to 600 lb. compression are said not to exceed the pressures resulting from detonation in engines of conventional types and designs.

Sperry is engaged in developing a supercharging compound expansion Diesel type engine recently described in these columns. This engine weighs, according to Sperry, 27 lb. per hp., but the principles involved are to be incorporated in an aeronautic engine to weigh not in excess of 5 lb. per hp.

The Sperry and some other engines designed for burning heavy fuel are in reality constant volume engines. that is, they burn the fuel injected at substantially constant volume and with considerable rise in pressure above that due to compression. In this respect they differ from the true Diesel engine in which the charge is injected gradually without material rise in pressure. Injection on the compression stroke results in adding area to the indicator card, but, of course, involves higher maximum pressures and temperatures. Newcomb and some others have experimented with injection engines using constant compression pressures, but without the high compression ratio employed in the Diesel type. Engines of this type possess most of the advantageous characteristics of other constant compression engines referred to above, but the difficulty of precise metering of the fuel injected in small cylinders has militated against their success.

Other efforts to develop new types of engines suitable for automotive use but intended to give much higher economies than the conventional types might be cited but space limitations forbid further discussion here.

Many attempts to develop air-cooled engines are now being made, and announcement of these developments is expected before many months. One advantage of this type of engine is the more uniform temperature of the combustion chamber under widely varying operating conditions and the lower loss of heat to the cylinder walls during combustion and the expansion stroke. To date it has not proved possible to use as high compression ratios as have been employed in water-cooled engines, hence economy at full load is not so good as in the latter type. Whether late developments will overcome this disadvantage, or whether the average economy of vehicles using this type of engine will result remains to be seen.

Better Fuel Utilization in Present Engines

It will be noted from the chart at the beginning of this article that there are seven main headings under which improvement in the utilization of fuel in present engines can be anticipated. It is entirely possible that some at least of the advantages referred to already under the head of development of better engines can be made with slight modifications in existing engines or engines of the same or similar types soon to be manufactured. Certain refinements in design, notably those factors controlling combustion to be treated under a later head, may make it possible to use much higher compression ratios than are now generally employed. Such an increase will, perhaps, more than any other one factor, favorably affect the fuel economy of the conventional type of engine, but every item which will contribute to this end should be given careful consideration.

Many investigators, including some of those connected

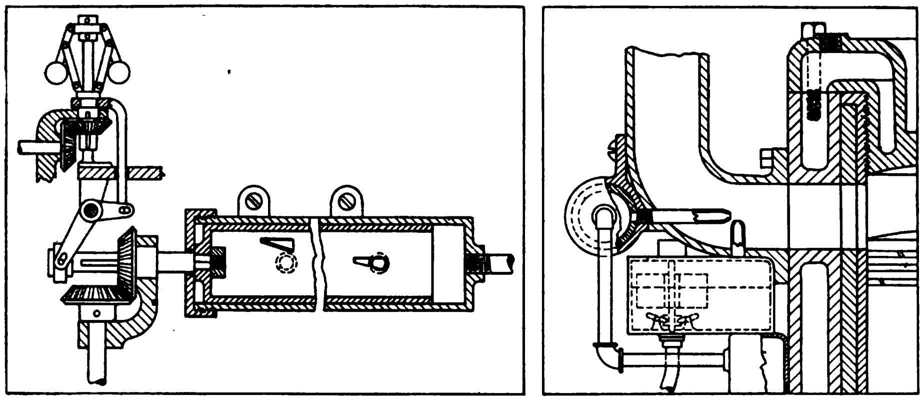


Fig 6—Diagrammatic view showing device used by Charter for timing and measuring charge in constant compression engine.

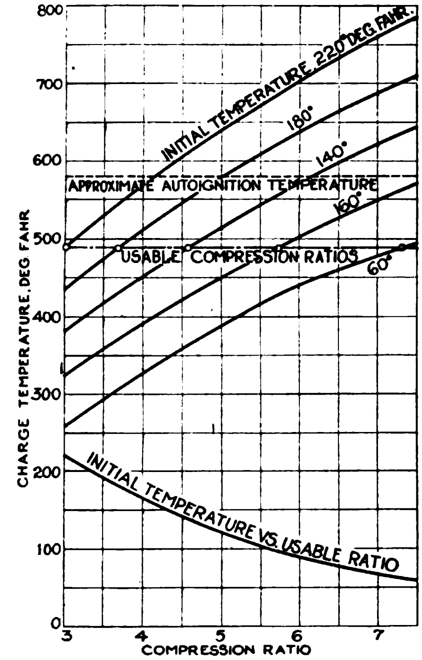


Fig. 7—Curves showing maximum allowable compression pressures with various initial temperatures as given by P. S. Tice.

with the largest automotive manufacturers in this country, are seeking means whereby higher compression ratios can be employed. Kettering is responsible for the statement that if the compression pressure of the conventional engine of to-day could be raised to from 120 to 140 lb. per sq. in. the efficiency would be doubled. Midgley states that in a one-hour run of a Liberty aircraft engine with a compression ratio of 5.3 to 1, using ordinary automobile gasoline instead of high test gasoline at wide open throttle, most of the piston heads were cracked due to detonation while every spark plug was injured. This shows clearly the effect of using with high compression pressures the average fuel now available, unless some means is taken for controlling detonation. This subject will be referred to later, but is mentioned here to illustrate the important bearing which the quality of fuel has in respect to controlling fuel economy. Tests made by Nelson show clearly the effect of higher compression ratios on the economy of one more or less conventional engine. The accompanying cut, Fig. 7, shows the maximum allowable compression with various initial temperatures, as given by P. S. Tice.

Better Proportioning and Heating of Fuel

The importance, as affecting fuel economy, of properly proportioning the air and fuel in the mixture entering the cylinder, and of heating this mixture a proper amount can scarcely be overemphasized. Much research work has been done for the purpose of determining exactly what mixture proportions and temperature are necessary for maximum economy. In this connection James, Dickinson and Sparrow reported the following conclusions resulting from tests at the Bureau of Standards: at constant speed, mixture ratio and power output, the fuel consumption in lbs. per bhp. hr. is independent of the temperatures and methods of heating the intake charge within the range tested. The rate at which an engine will accelerate with a given mixture ratio or carbureter setting is markedly affected by the amount of heat supplied and its method of application. Within the limits of their tests the greater the amount of heat supplied to the charge and the higher its temperature at the intake port the more rapidly the engine accelerated. W. E. Lay reports tests which prove that the mixtures giving maximum economy become leaner as the load increases. The mixture giving best economy at high temperature is leaner than one giving best economy at lower temperature. Thermal efficiency increases as the temperature at the carbureter inlet increases.

Fielder reporting on tests made for the Fifth Avenue Coach Co. shows that average economy is much increased by a device arranged to maintain a constant temperature of mixture even though atmospheric temperature conditions vary between wide limits.

Engineers interested in fuel conservation have often commented on the quite general practice of using rich mixtures as a means of securing rapid acceleration. In this connection Sparrow reports tests in which he found it possible to secure the same acceleration with a heated mixture consisting of 15.3 parts of air to 1 of fuel by weight as with an unheated mixture of 9.4 to 1 proportions. From this it is quite evident that properly heating the fuel effects not only much higher economy but enables good handling and acceleration, factors often gained otherwise by the use of over-rich and extremely wasteful mixtures.

Frank A. Howard has drawn attention to the fact that the ordinary engine gasoline sold to-day possesses sufficient inherent volatility to take and maintain the condition of a gas at a temperature at or below average intake manifold temperatures. Manifold condensation seldom if ever occurs and cylinder condensation is even less probable. Fuel once vaporized must, under the conditions in the manifold, remain a vapor; hence if liquid is found beyond the vaporizer it reached there as a liquid. Manifold condensation, Howard maintains, is impossible with ordinary gasoline above a temperature of about 125 deg. Fahr., because it is physically impossible for fuel vapor to condense when its partial pressure is lower than the determined vapor pressure of the liquid itself at that temperature and this is apparently the average condition in an engine manifold.

Norman calls attention to the fact that heating the air, or the whole charge, will unquestionably give reduced maximum power with the engine on the test-stand. On the other hand it will also make it possible to operate the engine satisfactorily over a greater range of mixture ratio. It is a question whether this smoother general operation is not worth more on the road than an increase of power on the test-stand amounting to perhaps 5 to 10 per cent. In any case, within certain limits, the leanest mixture means the greatest economy and air heating, even up to 250 deg. Fahr., is found to give improved economy by enabling the engine to run on leaner mixtures.

Dickinson points out that not only good operating conditions but good acceleration can be obtained with an economy mixture if the temperature is maintained at about the right point.

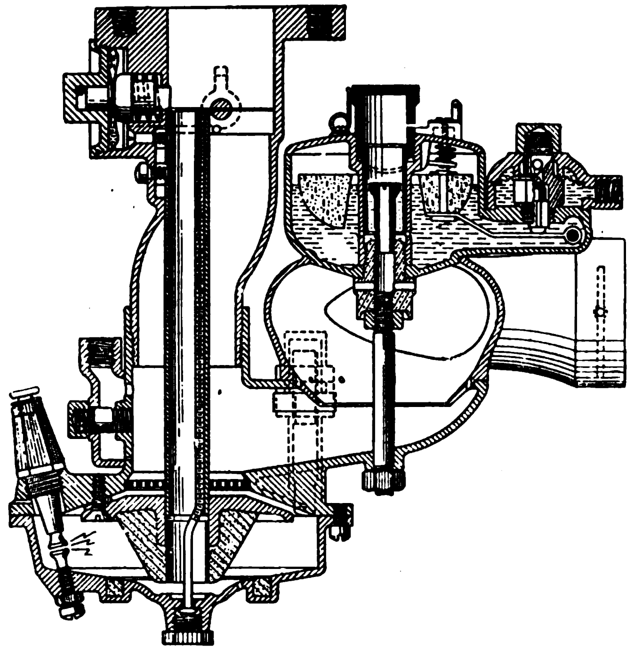


Fig. 8—Ensign fuel convertor.

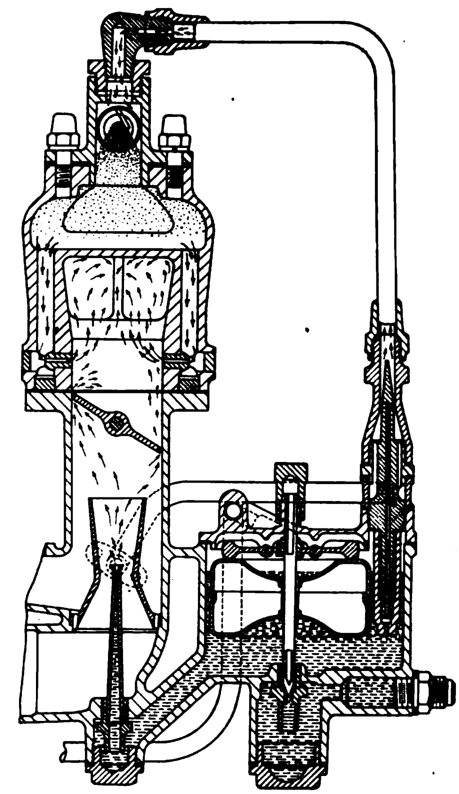


Fig. 9—Packard fuelizer.

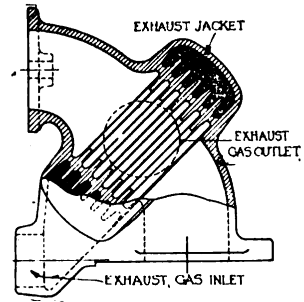


Fig. 11—Section of exhaust heated intake pipe designed by Nelson.

The most general means of maintaining the desired temperature of charge is to apply exhaust heat to the inlet manifold. This subject will be considered under the next heading, manifolding and distribution. One other method of supplying the heat necessary will be mentioned here, namely, that of burning a small portion of the charge for the purpose of heating and vaporizing the remaining portion. Two devices operating on this principle which have seen quite extensive use are the Ensign fuel converter illustrated in Fig. 8, and the Packard "fuelizer," so-called, illustrated in Fig. 9. The Ensign device is so arranged that heavy ends of the fuel not carried out of the carbureter in the air stream are collected below a gauze in the base chamber, together with some air. The rich mixture thus formed in the base chamber is ignited by the spark plug and the products of combustion discharged through the riser tube shown to a point above the throttle where they mix with and heat the remaining charge.

The Packard device is in effect a small supplementary carbureter arranged to function primarily under low throttle conditions, especially in starting. Fuel and air drawn through this device under the high velocity induced by the high vacuum in the manifold is fed to a chamber containing a spark plug where it is ignited. The hot products of combustion flow into the inlet manifold through small orifices above the throttle and thus heat the remainder of the charge. This device is said to overcome the difficulty experienced by some in securing a sufficiently high degree of exhaust heat under low loads to properly vaporize fuel in the charge.

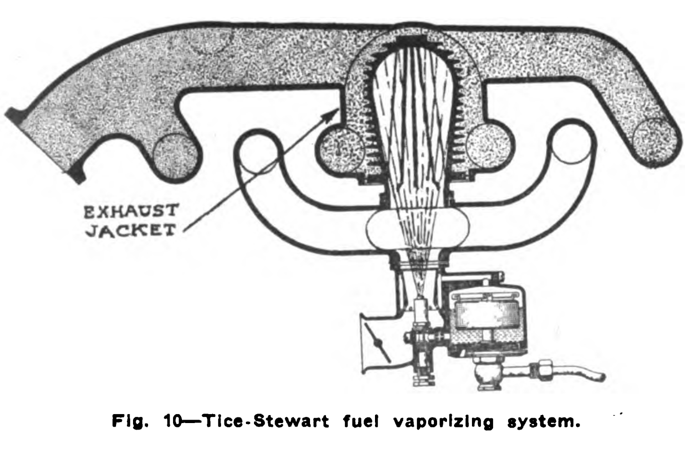


Fig. 10—Tice-Stewart fuel vaporizing system.

Another factor having a marked influence on vaporization is the degree of atomization of the fuel as it leaves the fuel nozzle. Fine atomization increases the fuel surface exposed to heat and thus enables more rapid vaporization. Atomization is facilitated by high velocity at the jet and in some cases by entraining air in the fuel stream prior to its discharge from the jet.

Better Distribution and Manifolding

The problem of properly heating the charge referred to under the previous heading is met in most cases by heating the inlet manifold. This is accomplished in various ways, the heat necessary being secured in most instances by the use of an exhaust jacket surrounding a portion of or the entire inlet manifold. Some investigators are of the opinion that too much heat is absorbed by the charge with a result of excessive rise in temperature when the entire manifold is jacketed, and for this reason most efforts are directed toward heating and vaporizing the fuel without unduly increasing the temperature in the entire charge. This is effected at least to some extent by use of the so-called hot-spot located, as a rule, opposite the discharge of the carbureter or its riser. Many efforts have been made to concentrate heat at this point, but it has been shown that liquid deposited out of the air stream tends to accumulate at the lower side of the manifold adjacent to the T so that considerable heat is required at this point.

Among early investigators who experimented with means for heating the fuel without excessive heating of the air was P. S. Tice, who developed the Stewart vaporizing system shown in Fig. 10. In this the liquid stream issuing from the carbureter is projected into an exhaust heated dome with internal and external ribs which provide considerable surface on which the fuel is vaporized. The vapor then issues into the manifold in the form of a fog and enters the cylinder at a temperature of about 150 deg. Fahr., which is said to remain approximately constant at all loads and speeds.

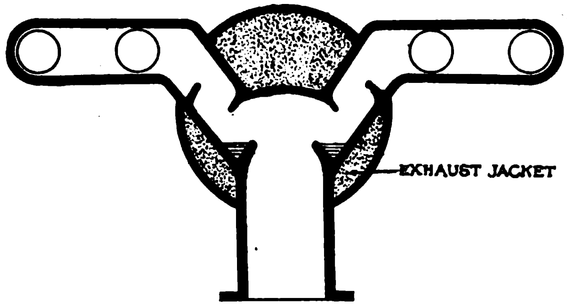


Fig. 12—Exhaust heated inlet pipe designed by Scarratt.

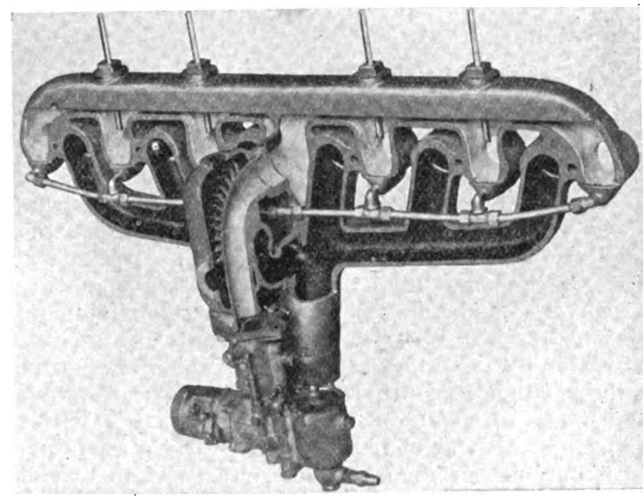


Fig. 13—Exhaust heated intake manifold designed by Dorris.

Other developments along similar lines are seen in the manifolds developed by Nelson, Fig. 11, Scarratt, Fig. 12, and Dorris, Fig. 13. It will be seen by reference to Figs. 11 and 12 that the liquid fuel in both cases is thrown against exhaust heated surfaces. Portions of the fuel not vaporized immediately are deposited out on the hot surface against which they are held under influence of gravity or centrifugal action until vaporized, after which they enter the air stream and are drawn into the cylinders. Fig. 13 shows an exhaust heated manifold so arranged that unvaporized portions of the fuel which reach the inlet ports in liquid condition are deposited out and are returned to an exhaust heated vaporizing pocket where they are converted into a gas and returned to the charge. The average temperature of the charge entering the cylinder in this case is said to be approximately 175 deg. Fahr.

Fig. 14 shows a type of inlet manifold developed by the International Harvester Co. Practically the entire inlet pipe is disposed within the exhaust header, yet according to D. L. Arnold, the charge is not heated sufficiently to materially affect the maximum power developed. The assumption is that the fuel rides the surface all the way round, as indicated by the arrows, thus insulating the core of air. With this manifold the engine is reported to develop 79 lb. brake m.e.p. on 0.6 lb. of gasoline per hp. hr., and with very little knock.

Howard, Mock and other investigators have drawn attention to the need for increasing the time which elapses between discharge of the fuel from the carburetor jet and the entrance of the fuel to the cylinder in order to facilitate vaporization. The Tice, Nelson, Scarratt and Dorris designs provide for this in the manner indicated. These and other designs also provide increased surface for transfer of exhaust heat from the exhaust jacket to the fuel deposited on the other side of the heating surface. By the use of large heating surfaces the temperature of the surface may be decreased. since the quantity of fuel vaporized is a function of time, heating surface and temperature difference, it is evident that all these factors must be considered in efforts to properly vaporize fuel in the charge.

One means of increasing the time element has been suggested by Mock. This involves the use of an expansion chamber with baffles between carbureter and engine. Liquid particles of fuel not vaporized would be deposited out in this chamber and vaporized by contact with exhaust heated walls.

O. C. Berry, discussing tests made at Purdue University, calls attention to the fact that too great an increase in the temperature of the mixture decreases the power considerably and does not increase the thermal efficiency. The mixture temperature giving maximum power in the Purdue test also gave maximum efficiency, and the mixture itself was fairly wet.

Crane, in discussing the subject of distribution, suggests the desirability of making the manifold in the first instance so as to give the best possible distribution without addition of heat and then adding sufficient heat for vaporization. According to his view the manifold should be made as short as possible and should have an upgrade all the way from carbureter to cylinder port. It should be of minimum diameter consistent with power development, and under ideal conditions should be free from liquid on its internal surface. Crane also calls attention to the disturbing effect, especially at low speeds, caused by late closing of the inlet valve, with consequent discharge into the inlet manifold of a portion of the charge already in the cylinder.

Tice and other investigators of the flow of the charge in glass manifolds have shown that liquid tends to accumulate on the walls and travel along them, accumulating, especially at points of low pressure. Dickinson states that distribution and acceleration are largely dependent upon the condition of the manifold surface. Both distribution and acceleration are improved when the manifold surface is relatively dry. James states that tests made at the Bureau of Standards indicate that a much closer study of conditions which determine ability to accelerate rapidly are needed.

From the foregoing analysis of factors affecting the vaporization and distribution of the mixture it will appear that much fundamental data bearing on this subject has been secured. Designs making use of this information are already in use, but much more development work is necessary to improve the performance of the average present day car. A test made on a large number of cars and trucks by the Bureau of Mines indicate that the average car under average operating conditions fails to burn from 20 to 30 per cent of the fuel fed through the carbureter. This enormous waste is the result of inaccurate metering of the fuel and air, incomplete vaporization,

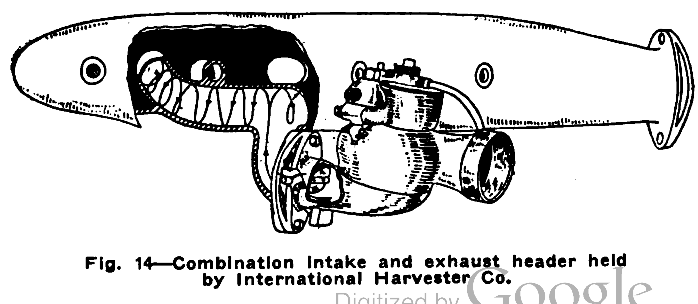


Fig. 14—Combination intake and exhaust header held by International Harvester Co.

poor distribution and mixing, resulting in incomplete combustion.

Control of Combustion

We have already seen that one of the most serious limiting factors in securing better utilization of fuel is the tendency of present day fuels to cause knocking of the engine. The precise cause of this phenomenon is not known, but is presumed to be due to detonation of the charge or portions thereof with accompanying development of extremely high pressures. Tests made at the Bureau of Standards have shown that maximum pressures of at least 1300 lb. per sq. in. are attained when detonation occurs under certain conditions. Experiments made by Dixon and others show that the rate at which flame travels through a combustible mixture varies in steps from the time of ignition. During the early period of combustion the flame is blue or green and travels at a relatively low constant speed. During the next period the rate of travel accelerates rapidly and the flame becomes yellow until it attains a constant and very rapid velocity which is termed detonation. The flame is usually white during the detonation period and the liberation of energy is extremely rapid.

If in a given volume of mixture the entire charge can be ignited before the flame has had an opportunity to attain the detonation velocity, detonation does not occur. It is possible to control detonation by at least four methods, as will be seen by reference to the chart at the beginning of this article. In this connection as Horning, Ricardo and others have pointed out turbulence of the charge is an extremely important element. If at the moment of ignition the charge is swirling or in rapid motion the flame is quickly spread to many points in the mixture. This is practically equivalent to igniting the mixture simultaneously at many points. Under these circumstances the flame has a minimum distance to travel and consequently does not have time to attain the detonation velocity.

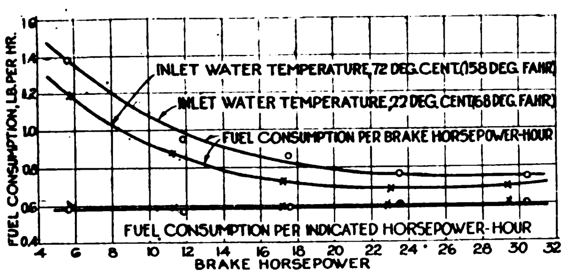


Fig. 15—Curves showing the increase in fuel consumption per brake hp. due to increased frictional losses, attributed to higher oil viscosity, at low as compared to high jacket temperatures.

There are two methods of creating turbulence in the combustion chamber. The first is to so locate the valve and proportion its size and lift that the charge, entering the combustion chamber at high velocity, is given a swirling motion which continues during the compression stroke and ignition period. To do this the combustion chamber must be so shaped as to minimize eddying and the velocity necessary through the valve must be so great as to limit the volumetric efficiency to a value lower than is otherwise necessary. Horning's recent paper on the subject of turbulence shows shapes of combustion chamber such that the gases being compressed in the clearing space are caused to move at high velocity, thus positively creating turbulence. This result is accomplished without unduly limiting the valve area and constitutes the second method of creating turbulence.

The second means of controlling detonation referred to in the chart is to so place the spark plug or plugs that the flame will have the shortest possible distance to travel. This is accomplished with a single plug when the plug is placed as near as possible to the center of gravity of the mixture. The use of two or more plugs properly placed and fired simultaneously further minimizes the distance to be traveled and may to some extent compensate for lack of turbulence.

Detonation is known to be controlled to some extent by pressure, and according to Midgely, Tice and others is greatly affected by temperature. Ricardo attributes detonation to the following phenomena; a combustible mixture in a closed chamber is ignited and the flame starts to travel from this point. The combustion raises the pressure of the gases burned and as a result the remaining unburnt gas is compressed and heated until finally it reaches the auto-ignition temperature and the entire mass is set off simultaneously. It will be seen that if the gas is already heated by contact with the piston head, exhaust valve or other hot parts of the combustion chamber, its auto-ignition temperature is more quickly reached. For this reason it is desirable to create turbulence which tends to equalize the temperature of the entire charge. It is desirable also to so design the piston, exhaust valve, spark plug and any other parts that may easily become overheated in such a way that a maximum of cooling results. Horning and others have pointed out that it is desirable to place the spark plug so that ignition will take place at a minimum distance from the hottest point. It should also be placed in the path of greatest turbulence and in, rather than opposite to, a pocket in the combustion chamber.

The pressure of the gases at the time of ignition is controlled primarily by the compression ratio, but can, as Nelson has pointed out, be controlled to some extent by variation in the valve timing. It is a matter of common knowledge that most engines tend to knock more readily at low than at high speeds. If then the compression pressure can be reduced at the lower speeds the tendency to knock will be less at these speeds. This is accomplished by employing a late closing of the inlet valve. At low speed some of the charge drawn into the cylinder is ejected again before the valve closes, while at high speeds this tendency is overcome by the greater inertia of incoming gas. This method of control, according to Nelson, makes possible the use of higher compression ratios than are otherwise useable.

Another important means of controlling detonation discovered and developed by Kettering and Midgley involves the use of so-called "doped" fuels. Small quantities of iodine and anilin among other substances have been found to control, at least within certain limits, the tendency of a fuel to knock, and much experimental work has been done with a view to developing a dope which will be readily available commercially and if possible be added to the fuel during the refining process. It is certain that if such a substance is found and generally employed far higher compression ratios can be used and correspondingly higher thermal efficiency attained.

Extensive research work initiated and conducted by Kettering and Midgley has shown that various classes of hydrocarbon fuels with different molecular structures have widely differing tendencies to detonate. Ethers have the greatest tendency to knock of the more common hydrocarbons, while the alcohols have the least tendency. Midgley was the first to arrange the common hydrocarbons in the order of their tendency to knock. He gives the following table of hydrocarbon fuels arranged in

order of tendency to detonate and giving the disadvantages of these fuels in other respects:

Fuels	Disadvantages
Ethers	Pre-ignition
Paraffins	None, if volatile
Olefins	Polymerize and stick intake valves
Naphthenes	None, if volatile
Aromatics	Form fluffy carbon
Alcohols	Low heating value

Ricardo has attempted, as reported in articles by him printed in these columns, to go a step further and assign to the various fuels a definite knocking value, but for reasons which cannot here be discussed there is reason to question the value of some of the results obtained, though in the main they probably serve a useful purpose.

Many tests on blended fuels, such as mixtures of gasoline and benzol or gasoline, benzol and alcohol, have been made with a view to counteracting knocking tendencies and other disadvantages. The value of fuels of this character is limited to some extent by lack of sufficient quantity for general use and means for general distribution. It has been definitely proved, however, that some fuels can be greatly improved by blending and for this reason it seems probable that such fuels will be more generally used in future than has been the case to date. The use of blended fuels enables the use of higher compression ratios and consequently higher economies in engines designed for their use.

The use of excess air or inert gas, such as products of combustion, as diluents to prevent detonation, has already been touched upon, and it seems probable that their use will increase in the future. The use of diluents may decrease the maximum output of engines of a given size and weight, but this detrimental effect can be partly if not wholly offset by the use of higher compression pressure and consequent higher mean effective pressures, while the thermal efficiency can be considerably increased. There seems to be great promise in this field which will doubtless receive much more general consideration in the near future.

The effect of spark timing on the control of combustion and the resultant effect upon economy has been investigated by Sparrow, Grimes and others. It has been customary to use extensively devices which increase the spark advance with speed. There is need for further consideration of means for securing the most effective spark advance with change in load. As the load decreases greater spark advance can be employed to advantage from the standpoint of better economy, and it may be possible to more or less positively control spark advance in relation to load. In any case this is a matter worthy of further consideration.

Better Load Factor

It is a well-known fact that the efficiency of the ordinary throttling Otto cycle engine falls off rapidly with decrease in load (see Fig. 15), and it is unfortunately true that the average driving condition in the case of the usual passenger car is one of low load operation under which the economy is necessarily poor. Anything which can be done to better the load factor will of course result in increased economy, but will under the usual circumstances correspondingly decrease what is generally called high gear ability. The advantages of high gear ratios in respect to load factor have been pointed out by Nelson and the disadvantages must also be taken into consideration. Nelson shows in one case that a change in rear axle gear ratio from 4.5 to 1 to 2.5 to 1 resulted in a maximum increase in the brake thermal efficiency of 53 per cent at 29 mi. per hr. car speed and 48 per cent at 10 mi. per hr. Gains in efficiency of this order should not longer be overlooked. While it is no doubt true that the American public objects to gear changing, which becomes more necessary as the gear ratio is increased and the car ability correspondingly decreased, many believe that means can be found to overcome this disadvantage by changes and improvements in transmission design. It is suggested in this connection that the possibility of two-speed axles be further investigated, the lower gear to be used in traffic and when maximum car ability is required and the higher gear as much as possible under average driving conditions. With the noise and general aversion to use of the lower gears of the transmission thus reduced and higher economies made possible, it is believed that such complication in mechanism and control as would be involved would be much more than offset.

The possibility of decreased total weight of vehicle in connection with its relation to gear ratio and load factor should also receive further consideration.

Friction and Acceleration Factors

The effect of friction and acceleration factors upon fuel economy has been much discussed, but too little heeded. There are many factors which contribute to the frictional resistance to motion of the car. The use of proper lubricant, especially the substitution of oil for grease in the transmission and rear axle, assists in materially reducing friction, as does also the proper selection of bearings and the fit and adjustment of bearing parts. A considerable proportion of the frictional loss in a car lies in the tires. Greater improvement in this regard has been made by the development and much more extensive use of cord tires, which absorb far less power than the ordinary fabric type. Tests by E. H. Lockwood show that the power absorbed by the fabric type exceeds by as much as 100 per cent that absorbed by the cord type. Inflation pressures also have a bearing upon frictional loss, the loss decreasing as the inflation pressure increases.

Lubricants, especially that used in the engine, should be selected with due regard to temperature conditions during operation. Sparrow has shown that, while the fuel consumption of an engine per indicated horsepower-hour remains substantially constant with change in temperature of jacket water, there is a very material difference in the fuel consumed per brake horsepower-hour, due to the much higher viscosity of the oil at low temperature. See Fig. 15.

The loss of power due to dragging brakes has often been mentioned in discussing frictional losses in cars, but much opportunity for improvement still exists in respect to the design of brakes which will not drag. The external band brake is a serious offender in this connection, and for this and other reasons is fortunately being abandoned on many cars.

Sparrow, in discussing the relative merits of large slow speed and small high-speed engines, shows that the former type is the more efficient relatively, due to the fact that friction losses increase materially with high speed. Frictional power losses increase to some extent as the load on the engine decreases at any given speed. This is one reason why the economy of the ordinary throttling engine decreases rapidly as the load decreases. James quotes figures which show in one case that, whereas only 2.85 hp. is required to propel a certain car on a level road at 20 miles per hour, the friction horsepower in the engine under these conditions amounts to 3.51 hp., showing that, under what may be regarded as ap-

proximately an average operating condition, a very large percentage of the fuel consumed goes simply to overcome frictional losses in the engine. These losses can be minimized by the use of larger and slower speed engines with proper gear reductions and a better power factor, as already pointed out. Here, again, the advantage of using a non-throttling, constant-compression engine, already referred to, is worthy of consideration.

The power absorbed in overcoming air resistance is not very great at moderate speeds, but increases with the square of the velocity and, therefore, becomes a large factor at high speed. This loss cannot be avoided, but can be minimized by reducing, so far as is practical, the frontal area of the car and improving the streamline form.

Frictional resistance to the motion of the car on the road is a function of the nature of the road surface and is a minimum on hard, smooth surfaces. It will thus be seen that good roads are an important factor in relation to fuel economy. Considerable saving in power and fuel can also be effected by proper road grading.

Gear ratio and weight are factors which, together with the power available, control the rate of acceleration of a given car. The lower the weight the higher the gear ratio that can be used for given power and the less fuel is consumed in acceleration and climbing.

Oil Dilution by Fuel

Less oil dilution by fuel, the last item listed in the chart at the beginning of the article, under the heading of better utilization of fuel in present engines, refers to dilution of lubricating oil in the crankcase by fuel passing the pistons. The waste of fuel in this respect, while not a large element in the total fuel consumption of a car, has a very serious effect upon the operation, wear and other factors, and results in waste of lubricant, for which there is as much need for conservation as there is for fuel conservation. Oil dilution can be minimized by the use of better-fitting pistons and rings, by better vaporization of the fuel during normal operation, with a minimum of raw or unvaporized fuel allowed to enter the cylinder, and by avoiding the use of the choke and other devices providing excessively rich mixtures for starting.

Better-fitting pistons and rings are secured by careful machine work and selection of well-mated parts in assembly. Better means for fuel vaporization have already been considered. The practice of using the choke or an over-rich mixture for starting is very general and results not only in the direct waste of fuel but in feeding into the cylinder raw liquid fuel, a portion of which invariably finds its way past the pistons. This loss can be minimized, if not entirely prevented, by the use of some pre-heating device, such as the Packard "fuelizer," or by the use of some very volatile liquid, such as petroleum ether, for priming. In the latter case exhaust heat resulting from the first few explosions in the cylinder provides means for vaporizing the fuel entering later in the normal way through the carbureter.

The Possibility and Advantage of Better Fuel

The items thus far enumerated as bearing upon the subject of better fuel economy are in large part subject to control by the automotive industry, or are of such nature that their solution can and should be sought by this industry. The problem does not end with the automotive industry, however. It is quite as important that the petroleum industry use its best effort to provide fuel that will so far as possible lend itself to most efficient utilization. It will not suffice to take the attitude that nothing can be done by the fuel industry save to furnish products obtainable from crude petroleum by direct and simple distillation processes. Much increase in gasoline production has resulted from the introduction of cracking processes which change the molecular structure of the fuel. It has been conclusively demonstrated by Midgley and others that certain other molecular changes in the average fuel produced would much better suit it for efficient use. The possibility of doing this must not be overlooked, even though it involves large investment in cracking stills or other equipment.

Crane is responsible for the statement that it is impossible to build a simple automotive engine which will effectively and efficiently handle, under all operating conditions, even the fuels at present available. Reasonably satisfactory operation is obtainable by the use of more or less complicated vaporizing devices, but even then really good economy is not secured, and the more complicated the device the more difficult becomes its use in the hands of the average vehicle operator. Horning, Crane and others have pointed out that portions of the fuel which distil at temperatures in excess of 400 deg. Fahr. are more or less useless and lead to difficulties in oil dilution, etc., which render them decidedly objectionable. Tests made by Sparrow indicate that increase in end point leads to direct increase in fuel consumption. In spite of these facts, the end point of commercial gasoline has been increasing for many years, and but little effort appears to have been made by the petroleum industry to maintain it within suitable bounds.

It is a well-known fact that the use of benzol, alcohol and other substances with gasoline make it possible to use the latter with much greater satisfaction and efficiency than when the gasoline is used alone. Unfortunately, neither benzol nor alcohol are produced in sufficient quantities to make it possible to use them as blending agents for even a large proportion of the gasoline now produced. Nevertheless, their production and use should be encouraged and steps to determine whether other blending agents forming a part of crude petroleum, or easily derivable therefrom, cannot be produced in sufficient quantity to be used to materially improve present-day gasolines.

This brings us to the important subject of the use of so-called "dopes." As already pointed out, Midgley and others have definitely demonstrated the advantage of using certain dopes. Efforts to find a suitable dope which can be produced and used in the normal process of refining are under way and should receive more general consideration. If, as seems entirely possible, it proves to be commercially feasible to produce fuels which will be free from the knocking tendency even under high compression, the available supply of crude petroleum can certainly be made to go much further than it will go if present methods and qualities of fuel are generally maintained in the market.

There is certainly great need for further and more effective co-operation between the automotive and petroleum industries with a view to producing both engines and fuels which will result in the most effective net result, to the end that our natural fuel resources may be conserved and utilized to the best advantage.

It will be seen from the foregoing that the fuel problem is exceedingly complex and must be made the subject of much further and more extensive research work. The co-operation attained to date in this direction in the automotive industry is highly commendable. It would seem that the petroleum industry has been less progressive and energetic in seeking the solution of the fuel problem, at least in so far as the public has been informed. Every effort should be made to bring about a better mutual understanding of existing problems.

FACTORS AFFECTING DESIGN

Advantages of Contact with the Vehicle in Road Use

No test is so likely to indicate weak points in a vehicle as road use. Every owner should be made a member of the factory experimental department. The results of such a policy are an invaluable aid to the engineer in making new designs and in correcting faults in old models.

By J. Edward Schipper

EVERY owner of a car or truck should be, figuratively speaking, a member of the factory experimental department. Viewed from that standpoint, every car on the road is a test car. Every trip made by an owner is a test trip. Every mishap pays for itself by the fund of data it supplies the factory metallurgical and engineering departments.

To realize fully this ideal situation would be an involved and expensive proceeding. There is no reason, however, why a high percentage of this information cannot be rendered available to the factory executives and engineering department in every automobile and truck plant. In fact, a great many companies have systems by which they are accomplishing this end, but very few, if any, are going into the matter as thoroughly as should be done at this stage of the industry.

To get this information into the hands of the proper people at the factory, it is necessary that the proper system be employed. The matter must be made a routine work, so that an uninterrupted flow of reports on cars in owners' hands is continually coming into the factory office. There are several methods of doing this, some of which will be described herewith, employed by various concerns in the passenger car and truck fields. Many of these are capable of further development and form the nucleus of a system which, if amplified, would reach the desired efficiency.

Use of Service Reports

In bringing out an improved series of a current model it is customary to utilize the reports turned over to the engineering department by the service manager. This is common practice in all concerns and it is by necessity that the cars on the road offer the direct information as to what improvements are necessary in models which are going through production. The reports that the service manager turns over to the engineering department, or which reach the engineering department by way of the metallurgical department, which has investigated broken parts turned over to them by the service department, are complete or incomplete in accordance as to whether or not the proper contact is maintained between the factory and the cars which are out.

There are always a certain number of parts coming back in the way of policy replacement. These are replacements made by the dealer to the consumer without charge, and in order to receive credit from the factory the dealer has returned them with a claim. This claim is investigated through the metallurgical or other departments concerned and the claim allowed or disallowed. At the same time information is gathered which is of benefit to the engineering department and which is so utilized by every factory in the business which makes any pretense of systematically organizing its affairs.

It is possible and necessary to go much further than this in order to maintain the proper contact with the cars which are out in the owners' hands. The policy replacement involves parts which are broken only during the three months' guarantee period. There are a number of other parts, however, which are broken after this period has expired and of which in many cases the engineering department at the factory is never informed. This is neglect of a source of information which is of the highest value in determining future dimensions, material specifications and structural design of future parts. To state the matter simply, there is not sufficiently direct contact between the owner and the plant. The owner has not been made a member of the experimental department. His car is not a factory test car.

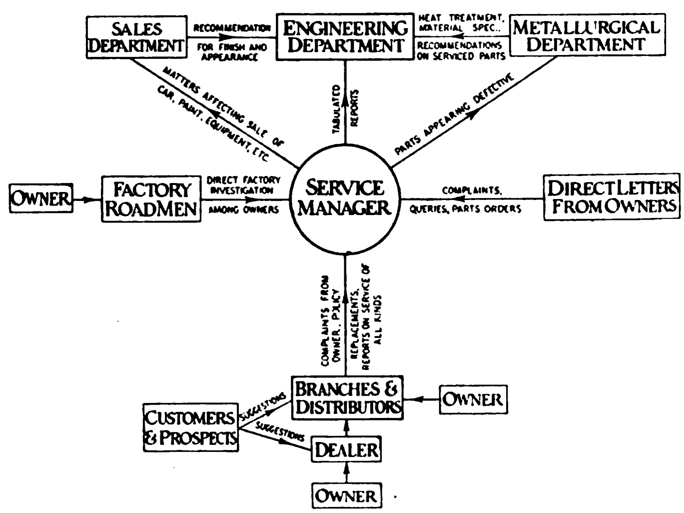
The Method

There is no one best method for keeping this contact. The method employed depends very largely upon the size of the organization and its output. A very good example of how this work can be carried out by a large organization is the method employed by the International Harvester Co., in following the fortune of its trucks in the hands of the owner. This organization has 100 factory branches through which its sales and service on trucks are handled and supervised. Each of these factory branches has what is known as a road engineer, whose sole duty it is to inspect the trucks in use in his territory. He is constantly on the road, going from one owner to the next, going over every one of the trucks in his territory, so that every truck the International Harvester Co. has in the field receives three to four inspections a year by these road engineers. A report on every truck is made up by the road engineer and forwarded to the service manager at the factory. It is the duty of the service manager at the factory to act as a clearing house for all of this information and to properly tabulate it and send it to the engineering department. By complete card index systems a record of every truck out is available.

It is possible to picture the tremendous amount of in-

formation that the engineering department has with a system of this kind. In his talk with the owner of the truck the road engineer is, of course, informed of every mishap which has occurred; he knows the service each particular truck has been giving and this information, coupled with the territorial peculiarities of the country in which the truck is operating, gives immediately a view of the service ability of that particular kind and size of truck in that particular country and on that particular kind of work.

This vast system could, of course, be only employed by a very large organization. To carry 100 road engineers on the payroll of a concern means a large annual expenditure, which could not be carried by any moderate size organization. It shows, however, the length to which a large and well-managed concern is willing to go in order to keep in touch with the vehicles in the users' hands. A continuous flow of priceless information is continually coming to the plant from every truck which it has turned out and puts into the field. By properly tabulating and charting these complaints and records, it is easy to see that the International Harvester Co. knows whether or not each part in its truck is properly designed; whether or not it has the proper material with the proper heat treatment, and every bit of other information regarding it which is necessary to determine whether or not to continue that particular feature in future designs.



Service Manager is clearing house for valuable engineering data.

The sales value of such a system must not be overlooked in considering the benefits which accrue from its use. When an owner of a truck is approached three or four times a year by a factory inspector and his vehicles given a thorough going over, with recommendations as to repairs, etc., it is easy to see that this owner is going to be impressed by the service he is receiving. When he buys another truck he is very apt to purchase one of the same make when such attention is given. The International Harvester Co. sold more than 6000 trucks during 1920, and did a gross business of over $9,000,000 in its truck department. In spite of the depression in the truck business generally, its quota to dealers has been practically as large for 1921 as for 1920. Is it not likely that this continuation of business has been largely due to this intimate contact between the factory and the car in the user's hands? In other words, the engineering department is not the only one which profits through the contact.

The Packard Motor Car Co. operates through a different system. At the factory there is a service engineer who makes periodic trips to the various distributers, talking directly with their technical men. These technical men are in the employ of the distributer and in this case act as the eyes of the organization and as the contact point with the owners of the Packard cars and trucks. The service engineer also takes care of all the complaints which come by mail to the factory and he also keeps a strict tabulation on all returned goods. These are tabulated under the head of the particular part and are so kept that at all times it is possible to see if the percentage of returns on any given parts are running above normal.

The keynote of this system is, of course, the technical man and the way he is handled by the distributer. If he is kept continually on the go and circulating among the owners' cars and trucks, he is an exact parallel with the road engineer, as described under the International Harvester system. On the other hand, if the technical man is an inside man, his contact is maintained only when trouble develops. In either way, however, he is the man who secures the reports on the cars and trucks on the road, and he files his reports with the service engineer at the factory who keeps in continual touch with him. The technical man makes frequent trips to the factory and thus acts as a direct go-between, connecting the manufacturing organization with the owners.

A monthly analysis of trouble complaints is made by the service engineer. He charts these under the monthly record head as number of complaints made, number investigated, number remedied. Then, in further detail, the cause of the compaint is noted and the remedy applied or suggested for future designs is entered. Under the subhead of how remedied, there are four classifications. These are:

(a) future design;
(b) manufacturing methods;
(c) metallurgical treatment, or
(d) educational campaign.

The educational campaign is started when it is found that certain troubles are developing, due to the misuse or improper driving of the owner. For instance, if a number of complaints are coming in on the clutch, indicating that owners are slipping the clutch too much in driving, and although it has been found that the clutch is perfectly satisfactory when properly used, that there are an abnormal number of complaints upon the clutch, an educational campaign on proper use of the clutch in driving would be started.

In addition to the technical men of the distributers, the factory itself has a number of technical men who go out among the owners and find if proper service is being given and if the cars are giving proper satisfaction. This is merely a check-up on the service, however, and has nothing directly to do with the communication between the factory and the car owner from a report of the cars on the road standpoint.

To give another example of the systems in use by the different concerns, the Hupp Motor Car Co. uses the distributer as the connecting link between the car on the road and the factory. When an owner comes into the distributer's service department with a complaint a careful record is made and is forwarded to the factory, where it goes to the service manager's desk. A copy of every complaint which comes in is sent to the engineering department and if it seems serious enough to the service engineer, a copy is also sent to the president. If the matter affects sales, such as complaints on the finish, etc., of the car, copies of these complaints are also sent to the sales department.

These three systems of operation are typical of those employed by manufacturing concerns to-day to keep a

contact between the factory and the cars which it has produced. The service manager at the plant is, of course, the man who must organize this system of contact and he therefore becomes a very prominent and important official in the organization if the work is carried on as it should be. It has not been the practice in very many organizations in the past to call in the service manager on an entirely new design. He is consulted, of course, on changes and, in fact, most changes come as a result of his reports and recommendations to the engineering department, or as the result of recommendations to the engineering department from the metallurgical end of the business, because of specimens or samples turned over to the metallurgical department by the service manager. Consequently, on revised models, he has been always consulted.

The day has now come, however, when the service manager should be taken into conference on entirely new models. There is no reason why the fund of experience which has come as the result of contact with thousands of owners' reports should not be used in just the same degree as the reports from the experimental engineering department, which secures the data from test cars on the road and the laboratory. The owner is an enthusiastic investigator. The car is a part of his daily life. After a few months or a year of driving, he becomes so intimately acquainted with his car that its slightest symptoms become apparent to him as quickly as it would to a trained observer. The factory wants to get the information at the disposal of this man. It can get it by carefully systematizing the work and by properly charting the complaints and information he passes along.

Watch Expenses

It would be advisable at the factory to divide this information and record it in almost the same way as the parts themselves are recorded; that is, by keeping the records in accordance with the parts numbers and filed under the head of the parts numbers, the information is immediately usable in every department of the factory. At the same time, when a part is to be changed, the record on that particular part as compiled from the service manager's reports, which, of course, have originated from the owner, are all listed under the number of the part under consideration. This immediately renders available a fund of information on the part under consideration and should be one of the main factors in preventing "bugs" in entirely new models, as well as making future models better than their predecessors.

The great point in installing a system of contact between the owner's car on the road and the factory is that the system utilized for getting the information into the proper hands at the factory shall not be too expensive. If an expenditure of from $2 to $5 per car is allotted for this purpose, depending on the quantity of output, a very complete and thorough system can be installed by factories having anywhere from a moderate to a heavy output. The practice of having road men out among the owners cannot be considered as expense without return, because a good road man will more than earn his keep by the amount of business he turns over to the service department. He will recommend certain definite repairs and will save the car owner money, because he will catch little troubles before they grow into big ones. He will make money for the organization by which he is employed, because he will direct the car owner to the service station instead of to some miscellaneous garage doing work for all classes and makes of cars.

Also, he brings money back into the business by his intimate contact with the owner, through which he tends to keep the owner satisfied with the product. Consequently he can be considered as doing some real, advance sales campaign work. When a man has been visited by a good factory road man and has become impressed by the fact that the organization which manufactured his car is interested in seeing that it gives him good service, it is unlikely that he will purchase any other make of vehicle when he buys subsequently. This applies to trucks as much as or more than it does to passenger cars.

The amount of data which, coming into the engineering department, is of definite use as material for determining on future design problems is difficult to reckon on a dollar and cent basis. When the amount of money which can be spent through an experimental department is considered, however, it is certain that this information is of the highest value and, furthermore, is much more complete and authentic than possibly could be secured from an experimental department. In the first place, the cars are in the hands of the type of driver which will operate the new product. Reports are secured from all localities of the country and consequently abnormal conditions in any one locality show up very readily. There are numerous examples of the effect of local conditions.

Not long ago, The Hupp Motor Car Co. noted that the high road speeds of California put an added duty on the cooling system of the car because uninterrupted travel at high speeds was more general in this particular locality than in any other. The speed laws permit of higher speeds and the roads are wide and straight. Complaints from the owners, which passed back through the dealer and then to the factory, gave an intimate knowledge of these conditions and allowed of slight alterations in the cooling water capacity to take care of the abnormal conditions. This would never have reached the factory except for the good system of contact with its owners.

Local Conditions

Another abnormal local condition has been noted by certain manufacturers around Birmingham, Ala. It has been found that the timing chains tend to etch more rapidly than elsewhere. Investigation has shown that the extensive use of benzol in this locality has caused, particularly in the winter time, a notable sulphuric acid content in the lubricating oil. This has acted upon the surface of the chain, setting up an electric current which has been sufficient to cause very marked chain etching and consequently to shorten chain life.

These facts have been brought to the attention of the engineering department by keeping close contact with records of the cars in owners' hands. There are literally hundreds of these abnormal conditions which prevail in different parts of the country and which it is almost impossible to foresee in the engineering department or experimental laboratory. The only reliable and sure way of finding out these conditions is by the proper contact with the cars which the factory has out. Consequently, it is advisable for a plant to make a study of the problem from its own individual standpoint, as the number of cars on the road will have a great deal to do with the way in which the system is worked out. The three examples given herewith of the International Harvester, Hupmobile and Packard factories suggest three systems which have proved successful. Any concern which has been in business for a year or more should adopt something along this line in order to reap the full benefit of the experience without which it is impossible to improve design readily.

FACTORS AFFECTING DESIGN

Engineer's Work Definitely Related to Human Element in the Plant

In many points of design, the engineer is limited by the abilities of the various human beings within the plant. The average accuracy of work will affect the tolerances while the cost of supervision is also a factor.

By Harry Tipper

THE purpose of the designing engineer in laying out the working drawings of his product is to express in that design the best practice compatible with the working conditions in the organization. It is the work of the engineer to include in his design improvements calculated to increase the service of the product, and in suggesting these improvements they must be measured necessarily by the possibilities of their practical development within the productive organization.

The development which the engineer can make is, therefore, limited by the practice among the supplies of raw material, machinery, and so forth, his knowledge of that practice, the application of the pure science in the actual production work and his observation in connection with it; the practice within the plant in all the elements of production, the accuracy and efficiency of that practice and its relation to the cost limitations imposed by the character of the product and its market.

The final design, therefore, is affected by a great many things inside and outside the plant. In all cases the most important part of the problem is the human element. In the matter of materials, tolerances must be met, specifications must be secured with a maximum uniformity so that the labor and time involved in the examination, rejection and replacement shall be reduced to a minimum. Machinery must be kept in accurate condition so that the work can be done within the required allowance within the plant. Inspection must be adequate without imposing too large a burden upon the expense of the business, and the practical changes required by the design must be such as can be made without too large an investment.

This article does not concern itself with the difficulties arising from the human inefficiency outside the plant. It is concerned with the limitations imposed upon the engineer on account of the human inefficiencies existing within the plant and their effect upon the final service of the product as an engineering matter.

Elements of Limitation

The limitations arise out of the following elements:

a—The maximum average accuracy of work.

b—The cost of the supervisory departmentals.

c—The knowledge of practice obtaining within the plant.

d—The original work of research and study which has been done within the plant.

Inasmuch as the first two elements deal with the general labor situation, and, therefore, the large number of individuals within the establishment, it is interesting to observe the limitations which may be imposed upon the designer by the conditions existing in the plant.

During the war, when plants sprang up over night, skilled mechanics were made in a week and men were called to inspection before they had become acquainted with snap gauges, block gauges, micrometers and testing tables; a great deal of material went through and was passed which amazed the man who used it because of its inaccurate operation. This work was not large in proportion considering the conditions, but it was sufficient in volume to represent an enormous cost to the Government and a tremendous loss of time and effort.

The mechanical equipment was all right; the system similar to those systems already adopted; the results did not reach the usual accuracy and were not as good. The fact is that accuracy is a human quality, a matter of mental alertness, care and co-ordinated mental and physical skill.

A great many engineers and manufacturers have been inclined to believe we were eliminating the human error by the accuracy of the mechanical equipment. Sometimes manufacturers of mechanical equipment have explained the perfection of their products by talking about the elimination of the human element.

We have been inclined to minimize the mental alertness and co-ordinated mental and physical skill required in order to produce accurate work from an accurate machine. The decrease of human efficiency in the war was no less observable in the inspection than it was at the bench.

Supervision from an inspection standpoint has increased quite largely as the tolerances have become closer in quantity machine work.

Even with the increased inspection and supervision the amount of rejected work per thousand dollars of product has not grown less and in some cases has grown larger.

Average Accuracy

The designing engineer is necessarily limited in his design work by the average possibility of accuracy and the cost of securing a certain accuracy. In some plants tolerances have been increased on some operations because the cost of securing the original tolerances was too great. It is of little use to insist upon accuracy to certain fine dimensions, plus or minus, if the actual product does not come within the limitations of that accuracy.

The mere fact that the mechanical equipment for such accuracy is provided does not insure its actual production. In fact, it insures very little. In a very large establishment in the automotive field where the system is considered efficient and the product very good, an examination of the inspection department showed that the key blue prints were out of date to a considerable percentage, while the other blue prints used by individual inspectors and foremen were obsolete to a much larger degree. In some of the departments blue prints were hardly used.

In a factory two or three weeks ago, I watched two men grinding small pins and checking their work with a gauge. The actions of the men had become almost automatic. It was evident that their minds were busy on other things a certain percentage of the time and it was equally evident that the work was not going through as accurately as it was supposed to come through.

One of the reasons for the variation in the action of completed machines is the tendency for tolerance errors to accumulate in a certain percentage of cases, while in other machines they do not accumulate.

These differences in accuracy and the increased cost of supervision as the drawings call for closer tolerance, nullify to a certain degree the purpose of the closer opertions and render the designing engineer's work useless to that extent.

We have leaned too much upon the ability of the mechanical device to take the place of human care and skill in dealing with the operation and inspection of the product as it passes through the plant.

Nothing can replace the efficiency of understanding in the manufacturing organization. Where the reason for the accuracy is not visible the object is to secure as much money and to get by with as much product as possible. Where the inspection is operated largely by men to whom the reasons for accuracy are just as obscure, the character of the inspection suffers to the same degree. Addition to the system of inspection does not decrease the error or the amount of rejected work because the individual alertness is not improved and the individual capacity to catch the mistake is not increased.

The engineer, of course, is limited not only by the efficiency of present practice as represented by the average efficiency of the worker, but by the cost of securing that general average through the supervision necessary for its maintenance. It is interesting to note that supervision has increased considerably in factories where the operations have been highly standardized and the number of workers is large. This adds to the total cost of the manufacturing operation and requires the engineer to accept lower standards of design because of the additional cost involved in securing the higher standards of work.

The improvement of practice within the plant depends upon the same human qualities as the maintenance of a high average in its accurate development. The constant elimination of unnecessary detail, the development of system to the point of efficiency without the burden of unnecessary motions, the proper division of responsibility come out of the human spirit within the plant and are not depended wholly upon the mechanical equipment. Constant development and practical improvement enable the engineer to put more service into the product without increasing its cost and in a way affect the character of the design itself.

Of course the value of the design is affected also by the character and quality of the human organization within the engineering department itself. The same difficulties are to be met in the routine work of preparing working drawings that are met in the routine work of turning these drawings into actual product.

The development of the departmentalized system with its centralized control has led to the same difficulty in improving the average accuracy and again the remedy is to be found in the alertness, the coordination of mental and physical skill and understanding, and not in the system of sub-division or centralization which occurs.

In the progress through a number of factories I have been impressed with the fact that the designing engineers are limited more strictly by the human inefficiencies than they have been willing to admit. In all departments from the experimental department to the individual shop, the average accuracy in workmanship is not increasing, the average cost of supervision is increasing and in some plants the product which is turned out does not represent the tolerance and fits that are required on the blue prints. Mechanical equipment can only improve the situation as the human efficiency is considered and taken care of.

Brake Lining Specifications

THE methods used by the passenuger car and motor truck manufacturers for testing serviceability of brake lining vary at the present time so greatly that it is extremely difficult for the brake lining manufacturers to produce linings that will meet the great variety of tests required. Realizing the importance of having some standard method of test generally acceptable to the industry a Brake Lining Subdivsiion of the Parts and Fittings Division of the Society of Automotive Engineers' Standards Committee has been appointed with a personnel consisting of brake lining manufacturers and automobile engineers. A meeting was held recently in New York at which the problems involved were thoroughly discussed.

At this meeting data covering a series of tests which had been run at the Bureau of Standards on a special testing machine recently described in these columns were submitted. It was decided to build several similar testing machines in order that all the members of the Subdivision can run a series of tests with a view to deciding upon a definite specification for testing brake lining after the results of the different tests are compared.

It was the consensus of opinion that any specification adopted should be such that it would not require expensive testing apparatus and that the establishment of a standard specification would be of great value to the passenger car, motor truck and axle manufacturers.

ANNOUNCEMENTS concerning the Engineering Number of AUTOMOTIVE INDUSTRIES indicated that a description of the Ricardo engine would be included. Numerous engine designs attributed to Ricardo are in existence, but we have been unable to secure working drawings of the particular engine using stratified or localized charge which we had in mind, for the reason that this engine was purely an experimental design. A diagramatic sketch showing the principle of operation of this engine, and some results of tests run on the experimental job are given in the lead article of this issue, "Where Are We Getting in Efforts to Solve the Fuel Problem?" We anticipate printing in an early issue a description and test results on the Ricardo supercharging engine, also referred to in the lead article of this issue.

FACTORS AFFECTING DESIGN

Taking Advantage of the Other Man's Knowledge

The design engineer, like other specialists, will do his task best if he takes advantage of the cooperation extended by contributory or related industries. His design is affected by production problems in these outside plants and a greater degree of consultation will be beneficial.

By Norman G. Shidle

SAMUEL JOHNSON never saw an automobile. But he one time made a remark to his follower, Boswell, which should be understood by every automobile designer and engineer. He said, "Knowledge is of two kinds; we know a subject ourselves, or we know where we can find information upon it."

Life is too short to allow a man to be a specialist along many lines. The best he can hope for is to understand one line thoroughly and to have a general knowledge of related lines. Approaching his task with this conception, the automotive design engineer will analyze carefully the sources of information available as regards those factors of production outside his own plant which have a bearing upon the work of designing.

Before the engineer is given the blank sheet of paper upon which to begin his design, he usually has imposed certain general specifications previously determined by the management. It is assumed that there is some purpose behind the building of every new car and every new model. The management will probably have determined from a survey of the market the general type of car and the price class in which it desires to manufacture. Within these limitations, then, the engineer begins to work out his design.

Limitations

But other limitations immediately appear; limitations imposed by the production practice which must bring into material being the car conceived in the mind of the engineer. Part of these production limitations are imposed by the equipment and production possibilities of the automobile plant itself; others by the practice of industries and companies which supply certain parts and materials to the automobile plant. In either case the engineer must take production problems and possibilities into consideration in making his design. The relation between outside production problems and design is important enough to merit careful consideration. In making designs, some engineers, of course, have taken cognizance of the limitations of outside production practice to a greater extent than others, so that some phases of this discussion will not be new to certain designers. But there are probably advantages to be gained from closer attention to these factors in almost every instance.

Sometimes designs, difficult of production, are made unconsciously, because the designer is unfamiliar with the limitations of practice in the industry by which the part must be made. In other cases an intricate design is consciously made to achieve a certain end. In any given instance, of course, it becomes necessary to judge whether the increased production expense of the difficult design is compensated for by its superior qualities from an engineering viewpoint.

Avoiding Difficulties

Conversations with executives in the drop forge, die casting, malleable casting, steel casting, transmission, ignition and similar industries, however, indicate that excessive costs are frequently run up by the necessity of producing intricate designs, which might have been simplified or made according to stock models without changing the inherent nature of the piece. This difficulty probably could have been avoided in many cases had the advice of the related industry been sought at a somewhat earlier stage of the design.

The experience of a die casting concern with a certain brush holder furnishes an excellent example of this. On this brush holder there were two round pins projecting. These pins fitted into two holes in another piece, and the flat plate from which they protruded had to fit flush with another flat surface. Because of this fact, in the original design there were very sharp shoulders where the pins met the flat surface.

Sharp shoulders of this kind cause trouble in die casting because of the danger of cracking when the piece is removed from the die. It was possible to make the piece as originally designed, but the percentage of imperfect pieces would necessarily have been rather large.

Had it been possible to leave a fillet between the pin and the flat surface, the die casting operation would have been simple. This was impossible, however, in this case, since such fillets would have prevented the flat surface fitting flush with the other flat surface in assembling. The die casting engineer finally changed the design by recessing the flat surface at the base of the pins and allowing for fillets in the recesses. In this way the die casting operation was made possible and the assembly necessities provided for as well.

Co-operation in this case enabled the customer not only to reduce his costs, but also to get a satisfactory and uniformly sound product day in and day out.

Any increased cost added to a car or truck becomes a serious matter at this time. The designer can profitably consider the possibilities for increased co-operation with related industries and the benefits which such co-operation may give. He must examine, at the same time, the limitations which bound the extent of such co-operative effort. The necessity for consultation will vary with each engineer in inverse proportion to his previous knowledge of the methods and practice of related industries. But every engineer can gain something from an attempt to utilize more fully the facilities offered by the various outside firms.

Standard Parts

This situation applies not only in relation to forgers and casters, but also in the contact between the engineer and the parts maker. Even the engineer, whose designing consists chiefly of collecting standard parts for assembly, is confronted with the same difficulties to some extent. A small change in a transmission part, a front axle or differential may give the assembled car a certain individuality in the eyes of the engineer, but may increase the total car cost without adding anything of real value from the consumers' standpoint.

A case in point occurred recently in connection with a certain shaft of a standard parts unit. The particular designing engineer desired to have one-sixteenth of an inch more machined from his shaft than was customary in producing the part in very large quantities for many other firms. The parts maker is authority for the statement that the extra machining accomplished no special purpose, as the weight factor involved was so minute as to be of no importance.

To meet the requirements of this engineer the parts maker had to retool a large number of machines and readjust his facilities to make the change. The increased cost was great and naturally added to the final selling price of the car.

This incident occurred during the time of peak demand for cars. It was not good practice then. At the present time several such incidents in connection with a single car might have serious results.

Time for Consultation

At what stage in the making of the design should the first contact be made between the engineer and, for example, the related industry? The case of a drop forger may be taken as an example. The drop forger is likely to feel that the contact is not made soon enough in a majority of cases. He has experienced difficulty many times when a design has been brought to him fully completed. He has been expected to produce a forging at a reasonable cost, even though some small feature of the design renders the forging process very difficult and expensive. A slight change in design might simplify the forging process immensely. But perhaps such a change at this stage of the design would necessitate other changes in other parts with which the part under discussion fitted.

Consequently, there is nothing to be done at this time except produce the difficult forging at a high cost, or change the design of other parts at a corresponding engineering expense. Neither alternative is thoroughly satisfactory to the automobile company, and friction with the drop forger often results.

The related industry engineer is likely to feel, as well, that he is not sufficiently taken into the confidence of the designer as regards the full design. To give the best service on the part which he is to make, he needs to know the details concerning the parts to which it is to fit in the finished design, and the other factors involved in any slight change which might be desirable on the particular piece. He often gives the best advice and assistance within his power on the basis of the data available, but sometimes feels that he is blamed for not giving better advice when he has really been asked to judge on the basis of insufficient data.

Designing New Parts

This is especially true in the case of new parts which have been made by the particular related industry only to a limited extent. As die casting has developed, for instance, the industry has been able each year to make parts which had never before been possible. The designing engineer, while he may understand die casting in general, is likely to fail to consider some small point in practice which seriously affects his finished piece, unless he gives the die caster full information.

One firm recently sent for die casting a dashboard gasoline gage. The drawing was given to the die casting concern; samples were asked for; but the designer failed to indicate what parts of this piece had to fit with other pieces in assembly; what parts had to be made to extremely close limits and on what parts a little leeway could be allowed. Here is what happened.

In die casting, ejector pins are necessary to eject the piece from the die after casting. These pins leave a small mark on the metal. The die caster always places these ejector pins in such a way that the mark will be left in a place that is not exposed or in a place where they can be removed without affecting the tolerances allowed.

The dies for this job were made up and the sample castings made. Then it transpired that the ejector pins had been placed on the only surface of the whole piece which was of any importance from the standpoint of having to fit accurately with another piece. Consequently, the dies had to be changed and the work was delayed. In this case the die caster stood the expense of the change, but this cannot always be expected. The difficulty would never have arisen had the die caster been given full information upon which to base his work.

To illustrate the kind of information necessary to the related industry plant, if it is to render intelligent and efficient service to the automotive engineer, the following list of questions is of interest. This list indicates the data which one large die casting firm considers essential when taking an order for a piece. The purpose of the questions is not to satisfy curiosity, but to give the die casting firm the data necessary to intelligent service. While the relative importance of the various items would be different in the case of forgings or castings of other kinds, and, in the case of unit parts makers, the necessity for full information along the lines indicated is present in any case. The list is as follows:

1. What kind of surface finish will part receive when finished?
2. What or where are important dimensions to be maintained?
3. Where is trade mark and part number to be located?
4. If machined, where is locating point?
5. Method of inspection?
6. Does it assemble with other parts?
7. Under what conditions is part to be used?
8. Accuracy required?
9. What metal shall be used?
10. Can we change design?
11. Present method of manufacture?
12. How will our castings be finished?

Some engineers have less trouble than others, but certain difficulties are sufficiently common to warrant

serious discussion. The executives in the related industries claim to have built up extensive engineering service facilities to aid the automobile engineer in the solution of his problems. These departments are capable of and ready to co-operate fully with the designer. The designer will benefit by their services in accordance with his desire for assistance and the extent to which he will take the related industries into his entire confidence.

The Designer's Side

Then there is the designer's side of the case. He naturally approaches his task with something of an artistic as well as a scientific viewpoint. He may desire to make his design not only satisfactory from a utility point of view, but also possessed of a certain individuality. He is not always content to sacrifice this individuality to the easiest production methods.

Economy of production is especially desirable, however, in all cases, other things being equal. The designer should consider very carefully before sacrificing economy to individuality, particularly where the part in question is not visible in the finished product.

One engineer, for instance, objected recently when a castings manufacturer was consulted about design details. The foundryman thought only of modifying the design in such a way as to make it easiest to cast. He failed to consider the engineer's viewpoint sufficiently. These two men needed a fuller consideration of each other's problems.

Moreover, the assistance given engineers by related industries has not always been rendered in a broad, unselfish manner. Some designers have found certain companies in related industries which would recommend changes in design to fit the part for production by the equipment of this particular company, when there was nothing inherent in the practice of the industry which would make production of the piece especially difficult. In other words, the advice was given with the purpose of modifying the design so that the particular company would be able to handle the order, even though it were not equipped to handle all classes of work in the most efficient manner possible.

The possibility of this factor entering has undoubtedly been one important cause of the engineer's reticence when discussing design with related industries. The degree to which this suspicion is justified varies with individual cases, but it has led many engineers to take the attitude of "Here is the design; now how much do you want for making the piece?" In brief, the presence of this factor has been largely responsible for what lack of co-operation still exists.

Making a Survey

When there is time a survey can be made. The engineer can consult with a number of firms, any one of which might get the final order. He can get some information from each one, can weigh that information in bulk and, by studying the results of his survey, determine rather accurately what are the real facts in the particular case.

The engineer might learn something from a skillful purchasing agent along this line. A purchasing agent for a big firm is rarely trained in the technical phases of the materials which he has to buy. But he listens carefully to the stories of the various salesmen who come to him; he draws from each of them what information he can; he learns something new every day. And after a while he is thoroughly capable of judging the relative merits of articles, the fairness of a price, or the production possibilities in any given case.

The purchasing agent is a student of human nature and a big user of common sense. The engineer can use his methods to advantage.

The engineer can consider how far it is possible to eliminate disturbing factors, overcome the intervening difficulties and gain the decided benefits which accrue from increased co-operation.

Co-operation Essential

The attitude, honesty and breadth of business vision of the particular firms involved will probably decide the possibilities for full co-operation in any given instance. An extensive survey of the situation, however, indicates that the progressive firms among the related industries have definitely come to a realization of the necessity for broad and honest service on their part when giving advice or rendering aid through consultation. Many of them have built up extensive research departments to anticipate the requirements of their customers, and are fully equipped to do any job that is within the scientific limits of the practice of their industry.

The trend toward better co-operation is voiced by one drop forge executive, who says: "The general trend among automotive engineers is to work more closely with the drop forge industry in designing important parts, so that difficulties can be eliminated and the best part for the lowest cost be produced." And by the die casting producer who said recently that "when we can make suggestions leading to a reduction in cost of the piece it is to our advantage, since our percentage of profit is the same in any case and the reduced cost means a satisfied customer." A general survey of the field indicates that the views expressed by these men are typical, and that the importance of intelligent cooperation is being more fully recognized.

Practically all of the progressive concerns in these contributory industries have recognized the truth stated by the die casters, and engineers can undoubtedly reduce costs and save effort by taking advantage to the fullest extent of the services which these firms are ready to render; by co-operating more closely with them in the early stages of design, and by recognizing fully the vital relation between the design and the production problems outside the automobile plant.

Magnet Steel of High Retentivity

AN alloy steel, remarkable for its high coercive force and strong residual magnetism, was discovered by K. Honda and H. Takagi in 1917, and was named "K.S." steel after Baron K. Sumitomo, who had made a liberal donation to the inventors' university. The steel, since improved, was first described by Honda and S. Saitô in the "Physical Review" of December last. The composition is in per cent, carbon 0.4 to 0.8, cobalt, 30 to 40, tungsten 5 to 9, chromium 1.5 to 3. The alloy is brittle, and the forging of it requires practice; it is best quenched at 950 deg. C. in oil, and requires no heat treatment when used for permanent magnets. The coercive force is up to three times as large as that of the best tungsten steel, whose residual magnetism it also surpasses. Prolonged heating in boiling water did not diminish the residual magnetism of the K.S. steel. The hysteresis loop has a very large area. By quenching the annealed steel, the Brinell hardness was raised from 444 to 652 and the Shore hardness from 38 to 55; the microstructure of the quenched, very hard steel is very fine. When specimens were dropped on a concrete floor from a height of 1 mile, the magnetization diminished only by 6 per cent. The K.S. steel is suited for short magnets.

FACTORS AFFECTING DESIGN

Some Production Problems Which Influence Design

Co-operation between the design and production departments is essential for economy, but design from the production standpoint only may result in unsatisfactory performance or excessive cost in service operations. Some items of design tending to facilitate production are enumerated.

By Herbert Chase

A LONG interval of development has occurred between the time when the artisan was usually the designer of the product which he produced with his own hands and the present day, when the machinist often knows little or nothing about the design of the intricate device on some part of which he performs one or two simple operations, often with the tools themselves guided so that all he must do is to clamp the piece in the machine. The mechanic is no longer a designer, but to be a good designer the engineer must know, at least in a general way, how machines and their operators will best be able to produce the parts for the mechanism he designs. He must know also what materials are suited for use in the piece, not only to give it proper strength, but to suit it to ready machining and heat treatment, if this be desirable, and to render it easy of assembly. These, of course, are not the only limitations upon design, but they are important and, of course, are increasingly important when quantity production is involved.

Conditions which govern the relation between the designing or the engineering and the production departments in different plants vary greatly, but are often determined by business policy and, so far as the automotive industry is concerned, plants may be roughly classified as follows:

(A) Plants in which the aim is to make the best possible product, without pecuniary consideration to cost. In such plants the final decision in the design usually rests with the engineering department, subject, of course, to review by the executive.

(B) Plants in which, within certain limits, lowest possible cost of production is the first consideration. In such plants the design is usually governed largely by the views of the production department, and the design may even be laid down by an engineer who is primarily a production man.

(C) Plants in which price limits are necessarily set, but in which certain leeway is allowed the engineering department so long as these limits are not exceeded. In such plants the engineering and production departments are substantially on a par and of necessity work in close harmony.

(D) Plants which merely assemble standard units. In such plants the engineering policy is determined largely by the purchasing department, which is apt to be guided more by the cost of the units available and their effect upon salability of the assembled product than upon engineering considerations, so long, of course, as the units will go together and perform with reasonable satisfaction.

In the case of plants in classes A and C, the original design is prepared by the engineering department after conference in which the executives and sales departments determine, in a general way, type and size of vehicle or part that will meet marketing conditions. Even these preliminary selections may involve an engineering investigation before an intelligent selection of type is possible. The original design will naturally be such as to facilitate production if the engineer knows production methods, but will not sacrifice engineering merit to a marked degree in order simply to make production easier, so long as the unit or machine is not too difficult of manufacture.

Plants in class B are of necessity controlled largely by the production department. Much money may be spent in perfecting the original design, which, when new, may compare favorably from an engineering standpoint with other up-to-date cars or parts in about the same class, but will be designed to minimize production costs. When once in production, however, changes in design become so expensive and affect service and other departments to such an extent that the tendency is to postpone the change until competition or some other factor compels it. Tooling costs are so great and changes in factory layout and routine so expensive that changes in design become well-nigh prohibitive, hence the functions of the engineering department, so far as design is concerned, are decidedly limited.

Since plants in class D are almost wholly dependent upon outside production facilities, changes in design are relatively easy of accomplishment, providing the producer of the parts or units involved are offering the desired equipment, while in any case the assembler is little affected.

From the foregoing it will be apparent that the effect upon production of design is quite different in various classes of plants, and it is probably quite as true that similar designs affect different plants in the same class in much different ways, for the organization, product and equipment are not the same in any two plants. For these reasons it is impossible to lay down any hard-and-fast rules governing the effect of design upon production problems, but certain rather general observations and

some concrete illustrations will perhaps serve to throw some light on the subject in hand, though there may be little that is new in what is said.

The designer can gain much useful information by acquainting himself fully with the production methods and facilities which the plant or plants which will be called upon to produce the parts for the assembly he is to design. There is a great difference in the facility of production as between pieces performing the same purpose but produced in different ways, and the designer who does not know or appreciate the difference in method labors under a handicap himself and, to a certain extent, places his company at a disadvantage in respect to competitors. Again, a piece which is easily produced in one shop with certain facilities may involve very difficult production problems to a shop differently equipped, yet by certain more or less non-essential changes in the design the second shop may be enabled to produce a piece performing the same function with equal efficacy and thus utilize equipment which would otherwise be idle.

It may seem more or less trite to suggest that closer co-operation between the design and production department is desirable, yet it is not an uncommon thing for the engineering department to belittle the suggestions and problems of the production department, when a little time and effort spent in examining the conditions which the latter department has to contend with would convince the engineer of the desirability of the change. On the other hand, the production department must not overlook the fact that other factors beside ease of production should be considered in the design. As a rule, the production department sees but little of its product after it leaves the plant and is apt to think of it largely from the viewpoint of facility in manufacture and assembly, and perhaps without due regard to serviceability or ease of dismantling in the repair shop. As an example along this line we have in mind a certain assembly of gears used in a rear axle. The design placed in production involved pressing one of the gears on its shaft after the gear was in place in the housing, for the opening in the housing for the shaft was not large enough to pass the gear. This made an awkward assembly and a difficult one to dismantle. It was, therefore, suggested that an opening of sufficient size to pass the gear be provided in the shaft axis, and the cover plate be arranged to carry the bearing. This was done, with the result the assembly of gears and shaft was facilitated and done independent of the housing, and dismantling was rendered unusually easy.

In another instance the production department suggested a change in the design of a truck hub with the intention of facilitating its production, this change involving extension of the hub, lengthening of the live axle and a change in the external surface of the hub such as to destroy the flat, conical shape. There was no doubt as to the advantage of the change from the production standpoint, but it would have increased the overall width of the truck and have rendered the axle much more liable to injury, since the conical shape tended to cause a blow to glance off. Thus the change would have increased liability to injury and helped to increase sales resistance by destroying a feature of real merit. The change was not made, but would probably have been made had the production department controlled the situation.

The ideal system is one in which the designers and the production men, as well as the sales and service departments, co-operate from the very start in preparing the design. This is well illustrated in the case of a certain manufacturer who had been purchasing a stock transmission from a parts maker, but for certain reasons had decided to build his own transmission unit. The engineer did not proceed with the new design before conferring with other department heads, but called a conference at which the engineering, production, service, sales, purchasing and advertising departments were represented. Among others, there were present men who specialized in the production of gears, in pattern making and foundry practice, in assembly of units and of the chassis frame units, in machining and heat treating, in repair, etc. Laid out on tables were the parts of the gearbox then in use and of other competing makes of gearboxes. All present were given an opportunity to examine these parts and then to express an opinion as to the general type of construction and features of design which they felt should be incorporated. At the direction of the chief engineer, who presided, a draftsman and stenographer made notes of the suggestions advanced. As a result of this conference a preliminary design was laid down incorporating, so far as possible, the suggestions made, and a second conference was called to criticise this design. As a result, several changes were made, and some experimental transmissions were then built. Following tests of these and the experience gained in the shop by making the samples, some further changes were made before quantity production started, but the final product was highly satisfactory from every standpoint. Furthermore, since all departments at interest were consulted, all were themselves sold on the job and knew its merits. This was an advantage, not only to the production, engineering and service departments, but to the sales and advertising departments, which more fully appreciated the merits and limitations of the design, but to the purchasing department, which better understood the reason why certain materials must be had to produce the desired result.

The foregoing procedure is not always necessary or desirable, but might with advantage be followed in more cases than at present. The procedure in some large production plants, in the case of a new design, is first to decide upon the general type and price of vehicle or unit to be produced, second to give the engineering department a free hand in laying down the design, so long as the foregoing limits are not exceeded, and third to depend upon co-operation between the engineering and production departments for such alterations as may seem to be desirable from the production standpoint to facilitate manufacture. If, as sometimes happens, the production department has the final decision, perhaps, in spite of sound engineering objection on the part of the designer, trouble which is expensive to remedy may result. Other instances in which the sales department has been successful in over-ruling the better judgment of the engineering department with disastrous results can be recalled, but from this it should not be concluded that the engineering department is infallible, for it, too, makes mistakes and is not always unprejudiced—in fact, is sometimes much too arbitrary in its decisions.

The diversity in policy and methods referred to above, as well as differences in organization, make it impossible, as indicated heretofore, to lay down hard-and-fast rules to govern the design as affecting production, but some general observations to which there will be many exceptions may not be amiss.

1. Machined faces on castings, such as cylinder blocks, for example, are produced most readily when these faces are parallel or at right angles and in as few planes as possible.

2. Drilling and tapping operations are often facilitated when the axes of the holes are parallel and at right angles to a machined face opposite the joints of entry of the drills.

(*Continued on page* 1313)

FACTORS AFFECTING DESIGN

A New Method of Automobile Body Suspension

New idea in body suspension is put forth here by Mr. Mercer. There are two supports on each side for connecting the body to the frame and the body sills are outside the frame. The design presents a new idea.

By George J. Mercer

CONSIDERABLE criticism has been directed against body work recently because of the lack of durability of many jobs. The body engineers, however, appear to be having their day in court and are attempting to justify the results of their work. Their defense is chiefly concentrated on the fact that bodies are subjected to excessive strains as they are now carried on the chassis. They claim that the body is bound to show early deterioration because it is thrown, bumped, twisted, and distorted all out of proportion to its ability to withstand such strains, and that limitations of weight and chassis construction usually prevent body construction sufficiently strong to stand up under such treatment.

The body really is called upon to withstand greater strains and harder usage than any other part of the car, considering the limitations under which it is built. A body can readily be made to hold together and to perform properly if it is made sufficiently strong. Such construction, however, means added weight, since the frame must be heavier than usual, heavier gage metal and additional braces must be used.

To do this is not feasible since the ideal body, from a practical standpoint, is that which is built as light as possible, but sufficiently strong to stand up.

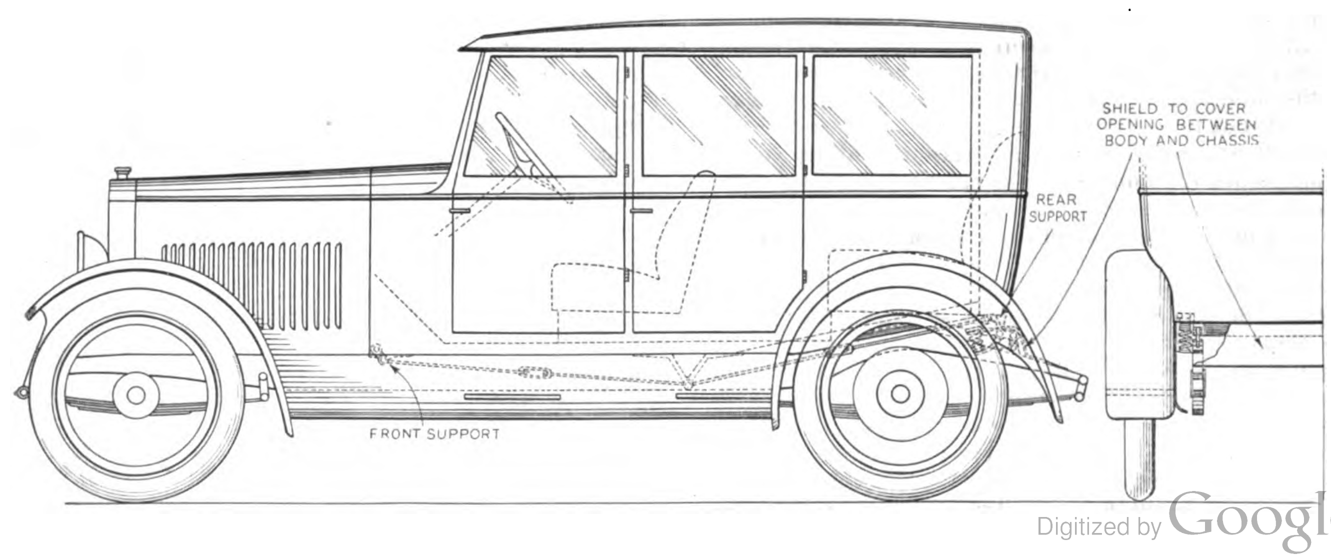
As a result of these necessities the average body is virtually a shell or casing. It is not even a completely self-bracing structure, because the cutouts for windows and doors limit the ability of one part to brace another.

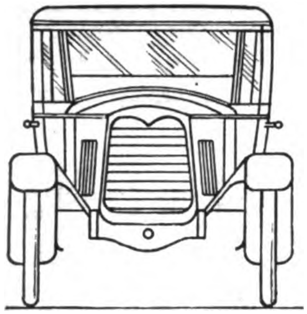
Real progress has been made, however, in the construction of both open and closed body types. Reduction in the variety of body types produced has been a material help in this progress, since the builder can concentrate his efforts for improvement without a greatly increased expenditure. Past experience has shown where the strains are greatest, while the improved quality of steel has aided development materially as well. Steel can be so easily worked now that it has supplanted aluminum in many cases. It can also be welded in such a way that the joints are as strong as the rest of the sheet. Thus the whole outer panel can be joined, although there are certain points at which it is better to allow the body to work out the strains. By joining the outer panel in this manner a compact self-supporting exterior is produced which materially lengthens the life of the body.

It is conceded that the bodies of the future will be made lighter and stronger than those of the past. This increased strength will probably be obtained through the use of interior bracing, which will make all parts support the strains instead of having the strains localized as is usually the case at present. Combination wood and steel bodies will continue to be made for a long time to come, because such bodies make for ease of manufacture and low initial production costs. It costs more to start in all-metal production, yet this type has its advantages.

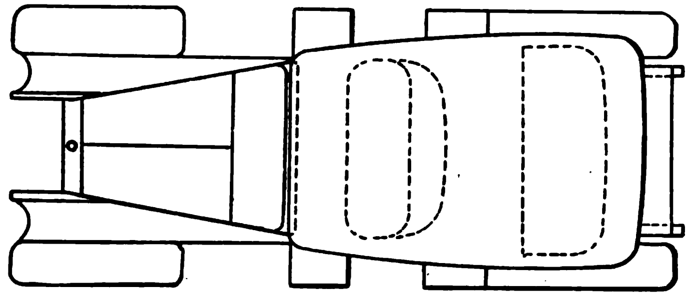
The combination body, however, can be made lighter than the all-metal body, and lends itself better to present manufacturing methods.

The all-metal body presents certain advantages in connection with finishing not given by the combination type. Enameling or baking processes can be used instead of

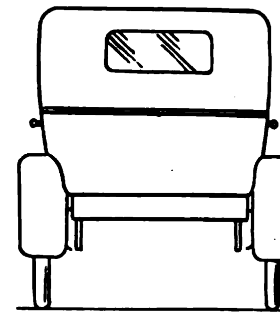




FRONT VIEW



TOP VIEW



REAR VIEW

painting. Such processes give a more durable finish to the body surface and can be applied in about one-tenth the time and space required for regular painting. These methods are possible also, however, with the combination body in some cases. The writer has built a combination body on which the panels were enameled and believes that this will be the general practice of the future.

These statements are made, not because the writer is preparing to demonstrate any theories, but simply to present one of the methods which he believes will become more common as time goes on and to help establish its relative value in solving the chief body engineering problem that exists to-day—body deterioration.

New Body Suspension Method

It is possible, however, to compensate for excessive chassis distortion by a method of body suspension different from that now in general use. The accompanying illustrations show theoretically this entirely new idea. The plan has been worked out by the writer on paper only, for the purpose of illustrating publicly a theory which may at least bring out a useful thought. Before any solution of the difficulties of body panels breaking and coming apart at the joints, doors jamming, roofs squeaking, etc., can be found, the method of assembling the body on the frame must be taken into consideration and used as the starting point for the investigation.

It is not necessary at this time to prove that the body is subject to distortion and jolts because of the constant weave of the frame when the car is in motion. This fact is common knowledge. An open car can absorb a great deal of these strains, because it is less rigid than the closed car. Therefore the weave does not appreciably shorten the life of the body, provided the body can weave in unison with the frame and provided the weave can be absorbed at points where the panels meet but are not welded.

The closed body with a permanent roof is rigid. The jolts are like hammer blows administered directly on the body. The accompanying illustration shows one method of supporting the body semi-independent of the chassis and thus augmenting the power of the rear springs to absorb the shocks.

In working out this new idea, the writer intended that the appearance of the car should not be materially different than that of the ordinary car when completed, and that any devices added should not appear grotesque. The illustrations showing the side view of the completed car, together with a miniature of the front, back and top, will indicate the degree to which he has accomplished his purpose.

The side view has been utilized to show the new method of suspension, as has the section of the rear view. The two sectional views show in larger size the detail of the support.

Looking first at the side view, it will be noted that there are two supports on each side for connecting the body to the frame. The supports are indicated on the drawing. The front support is near the dash and is simply a pin or socket. The pin is fastened to the frame and the socket to the body, so that the body can move up and down at the rear, rotating on the pin support at the front.

The chief point is that the body sills are outside the frame, with sufficient clearance to allow the chassis frame to move freely up and down within the space allotted, without touching body sills or floorboards. As the body will be supported only at the ends, the weight of the body must be supported between these extremes. A truss with two turnbuckles provides this support. The truss rod is anchored to the irons that form the supports and the body frame, therefore, is an entirely self-supported unit. The truss is outside the chassis frame and is hidden by the splasher forward of the rear mudguard.

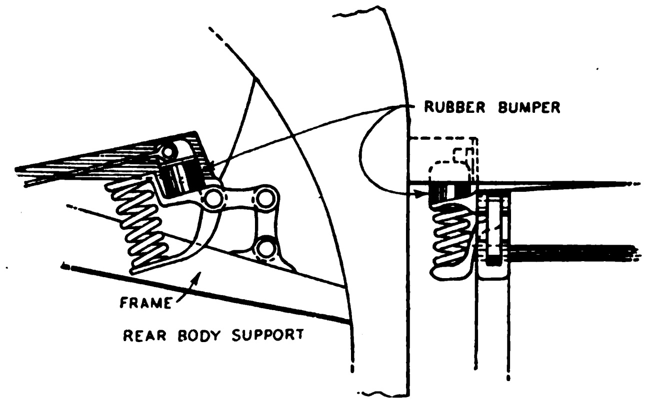
Assembly Advantages

The splasher is of the type chiefly used on roadsters and touring models. Steps are used in place of runboards to simplify the assembling of the body to the chassis. This assembly can be accomplished simply by making connection at the four points. The splashers and rear mudguards can be put on the body before the body is set on the frame of the car. Thus the inconvenience of assembling the rear guards to the body after the body is mounted is avoided. The whole body, splashers, and rear guards can be raised above the frame and lowered until the pins can be slipped into place. Then the front guards can be connected to the splasher and the car is complete. During the entire operation the truss is accessible for the purpose of adjusting the door openings.

The enlarged side view shows the body supported on an arm that in turn is supported at the rear to a movable linkage to the frame. At the front it rests on a spiral spring, that in turn is supported at the bottom from the body. Opposite the spring at the top is a rubber bumper. When the chassis is forced or thrown quickly upward, the movement instead of being transmitted to the body as a shock will communicate its force to the end of the arm supporting the body at the point where it it attached. This will throw the forward end of the arm down at the front against the spring, and as the spring action is quickly responsive, the result will be that the upward throw of the chassis frame will simply register on the spring, and the body being supported at the center of the arm movement, remains fairly stationary during a vigorous oscillating action of the chassis.

The principal function of this compensating device is to provide for the upward thrust of the frame. When riding level there will be no action different than with the average car. When the one side of the car drops into a deep hole, naturally the side of the body will follow, because it is tied together. The rubber bumper will help a trifle, however, and the action will certainly be easier than when the body is bolted tight to the frame. But as stated before, the device is primarily to absorb the sudden

up jolts, by permitting the frame to rise without taking the body with it. And since the action is one way, there will not be an added oscillation to the body when conditions are normal.



The Cost Phase

In determining the practicability of any new design, the question of cost is always important. It is fair that the design should be examined from the cost as well as the engineering standpoint. Viewing this new idea from the cost angle, several definite points appear. The chief factor in the new design tending to increase cost is the expense of truss and forgings at back and front. These parts must be real safety appliances. Steel castings would probably be the best material for combining the requisite strength with reasonable cheapness.

Several points in regard to the production, however, tend to offset the increased cost mentioned. These may be listed as follows:

1. Saving in mounting body on frame. Guards and splashers can be put on before body is mounted.
2. Saving of time, labor, and material in putting on neversqueak material and bolts.
3. Saving of trouble which often occurs when bolts pull body out of true and doors will not work. In such cases the bolts have to be loosened, the body shimmed up, and tried out for door clearance.
4. Greater ease in riding in rear seat increases the life of body, because body does not register all road bumps.

A fair comparison of costs, considering as factors the increased life of the body and the elimination of many customers' kicks, will show that the first cost of adding this or some similar device will not be prohibitive in any sense. Moreover, this initial cost will be so nearly balanced by the cost of the parts displaced and the time saved that cost will not be a factor in determining its adoption, once its effectiveness has been demonstrated.

The tentative plan suggested is not to be confused with something that has been tried out and tested. It cannot be referred to, therefore, as something that definitely will alleviate the problem that has brought the idea to the writer.

This design is set forward merely as the outcome of thought expended in trying to find some way of improving the form of body suspension in use. The idea of having the body suspended and of allowing a semi-swinging motion for body play is based on the idea in use on old carriage construction. There the body was suspended from straps. Cumbersome as this form of suspension appears, it made a wonderfully easy riding coach, and the adoption of steel springs seldom if ever were as easy for the passenger as the straps that they superseded. Therefore with this idea in mind as the basis for a plan, the writer has approached the subject with the result above illustrated. The idea is presented with the purpose of starting on the first lap of investigation designed to clean up mooted body questions that have remained too long in the background, simply because other matters more vital to the life of the car had to be settled first. Too often those in charge of the body department in car factories are not practical men in the sense of having had body experience. This is so because the bodies are more often than not made outside the factory by contractors and the factory body man is frequently an executive who arranges for the quantity and price, relying on the contractor for the practical part of the work. Under this plan, the factory representative is really a production man rather than an engineer. Therefore it has taken time to arrive at the stage of putting the spotlight on body troubles and treating them from an engineering point of view and of trying to eliminate the difficulties at the source.

German Car Prices Rise

INCREASES ranging from 125 to 130 per cent were made in the prices of passenger automobiles in 1920 in Germany. According to information furnished by the Deutsche Automobilhaendlerverband (German Association of Automobile Dealers) of Berlin, and forwarded to the Bureau of Foreign and Domestic Commerce by Howard W. Adams, Berlin, American representative of the Department of Commerce, the prices, in marks, of automobiles in Germany for 1920 were as follows:

	5 Horsepower	10 Horsepower	16 Horsepower
Jan. 10..	18,000	32,000	41,000
Feb. 11..	31,500	56,000	71,750
May 1 ..	39,375	70,000	89,687
June 11.	40,000	75,000	95,000
Sept. 3 .	37,500	70,000	89,000
Dec. 21 .	40,000	77,000	92,000

The figures in the foregoing table represent the minimum domestic prices as furnished the Federal Department of Export Control in application for export permits. These prices apply to new passenger automobiles of average grade. The finer grade passenger automobiles commanded prices relatively higher than those indicated.

The 1920 prices for motor trucks also showed sharp increases, practically the same as those for passenger cars, but not so great from a percentage basis because of the higher bases applying at the first of the year. Prices of motor trucks were as follows, there being a drop beginning in September:

	2-ton	3-ton	4-ton
Jan. 10	60,000	70,000	75,000
Feb. 4	80,000	88,000	93,000
May 1	120,000	130,000	140,000
June 11	120,000	130,000	140,000
Sept. 3	102,000	112,000	122,000
Dec. 21	102,000	112,000	122,000

There was a much greater fluctuation in the prices of used cars, both passenger and trucks, during 1920. The heavy increases in the prices of passenger automobiles was not so much the result of the generally enhanced cost of labor and materials as it was the effect of the new tax on turnover of Dec. 24, 1919, which went into effect on Jan. 1, 1920. This measure carries with it a tax of 15 per cent upon certain articles of luxury, including passenger automobiles.

Problems and Possibilities of the Aluminum Piston

The aluminum piston has been rather widely adopted both in America and England for automobile work. It played an important part in airplane engine development. Its various advantages and limitations are discussed here in detail by an eminent authority on this subject.

By Dr. Walter Rosenhain, F.R.S.

THAT the aluminum piston played a very important part in the development of the airplane engine during the war is an undoubted fact. Whether it will attain—or retain—an equally important place in automobile engines remains for the future to prove, but it is undoubtedly being widely adopted both in England and America. That there are very wide differences between the airplane engine and the automobile engine is, of course, fully recognized, and the question arises whether these differences seriously affect the value of the aluminum piston for the latter purpose. We can form some opinion upon that question by considering the various factors which determine the utility of the light alloy piston in all types of engine.

At first sight, the value of a piston made of a light alloy of aluminum would appear to reside in this very fact of lightness; a saving of weight in any part of an engine, whether for service in the air or on the road, would seem to be valuable, and particularly so in a fast moving, reciprocating part. Yet in aero engine practice, saving of weight by the use of light alloy pistons has always been a minor consideration. Actually, the alloys used have always been regarded as very considerably weaker than cast iron, and the sections of the piston castings as used for cast iron have always been considerably increased when that material has been replaced by an aluminum alloy, with the result that the aluminum piston has often been quite as heavy as the iron one which it has replaced. Thus one possible advantage of the aluminum alloy piston has been deliberately sacrificed, and in the case of the modern alloys, which attain a strength quite comparable with that of cast iron even at the working temperature of the piston, such a sacrifice has been very largely unnecessary from the point of view of strength and stiffness. It has, however, had a countervailing advantage from a point of view next to be discussed.

Heat Conductivity, Not Weight, the Prime Advantage

The real advantage to be derived from the use of an aluminum alloy piston undoubtedly resides in the fact that these alloys possess a very much higher power of conducting heat than cast iron. If such units are chosen that the thermal conductivity of cast iron stands at 11, that of pure aluminum is 52, while most of the alloys which have been used for pistons have a thermal conductivity in the neighborhood of 40, or nearly four times that of cast iron or steel. A piston having a given cross sectional area in those parts which serve to conduct away the heat will therefore carry away approximately four times as much heat if made of an aluminum alloy than if made of iron. Further, if the section of the piston is increased so as to bring the weight approximately up to that of an iron one, this capacity for conducting away heat may be further multiplied by 2 or 2.5. This power of increased cooling of the combustion space has proved extremely valuable in the aeroplane engine. There the power output of a unit of given weight was limited, in one direction, by the amount of compression to which the explosive mixture in the cylinder could be exposed before ignition. This admissible compression ratio depends upon the temperature which the compressed gases attain, since too high a temperature leads to preignition. Thanks to the cooling effect of the aluminum alloy pistons, it became possible to increase the compression ratios of the engines without risk of preignition, thus producing a very marked increase in power, running in some cases up to something like 20 per cent and at the same time effecting a decrease in fuel consumption per horsepower hour. The actual difference in temperature which gave rise to these results has been estimated in various ways—since direct measurement of the temperature of the head of a working piston is by no means easy. Two estimates obtained in very different ways, however, both lead to a similar figure,—viz., that the head of an aluminum piston of good design never rises much above a temperature of 450 deg. Cent., while in a cast iron piston in the same type of engine temperatures of 450 deg. Cent. may be exceeded.

Advantages and Disadvantages of Aluminum Pistons

In the airplane engine, where the highest possible efficiency, not only in regard to fuel consumption, but more especially in power output per unit of weight, is of supreme importance, there could be no doubt of the very great value of the advantages to be gained by the use of the light alloy piston. For the automobile engine, however, conditions are distinctly different and other factors enter largely into the problem. Yet here, too, engine efficiency both in regard to weight and to fuel consumption is of considerable importance, and is likely to be increasingly so in the future. There is, further, the undoubted fact that it is better for an engine in every way if the temperature of the combustion head can be kept down. This is particularly so in the case of air cooled engines, but even when there is water cooling, such matters as lubrication and others are favorably affected by keeping down the temperature. The aluminum alloy piston, therefore, has a certain definite advantage even in the automobile engine, and the only question which can affect its widespread adoption is whether the disadvantages which may attach to it outweigh the gain. This is, necessarily,

a matter for the individual judgment of each designer and one upon which actual service experience must be consulted before final judgment can be given. All that can be done here is to state briefly some of the factors of the problem.

Probably the most serious disadvantage of the aluminum alloys from the point of view of their use as pistons is their relatively high coefficient of thermal expansion. The various alloys which have been used or advocated for pistons do not differ very much from one another in this respect, the coefficient of expansion lying in all of them in the neighborhood of 0.000023 per deg. Cent., as compared with 0.000010 for iron or steel. The aluminum piston, for a given rise in temperature, will therefore expand about two and a half times as much as one made of iron, but—it must be remembered—under similar working conditions, the light alloy piston will not get nearly so hot. If we accept the maximum working temperatures mentioned above—250 deg. Cent. and 450 deg. Cent.—it will be seen that the actual expansion of the hottest parts of the two pistons will not be very different—the expansion of the aluminum alloy piston head being, perhaps, 50 per cent greater than that of the iron one. In view of the fact that these expansions are themselves extremely small, this difference does not amount to very much. It does, of course, demand a slightly greater clearance allowance between piston and cylinder when cold, and this is sometimes objected to on the ground of causing "piston slap" when the engine is started from cold. Even this, however, can be very considerably reduced by a device which takes account of the fact that the lower or "skirt" end of the piston is always very much cooler than the head when the engine is working. It is, therefore, possible to make the initial clearance (when cold) between the piston and cylinder distinctly smaller at the skirt end of the piston. This closer fit of the piston skirt tends to prevent "slap" to a very considerable extent.

Heat Treatment for Aluminum Pistons

It may be objected at this point that in practice it has been found necessary to allow much larger initial clearances with aluminum pistons as compared with those made of iron or steel than the above remarks would suggest. This kind of experience, however, is really the result of employing aluminum alloy castings for pistons without proper previous treatment. Such thin walled hollow castings of light alloys, owing to their high shrinkage and high thermal expansion, are often very considerably stressed internally when taken from the mold. Even during machining they sometimes show signs of slight distortion when the outer layers are removed. When a casting in this condition is put into an engine and exposed to heat and vibration, there is a great tendency for a further release of stress to occur, with resulting distortion of the piston. This is not to be confused with what is often spoken of as "growth" of such castings; here there is no real growth at all, but merely a slight change of shape resulting from the release of internal stresses. Yet such slight distortion, perhaps rendering the piston slightly oval instead of circular in section, will make the piston much too tight in the cylinder unless excessive initial clearance has been allowed. Fortunately, there is a simple remedy for this difficulty: If the castings, before being machined, are "annealed" by simply heating them up to a temperature a little above 400 deg. Cent. (but not above 450 deg. Cent.), followed by moderately slow cooling, then such subsequent distortion cannot occur and much smaller clearances can be safely employed. This preliminary annealing or baking also takes care of the very small amount of real "growth" which may occur in some of the alloys. Only where the alloy has been previously hardened by heat treatment does it become undesirable to employ so high a "baking" temperature as that suggested above. In that case a baking or "tempering" for several hours at 250 deg. Cent. is advisable and satisfactory.

The next point to be considered in regard to the use of aluminum alloys for pistons is their strength, particularly when hot. The very fact that such pistons have been successfully used in aero engines during the war serves to prove that their strength under working conditions is sufficient for the purpose. None the less, it is interesting to examine the question of strength rather more closely, since it has been suggested above that, with the best of the alloys now available, the strength at the working temperature is so good that the pistons could safely be made much lighter than is the present practice. When we look at the records of strength tests made on various piston alloys, particularly at high temperatures, it is surprising that such material should have stood up as well as it has done to the exacting conditions of piston service in a high speed, high duty aeronautical engine.

Alloys Used for Piston Castings

A very large number of such pistons were made, during the war, of an alloy containing 12 per cent of copper, the remainder being aluminum and impurities. At the ordinary temperature, this alloy in the form of a chill cast bar gives a tensile strength of rather less than 22,500 lb. per sq. in., and at 250 deg. Cent. this has fallen to less than 8000 lb. Even this compares favorably with the usual casting alloy containing about 13 per cent of zinc and 2.5 per cent of copper, which at the ordinary temperature registers a tensile strength of 15,000 lb. per sq. in., but falls, at 250 deg. Cent., as low as 4800 lb. This latter alloy, like all those containing any considerable proportion of zinc, is thus entirely unsuited for use in pistons, although—curiously enough—some German airplane engine pistons were found to contain about 9 per cent. of zinc. Investigation into the properties of aluminum alloys at high temperatures, however, soon led to the improvement of the alloys. A first step consisted in the introduction of manganese. An alloy containing 14 per cent of copper and 1 per cent of manganese was found to possess a very remarkable property. Its tensile strength at the ordinary temperature was about 10,000 lb. per sq. in., but while in all other aluminum alloys the strength falls off with temperature, in this alloy it was found to rise up to a maximum which was reached in the neighborhood of 250 deg. Cent., where this alloy gave a test of 11,000 lb. per sq. in. This alloy, however, undoubtedly suffers from too high a content of copper, and the stiffening effect of nickel was next studied. Finally, an alloy was evolved which contains 4 per cent of copper, 2 per cent of nickel and 1.5 per cent of magnesium, which in the chill cast condition shows a tensile strength of over 15,000 lb. per sq. in., and at 250 deg. Cent. still maintains a strength of 13,500 lb. per sq. in. More recently, by special heat treatment, the strength of this alloy has been increased to a very marked degree, and its future use for pistons is strongly indicated. It is, however, an alloy which undoubtedly requires special care in its preparation, but the difficulties are no greater than those inherent in the adoption of any new type of alloy, and they have been successfully overcome by aluminum founders on quite a large scale. Given a material of this order of strength at the working temperature, there would appear to be no reason, from the strength point of view, why the light alloy piston should be made of greater section at any point than that which serves well in cast iron. On the other hand, although adherence to the scantlings adopted with cast iron pistons will result in an appreciable saving

of weight, it will to that extent also lessen the power of the piston to conduct away heat from the combustion space. Curiously enough, it would seem that in the airplane engine the heat conducting power is of greater importance than a saving of weight. In the automobile engine, where compression ratios need not be pushed to the extreme, on the contrary, it is probable that a saving in weight of the pistons, by lessening the inertia stresses and generally reducing vibration, may offer greater advantages than the additional cooling power of a piston with thicker walls. Whichever side of this balance of advantages be taken as greater, it is obvious that the design of the piston itself should be carefully considered, not merely from the point of view of strength, but also from that of heat conduction. Wall thicknesses should be proportioned so as to correspond, at each point, with the quantity of heat which has to be conducted away, and a thickening of the piston walls, as a compensation for a removal or reduction in the size of the customary internal ribs, would seem desirable. Another important point, also, in regard to piston design is that the inner surface of the piston head should not be "pocketed"—i.e., it should be exposed as freely and directly as possible to cooling by splashing oil. There is also a further factor of design to be borne in mind, and that is facility of casting. Pistons should, wherever possible, be cast in chill (iron) molds with chill cores. These latter it is necessary to remove at the right moment as soon as the casting has "set," otherwise the contraction of the casting is liable to make it bind on the core and to split during cooling. The interior of the piston should therefore be so designed that a metal core made in two or three simple parts can be easily and quickly withdrawn when desired.

Shrinkage and Other Factors in Casting

As in other light alloy castings, defects are not unknown in the case of pistons cast in these materials. It was thought at one time that different aluminum alloys possess widely different degrees of shrinkage during solidification, but careful measurement has shown that this is not the case even in widely different alloys. In all of them, however, shrinkage is considerable and must be allowed for in making the castings. The necessity of removing a metal core at the right moment has already been indicated. Further, care is required to secure the solidification of the casting in the proper sequence. If thicker parts are connected together by thinner ones, provision must be made for "feeding" these thicker parts with liquid metal from some "gate" or "riser." If this is not done, the metal—still partly liquid—which has filled these thicker spaces in the mold becomes cut off from the rest by the earlier freezing of the adjacent thinner parts, and the subsequent contraction of the thicker portions leads to what is known as a "draw"—in reality a shrinkage cavity which is frequently distributed over a certain region in the form of sponginess. Piston castings containing such "drawn" places are very apt to be seriously porous. It is, accordingly, sound practice to subject piston castings to hydraulic pressure test before putting them into service. If a spongy "drawn" place should become exposed to the explosion gases, the piston is very likely to be damaged by erosion, the hot gases under pressure being forced into the pores and then rushing out again as the pressure in the cylinder falls.

At one time it was thought that the occasional failure of aluminum alloy pistons by what is known as "burning" could be ascribed to the existence of spongy places. Fuller experience, however, has shown that such "burning" can occur with perfectly sound pistons. In the great majority of cases such burning arises from defective lubrication leading to local heating. On the other hand, it seems probable that in some cases, at all events, the relatively very weak nature of the alloys used for piston castings is in reality to be blamed for these failures. Owing to the very soft, weak state of some of these metals at the working temperatures, particles become loosened on the heated surface. These are exposed to the flame of the explosion on all sides and are melted at the edges, thus giving rise to the idea that the burning of the piston is due to partial local melting of the more fusible constituent of the alloy (the aluminum-copper eutectic). Actually, the body of the piston does not approach the temperature required to melt this eutectic by several hundred degrees. At all events, where the very much stronger alloys now available are employed, this cause of "burning" will be eliminated.

Piston Pin Bushes and Piston Rings

There are two other points connected with the aluminum alloy piston which deserve mention here; these relate respectively to the piston pin bushes or bearings and to the piston rings. Taking the latter first, the usual practice hitherto has been to employ the ordinary cast iron ring with the light alloy piston, and this combination has worked satisfactorily. It has been suggested that the presence of these relatively poorly conducting rings between the piston and the cylinder lessens the flow of heat from the one to the other. This may be true to a very slight extent, but the greater part of the heat flow must take place through the broad surface of the piston skirt which takes its bearing upon the cylinder wall on the side toward which the piston is pressed by the obliquity of the thrust of the connecting rod. A realization of this fact suggests the importance of making this surface large enough—i.e., of not making the piston as a whole too short. Very short pistons have failed, not only because they did not produce efficient cooling but also because the bearing pressure against the cylinder wall became too high. Where this error is avoided, however, the aluminum alloy piston works extremely well in a cast iron or steel cylinder. An attempt has been made to use an aluminum piston in a cylinder of a similar light alloy, but although a certain degree of success has been claimed, no serious attempt to introduce such a construction into engine practice has yet been made. Reverting to the question of piston rings, however, there is a certain objection to the use of the iron rings, since their greater density causes them to "hammer" upon the walls of the grooves in the piston. In the course of time this action tends to widen the grooves, which successively intensifies the evil by allowing greater amplitude of motion to the rings. A curious metallic, ringing sound is sometimes heard from an engine in this condition. The use of light alloy piston rings has therefore been suggested, but no serious amount of experience with these is yet available, the main doubt being whether they would satisfactorily retain the requisite "spring" to maintain a gas tight joint with the cylinder.

Finally, the manner in which the piston pin is to be carried in the light alloy piston remains to be considered. A good deal depends upon whether the pin is to remain fixed in the piston, the rocking motion to be taken by the "small end" bearing of the connecting rod, or whether the pin is to "float"—i.e., to be free to rotate relatively to either the piston or the connecting rod. In the majority of aero engines the latter state of affairs prevails, and for that purpose the aluminum alloy piston is generally provided with a cast iron bush which is inserted in one of two ways: it is either "cast in" or screwed in. The latter method requires no comment, but it must be borne in mind that a tight screwed fit when cold is likely to

(*Continued on page 1301*)

Engineering Analysis of European Four Wheel Brakes

The four-wheel braking system is making great progress in Europe and the results achieved are worthy of serious attention from American Engineers. This article discusses the engineering features of the chief types and presents the results of tests recently made. Uniformity in size noted.

By W. F. Bradley and S. Gerster

ALTHOUGH brakes on the rear wheels, or on the rear wheels and transmission, are to be found on the vast majority of automobiles, the front wheel braking system is making such progress, particularly in Europe, as to be worthy the close attention of all American engineers. The movement is not at all new, for at various intervals during the last twenty years more or less spasmodic efforts have been made to introduce four-wheel braking. The last time any effort was made to promote the use of four-wheel brakes was about 1910, when the Allen-Liversedge brakes appeared in England and the French engineer Perrot produced the Argyll chassis with brakes on all four wheels.

The present revival, which dates from the Armistice, differs from the others by reason of the fact that the four-wheel braking systems are perfectly satisfactory. It cannot be denied that the Perrot system as used notably by Delage, Hispano-Suiza and Darracq, as well as the Isotta-Fraschini system, gives perfect results from the standpoint of the user and are infinitely superior to the best brakes on rear wheels and transmission. The fears that exist in the minds of certain motorists, and which are shared to some extent by engineers, that four-wheel braking systems require delicate adjustment and are apt to interfere with steering are absolutely unfounded. It has been proved over and over again that when properly laid out these braking systems require no more attention and are no more delicate than any others.

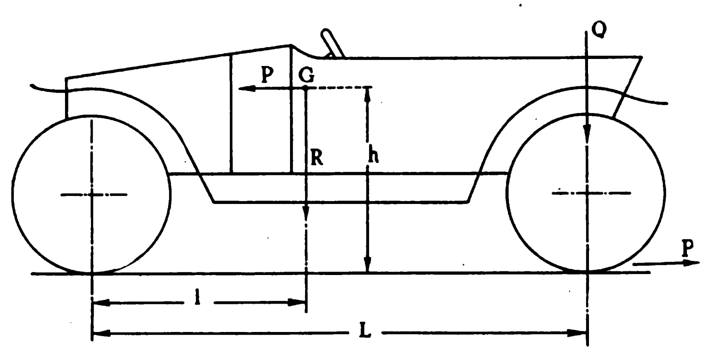


Fig. 1—Diagram of forces and reactions in braking.

Faculty of Adjustment

The cars with a four-wheel braking system are far above the average in the facility of adjustment. This, of course, is not due to the fact that brakes are placed on all the wheels, but because the complete design has been brought up to date and adjustment features have been given serious attention. As an example, Delage last year made a demonstration run of 3200 miles in six consecutive days, running in daylight only without a change of driver, and the total time for adjusting brakes and taking up wear was less than four minutes, and on no occasion was it necessary to use tools.

The only serious objection that can be made against four-wheel brakes is their extra cost. The front axle must be specially laid out for the extra stresses involved by reason of the braking effort, and numerous additional parts are required, this adding from $200 to $300 per chassis to production costs. It should be observed that up to the present four-wheel brakes have only been applied, in Europe, to high grade and costly automobiles, to which this additional production cost could be added without any great inconvenience. The full list of those actually in production on cars with four-wheel brakes is as follows: Delage, Darracq, Hispano-Suiza, Bellanger, Excelsior, Metallurgique, Piccard-Pictet, Isotta-Fraschini, Elizalde, all of these being high grade jobs. Delage, however, is now laying out a popular 10-hp. model, to be sold at a competitive price, to which front wheel brakes will be applied. This will be the first small car to be produced with this braking system. There is every reason to believe that next year other builders of small and medium cars will take up this feature. A development of some importance is that dealers, and particularly those with racing experience, now undertake to transform cars before delivering them to clients, by adding front wheel brakes. This modification is undertaken with the Perrot system, and in every case the front axle is changed.

Center of Gravity

The power of rear wheel brakes decreases as the wheelbase is shortened, as the center of gravity is raised, and as this centre is moved toward the front axle. The maximum braking effort obtainable with a car having brakes on all four wheels is found by the equation (1):

$$P = \frac{R \times l \times \mu}{L + (L \times h \times \mu)} \qquad (1)$$

This formula has been drawn up in accordance with Fig. 1, in which G is the centre of gravity; R the weight of the car; h the height of the centre of gravity; l the distance of the centre of gravity from the front axle; L the wheelbase; μ the coefficient of friction, and Q the weight on the rear axle. Equation (1) is the result of the two equations of equilibrium:

$$P = Q\,\mu \text{ and } Q = \frac{R \times L}{L} - P \times h^*$$

*See footnote on next page.

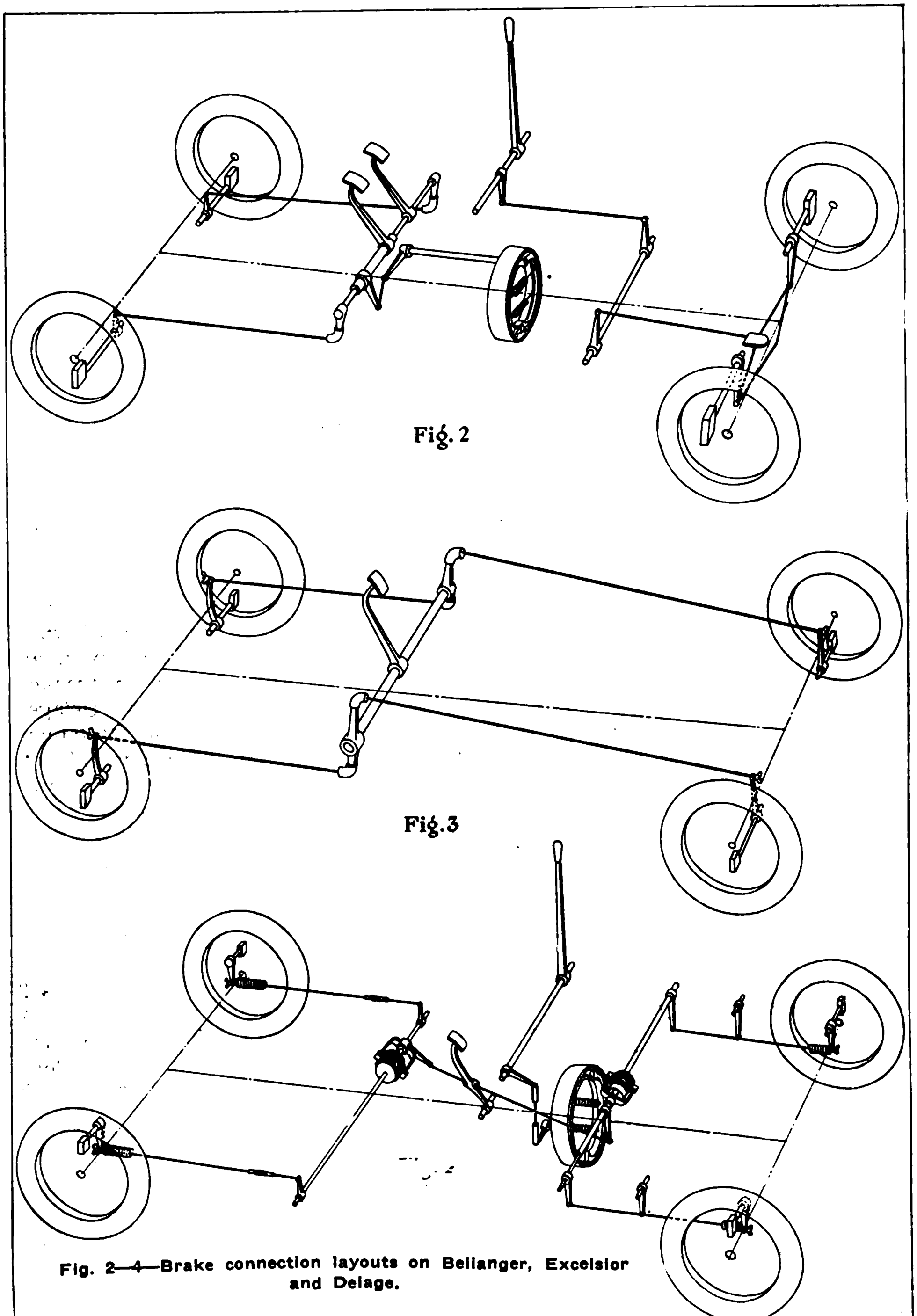


Fig. 2

Fig. 3

Fig. 2—4—Brake connection layouts on Bellanger, Excelsior and Delage.

on the supposition that the mass pivots around the point of contact of the front wheels with the ground.

By applying this formula it is seen that when the brakes are applied on the rear wheels only the rear axle is relieved of some of its load, which is transferred to the front axle. It is this transfer of weight from the rear to the front, when braking on the rear axle only, which is the cause of rear wheel skids with which every driver is familiar. This is so well known that skilled drivers frequently make use of the brakes to start a skid which will enable them to make a quicker turn than is possible with the steering wheel only.

Tests

When braking simultaneously on all four wheels, an effort can be obtained equal to the weight of the car multiplied by the coefficient of friction, this being the maximum retarding force. Taking a specific case of a car weighing 3306 lb., of which 1980 lb. on the rear axle, Perrot has calculated that the results shown in Table 1 would be obtained with rear wheel brakes only and with brakes on all four wheels.

It is interesting to compare these theoretical figures with the practical results obtained by the writer on a Darracq eight-cylinder car fitted with Perrot front wheel brakes. This was a chassis picked haphazard out of the shops and driven by a mechanic who had not been through any special training in the use of front wheel brakes.

With its loaded test body and two men aboard the weights were 2204 lb. on the front axle and 2623 lb. on the rear axle. Tests were made on an ordinary macadam road, on two different days, the first being very wet and the second being

Table I

	Distance covered, Rear wheel brakes*	Distance covered, Four wheel brakes
6 miles	3.5 feet	2.1 feet
20 miles	33.0 feet	19.0 feet
25 miles	57.0 feet	35.0 feet
40 miles	173.0 feet	102.0 feet
50 miles	229.0 feet	137.0 feet
60 miles	355.0 feet	210.0 feet

*See preceding page.—We think this expression should be

$$Q = \frac{R \times l}{L} - \frac{P \times h}{L}$$

The first term of the right hand side evidently represents the weight on the rear wheels with the car at rest and the second term the amount of weight transferred from the rear to the front wheels by the rear wheel braking action. The chassis may then be considered fulcrumed around the line of rear wheel ground contact and the moment of the inertia force around this line is Ph. This moment is balanced by the moment of the weight transferred to the front wheels whose distance from the line is L. Hence, if we call the transferred weight w, we have $wL = Ph$, and $w = \frac{Ph}{L}$. Another method of reasoning is as follows: The weight transferred cannot be expressed by Ph, because this is a moment expressed in pound-feet, and not a weight. To be made a weight this must be divided by a length again.—EDITOR.

Table II—Darracq Tests

	Four wheel brakes, Distance covered	Conditions
20 miles	28.4 feet	Dry Tarmac road
30 miles	40.0 feet	Dry Tarmac road
30 mlies	54.6 feet	Dry macadam
30 miles	65.6 feet	Wet macadam
40 miles	105.0 feet	Dry macadam
40 miles	108.0 feet	Dry Tarmac road
40 miles	98.4 feet	Wet macadam
50 miles	137.7 feet	Dry macadam
50 miles	147.6 feet	Wet macadam
60 miles	229.6 feet	Dry macadam
60 miles	239.5 feet	Wet macadam
	Rear wheel brakes only	
30 miles	122.9 feet	Dry macadam
40 miles	242.7 feet	Dry macadam
50 miles	319.8 feet	Dry macadam
60 miles	429.7 feet	Dry macadam

quite dry. On the dry day some tests were also made on a Tarmac type road, when it was found that quicker stops could be made up to 35 m.p.h., but beyond this speed the car could be stopped in a shorter distance on ordinary macadam. With the same chassis and on the same road, tests were made with the rear wheel brakes only with the results in Table II. The Darracq used for these tests has steel-lined aluminum drums of 16 in. diameter, with Ferodo lined shoes of 2 in. face width.

The figures were obtained by running the car at the required speed and dropping a sandbag overboard at the moment the signal was given to the driver to stop. The distance was measured from the point when the sandbag hit the ground (care being taken to see that the bag did not slide on the road) to the centre of the chassis. At high speeds it was rather difficult to obtain coordination between the dropping of the bag and the applying of the brakes, and several tests were made when this was in any doubt. It is obvious that these figures could be improved on, if desired, but their value lies in the fact that they are quite normal and represent the distances in which any driver could pull up with a car of this weight and this brake equipment.

It is interesting to examine these practical tests from a theoretical standpoint, calculating the distance in which the car can be stopped by the formula.

Distance required to stop:

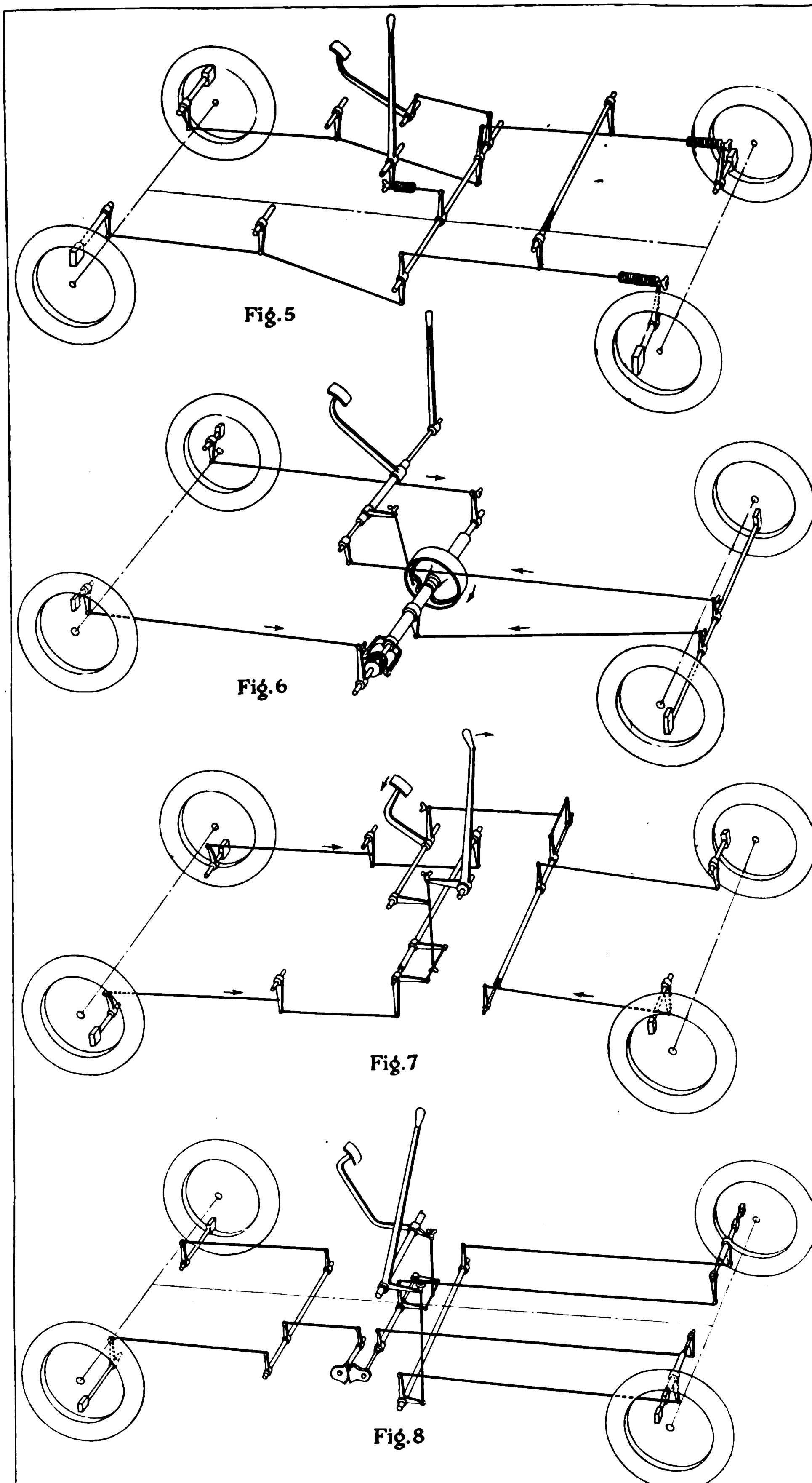
$$L. = 0.00393 \frac{P V^2}{F}$$

and taking as the coefficient of adherence of the wheels to the road 0.60. The comparative results are shown in Table 3.

Theoretical and Practical Relation

It will be observed that in the case of brakes on all four wheels there is very little difference between the theoretical figures and those obtained by the practical test. In the case of rear wheel brakes only the difference is greater, theory showing a much shorter stopping distance than is obtained in practice. This is due to the fact that when brakes are applied on the rear wheels, a portion of the weight on the rear axle is transferred to the front axle, and this reduction of weight on the rear is not taken into consideration in the calculations as usually made.

Claims have been made for considerably better performance than the above, and the following figures have been published as actual performance results for a hydraulic four-wheel braking system:



Figs. 5-8—Brake connection layouts on the Darracq, Hispano-Suiza, Isotta-Fraschini and Metallurgique. In each case there is one pedal and one brake lever.

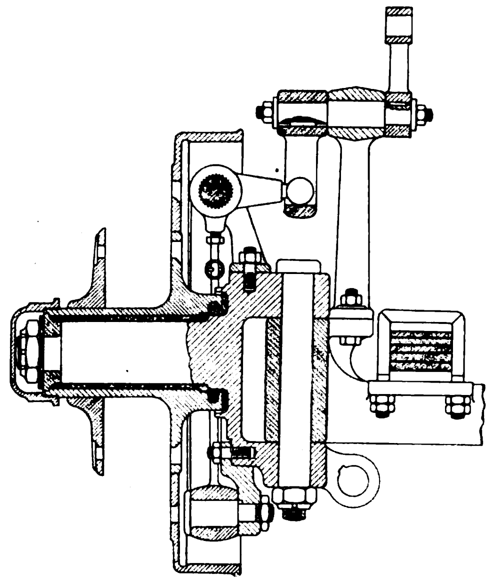


Fig. 9—Front Wheel brake of Dufour truck (1904).

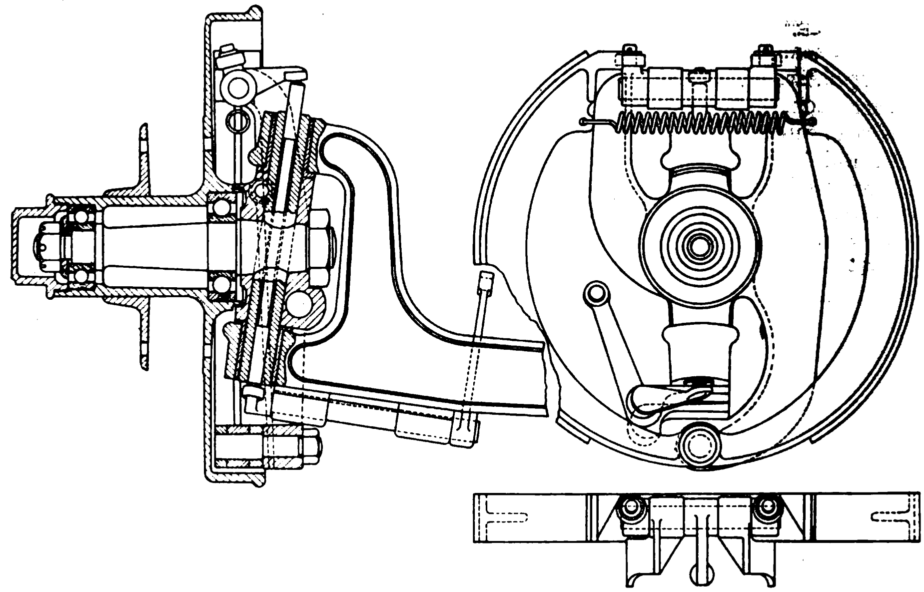


Fig. 10—Scat front wheel brake of 1910 showing inclined steering pivot.

Speed	Stopping distance
15 miles	9 feet
20 miles	16 feet
30 miles	36 feet
40 miles	64 feet
60 miles	144 feet

An examination shows that these are not performance but theoretical figures, for in every case from 15 to 60 miles an hour the coefficient of adherence is found to be 0.834. Obviously the coefficient of adherence is not absolutely uniform in any series of practical tests over a wide range of speeds. Further, the coefficient adopted is too high, 0.6 being a much more reasonable figure than 0.834. Figures such as these are harmful by reason of the wrong impression they convey regarding the value of four-wheel brakes.

On all cars built in Europe the brakes are applied simultaneously on the front and rear. There is no attempt to apply the rear wheel brakes ahead of the front wheel brakes, nor has any such arrangement been found necessary in practice. The only exception to the above is the Bellanger, Fig. 2, on which car the front and the transmission brakes are applied simultaneously by the pedal, and the rear wheel brakes are operated by side lever. Before the war Isotta-Fraschini had independent control of front and rear wheel brakes, the side lever being for the front and pedal for the rear. In practice the arrangement was not good, and the latest type Isotta-Fraschini brakes simultaneously on all four wheels. Various systems of brake application are in use: straight, diagonal, with equalizing mechanism, and without equalizers.

Table III

Speed	Rear brakes only		Four wheel brakes	
Miles	Theoretical	Practical	Theoretical	Practical
20	41.2	....	22.1	28.4
30	93.1	122.9	50.0	54.6
40	165.6	242.7	89.0	105.0
50	258.8	319.8	139.0	137.7
60	372.0	429.7	201.0	229.6

Excelsior (Fig. 3) brakes diagonally, so that the pressure is equalized at opposite corners, and if a brake cable

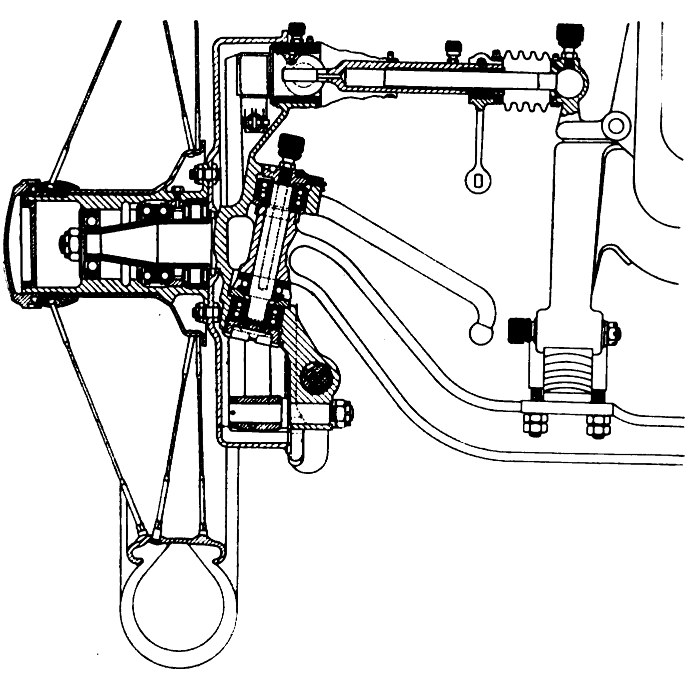


Fig. 11—Delage brake with cam above axle

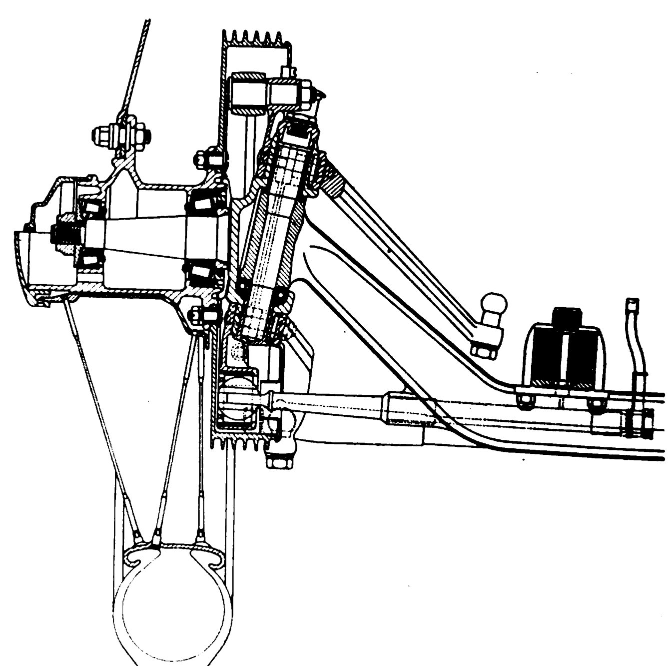


Fig. 12—Metallurgique brake with cam below axle

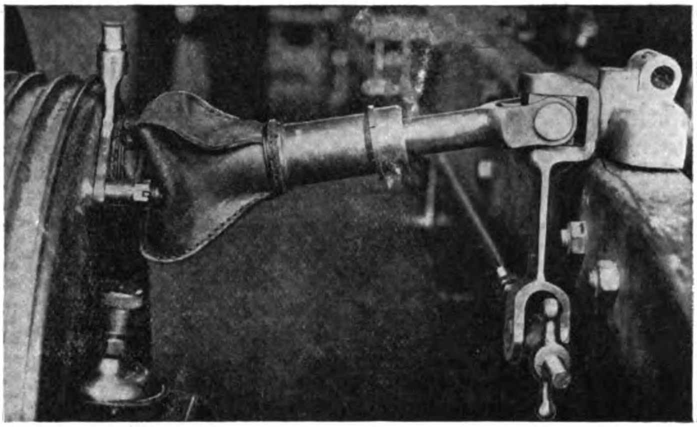


Fig. 13—Detail of Darracq brake operating mechanism on front wheel.

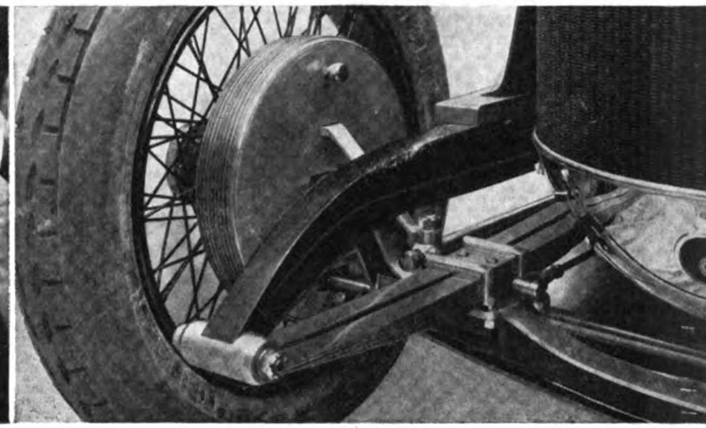


Fig. 14—Bellanger brakes and double springs.

broke a front and a rear wheel on opposite sides would still get the same braking effort. This is one of the patented features of Perrot's system, and was used by him on the first Argyll cars to have four wheel brakes. Curiously, however, those firms producing under Perrot license do not adopt this particular feature.

Delage, who has had more practical experience than any other firm on front wheel brakes, builds under Perrot license and brakes by pedal through two bevel type differentials (Fig. 4). There is a brake on the transmission, operated by hand, but its only practical use is to lock the car in a standing position. On the new 10-hp. type now going into production Delage has abandoned the transmission brake As under French law there must be two independent sets of brakes, it is assumed that the rear wheel brakes will be operated by lever as well as by pedal. Some such arrangement is necessary in order to lock the car in a standing position.

Darracq has simultaneous operation of the four brakes by pedal or by lever (Fig. 5), but unlike the Delage there is no equalizing mechanism. After long road tests of the two types it is difficult to determine which has the advantage in this particular respect. On the Darracq it is necessary to adjust the two front and the two rear wheels together, but once adjusted there appears to be no tendency for them to wear unevenly. On the Delage, on the other hand, any differences between the two wheels forming a pair will be taken care of by the differential. Obviously the Darracq is a cheaper production job.

Hispano-Suiza is the only one making use of a relay brake, as shown in Fig. 6. This device has been adopted in order to reduce the effort required to apply the brakes, and is successful to such an extent that the pressure required on the brake pedal is hardly any more than that for the accelerator. On the Hispano-Suiza all four brakes are applied by pedal, but the rear wheel brakes can be applied separately by lever.

Isotta-Fraschini brakes by means of pedal on all four wheels, or by means of the central lever, shown in Fig. 7. Metallurgique is rather special with the use of rear wheel drums having twice the width of those at the front and containing double brakes, one set being connected up to the front and operated by pedal, and the second set being controlled by hand. There is no brake on the transmission. The layout is shown in Fig. 8.

There is a certain historic interest in noting that one of the first front wheel brakes was used on the Dufour truck in 1904 (Fig. 9). This brake was very defective, for the axis of the steering pivot being a considerable distance from the point of contact of the wheel with the ground, there was a reaction on the connecting rod when the brakes were applied, and when one wheel was on dry ground and the other on a wet patch, there was considerable reaction on the steering gear.

When front wheel brakes came up again in 1910, on the Allen-Liversedge, the Argyll, and the Scat cars, the extended axis of the steering pivots cut the axis of the wheels at their point of contact with the ground, as shown in Fig. 10, which represents the Scat brakes of that period, so that the steering was not affected by unequal braking efforts on the front wheels.

All modern four-wheel brakes are on this principle, while the brakes themselves may be divided into two distinct classes—those built on the Perrot system with the cam and operating mechanism mounted above the axle, as shown in Fig. 11, on the Delage and as also used by Darracq and Hispano-Suiza, and those on the Isotta-Fraschini system with the cam below the axle. This latter design is adopted by Excelsior, Metallurgique (Fig. 12), Bellanger, and Piccard-Pictet.

With the Perrot system an extremely flexible connection is required from frame member to the brake drum. The brake camshaft is telescopic and is carried at its outer extremity on the frame member. Alternative methods of

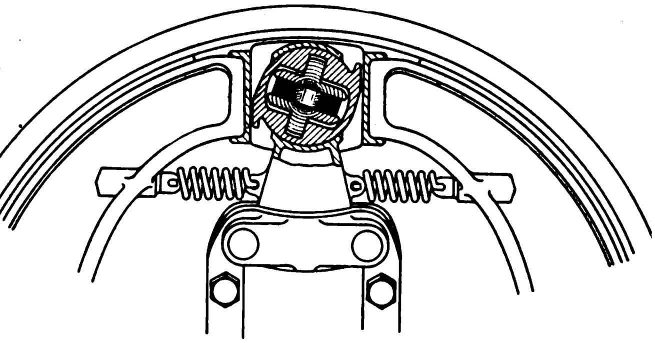


Fig. 15—Ball universal joint in brake cam on Metallurgique.

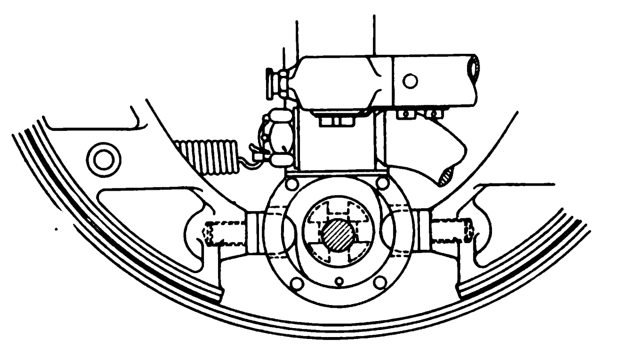


Fig. 16—Method of operating brake shoes on Bellanger.

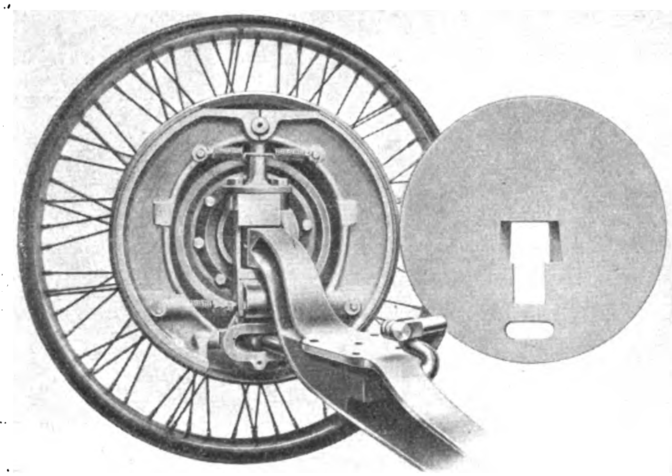


Fig. 17—Details of Bellanger brake.

mounting are shown in the Delage (Fig. 11) with a spherical connection on top of the frame member, and the Darracq (Fig. 13) with a yoke type of universal carried in the radiator support. On the latest Darracq the brake camshaft is mounted on the frame member, independently of the radiator support.

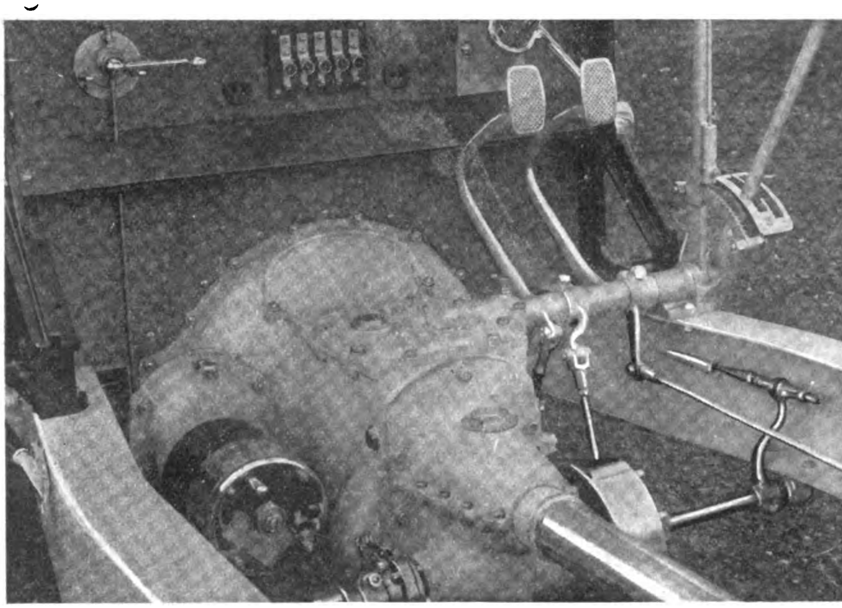


Fig. 18—Hispano-Suiza brake connections.

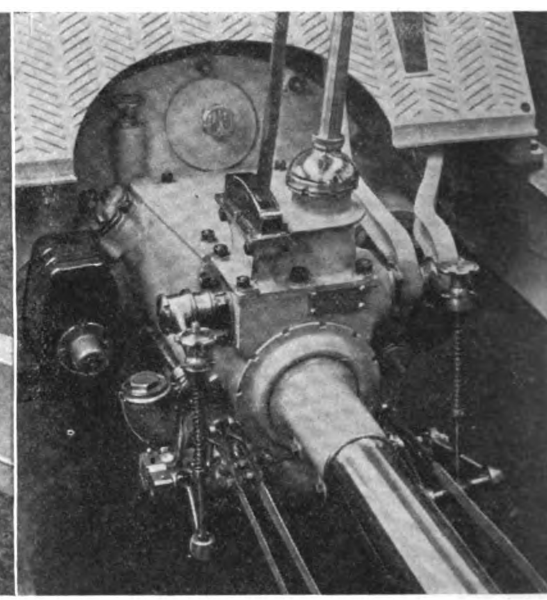


Fig. 19—Metallurgique brake adjustment.

The Perrot System

Advantages claimed for the Perrot system (Delage, Darracq, Hispano-Suiza, etc.) are that the whole of the brake operating mechanism being placed at the highest point there is the maximum protection against mud and dust. It is quite an easy matter, by the use of a leather gaiter, to completely protect the moving parts of the telescopic camshaft. The braking is not seriously affected with this design in case the front axle is bent in an accident, whereas with the brake camshaft mounted in the axle any accident to this latter makes the brakes inoperative, and the breakage of the main leaf of the front spring renders the brakes on the front wheels useless. As a remedy against this Bellanger uses double springs at the front (Fig. 14), held to the axle by a single pair of clips. It is most unlikely that two main levers will break simultaneously.

Generally a stop is fitted behind the rear shackle of the front spring to prevent the axle moving back in case of spring breakage. A third claim for the Perrot system is that it allows of the use of an axle with a bigger road clearance than is possible when the brake operating mechanism is carried in the axle itself. The objection can be raised against some of these designs that they are not very suitable for cheap production. An example is the spherical universal in the brake cam on the Metallurgique, shown in Fig. 15. The method of brake shoe operation on the Bellanger is shown in Fig. 16, with details of the brake in Fig. 17.

Uniformity in Size

On all the European high grade cars at present employing four-wheel brakes there is a large degree of uniformity in size, the drums varying in diameter from 15 to 16 in. and the shoes having a width of from 2 to 2½ in. on the Delage, Darracq, Hispano-Suiza, Metallurgique, Excelsior, Bellanger, and Piccard-Pictet cars. In all cases the brakes are internal expanding, the external contracting brake being quite unknown in Europe. Large use is made of ribbed cast aluminum drums with steel liners and aluminum shoes, this combination of metals being adopted in

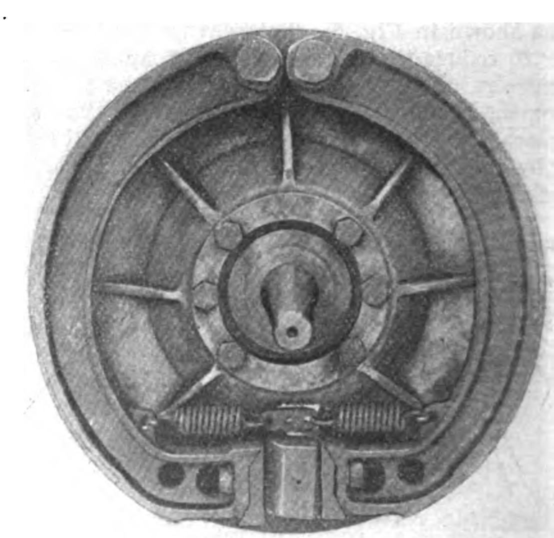


Fig. 20—Excelsior brake showing micrometer adjustment.

order to reduce unsprung weight to the lowest limits. Ferodo brake lining is used in the majority of cases, and while this gives fair satisfaction, it is admitted that the ideal lining has yet to be found. One of the objections raised against Ferodo is that when it becomes hot under strenuous service it assumes a spongy, almost rubbery character, with a loss of efficiency. Excellent results are claimed by Excelsior with alternating bands of cast iron and Ferodo. The dust from the iron shoes becomes impregnated in the fabric lining and improves its general efficiency.

Adjusting Arrangements

Much of the detail of these high-class braking systems is worth studying, and particularly the attention which has been given to arrangements for taking up wear and rapidly adjusting the brakes. On Delage and Darracq cars the normal wear is taken up by four butterfly nuts, two at the front and two at the rear of the chassis, shown in the case of the Darracq in Fig. 13. Delage also uses a bevel gear type of differential as balancing gear, the whole being in an aluminum housing. The use by Hispano-Suiza of steel cables for the front wheel brakes only is interesting, these cables going through guides in the frame members (Fig. 18), and adjustment being by butterfly nuts reached by lifting up the floor boards. Metallurgique unites all the brake adjustment at the rear of the gearbox, shown in Fig. 19. This firm also employs steel ribbons in place of the more commonly used brake rods, but to prevent rattle they are mounted vertically. Excelsior is the only firm using cable connections throughout, this choice being justified by the diagonal operation of the brakes. This firm provides for adjustment between the spherical cam and the brake shoes by having the hardened steel face pieces in the form of wedges with notches giving adjustments of one millimeter, as shown in Fig. 20.

French Semi-Diesel Competition

By W. F. Bradley

LITTLE public interest having been displayed in the semi-Diesel engine competition for French productions only, announced by the Automobile Club of France, this event has been withdrawn and new rules have been issued for a competition open to foreign nations on invitation. Those who are invited to take part are England, Belgium, Denmark, United States, Holland, Italy, Norway, Sweden and Switzerland. The bench tests will begin on October 15, 1921, and entries are received until August 1.

Four different classes of semi-Diesel engines are provided for under the rules, as follows:

Class 1, from 2½ to 9 hp.
Class 2, from 10 to 24 hp.
Class 3, from 25 to 34 hp.
Class 4, from 35 to 50 hp.

In the two latter classes the engines must have at least two cylinders.

The object of this competition is to encourage the development of semi-Diesel engines suitable for use on fishing boats, on agricultural tractors and for general stationary work. There are no restrictions on the type of fuel used, which may be either a petroleum by-product or derived from coal tar, on condition that it is readily obtainable commercially. Water injection is permitted.

The engines must develop their rated power at 450 r.p.m. for the first class; 400 for the second class; 350 for the third class, and 300 for the fourth class, the tolerances being 20 per cent plus or minus. While no weight limit is fixed, the total weight of the engine will be taken into consideration in making the awards. Fuel consumption must not exceed 450 grammes per horsepower-hour for fuel having a calorific value of 10,000 calories.

There will be six practical bench tests, as follows: (1) A 3-hour test under full load, followed by a similar test on the following day, it being absolutely forbidden to touch the engine between the two trials; (2) a 3-hour test at the same speed as the first test, but under half load; (3) a 3-hour test at half the maximum speed, with the load corresponding to this engine speed; (4) a 1-hour test at half maximum speed and at one-eighth maximum load; (5) a 1-hour test without load; (6) various starting tests, during which the engine must be started up from cold with the fuel used in normal running in a maximum time of 20 minutes. There will also be a series of tests at varying speeds and with quick changes from these different speeds. The ease with which the engine can be started up and reversed, the absence of noise and vibration and the east of starting after a long stop will be taken into consideration by the jury.

Awards in this competition will be made by the attribution of points for construction and operation on the following basis:

Construction.	Points.
Quality of construction	0 to 100
Ignition	0 to 100
Ease of dismounting and inspection of various parts	0 to 40
Interchangeability of parts	0 to 40
Lubrication	0 to 40
Ease of inspection and cleaning of valves	0 to 40
Joints for valve seats and piping	0 to 40
Operation.	**Points.**
General operation (noise, vibration, etc.)	0 to 200
Ease of starting	0 to 200
Ease of control	0 to 400
Consumption of lubricating oils	0 to 100
Fuel consumption under full load	0 to 500
Fuel consumption under half load	0 to 200
Fuel consumption without load	0 to 100
Fuel consumption under full load (half speed)	0 to 200
Fuel consumption with one-eighth load (half speed)	0 to 100
Weight per horsepower	0 to 100
Price of the engine	0 to 400
Ability to withstand racing	0 to 100

Some attention is being paid by French manufacturers to the development of semi-Diesel engines, not only for stationary work, but for use on trucks and agricultural tractors. Peugeot is working on this problem; Delaunay-Belleville has brought out an agricultural tractor with a semi-Diesel engine, and the S. M. I. M. Company has a truck engine in operation.

THE longest motor transport line in Spain was recently opened from Santander, on the shores of the Bay of Biscay, to the town of Burgos. The distance between the two towns is 96 miles, and the road is of a very difficult character, for starting from the sea level the route rises to an altitude of 3280 feet at Puerto del Escudo and drops down abruptly to Burgos. In certain places 18 per cent gradients are encountered. This line will carry both passengers and goods, the regular daily service being assured by four Fiat omnibuses and four lorries of the same make. The opening of this service was made the occasion of much local rejoicing, and a crowd estimated at 20,000 persons gathered to see the arrival of the first cars.

Tolerance Systems for Cylindrical Fits

The tolerances allowed must agree closely with the requirements if the limit gaging system is to be utilized to its fullest advantage. This article discusses the various tolerance systems used in connection with cylindrical fits and points out the various factors involved in each.

By P. M. Heldt

MANUFACTURE on the interchangeable plan was made possible by holding to close limits of measurement those parts which have to fit other parts, the dimensions being checked by means of limit gages. The manufacture of parts to limits is not at all new, but has been the accepted practice in the automobile industry during the past eight or ten years. But in the setting of the tolerances for different classes of work there has been in the past very little method, and there has been no uniformity in the practices of different shops. It is evident that the full advantage of a limit gaging system cannot possibly be obtained unless the tolerances allowed agree closely with the requirements. Of course, the average fit becomes better the closer the tolerances are made, but, unfortunately, exceedingly close tolerances mean high cost of production and high wastage. On the other hand, if the tolerances are made too large the parts will not go together properly and may require hand-fitting in assembling—the very thing it is desired to avoid by the limit system—or the rejection of parts in the assembling department which were passed by the inspectors.

There are two ways of looking at the matter of tolerances. In the first place, there would be no use in setting tolerances so close that the workmen cannot work to them. This was the point of view generally taken in earlier years, when the shop foreman was intrusted with the task of fixing the tolerances to which he thought the shop could work on any particular part, and these were set down on the drawings.

In recent years it has been found, however, that a shop force, provided it is furnished with suitable equipment and the working conditions are right, particularly as regards lighting, can be quickly trained to work to almost any degree of precision that may be called for. Hence in future there is no reason why the tolerances should not be determined solely with regard to the requirements of the work in hand. It will then be possible to standardize tolerances, so that parts made in different shops will be interchangeable. The need for such standardized systems of fits and tolerances became very apparent during the war when contracts for machine parts were let to an unprecedented extent. Had a complete system of standardized fits and tolerances been in existence at that time, untold trouble and waste would have been avoided. Although, as stated above, a shop force may be trained to work to any degree of precision that may be called for, the higher the precision the more expensive the work, and the tolerances should be set no closer than the purpose for which the part is intended actually necessitates.

When a shaft fits into a bore the character of the fit depends entirely upon the relation between the diameters of the shaft and bore. The question is sometimes asked, How large must a shaft be in order to just go into a hole of 1 in. diameter? The answer is that it must be 1 in. in diameter, in which case it will fit snugly into the bore, giving what is known as a push fit. If the shaft is made the least bit smaller in diameter it will enter the bore with a certain degree of freedom, whereas if it is the least bit larger it will require considerable force to cause it to enter. The degree of freedom on the one hand and the amount of force required on the other vary continuously with the difference in the diameters of shaft and bore. This difference, known as the allowance, may have an endless number of values, and there is, therefore, an endless number of degrees of fit that can be obtained. The necessity for determining upon a limited number of classes of fit arises from the fact that it is commercially impossible to make either shafts or bores to absolutely definite dimensions.

Tolerances must be set on both the bore and the shaft diameters. For instance, if for a particular part we set limits of 0.999 and 1.000 for the shaft and 1.000 and 1.001 for the bore, then it is possible for a 1.000-in. shaft to come together with a 1.000-in. bore and a 0.999-in. shaft with a 1.001-in. bore, representing the two extreme cases. There will always be such differences in fits of a certain class, but the extremes must not be far enough apart to completely change the character of the fit.

Three Fundamental Classes

In various systems there are different classes of fits. The British, in their deliberations on the subject, distinguished between three fundamental classes, viz., running fits, in which the bore is greater than the shaft diameter; interference fits, in which the bore is smaller than the shaft diameter, and transition fits, intermediate between the two. This classification is handy for purposes of discussion, but all actual systems of fits comprise a greater number. The lowest number is four, namely, running fit, sliding fit, push fit and force fit. A system of allowances and tolerances covering four fits is given in Table I, this having been evolved by J. E. Reinecker, a German machine tool manufacturer, and is in millimeters. The allowance is the difference between the shaft diameter and bore, being positive (+) when the shaft diameter is greater than the bore and negative (—) when the shaft diameter is less than the bore. The tolerances in this system are equally distributed on both sides of the nominal dimensions. This Reinecker system is typical of early attempts to standardize fits. Of late years the subject has been greatly elaborated.

As the class of fit depends upon the average difference in diameter between bore and shaft, it follows that if the bore is held constant for all classes of fit the shaft diameter must vary with the class of fit, and, conversely,

Table 1

Reinecker System of Tolerances

Diameter Ranges	Allowances for Different Classes of Fit: Running Fit	Sliding Fit	Push Fit	Force Fit
10– 16	—0.02 to —0.045	—0.01 to —0.035	+0.005 to —0.02	+0.02 to —0.005
17– 29	—0.025 to —0.06	—0.01 to —0.045	+0.01 to —0.025	+0.03 to —0.005
30– 50	—0.03 to —0.075	—0.01 to —0.055	+0.01 to —0.035	+0.04 to —0.005
51– 80	—0.035 to —0.09	—0.015 to —0.065	+0.01 to —0.04	+0.05 to —0.005
81–120	—0.045 to —0.11	—0.015 to —0.075	+0.015 to —0.045	+0.06 to —0.005
121–200	—0.055 to —0.13	—0.015 to —0.08	+0.015 to —0.05	+0.07 to —0.005

Limits for Bore and Shaft Diameter

Diameter Ranges	Bore Tolerance	Shaft Diameter Tolerances: Running Fit	Sliding Fit	Push Fit	Force Fit
10– 16	0.015	0.010	0.010	0.010	0.010
17– 29	0.020	0.015	0.015	0.015	0.015
30– 50	0.025	0.020	0.020	0.020	0.020
51– 80	0.030	0.025	0.020	0.020	0.025
81–120	0.035	0.030	0.025	0.025	0.030
121–200	0.040	0.035	0.025	0.025	0.035

In the lower table the figures represent the total tolerance or difference between the upper and lower limits.

if the shaft diameter is held constant for all classes of fit, the bore diameter must vary. The first system is known as the bore basis and the second as the shaft basis. The superiority of the one or the other of these alternate systems has been a much-discussed question. Superficially considered, there seems to be no great advantage one way or the other, but when the problem is closely looked into many points of difference come to light. Account must be taken, in the first place, of previous practice, as a large amount of capital is invested in gages, reamers, arbors, etc., and in case of a change in basic dimensions these tools are rendered useless.

Bore Basis and Shaft Basis

In England the subject of fits and tolerances was handled by a subcommittee of the Committee on Machine Parts, Their Gaging and Nomenclature, appointed by the British Engineering Standards Association, and this committee, after several sessions, decided to adopt the bore basis. In Germany, where the subject is handled by a subcommittee of the Standards Committee of the German Industry, the conclusion was reached that both the bore basis and the shaft basis would have to be retained.

The chief reason for the preference of the bore basis over the shaft basis is that the bore is usually finished by a reamer and also must fit a mandrel, and if the bore is constant for all classes of fit it saves a great deal on reamer and mandrel equipment. The German committee found it impossible to agree on a single system, as important branches of the German industry had been working on the shaft basis and, in view of their investments in gages and tools, they wanted to continue to do so, whereas the machine tool industry and the precision industry felt they could not give up the bore basis.

Advantages of Shaft Basis

The shaft basis has advantages in those branches of industry where cold rolled steel is used to quite an extent, as with this system fits of different kinds can be made on the same shaft without any offsets or shoulders on the shaft. This entails cheaper construction, hence is to be preferred in many lines, such as shop equipment, agricultural machinery, etc. In many cases it is a much easier matter to replace a smooth than a stepped shaft. The shaft basis was also claimed to be preferable where ball bearings are used, because German ball bearing manufacturers want to turn out their bearings with only one inner and one outer diameter for each size, with the zero line in both cases as the limit. This places the outer race on the shaft basis and at the same time gives a press fit for the inner race on the standard shaft. It is believed that the shaft basis offers a balance of advantages to firms specializing on a narrow line of products, whereas the bore basis is to be preferred by shops taking in almost any kind of work, which must, therefore, have a large range of equipment.

Disposition of Tolerances

Another question that comes up in the consideration of fits is the disposition of tolerances. Formerly it was customary to distribute these equally on both sides of the nominal dimension, and such dimension figures as 2.500 ± 0.001 in. were commonly used. But this sometimes led to trouble. Suppose, for instance, that a designer wanted a running fit on a 1¼-in. shaft and figured that an allowance of 0.001 was necessary to give clearance for the oil film. If at the same time he figured on plus and minus tolerances of 0.001 in. each, he would dimension his bore 1.250 ± 0.001 in. and his shaft 1.249 ± 0.001 in. However, in that case his minimum bore would be 1.249 in. and his maximum shaft 1.250 in., and instead of getting a running fit he would get a press fit in this extreme case. Such mistakes are not unavoidable with symmetrically disposed tolerances (the bilateral system), but they are more likely to occur with them than with the unilateral system.

Most of the arguments that have been adduced in favor of symmetrically disposed tolerances have to do with considerations of established practice. This was the common system some years ago and most of the firms which then adopted the limit gage system are equipped for it. These firms may not be very numerous, but, on the other hand, they include some of the largest concerns in the machinery industry. If the nominal size were made the low limit for bores, that is, if the tolerances were entirely disposed on one side of the nominal size, then all mandrels and reamers made for standard holes would be rendered useless. In Europe the point has been raised that ball and roller bearings as at present standardized can in many cases most easily be dealt with if the limits of the holes to receive the outer races are controlled by gages having at least one minus limit. However, in a set of shaft and housing fits proposed to the Standards Committee of the S. A. E. last January by a subcommittee largely composed of representatives of the bearing industry, housing bores with only plus tolerances were recommended. For the shafts also only positive tolerances are recommended. It has further been argued against the introduction of tolerances all to one side of the nominal dimensions that the introduction of any new system necessarily entails much extra control and work which is hardly warranted by the theoretical gain put forward in favor of the change.

An argument of a different character put forward in favor of the bilateral system is to the effect that where the bore basis is used it results in holes nearer, on the average, to the standard size. Where the low limit is the nominal size no hole can possibly be of standard size unless the "go" end of the gage be forced into the hole, which in that case will be of exactly the same size as the gage. Under such conditions there is no margin for error, and the operator, to obtain the desired result, namely, a standard hole, is obliged to exercise extreme care. Such use, moreover, is very injurious to the gage. In order to preserve the accuracy of the gages the pieces should enter the "go side" freely and the operator should be given full opportunity to take advantage of the permitted tolerance. With plus and minus limits both these advantages can be obtained, while the majority of holes produced will be very close to the standard size.

It is a rather strange fact that whereas England quickly reached a decision in the question of shaft basis vs. bore basis, which had proved a stumbling block in Ger-

many, at least in the sense that it was found impossible to adopt one of the two to the exclusion of the other, Germany disposed quickly of the problem of the disposition of tolerances on which no decision could be arrived at in England. In the German system the nominal dimension is the maximum dimension of the shaft where the shaft basis is used, and the minimum dimension of the bore with the bore basis.

In England representatives of the mechanical industries as late as the latter part of 1919 seemed to be divided into two substantially equal camps with no side willing to yield, for a committee report issued at that time stated that no decision could be made until further light had been thrown on the subject. However, recent private reports are to the effect that since that time there has been a marked change in England in favor of the unilateral system.

Advantages of the Bilateral System

The chief advantage claimed for using the zero line as the limit is that it is clearer than the system of symmetrically disposed tolerances. With the former system and the bore basis the shafts for all fits which are stationary, in the sense that there is no continued motion between the parts in operation, are given a positive deviation, those for all running fits, negative deviations. On the contrary, on the shaft basis the bores for running fits receive plus deviations, those for stationary fits minus deviations. The sign of the deviation therefore characterizes the kind of fit. Another advantage resides in the fact that one of the limiting dimensions is a standard dimension. The "go" side of all gages is a standard dimension for all qualities of fit. This facilitates the introduction of such a system by firms which previously made use of standard gages.

Qualities of Fit

It is obvious that not all industries can make use of the same quality of fits. Corn shellers, for instance, do not have to be built as accurately as aircraft engines. In the coarser grades of work where a running fit is wanted it is essential that the maximum shaft diameter be slightly less than the minimum hole diameter, but it does not matter so much if there is considerable clearance between the minimum shaft diameter and the maximum bore. Opinions as to the number of qualities needed differ. At the meeting of the British Committee above referred to some representatives thought that four or five qualities of work (degrees of fineness of tolerance) would be needed, while others thought three would be sufficient. In France only two qualities are in use. The Germans have adopted four qualities.

The system of standard cylindrical fits as worked out by the Standards Committee of the German Industry comprises eight classes of fit—press fit, light press fit, push fit, sliding fit, close running fit, running fit, free running fit and loose running fit—and four qualities of fit—coarse fit, plain fit, precision fit and high precision fit. The high precision quality goes together only with the sliding, push, light press and press fits. Precision fits are specified for all eight classes of fit. Plain fits are specified in conjunction with four classes of fit, viz., loose

THE NEWALL STANDARD TABLES OF LIMITS
(In Use in England)

TOLERANCES IN STANDARD HOLES (CLASSES A AND B)

Nominal Diameters	Up to ½"	9/16"-1"	1 1/16"-2"	2 1/16"-3"	3 1/16"-4"	4 1/16"-5"	5 1/16"-6"	6 1/16"-7"	7 1/16"-8"	8 1/16"-9"	9 1/16"-10"	10 1/16"-11"	11 1/16"-12"
High limit	+.00025	+.00050	+.00075	+.00100	+.00100	+.00100	+.00150	+.00150	+.00175	+.00175	+.00175	+.00200	+ 00200
Low limit	—.0025	—.00025	—.00025	—.00050	—.00050	—.00050	—.00050	—.00075	—.00075	—.00100	—.00100	—.00100	—.00100
Tolerance	.00050	.00075	.00100	.00150	.00150	.00150	.00200	.00225	.00250	.00275	.00275	.00300	.00300
High limit	+.00050	+.00075	+.00100	+.00125	+.00150	+.00175	+.00200	+.00225	+.00225	+.00250	+.00250	+.00275	+.00275
Low limit	—.00050	—.00050	—.00050	—.00075	—.00075	—.00075	—.00100	—.00100	—.00125	—.00125	—.00125	—.00125	—.00150
Tolerance	.0.0100	.00125	.00150	.00200	.00225	.00250	.00300	.00325	.00350	.00375	.00375	.00400	.00425

ALLOWANCES FOR VARIOUS FITS

Force Fits (Class F)

Nominal Diameters	Up to ½"	9/16"-1"	1 1/16"-2"	2 1/16"-3"	3 1/16"-4"	4 1/16"-5"	5 1/16"-6"	6 1/16"-7"	7 1/16"-8"	8 1/16"-9"	9 1/16"-10"	10 1/16"-11"	11 1/16"-12"
High limit	+.00100	+.00200	+.00400	+.00600	+.00800	+.01000	+.01200	+.014	+.016	+.018	+.020	+.022	+.024
Low limit	+.00050	+.00150	+.00300	+.00450	+.00600	+.00800	—.01000	+.012	—.014	—.016	—.018	—.020	—.022
Tolerance	.00050	.00050	.00100	.00150	.00200	.00200	.00200	.002	.002	.002	.002	.002	.002

Driving Fits (Class D)

Nominal Diameters	Up to ½"	9/16"-1"	1 1/16"-2"	2 1/16"-3"	3 1/16"-4"	4 1/16"-5"	5 1/16"-6"	6 1/16"-7"	7 1/16"-8"	8 1/16"-9"	9 1/16"-10"	10 1/16"-11"	11 1/16"-12"
High limit	+.00050	+.00100	+.00150	+.00250	+.00300	+.00350	+.00400	+.00450	+.00500	+.00550	+.00600	+.00650	+.00700
Low limit	+.00025	+.00075	+.00100	+.00150	+.00200	+.00250	+.00300	+.00300	+.00350	+00.400	+.00450	+.00450	+.00500
Tolerance	.0025	.00025	.00050	.00100	.00100	.00100	.00100	.00150	.00150	.00150	.00150	.00200	.00200

Push Fits (Class P)

Nominal Diameters	Up to ½"	9/16"-1"	1 1/16"-2"	2 1/16"-3"	3 1/16"-4"	4 1/16"-5"	5 1/16"-6"	6 1/16"-7"	7 1/16"-8"	8 1/16"-9"	9 1/16"-10"	10 1/16"-11"	11 1/16"-12"
High limit	—.00025	—.00025	—.00025	—.0005	—.0005	—.0005	—.0005	—.00050	—.00050	—.00050	—.00075	—.00075	—.00075
Low limit	—.00075	—.00075	—.00075	—.0010	—.0010	—.0010	—.0010	—.00125	—.00150	—.00150	—.00200	—.00200	—.00200
Tolerance	.0005	.0005	.0005	.0005	.0005	.0005	.0005	.00075	.00100	.00100	.00125	.00125	.00125

Running Fits (Classes X, Y and Z)

Nominal Diameters	Up to ½"	9/16"-1"	1 1/16"-2"	2 1/16"-3"	3 1/16"-4"	4 1/16"-5"	5 1/16"-6"	6 1/16"-7"	7 1/16"-8"	8 1/16"-9"	9 1/16"-10"	10 1/16"-11"	11 1/16"-12"
High limit	—.00100	—.00125	—.00175	—.00200	—.00250	—.00300	—.00350	—.00350	—.00350	—.00375	—.00400	—.00400	—.00425
Low limit	—.00200	—.00275	—.00350	—.00425	—.00500	—.00575	—.00650	—.00675	—.00700	—.00750	—.00800	—.00825	—.00850
Tolerance	.00100	.00150	—.00175	.00225	.00250	.00275	.00300	.00325	.00350	.00375	.00400	.00425	.00425
High limit	—.00075	—.00100	—.00125	—.00150	—.00200	—.00225	—.00250	—.00275	—.00275	—.00300	—.00325	—.00325	— 00350
Low limit	—.00125	—.00200	—.00250	—.00300	—.00350	—.00400	—.00450	—.00475	—.00500	—.00550	—.00575	—.00600	—.00625
Tolerance	.00050	.00100	.00125	.00150	.00150	.00175	.00200	.00200	.00225	.00250	.00250	.00275	.00275
High limit	—.00050	—.00075	—.00075	—.00100	—.00100	—.00125	—.00125	—.00125	—.00150	—.00150	—.00150	—.00175	—.00175
Low limit	—.00075	—.00125	—.00150	—.00200	—.00225	—.00250	—.00275	—.00275	—.00300	—.00300	—.00325	—.00350	— 00350
Tolerance	.00025	.00050	—.00075	—.00100	—.00125	—.00125	—.00150	.00150	.00150	.00150	.00175	.00175	.00175

running, running, tight and centering. Coarse fits are specified in connection with only two classes of fit, coarse running and tight.

Variation of Tolerance With Diameter

Naturally the allowances as well as the tolerances must increase with the diameter of the piece. At a meeting of the British Committee held in the fall of 1919, the view was expressed that further experimental work was needed before the basis on which allowances and tolerances should be determined could be settled, but those in attendance were of the opinion that the formula

$$\text{Allowances} = a + b\sqrt{D}$$

would give suitable results and might be accepted provisionally, a and b being constants and D the diameter. On the other hand, the German Committee adopted the expression

$$0.005\sqrt[3]{D}$$

for the unit of tolerance which serves to measure the tolerance, allowance, clearance, interference, etc. This is supposed to be the minimum permissible clearance between shaft and bore when using a light lubricating oil, taking into account the extreme wear of the "go" side of both the plug and caliper gages. Such a tolerance unit is a convenience, as it permits of tabulating the whole system of fits without giving the tolerances for many different ranges of size. For a 1-in. shaft this tolerance unit figures out to 0.00058 in. In the German standard system of fits all tolerances, clearances and interferences are given in multiples and fractions of the tolerance unit.

Wear and Marking of Gages

The German Standards Committee has also considered and set limits for the permissible wear of gages. These limits are as follows: 0.25 tolerance unit for a tolerance of 1 unit; 0.35 tolerance unit for a tolerance of 1.5 units; 0.40 unit for a tolerance of 2 units; 0.50 unit for a tolerance of 2.5 units, and 0.60 unit for a tolerance of 3 units.

In order that there may be no confusion between gages for different quality of fit the gages are to be given a coat of enamel of different colors, the colors chosen being as follows:

High precision fit gages, azure blue.
Precision fit gages, black.
Plain fit gages, "postal" yellow.
Coarse fit gages, light green.

The "no go" side of all gages will be painted a brilliant red. The nominal size is stamped on the gage, as well as letters denoting the class and quality of fit and whether it belongs to the bore basis or shaft basis system.

Distribution of Errors Over Tolerance Range

An interesting investigation of the distribution of errors when working to limit gages has been made by John A. Prestwhich & Co. of Tottenham, England. This concern uses the bilateral system of fits. In that case the dimension midway between the limits is the one desired by the designer, and it might be expected that the same number of parts would be over the standard as below the standard size, the same as in the case of a marksman shooting at a target a large number of times there will be the same number of hits to the right as to the left of the bullseye. The theoretical distribution of errors in such a case is given by the Gauss equation of probability represented by curves A, Fig. 1. Prestwhich & Co., by means of a highly accurate liquid gage measured up 74 finished crankpins and found that these

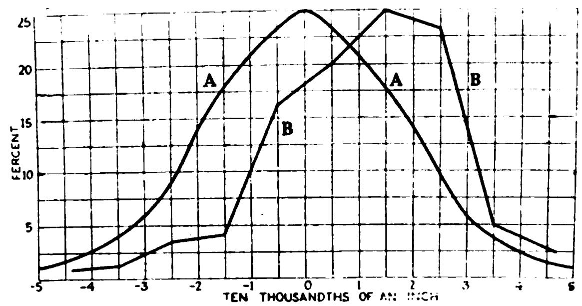


Fig. 1—Distribution of errors within permissible limits.

varied as shown by curve B, Fig. 1. The abscissas show the deviations from the standard size in ten thousandths of an inch, the tolerances being + and — 0.0005 in., whereas the ordinates show the percentage of the total number of pins between the limits represented by adjacent verticals. It is seen that this curve is displaced to the probable error curve by about 0.00015 in. This is easily explained, because in turning down a shaft the workman does not make any special effort to obtain the standard size but merely to come within the specified limits. On approaching the upper limit he gets very cautious, and as soon as he has reduced the diameter below this limit he stops because he has met the requirements. He keeps away from the lower limit for fear of going beyond it. There is, therefore, a natural bias toward the upper side, and the reasoning on which the curve of natural errors (A) is based does not apply to this case. Prestwhich & Co. draw the conclusion that if the tolerances had been set at + 0.00035 and — 0.00065 instead of at ± 0.0005 in. a great number of the shafts would have been of the standard size and the accuracy in general would have been closer.

Standard Tolerances in Engineering Contracts

Undoubtedly, once a standard system of tolerances is adopted it will be used to a large extent for acceptance inspection and specified for this use in contracts. All that is necessary is to mention the number or letter of the standards sheet in the contract, stating that parts will be accepted on the basis of inspection according to the particular standard. In this connection account must be taken of the wear of the "go" side of gages. Cases might occur where the manufacturer's inspection department used a gage worn nearly to the permissible limit, but the customer's inspector might use a new gage and reject parts which had been passed by the manufacturer's inspection department. In order to be thoroughly practical a system of fits must specify the allowable wear of the "go" side of gages and parts must be accepted if they don't exceed the measurement of the new gage on the "no go" side and the measurement of a worn gage on the "go side." In the German system the limits given in the standards sheets are working limits and they may be exceeded by the contractor by the amount of gage wear permissible. If any special tolerances are given in contract drawings they represent acceptance values or guarantees. It is the intention in Germany to have the standards adopted as legal by Parliament so their use in commercial contracts will be binding.

The German system of fits has been adopted by the Austrian and Swiss standards committees. In England the movement seems to have reached a stage of deadlock, owing to inability to agree on the question of disposition of tolerances, but there is no doubt that it will be taken up again in the near future, especially if other countries settle the matter in a satisfactory way.

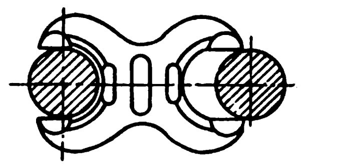
GERMAN INDUSTRIAL STANDARDS	**Precision Fit** Shaft Basis	G. I. STANDARD **40**

Abbreviated Designation for Shaft—fN

The precision fit is applicable to the running fits—loose running fit, free running fit, running fit and close running fit, as well as to the sensitive fits—sliding fit, push fit, light press fit and press fit. But the latter must be machined according to the high precision standard, G. I. Standards 48 to 51, if particularly rigid demands are made with regard to similarity of fit.

"Go" Side

The gage must go over the shaft by reason of its weight alone.



"No Go" Side

It must be impossible to pass the gago over the shaft and it must at most grab the shaft.

Dimensions in MM.

Diameter Ranges	New Gage Deviations Upward	New Gage Deviations Downward	Worn Gage Go Side Permissible wear	Worn Gage Go Side Deviation	Gage
	Go Side	No Go Side			
1 to 3	0	− 0.005	0.0015	+0.0015	Caliper Gage
Above 3 to 6	0	− 0.008	0.002	+0.002	
Above 6 to 10	0	− 0.010	0.003	+0.003	
Above 10 to 18	0	− 0.012	0.0035	+0.0035	
Above 18 to 30	0	− 0.015	0.004	+0.004	
Above 30 to 50	0	− 0.018	0.0045	+0.0045	
Above 50 to 80	0	− 0.020	0.0055	+0.0055	
Above 80 to 120	0	− 0.022	0.006	+0.006	
Above 120 to 180	0	− 0.025	0.007	+0.007	
Above 180 to 260	0	− 0.030	0.008	+0.008	
Above 260 to 360	0	− 0.035	0.009	+0.009	
Above 360 to 500	0	− 0.040	0.010	+0.010	
Tolerance Units	0	− 1	0.25	+0.2	

The deviations of this sheet are identical with those of the sliding fit shaft of the bore basis system according to G. I. Standard 23.

This sheet also specifies the shaft basis shaft for high precision fits.

Sample German standards sheet giving tolerances for precision fits on the shaft basis.

Using German Tolerance Chart With English Measures

The German tolerance unit is equal to 0.00058 in. for a nominal diameter of 1 in. Using the chart of the system, it is an easy matter to calculate the limits in inches for any nominal diameter, class and quality of fit. Suppose that the bore basis is to be used and it is desired to find the necessary limits for a 1.5-in. shaft and bore which are to be a running fit of precision quality. Referring to the chart, the lower limit for the bore is found to be the zero line, that is 1.5 in. The upward deviation is 1.5 tolerance units. This amounts to

$$1.5 \times 0.00058 \times \sqrt[3]{1.5} = 0.001 \text{ in.}$$

The limits for the bore, therefore, will be 1.500 and 1.501 in. The deviations for the shaft are — 1.5 and — 3 tolerance units. Hence the limits for the shaft are 1.49[illegible] and 1.498 in.

Now let us take a 2-in. shaft and bore under the shaft basis to have a running fit of coarse quality. The shaft deviations are + zero and — 9 tolerance units, and the bore deviations + 9 and + 18 tolerance units. Nine tolerance units in this case amount to

$$9 \times 0.00058 \times \sqrt[3]{2} = 0.0065 \text{ in.}$$

and 18 tolerance units = 0.013 in. Hence the limits for the shaft would be 1.9935 and 2 in. and the limits for the bore 2.0065 and 2.013 in.

Tolerances in S. A. E. Standards

In the S. A. E. standards there are a good many examples of tolerances and these reflect modern American practice which, however, is not based on a unified or standardized system. For instance, on poppet valve stems a tolerance of 0.001 in. is allowed and both limits show downward deviations from the nominal size, the stem being intended to be a free sliding fit in the reamed bushing. Shanks of connecting rod bolts are dimensioned so that the maximum diameter is identical with the nominal size and the minimum from 0.002 to 0.004 in. smaller, according to the nominal size. The starting crankshaft end has limits of 0.998 and 1.000 in. and for the attached starting crank the hub bore limits are 0.9990 and 1.0005 in., while for the removable starting crank the hub bore limits are 1.010 and 1.015 in. This evidently corresponds to the shaft basis and tolerances to one side of the zero line. The tolerance on the shaft is a little larger than that corresponding to the plain fit of the German system. On rod end pins both deviations from the nominal size are negative, on the ½-in. size — 0.004 and — 0.007 in., for instance. The holes in the rod ends through which these pins go have both positive and negative deviations, + 0.001 and — 0.002 in. for the ½-in. size, for instance. The practice represented by these figures does not seem to fit in with any of the systems above discussed. In splined fittings the bore basis and tolerances to one side of the nominal dimension are used.

Tolerances in Ballbearing Mountings

The proposed standard ballbearing mountings submitted to the S. A. E. last winter correspond neither to the shaft basis nor to the bore basis. The inner race should be a press fit on the shaft. Let us take the 25 mm. bore size. For a high precision fit, according to the German system the tolerance on the shaft diameter would be 0.00057 in., the proposed tolerance was 0.0005 in. The tolerance on the bore, according to the German system would be the same, that is, 0.00057 in., that in bearings, according to the American standard is 0.0006 in. The maximum allowance in the German high precision press fit is + 2 tolerance units = + 0.00114 in., the minimum, zero. In the proposed American standard the maximum allowance is + 0.0009 in., the minimum, — 0.0002 in. Hence the tolerances on this size of bearing and shaft corresponded very closely to the German high precision fit, and the allowance lies between the German press and light press fits, somewhat closer to the former.

If now we take the largest size of bearing listed, with a bore of 205 mm., we find the following (the figures in parentheses following the different values correspond to the German high precision fit, hole basis, for the same nominal size). Tolerance on shaft, 0.0005 in. (0.00116); tolerance on bore, 0.0008 in. (0.00116); maximum allowance, + 0.0011 (0.0022); minimum allowance — 0.0002 in. (0). This shows that on the larger shafts the tolerance allowed in the proposed American system was less than half as great as that of the German high precision fit, which supports the contention made in the discussion at the Standards Committee meeting that the proposed tolerances were too fine.

The proposed housing bores are not held quite so close. For instance, for an 80 mm. outside diameter bearing the housing tolerance is 0.0010 in. (0.00085 in.); the bearing diameter tolerance, 0.0005 in. (0.00085 in.); the maximum allowance, — 0.0015 (— 0.0017 in. for sliding fit); the minimum allowance, 0 (0). For the largest size of bearing listed (400 mm. outside diameter) the figures are as follows: Housing bore tolerance. 0.0020 in. (0.00145 in.); bearing outer race tolerance, 0.0012 (0.00145 in.); maximum allowance, 0.0032 (0.0029); minimum allowance, (0).

Another S. A. E. standard involving a cylindrical fit is that of spring eye bushing and bolt tolerances. The tolerances on the eye bushings are set at + 0.001 and — 0.003 and those on the bolts at — 0.005 and — 0.008 in.

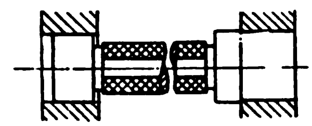
GERMAN INDUSTRIAL STANDARDS	**Precision Fit** Shaft Basis—Free Running Fit	G. I. STANDARD **41**

Abbreviated Designation for Free Running Fit—LL

Free running fits are used for joined parts which are to move relative to each other with plenty of play

"Go" Side

The gage must enter without force.



"No Go" Side

The gage must not enter but at most bite.

Dimensions in MM

Diameter Ranges	New Gage				Worn Gage		Gage
	Deviations		Maximum Play Calculated	Minimum Play Calculated	Go Side		
	Upward	Downward			Permissible wear	Deviation	
	No Go Side	Go Side					
1 to 3	+0.035	+0.018	0.040	0.018	0.003	+0.015	Plug Gage
Above 3 to 6	+0.045	+0.025	0.053	0.025	0.005	+0.020	
Above 6 to 10	+0.055	+0.030	0.065	0.030	0.005	+0.025	
Above 10 to 18	+0.065	+0.035	0.077	0.035	0.005	+0.030	
Above 18 to 30	+0.080	+0.040	0.095	0.045	0.008	+0.037	
Above 30 to 50	+0.095	+0.050	0.113	0.050	0.008	+0.042	
Above 50 to 80	+0.110	+0.060	0.130	0.060	0.010	+0.050	Flat Gage*
Above 80 to 120	+0.130	+0.070	0.152	0.070	0.012	+0.058	
Above 120 to 180	+0.150	+0.080	0.175	0.080	0.012	+0.068	
Above 180 to 260	+0.170	+0.090	0.200	0.090	0.015	+0.075	
Above 260 to 360	+0.190	+0.100	0.225	0.100	0.018	+0.092	Length Gage*
Above 360 to 500	+0.220	+0.120	0.250	0.120	0.020	+0.100	
Tolerance Units	—5.5	—3	6.5	3	0.5	—2.5	

*When flat gages or length gages are used the fits are apt to be slightly closer than when plug gages are used.

Sample German standard sheet giving tolerances for precision free running fits on the shaft basis.

Status of Movement in U. S.

So far not much has been done in the United States to standardize cylindrical fits, but the machinery for taking up the work exists here. The American Engineering Standards Committee has designated the American Society of Mechanical Engineers sponsor for standards on gages and gaging and the subject of fits would seem to come within the province of the committee appointed under this arrangement. This committee has recently issued a questionnaire dealing with the subject of fits and tolerances in general and no further steps will be taken until the replies to this questionnaire have been received and the information contained in them has been sifted and compared.

A line of standardization work closely related to that on cylindrical fits is screw thread standardization, and considerable progress in this has been made by the National Screw Thread Commission, a progress report of which was issued only recently. The National Screw Thread Commission recommends the adoption of four classes of fit for screw threads—loose, medium, close and wrench fit, and two qualities of work (or subdivisions) under medium and wrench fits. The commission also recommends the adoption of the bore basis. That is, the pitch diameters of the minimum nuts for all fits are the theoretical pitch diameters for the particular bolt size and all tolerances on nut pitch and other diameters are upward. The maximum screw is below basic for the loose fit, basic for the two medium fits and above basic for the close fit and the two wrench fits. The tolerances on all screws are minus.

If the recommended screw thread standards are adopted, as there is every likelihood that they will be (with possibly minor changes) the work of the Screw Thread Commission will furnish guidance for the Committee on Gages and Gaging or that on Allowances and Tolerances if one should be appointed. The Bureau of Standards has expressed itself as follows on the various questions arising in connection with the standardization of cylindrical fits:

"The Bureau is in favor of the use of the principle of the standard hole as against that of the standard shaft. There are, however, certain special cases in which the standard shaft is good engineering practice. For example, in machine tool building in cases where a single

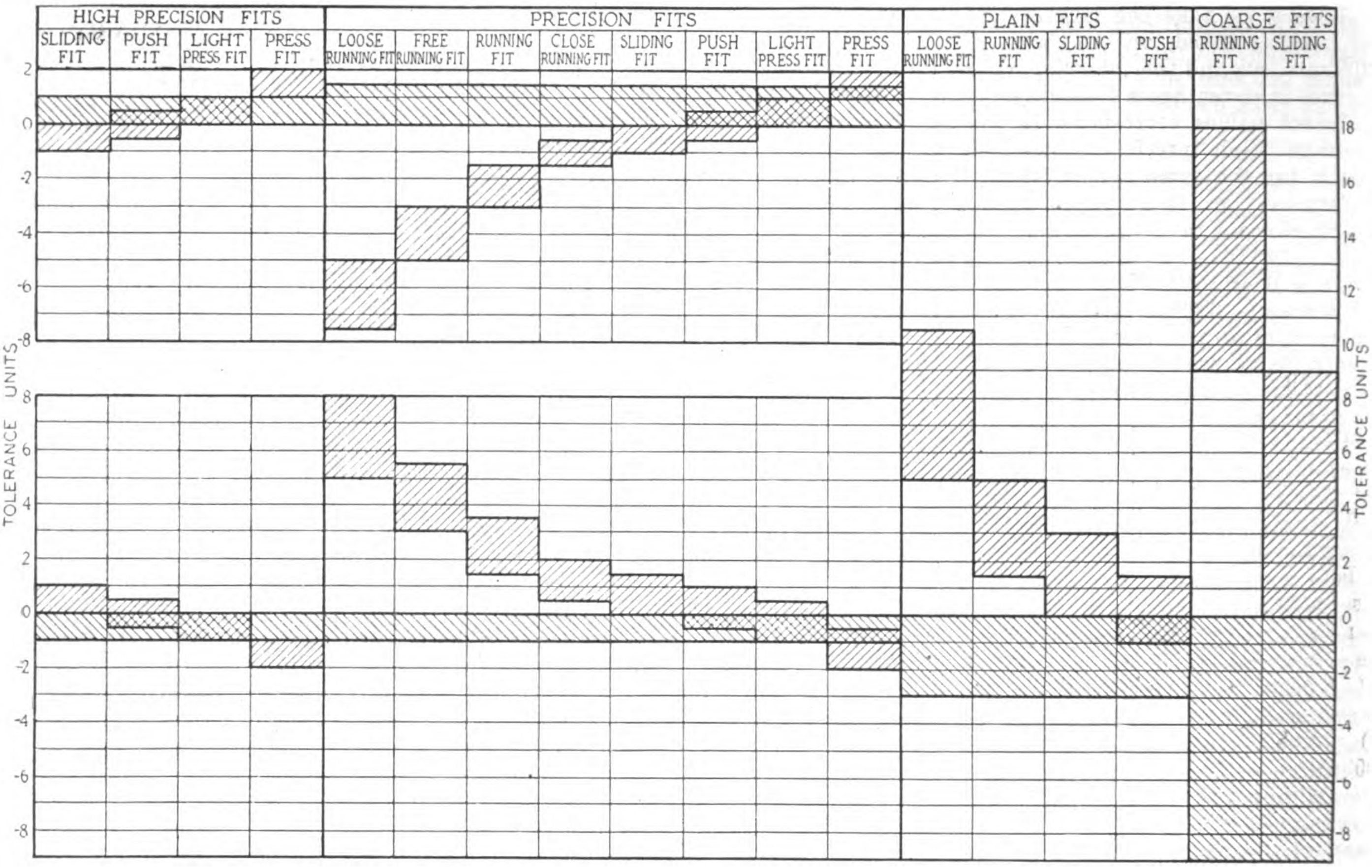


Diagram in upper left hand corner shows tolerances for hole basis. The larger diagram shows tolerances for shaft basis. Both diagrams represent the German standard system for cylindrical fits.

shaft runs in several bearings, requiring different qualities of fit, it is good practice to keep the shaft of uniform diameter and vary the journals to obtain the kind of fit required at each bearing.

"It is the opinion of the Bureau that in general the minimum hole should be of basic size and that the tolerances on the hole should be plus, and that the maximum

(*Continued on page* 1283)

Definition of Terms

Fit in general denotes the physical correlation of two parts joined together, and is characterized by the clearance or interference.

Clearance is the free space between bore and shaft.

Interference is the amount by which the diameter of the shaft to be inserted exceeds the bore.

Allowance is the difference between shaft diameter and bore; it is positive when the shaft diameter is greater than the bore and negative when the shaft diameter is smaller than the bore. Positive allowance is interference; negative allowance, clearance.

Maximum and minimum limits are the extreme dimensions between which the actual dimensions of the completed part must lie.

Tolerance is the difference between the greatest permissible (maximum) dimension and the smallest permissible (minimum) dimension of a piece of work.

Minimum clearance is the difference between the minimum bore and the maximum shaft diameter.

Maximum clearance is the difference between maximum bore and minimum shaft diameter.

Minimum interference is the difference between the minimum shaft diameter and the maximum bore.

Maximum interference is the difference between the maximum shaft diameter and minimum bore.

Nominal dimension is the measurement which indicates the size of the part.

Deviation is the difference between the actual and nominal dimension.

The upward deviation added to or subtracted from the nominal dimension gives the maximum dimension.

The downward deviation added to or subtracted from the nominal dimension gives the minimum dimension.

Qualities of fit are grades of workmanship according to which the precision of fits is graded.

Unilateral system is a system in which there are tolerances on one side of the nominal dimension only.

Bilateral system is a system in which there are tolerances on both sides of the nominal dimension.

The bore basis is characterized by the following:

The bore remains the same for any particular quality of fit, that is, the diameter of bore does not change with a change in the class of fit, whereas the diameter of the shaft is made different according to the class of fit. The downward deviation of the bore is zero, therefore the zero line is the lower limit of the bore diameter. Shafts on which there are fits of different classes must be offset.

The shaft basis is characterized by the following:

The shaft diameter remains the same for any particular quality of fit, that is, the shaft diameter does not change with a change in the class of fit, whereas the bore diameter is made different according to the class of fit. The upward deviation of the shaft is zero, hence the zero line is the maximum or upper limit of the shaft diameter. Shafts on which there are fits of different classes may be either smooth or offset.

Storage Battery Equipment Important Design Problem

The designer has before him the problem of selecting storage battery equipment and of determining its position on the car. This article discusses the factors influencing performance and points out its intimate relation with owner satisfaction. Advantages of standardized equipment.

By Donald D. Blanchard

THE storage battery is to-day a most important part of automobile equipment. By the almost universal adoption of battery ignition in passenger-car practice, the satisfactory performance of the car has been inseparably linked with the performance of the battery. It is, therefore, a matter of prime importance that the automobile engineer choose wisely when selecting a battery for the car he has designed.

In making a selection, the fact that the average owner is prone to neglect the battery should not be lost sight of. This is an unfortunate condition, but nevertheless one that must be met, and the car designer must choose a battery that will most satisfactorily withstand abusive service. He should select a battery that has the reserve capacity to start the engine in cold weather when conditions are most unfavorable. He should locate his battery on the chassis where it will be convenient for the driver to maintain it.

The car manufacturer does not warrant the performance of such parts and equipment as he buys from other companies, and the battery is included in this class. However, when a car is sold, there is some moral obligation that it will give satisfactory service in the hands of the owner. Despite the fact that the car manufacturer is not responsible for the performance of the battery, he is very much interested in it. The owner expects service from his car, and if he doesn't get it because of an unsatisfactory battery, he is disappointed. The prestige of the car suffers in his mind, and in the minds of the people with whom he comes in contact.

Satisfied owners are becoming an increasingly important factor in automobile merchandising, and in this competitive market the dealer needs all the assistance that he can get from this source. A battery that is not selected purely on the performance basis, jeopardizes the prestige of the car. Free service on the battery under the warranty is performed by the battery service station, and consequently the dealer is not under any direct expense if the battery gives trouble. But an unsatisfactory battery increases the selling expense because the dealer does not have all the assistance that satisfied owners can give him.

Capacity is perhaps the most important factor in battery performance. The battery must be able to start the engine in cold weather when the oil is congealed, when the fuel vaporizes poorly, and when the normal capacity of the battery is very materially reduced. These are the most difficult conditions under which the battery must operate. They are the conditions which the engineer must have in mind.

Increased capacity naturally means increased cost. Capacity can only be secured by increasing the size of the battery. But the difference is hardly worthy of a second thought when considered in comparison with the resultant increase in owner satisfaction. On a large production job, a small saving on each battery amounts to a considerable sum, but it is an economy that is dearly paid for.

A somewhat parallel case is found in tire equipment. Some years ago fabric tires were standard on all makes of cars. Since the development of the cord tire there has been a gradual change until now most makes are equipped with this type of tire. The cord tire is more expensive, but it gives better service. Car manufacturers have found that this addition to the first cost has increased the salability of their products. There is no reason to believe that a similar investment in an oversize battery would not produce results that would justify themselves.

Careless Owners

The careless owner is another factor that the engineer must consider in the selection of the battery. An analysis may show that a certain size of battery will meet the needs of the car assuming that the driver takes care of the battery and uses it judiciously. But the battery that is dependable under favorable conditions such as these, may be very unsatisfactory in the hands of a driver who does not bother to maintain it. A battery with reserve capacity is needed to keep this man's car on the road.

A statement that car manufacturers have economized on the first cost of batteries would be impossible to prove, nevertheless there are battery service men who believe that, in many cases where battery trouble is experienced, it is the result of the car manufacturer's economizing on this important piece of equipment. The belief is also current that battery trouble is often traceable to the fact that the battery specified for the car is too small.

Some years ago O. W. A. Oetting of the Willard Storage Battery Co., presented a paper before the Society of Automotive Engineers, in which he gave a table of recommended battery capacities as related to piston displacement. The writer applied this criterion to about forty popular makes of car, and found that about 25 per cent of them are equipped with batteries that are too small. There are no records to show, however, that the makes of car that do not measure up to this criterion experience more battery trouble than those which meet its requirements.

Price should not enter into the selection of a battery. If a car must be built to sell at a certain price, the battery is the wrong place to economize. It is one of the weak links on which the chain of owner satisfaction is dependent, and it is well worth while to bolster up its strength in every possible way.

Plate Thickness

The effect that the thickness of the plate has on the life and service of a battery also merits serious consideration. The capacity of a cell depends on its positive plate area and, in the automobile battery, this area has been made large in order to get sufficient current for starting. The weight and bulk of the battery must be kept down, however, and this has caused the use of a plate that is comparatively thin. The thin plate has two disadvantages: First, it is mechanically weak in the direction of the stresses produced by buckling. Second, due to the gradual disintegration of the active material in the positive plate, the thick plate has a longer life than the thin plate, inasmuch as it has more active material to shed, than a thinner plate.

Considerations of weight, bulk and price have doubtless influenced the selection of the thin plate battery. But it seems that it might be worth while to disregard these objections because of the important advantages of the thicker plate. The advisability of this procedure is indicated by the unusually successful results that have been obtained with thick plate batteries in passenger car service. It is not uncommon to find batteries of this type that have seen four and five years' service without being opened.

The thin plate will give dependable service provided it receives proper care and is used judiciously. But it lacks the ruggedness of the heavier plate, and consequently will not stand up as well under abuse. For this reason the thick plate is preferable, as the average driver does not show any particular interest in the battery until it refuses to crank the engine, or fails to supply current for the ignition and lights.

The rate at which charging current is supplied to the battery by the generator has a determining effect on battery performance. The driver who makes long daylight runs at touring speeds makes a very small demand on the battery, while a doctor who uses his car for making calls in a city puts a very heavy load on the battery because of the number of starts and the shortness of the intervening runs. A charging rate that would keep the doctor's battery in good shape would overheat the other man's battery, and a charging rate that would answer for the first man would starve the doctor's battery.

The charging rate is ordinarily set by the manufacturer of the electrical equipment to meet the requirements of the average driver as nearly as they can be judged. Some electrical manufacturers seal this adjustment, and their warranty is invalidated if the adjustment is changed without their authorization. It is not generally believed that the typical owner has sufficient knowledge and experience to make this adjustment.

Assuming the correctness of this viewpoint, it appears that it would be well worth while for dealers to watch all cars they sell for some weeks after delivery, in an effort to determine whether the current adjustment on the generator is correctly made for the needs of the individual driver. This is a problem for the dealer to handle, but the manufacturer might well exert his influence to secure a more general adoption of this policy.

However, there are some practical men who do not believe that the adjustment of the charging rate is beyond the ability of the owner. They believe that this adjustment should be made accessible so that the owner can change it conveniently. One battery man with whom the writer talked goes so far as to say that the adjustment should be brought up to the dash. He argues that this adjustment is very nearly as important to the operation of the car as the adjustment of the carbureter.

Owner Education Difficult

It seems to be an impossible job to educate the owner into taking care of his battery. He will keep oil in the crankcase, and perhaps give the various grease cups that are distributed around the car a little attention now and then. But the battery is hidden from his view, and may not give any warning of its condition until expensive repairs are necessary. Its chances of being maintained are very poor.

The battery manufacturers are attempting to combat this negligence by giving periodical free inspections, and they are meeting with some success. The automobile manufacturer can help in this work by making it easy for the owner to maintain the battery by putting it in an accessible position. The battery has been put in almost every part of the chassis, often without giving the convenience of the owner and the service station the slightest thought. From the standpoint of accessibility the most desirable position is in a box on the running-board, but present styles demand clean running-boards. This is where the battery was first placed, and it would be a good thing for battery performance if it were returned to this position.

In placing the battery in the chassis the engineer should consider both the owner and the service station. The owner adds distilled water and makes hydrometer tests. At least he should do this, and the chances of his doing so are immeasurably enhanced if he can do the job without removing a large number of parts and going through a lot of gymnastics. The service station has to remove the battery, and it should be placed so that it can be lifted out with a straight pull. By making the battery accessible and easily removable, the charges the owner must pay for battery service will be reduced. The battery should not be placed near the exhaust pipe, since it gets rather warm in summer and any outside heat only makes conditions worse.

There is a need for an instrument that will show both water level and state of charge in all cells by means of an indicator on the dash. Various devices have been developed which partially fulfill this need, and some of them have considerable merit. But none of them indicate the battery condition completely. One of them indicates conditions in one cell, another warns of excessive temperatures by means of a thermostat clamped on the connector, and a third provides for measuring the voltage at a fixed discharge rate. An instrument that would indicate battery conditions completely should have a wide sale and should lead to improved battery performance.

Car manufacturers have done much to simplify the problem of battery service within the last few years by the adoption of standardized types of batteries. There is still room for improvement in this respect, but conditions are much better than they were some years ago.

The battery must be proportioned to the size of the engine. This precludes the possibility of having one battery that will be standard for all cars. But it is possible for the automobile engineer to arrange the chassis so that a standardized type in the capacity required can be used. There is no good reason why two cars, having 6-volt electrical systems and using 100-ampere-hour batteries, should not use the same type of battery. The reason this is not always possible is because the shapes of the battery compartments are not

the same and the leads are not brought out in the same manner.

The use of standardized types in the different capacities has two important advantages. First, the cost of the battery is reduced, due to the economies of large production, and, second, the problem of supplying service is simplified.

The battery service station must be prepared to supply a new battery for any car, and also to supply a rental battery to the owner whose battery is undergoing repairs. If the car manufacturer arranges his chassis so that a special battery is required for it, then the dealer must stock new and rental batteries in order to render service on this car. On the other hand, if the car is designed for a battery that can be used in several other makes of cars, the dealer can economize on his stock.

In 1920 cars this difficulty is less pronounced than in previous years. In fact, each year has seen a reduction in the number of battery types required for the better known makes of car. A survey of forty popular American cars shows that eleven different types of batteries are required for these automobiles. The word type covers the size of plate, number of plates per cell, number of cells and the arrangement of the cells, but does not include the form of terminals required. Four plate sizes are used in these eleven batteries.

Standardized Terminals

Standardized terminals are not as important as standardized types. It is a simple matter for the service station to provide terminals that will fit the cables on the car. However, standardization of terminal forms has not progressed as far as the standardization of battery types. Seventeen terminal arrangements are required for the forty makes of cars considered.

One battery out of the eleven fits ten of the forty cars. Five of these cars have the same terminal arrangement, but four different terminal arrangements are required to service the other five in this group. The most favored terminal construction is the bare taper post to which the cables are clamped. It provides the simplest arrangement for the service station and appears on more cars than any other form of terminal. It would doubtless be an improvement if all manufacturers adopted this type of terminal, as the construction gives very satisfactory service.

The present method of handling standard equipment batteries is not entirely satisfactory. If the battery is shipped wet, its life commences just as soon as the battery manufacturer puts electrolyte into it. From there it goes to the car manufacturer, who installs it in the car. The next step is the shipment of the car to the dealer, who, in turn, delivers it to the customer. If the demand is ahead of production, a comparatively short time elapses before the battery is in actual use.

Wet or Dry?

The longer the period that elapses between the time the battery is made ready for service and the time it actually goes into service the shorter will be its useful life. Furthermore, if the battery is not given an occasional boosting charge during the period before delivery, there is a strong possibility that its plates will be damaged. This is a real objection at this time, because there are instances where batteries have been in the hands of the car manufacturer and dealer for over a year before delivery.

In the case of a battery that is shipped dry, no loss of life or plate deterioration takes place. However, this practice is also open to objection. When a dealer goes to the freight station to get a car he must take a battery with him to replace the dry-shipped battery that comes with the car in order to get current for the ignition and starter. The battery shipped with car must then be prepared for service. In some places this matter is handled in the following manner: The car dealer takes the dry battery to the battery service station, who gives him a battery that is ready for service in exchange, charging the dealer a small fee for the work involved.

Shipping the battery wet is open to the objection that the customer may get a battery which has used up much of its useful life. Shipping the battery dry is open to the objection of the trouble and expense of putting a serviceable battery in the car. It has been suggested that both of these objections could be obviated if the car were shipped to the dealer without a battery. When the dealer sells the car he could draw on the local battery dealer handling the battery which is specified as standard equipment for a battery to fit the car. In this way every car purchaser would get a new battery, and the dealer would not have the expense of switching batteries. This method might introduce some complications, but it is thought that a satisfactory method of handling standard equipment batteries in this manner could be worked out. In the case of batteries shipped wet it would be a decided improvement over the present method.

On the whole, the battery gives reasonably satisfactory service in view of what is expected of it and the care it receives. The most important factor affecting its life and dependability is the care and use given it by the driver of the car in which it is installed. A great deal can be done to improve battery performance by the education of the owner on these points.

Tolerance Systems for Cylindrical Fits

(*Continued from page* 1280)

shaft should be of such a size as to give the quality of fit desired, all tolerance on the shaft being minus. This rule should be strictly adhered to for interchangeable manufacture. In case selective assembly is to be employed then the tolerance on the shaft may properly be plus.

"A temperature of 68 deg. F. (20° C.) was adopted by the Bureau of Standards and by the War Department as the standard temperature for all munition gages in 1917, and was used in all gage work during the war. This temperature has also been selected by the National Screw Thread Commission as the temperature at which all gages and gaged products should be standard, and has been adopted by the S. A. M. E. Sectional Committee on Plain Limit Gages. This temperature is coming more and more into use in this country and seems likely to be very generally adopted."

THE trials of the rigid airship R-80, which has been built by Vickers, Ltd., at Barrow, are now in progress. It will be recalled that some changes have been made in the structure of the airship since she was originally launched in July last. In the altered form she has a gas capacity of 1,250,000 cubic feet, a gross lift of 38½ tons and a disposable lift of about 17½ tons. The propelling power consists of four Wolseley-Maybach engines, each of 230 horsepower. Two of them are housed in the forward gondola and geared to a single propeller, the others being carried in single units in the wing gondolas. The R-80, at the cruising speed of 50 miles per hour, would have, it is estimated, a radius of 6500 miles. The R-36, which is being built at the Beardmore aerodrome at Inchinnan, is nearing completion, and will be ready for her trials in the course of a few weeks.

An Estimate and Analysis of Various Forms of Tractor Transmissions

Generally speaking, the smallest number of gear reductions is the best on tractor transmissions. The statement must be qualified, however, and this article discusses the advantages and disadvantages of the various types of gears. Several gear calculations are worked out by the writer.

By P. M. Heldt

TRANSMISSION losses are a small item in the automobile, as the average American passenger car runs upward of 90 per cent of the time on high gear, in which case the engine power is transmitted through only a single pair of gears. These gears, moreover, are cut very accurately, in order to insure quiet operation, and accuracy of tooth form at the same time insures high efficiency of transmission.

In a farm tractor, on the other hand, where the speed reduction between the engine crankshaft and the driving wheels is about ten times as great as in a passenger car, there are practically always several pairs of gears through which the power is transmitted successively before it reaches the driving wheels. The number of gear reductions and the arrangement of the gears are matters in regard to which a great deal of difference of opinion still persists. Generally speaking, the smaller the number of gear reductions the better, but the statement requires some modifications. The smallest number of reductions is the best only if it permits of safe maximum tooth pressures, gear wheels not too large in diameter so they can be fully enclosed, an adequate ground clearance, and a suitable location of the engine and power take off.

Representative figures determining the gear reduction required are as follows: Engine speed, 900 r.p.m.; drive wheel diameter, 54 in.; plowing speed, 2¾ m.p.h. The driving wheels of such a tractor would rotate at

$$\frac{2\frac{3}{4} \times 5280 \times 12}{54 \times 3.1416 \times 60} = 17.1 \text{ r.p.m.}$$

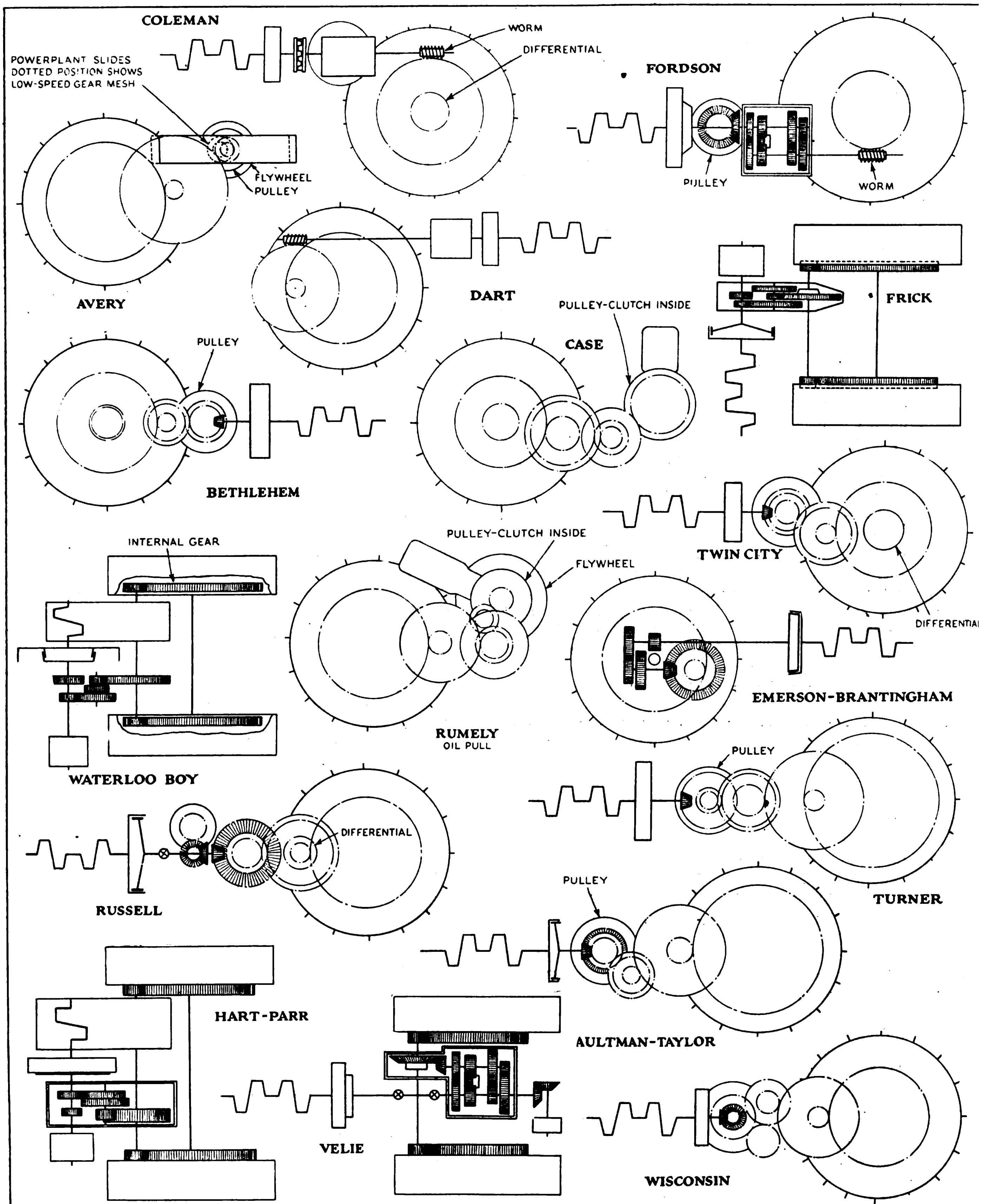
and the gear ratio therefore must be

$$\frac{900}{17.1} = 52.6$$

Such a large ratio can hardly be obtained in two steps by means of spur and bevel gears and where these types of gear are used exclusively it is customary to have three sets. This is the more necessary because the low speed, which is usually only about two-thirds the high, is obtained by the same number of gear reductions. This speed is sometimes as low as 1½ m.p.h. and then requires a speed reduction of nearly one hundred to one.

Almost all the known transmission devices are employed in tractors, including spur gears, internal gears, bevel gears, worm gears, roller chains and friction disks. Of these the spur gear is used most extensively, undoubtedly because it has a balance of advantages in its favor, when cost of construction, efficiency of operation and ease of mounting are considered. There is hardly a tractor that has not at least one pair of spur gears in its transmission train. Bevel gears are used where the power has to be transmitted between shafts at right angles to each other. They are considered as rather undesirable by some designers, and in order to obviate the need for them, four-cylinder engines are sometimes placed transversely across the tractor frame, giving rise to what is known as the all spur gear transmission. With twin cylinder or horizontal opposed engines the crankshaft naturally extends across the frame, while if a four-cylinder vertical engine is thus placed it gives the impression that the designer is going out of his way to avoid the bevel gears. There are three objections to bevel gears. In the first place, they cannot be cut as accurately as spur gears; secondly, they are more expensive to manufacture than spur gears, and, lastly, they create a great deal of end thrust which must be provided for in the bearing design. On account of the lesser accuracy of tooth form and the greater total bearing pressure, the bevel gear is undoubtedly slightly less efficient than the spur gear. Owing to the fact that bevel gears nearly always overhang their bearings, the radial loads of bevel gears usually are considerably greater than the loads due to corresponding spur gears. Where a pair of bevel gears is used it is not usual to obtain any great reduction in speed from it. Thus under certain conditions one more pair of gears may be required to obtain the predetermined reduction than if spur gears were used exclusively. Contrary to automobile practice, the bevel gearset is generally placed at the forward end of the transmission instead of at the rear end. The advantage of this is that the thrust loads to be provided for are very much smaller.

By the use of the worm and worm wheel for the transmission it is possible to locate the engine with its axis in a fore and aft direction and yet do without a pair of bevel gears. It does not matter whether the worm is the only transmission element, that is, whether a single reduction is used, or not. A single step reduction by worm and wheel is used in the Coleman tractor, a diagram of the transmission of which is shown on opposite page. In its earlier form the Coleman had only a single speed, the power being transmitted directly from the engine crankshaft through the worm and wheel to the rear axle. The present model has two forward speeds, the high speed being a direct drive and the low speed a back-geared drive. A transmission of this type has the advantage of great simplicity of construction and should be cheaper to produce than any other system. The tooth pressures undoubtedly are very high, and so also are the thrust loads which must be provided for. Neither the tooth pressure nor the thrust load is as great, however, as in a tractor with final drive by worm and wheel and a first reduction by some other form of gearing, for while the rear axle torque would be the same the worm wheel pitch diameter would be less in the double reduction drive. The double reduction transmission, including one reduction by worm



Diagrams of power transmission mechanism in different makes of farm tractors

and wheel, is used in the Fordson and several other tractors. In the Fordson the worm and wheel constitute the final drive, while in the others it constitutes the first reduction. The advantage is claimed for this latter arrangement that a worm gear is most efficient at high speeds, while a spur or internal gear is most efficient at low speeds of rotation. For a given horse power transmitted the tooth pressure is lower the higher the speed of the worm, and there is therefore less danger of forcing the film of oil from between the teeth of the worm and wheel. The rather low efficiency of the spur and internal gear at high speeds is due to inaccuracies in the form of the teeth which give rise to violent shocks at high speeds. A first reduction by worm and wheel and a second reduction by internal gears is used on the Dart tractor and a first reduction by worm and wheel and a final reduction by spur gears inclosed in the central case is used on the W-S-M and the Farquhar tractor.

Two step reductions with spur gears only are occasionally used, the Avery furnishing an example of this form of construction. This necessitates rather low engine speeds and large diameter gear wheels. For instance, if the engine speed is 600 r.p.m., the drive wheel diameter 48 in., and the plowing speed 2¾ m.p.h., the reduction ratio between engine crankshaft and rear wheels needs to be only a little over 31, and this can be obtained in two steps. The wheels, however, will be so large in diameter that it is practically impossible to enclose them, and tractors of the all enclosed type with spur gear transmission always have more than two steps to the transmission.

The three step reduction is undoubtedly the most popular type of transmission, being found in many different designs of tractors with both all spur gear and spur and bevel gear transmission. If there is any type of tractor transmission that may be said to be typical in that it is used on a greater number of designs than any other, it is the three step transmission with a first reduction by bevel gears and the other two reductions by spur gears. The sliding pinions are then mounted on the shaft carrying the wheel of the bevel gearset. This involves sliding the pinions on a transverse shaft, which is not quite as convenient as sliding them on a longitudinal shaft, but as the gears of a tractor are shifted only very rarely and then only while the tractor is stationary, this is not a serious objection. It is not an easy matter to get along with less than three reductions, unless a worm drive is used, because with spur and bevel gears the wheels become so large that it is practically out of the question to enclose them.

With a three step transmission the last set of gears may be placed either on the wheels in the form of bull gears, in which case they are, of course, either entirely exposed or only imperfectly enclosed, or else placed at the center of the axle and enclosed within the axle housing. The latter arrangement is being favored more and more, because exposed gears cannot be lubricated and wear out rather rapidly. In the former class with the final drive at the wheels must be included a few with exposed chain drive to the wheels.

After the three step transmissions come the four step, and these, too, are quite numerous, especially among the older designs of tractors. These tractors in a great many cases have wheels of very large diameter, and as they are intended for plowing at low speed they require a very large reduction ratio.

The accompanying sketches show diagrammatically the arrangement of the power transmitting members on a large number of American machines, including representatives of practically all types.

It has become very common to use teeth with 20 deg. pressure angle, tractor designers following automobile practice in this respect. The 20 deg. pressure angle has the advantage that there is less undercutting in the pinions, and consequently the teeth are much stronger. The Fellows stub tooth, in which the radial tooth elements are the same as those of a standard involute gear tooth of a diametral pitch two numbers higher, is probably most widely used, but there is also some call for full depth 20 deg. teeth, while recently an attempt has been made to standardize the depth of stub teeth at 0.8 the depth of standard 14½ deg. involute teeth.

Gear Calculations

In the selection of the pitch the designer does not have much guidance of a theoretical nature. There is, on the one hand, a leaning toward the finer pitches, because their use permits of a greater reduction being obtained by means of a single pair of gears. The minimum number of teeth in the pinion is more or less fixed, and the finer the pitch the smaller will be the wheel diameter for a given reduction ratio or the greater the reduction ratio for a given wheel diameter. On the other hand, a coarser pitch gives a stronger tooth. There should evidently be some relation between the pitch and width of face. If the width of face is exceedingly great it is impossible to obtain uniform tooth pressure over the entire width, and part of the faces may even be entirely out of contact. The best width is evidently the maximum for which fairly uniform contact is obtainable. If, with a certain pitch. the required width figures out greater than this, it is advisable to choose a coarser pitch, which will permit of a smaller face width. In industrial gear design it has been a long established practice to make the face equal to eight divided by the diametral pitch. It is believed that, owing to improvement in mounting practice since this rule was adopted, it is now practical to go to a face width equal to 10 divided by the diametral pitch. In automotive work the accuracy of mounting is certainly equal to that in the best industrial work and face widths as arrived at by the latter rule are not excessive. Ten divided by the diametral pitch is substantially equal to three times the circular pitch.

Let us assume an engine delivering 25 b.hp. at 900 r.p.m. This corresponds to a torque of

$$\frac{25 \times 33{,}000}{900 \times 6.28} = 146 \text{ lb.-ft.}$$

or

$$12 \times 146 = 1750 \text{ lb.-in.}$$

For the low speed a reduction ratio of about 64 to 1 may be required. This can be obtained in three stops so proportioned that the driven wheels will increase in diameter fairly gradually from front to rear. The first step is generally made rather small, one of the reasons being that the first reduction pair precedes the sliding gearsets, and the higher the reduction ratio the more difficult it is to slide the pinions on the splined shaft. A first reduction of 2 to 1 corresponds closely to current practice, and this leaves a total reduction ratio for the intermediate (low speed) and final reductions of 32 to 1. Both of these reductions may be made the same, or about 5⅔ to 1. Owing to the use of finer pitch teeth in the intermediate as compared with the final reduction gears, the intermediate wheel will have a diameter about midway between the bevel gear and the rear axle gear, thus giving a gradually deepening form of gearcase.

With bevel gears in automotive practice it is customary to make the face width equal to one-quarter the pitch line length. The maximum face length permissible in bevel gears is one-third the pitch line length, and somewhat smaller lengths are better because more nearly uniform pressure along the face of the tooth is assured.

A formula for the strength of bevel gears is as follows:

$$F = \frac{S L p y}{3}(1 - a^2)$$

where

F = the tangential force on the maximum pitch circle of the pinion.
S = the permissible stress in the gear teeth.
L = the pitch line length.
p = the circular pitch.
y = the Lewis constant for the number of teeth in the pinion.
a = the ratio between face width and pitch line length.

This equation can be transformed into a somewhat more convenient form.

Let

$c = (1 - a^2)$ = the face width factor.
v = reduction ratio.
n = number of teeth in pinion.
d = the maximum pitch diameter.

and

T = the torque to be transmitted, in lb.-in.

Then

$$\frac{Fd}{2} = T$$

and

$$F = \frac{2T}{d}$$

Also,

$$p = \frac{d\pi}{n}$$

and

$$L = \sqrt{(1/2)^2 + (v/2)^2}\, d = v d$$

Substituting in the above formula we get

$$\frac{2T}{d} = \frac{S \times \sqrt{(1/2)^2 + (v/2)^2}\, d \times d\pi \times y \times c}{n}$$

which simplified gives

$$T = \frac{S v d^3 y c}{2n}$$

The values of v, y and c can be obtained from the three tables herewith.

As the gears will be small in any case it is better not to use too small a number of teeth in this set. We will assume that the pinion has 18 teeth and the gear 36 to give the assumed reduction of 2 to 1. The stress in the teeth for heat treated gears may be taken at 16,000 lb. p. sq. in. Inserting values in the equation for strength,

$$1750 = \frac{3.14 \times 16{,}000 \times 1.12 \times d^3 \times 0.131 \times 0.193}{2 \times 18}$$

$$= 39.5\, d^3$$

$$d^3 = \frac{1750}{39.5} = 44.4$$

$$d = \sqrt[3]{44.4} = 3.54 \text{ in.}$$

This should be the maximum pitch diameter. As there are 18 teeth, the diametral pitch will be

$$\frac{18}{3.54} = 5.09,$$

which is very close to 5, and 5 pitch teeth must be used. The true maximum pitch diameter will then be

$$\frac{18}{5} = 3.600 \text{ in.}$$

The torque on the intermediate pinion shaft will be 3500 in.-lb. Taking the Lewis formula for gear tooth strength

$$F = S p f y$$

Here again

$$F = \frac{2T}{d}$$

and, substituting,

$$\frac{2T}{d} = S f p y$$

Also,

$$p = \frac{d\pi}{n}$$

and

$$f = 3p = \frac{3d\pi}{n}$$

Substituting again

$$\frac{2T}{d} = S \times \frac{d\pi}{n} \times \frac{3d\pi}{n} \times y$$

$$T = \frac{3}{2}\frac{S d^3 \pi^2 y}{n^2} = \frac{14.8\, S d^3 y}{n^2}$$

As stated above, $T = 3500$. Let $S = 16{,}000$ lb. p. sq. in. Assume $n = 12$. Then

$$3500 = \frac{14.8 \times 16{,}000 \times d^3 \times 0.104}{12 \times 12}$$

$$d^3 = \frac{3500 \times 12 \times 12}{14.8 \times 16{,}000 \times 0.104} = 20.5$$

$$d = 2.74$$

The diametral pitch would be

$$\frac{12}{2.74} = 4.38$$

Assume $n = 13$

Then

$$d^3 = \frac{3500 \times 13 \times 13}{14.8 \times 16{,}000 \times 0.111} = 22.5$$

$$d = 2.825$$

The diametral pitch would be

$$\frac{13}{2.825} = 4.60$$

Assume $n = 14$

Then

$$d^3 = \frac{3500 \times 14 \times 14}{14.8 \times 16{,}000 \times 0.117} = 24.8$$

$$d = \sqrt[3]{24.8} = 2.92$$

and the diametral pitch is

$$\frac{14}{2.92} = 2.92$$

Assume $n = 15$, then

$$d^3 = \frac{3500 \times 15 \times 15}{14.8 \times 16{,}000 \times 0.122} = 27.3$$

$$d = \sqrt[3]{27.3} = 3.01$$

and the diametral pitch is

$$\frac{15}{3.01} = 5 \text{ substantially.}$$

Any of the above pinions would do so far as strength is concerned but fractional pitches ordinarily are not used, and therefore the last mentioned should be chosen, that is, a pinion of 15 teeth and 5 diametral pitch. We have assumed that the face width is 3 times the circular pitch; hence

$$p = \frac{3.1416 \times 3}{5} = 1.88 \text{ in. } (1\tfrac{7}{8} \text{ in.})$$

The mating gear will then have

$$5\tfrac{2}{3} \times 15 = 85 \text{ teeth.}$$

The torque on the final reduction pinion will be $5\frac{2}{3}$ times as great as on the intermediate pinion. The necessary increase in strength will be obtained by increasing

the circular pitch, the pitch diameter and the width of face, each factor in the same proportion as far as possible. The multiplying factor therefore will be

$$\sqrt[3]{5.67} = 1.78$$

This would make the circular pitch

$$\frac{3.1416 \times 1.78}{5} = 1.12$$

The nearest standard circular pitch is 1.05 (3 diametral pitch). The face width is again 3 times the circular pitch which makes it

$$3 \times 1.05 = 3.15, \text{ say } 3.25 \text{ in.}$$

and since the product pitch diameter $\times$ circular pitch $\times$ face must be 5⅔ times as great for the final drive as for the intermediate pinion we have

$$3 \times 0.63 \times 1.87 \times 5.67 = x \times 1.05 \times 3.25$$

$$x = \frac{3 \times 0.63 \times 1.87 \times 5.67}{1.05 \times 3.25} = 5.86 \text{ in.}$$

Hence the number of teeth required would be

$$3 \times 5.86 = 17.6$$

However, owing to the much lower peripheral speed it is permissible to increase the stress in the metal from 16,000 to between 18,000 and 19,000 lb. p. sq. in., and this permits of the use of 15 teeth in this pinion also.

VALUES OF REDUCTION FACTOR (v)

Reduction Ratio, r	Reduction Factor, v
1:1	0.707
1:1.25	0.800
1:1.5	0.900
1:1.75	1.006
1:2	1.120
1:2.5	1.345
1:3	1.580
1:3.5	1.820
1:4	2.060

FACE LENGTH FACTORS (c)

a —	c —
0.18	0.150
0.20	0.162
0.22	0.175
0.24	0.187
0.26	0.198
0.28	0.209
0.30	0.219
0.32	0.228

VALUES OF LEWIS FACTOR y FOR 20 DEG. PRESSURE ANGLE FIGURED ON BASIS OF 0.75 STANDARD HEIGHT

No. of Teeth	y
12	0.104
13	0.111
14	0.117
15	0.122
16	0.125
17	0.128
18	0.131
19	0.133
20	0.136
21	0.139
23	0.141
25	0.144
27	0.148
30	0.152
36	0.160
48	0.171

Federal Aid Roads Under Construction or Completed

OF the 22,030 miles of Federal aid roads which have been built or are now under construction, more than two-thirds are earth roads, sand clay, or gravel, says the chief of the Bureau of Public Roads, United States Department of Agriculture. These have cost less than one-third of the total amount expended, as compared with nearly 50 per cent of the estimated cost applied to 4890 miles of hard-surfaced roads. A study of local conditions by an engineer of the bureau is necessary before a road project may receive Federal aid.

The type of road to be used and the most suitable surface with respect to the traffic of the locality must be determined. Service must be satisfactory, while costs must be kept low, both for building and maintenance. There must be a careful analysis both of the engineering and economic conditions for each particular project. There are individual considerations in every case which affect the determination as to the best type of road materials for that locality.

The mileage of Federal aid roads which have been built or are now under construction is nearly sufficient to encircle the globe. This is the record of work accomplished since July, 1916, when the Federal Government first stepped in to aid in the enormous task of building highways that are now called upon to carry more than 9,000,000 motor vehicles plus a very substantial horse-drawn traffic in the forty-eight States. The Federal aid law is well named. The Department of Agriculture has given the broadest possible construction to the law for the purpose of providing the greatest mileage of highways suited to the traffic to be carried over them at the minimum expense. An analysis by the Bureau of Public Roads of the projects under contract shows that all types of roads, from the graded earth road up to the finest paved surfaces, have been built.

Use Many Kinds of Road Surface

Granting that the preparation of the roadbed has been properly done, many kinds of road surfaces will give excellent service. The element of time is important. There are so many miles of roads to be constructed and their cost will be so enormous that the most careful and detailed study of each road project must be made to provide, at the lowest possible cost, roads which will give satisfactory service and which can be maintained without undue depreciation under the traffic which is to use them. Many times the question has been asked the bureau, What type of road is best? The answer is always the same: There is no one best kind or type.

A recent statement issued by the officials of the bureau expresses this thought in the following language:

"It is the policy of this bureau to consider the conditions on each individual Federal aid project, as there are elements, such as subgrade, drainage and present and prospective traffic, which vitally affect the determination of the standards of construction to be used."

That is, there must be a careful analysis both of the engineering and economic conditions for each particular case to determine the kinds of materials that can be used successfully, and after these facts are determined then the various types of construction which can be used economically should be brought into competition to secure the best possible results. There have been occasional attempts to write into State laws or the governing conditions of bond issues a requirement as to the type or kind of roads to be constructed. To follow such a course would be most unfortunate.

The cost must always be considered in determining the type of road surfaces which are selected, and the allowable cost must be determined by the traffic which is to be borne. Local conditions vary to such an extent that very careful consideration must be given each project before determining the character or type of roads to be built. This principle was recently expressed to a chamber of commerce, asking for information, in the following language:

"Types of highways should not be specified by law. This is a matter to be decided by the State highway department, in which should be lodged full authority both to construct and to maintain. Competition between different types of material should be maintained and selection made to fit traffic requirements in each case. The bureau does not recommend any one type to exclusion of others."

Specification of Electroplating for the Automotive Industry

There is a need for scientific study of plating methods and of determining or specifying the quality of finished products. This article describes uses and technical details of electroplating and points out the possibility of cooperation between technical men and electroplaters.

By William Blum*

IT is safe to say that the prospective purchaser of an automobile gives less conscious consideration to the kind or quality of electroplating upon it than to any other single factor. And it is equally true that in most cases the electroplating has very little effect upon the actual period of possible service of the car. It is probable, however, that the general appearance of the electroplating may produce an unconscious effect upon the purchaser of a new car and certainly the condition of the plated metal parts has a very decided effect upon the appearance and salability of a used car.

One reason for the small amount of consideration that has been given to electroplating in this and many other industries is that this process has been looked upon as useful chiefly for ornamental purposes and its value for the prevention of corrosion has been almost overlooked. Even though electroplating constitutes a very minor part of the total cost of a finished car or airplane, it must be given greater consideration than heretofore if uniformly satisfactory products are to be obtained.

Choice of Plating

When electroplating is mentioned, nickel is the only metal which is considered by the average person and even by many engineers. There is a good reason for the extensive use of nickel plating, as this metal has a pleasing appearance and possesses to an unusual degree the property of resistance to tarnish under the usual atmospheric conditions. It is reasonable, therefore, that wherever appearance is a primary consideration nickel plating should be employed, as indeed it is on many exposed parts of automobiles. Where the base metal is of brass it is probable that no other coating than nickel need be considered in the automotive industry, unless it is necessary to avoid the presence of bright coatings as in military airplanes.

With steel parts, however, it is very essential that they be protected against corrosion, especially if they are relatively inaccessible and are not intentionally or incidentally coated with a film of oil. Where steel parts must be protected and where appearance is not a primary consideration, all experience indicates that zinc coatings should be given preference. The value of zinc for this purpose depends upon the fact that when zinc and iron are in contact in the presence of moisture, the zinc is the more readily corroded and by virtue of this property it prevents the iron from corroding. This difference in the susceptibility of metals to corrosion is connected with their relative positions in the electrochemical series, in which zinc is above iron. If, on the other hand, iron is in contact with copper under similar conditions, the iron is more readily corroded than the copper (which is below iron in the series) and the presence of the copper actually accelerates the corrosion of the iron.

Nickel behaves somewhat similarly to copper, but, fortunately, its electrochemical potential is closer to that of iron than is the potential of copper, and, consequently, the presence of nickel does not appreciably accelerate the corrosion of the iron, although it does not prevent such corrosion if the iron is exposed.

The question as to which kind of plating should be employed in any particular case depends very largely upon the purpose for which the articles are to be used and the degree of exposure to which they may be subjected. This problem of the proper choice of protective coatings for iron and steel received very serious consideration during the war, and extended investigations were carried out upon it at the Bureau of Standards. The results of these tests are summarized in Circular 80 of the Bureau of Standards upon "Protective Metallic Coatings for the Rustproofing of Iron and Steel." During the war a suggested classification of protective coatings on military supplies was proposed by the Bureau of Standards[1]. In this proposed classification the four principal groups of present interest were as follows:

(1) Metal requiring protection only during storage or transportation, for which the application of grease or slushing oils was recommended.

(2) Metal for indoor use or for mild exposure, or which can be frequently cleaned and oiled. For this purpose almost any protective coatings that furnish the desired color, appearance and resistance to abrasion might be employed. Among the processes used are various kinds of plating, and the different chemical finishes including the oxide coatings such as blueing and browning, and the phosphate finishes such as the Parker Process.

(3) For steel subject to moderate outdoor exposure or which it is desired to salvage, light zinc coatings were recommended.

(4) For steel exposed to severe outdoor or marine conditions relatively thick zinc coatings should always be employed.

If an attempt is made to apply such a classification to the automotive industries it is necessary to distinguish between the passenger car in which consideration must

*Chemist, United States Bureau of Standards. Published by permission of the Director of the Bureau of Standards.

[1] Military Applications of Electroplating, by William Blum. Transactions of the American Electrochemical Society, 34, page 169, 1918.

always be given to appearance, and the motor truck or airplane in which strength and durability are the principal considerations.

In general it may be stated that for the first group nickel plating must be employed on all prominently exposed parts, but zinc coatings should be specified for those parts which are not exposed or which can be covered with a suitable paint or enamel. As an instance of the latter application may be cited the almost universal use of zinc plating (electrogalvanizing) in the manufacture of rims. For auto trucks and airplanes zinc should be used almost exclusively. In spite of the superior value of zinc in furnishing protection against corrosion it has been only within recent years that its use for many purposes has superseded that of nickel or the still more objectionable copper coatings. It is interesting to note that during the early part of the war practically all airplane parts were copper plated, and it was not until near the conclusion of the war that zinc plating for this purpose was adopted by the Navy Department and subsequently by the War Department. Even since that time, however, many airplane manufacturers have continued the use of copper and nickel plating, and in one case within a year the author has seen a new airplane in which steel parts in immediate contact with each other were coated with four different metals, namely, copper, nickel, zinc and tin, although zinc might have been used to advantage on all!

Practically the only extended application of copper plating in the automotive industries is in connection with case hardening where it is employed to protect certain parts of the steel from the hardening action. The use of copper plating preparatory to nickel plating is not necessary and there is no evidence to show that steel plated with these two metals is any better protected against corrosion than if plated properly with nickel alone. In some cases the presence of the copper may actually accelerate corrosion of the steel when the latter is exposed by abrasion.

Sometimes copper coatings are deposited previous to nickeling in order to furnish a surface which can be readily buffed to a high finish. A good illustration of this use of copper plating is in the manufacture of lamp reflectors which, if made of steel, are successively plated in the following baths:

(1) cyanide copper,
(2) acid copper (and then buffed),
(3) nickel, and
(4) silver, after which they receive the final buffing.

Owing to the fact that zinc does not possess a pleasing appearance, and that it readily tarnishes and turns white on exposure, various methods have been proposed for covering the zinc coatings. Nickel plating over zinc plating is sometimes carried out successfully, but even in those cases where initially adherent deposits of nickel are obtained, there is a marked tendency for the nickel to peel subsequently if the zinc is exposed either through porosity of the nickel, or its abrasion. Although paints and enamels do not adhere well to hot-galvanized surfaces, good adhesion is usually secured upon the zinc plated or "electrogalvanized" surfaces. Where the enamels are to be baked, it is frequently advantageous to heat the zinc plated articles to the temperature of the enameling ovens for a short time in order to expel any occluded gases or moisture. After the parts are cool the enamels are applied as usual and baked. By this method the chance of "blistering" of enamel is reduced.

Basis of Specifications for Plating

Having determined what kind of plating shall be used for a given purpose, it is possible to specify or control the quality of the product by either or both of two methods, which depend respectively upon:

(1) the definition of the details of the process to be employed to insure a satisfactory product; or

(2) the specification of certain properties in the finished product.

From the standpoint of the purchaser or user of equipment it is entirely immaterial what process is employed to yield a certain result, provided only that the product has the desired properties. In general it is preferable to avoid specification of process details, both because such a procedure tends to decrease the responsibility and initiative of the operator, and because it is practically impossible in the present state of the electroplating industry to predetermine or control the exact conditions of operation.

From the standpoint of the factory engineer, however, it is often essential to consider the details of the process in order that those conditions may be selected which will yield a product to meet any specified requirements. In attempting to fix the conditions for plating, every effort should be made to foster co-operation between the technical staff and the plater. There is to-day a great need and demand for reliable information upon plating operations, which can be met only by the harmonious cooperation of engineers and chemists with the electroplaters. The American Electroplaters' Society, composed of foreman electroplaters, is working diligently to advance the state of this industry and will welcome advice and assistance from all interested.

Methods of Plating

It is not within the province of this paper to discuss in detail the methods to be employed in plating, but it may be of interest to point out the various factors which may determine the quality of the product.

In general the **cleaning** of metal preparatory to plating is very essential to the production of adherent or impermeable deposits. The cleaning operations usually consist of the removal of grease by means of suitable alkaline solutions and the removal of oxide or scale either by pickling or by mechanical processes, such as sand blasting. In cases of defective plating the cleaning operations should be carefully investigated in order to determine whether they are effectively carried out.

The **composition** of the plating solutions may have a very direct bearing upon the quality and particularly the uniformity of the work. In zinc plating, satisfactory results can be obtained both from sulphate and from cyanide solutions, although the latter usually possess better "throwing power," i.e. ability to plate in deep recesses. The basis of practically all nickel plating solutions is nickel sulphate, which may be supplied either as such in the form known as "single salts" or in combination with ammonium sulphate to form the so-called "double salts." The beneficial effect of boric acid in yielding brighter deposits is probably due to the maintenance of a slight acidity in the solutions. Ammonium chloride or sodium chloride is frequently added for the purpose of assisting in the corrosion of the nickel anodes, especially if they have a high nickel content.

The composition and physical condition of the **nickel anodes** must be considered in connection with the composition of the solution. Practically all the anodes used at present are cast anodes which contain iron and carbon, frequently added intentionally to facilitate casting and the subsequent solution of the anode.

The **temperature** of the plating bath may have an appreciable effect upon the character of the deposit. In general, deposits produced from warm baths are slightly coarser grained and softer than those from baths

at ordinary temperature. In the case of nickel, warming of the baths may be advantageous in removing the tendency to brittleness of the deposits which is frequently observed. Until recently most electroplating baths were regulated by controlling the voltage. More satisfactory results are obtained by the use of ammeters and the adjustment of the current to produce a certain current density (e.g. amperes per square foot) upon the work. By control of the **current density** and the **time of deposition** the average thickness of the deposit can be regulated. It is not now possible to specify even the desirable limits of all of the above factors in the operation of plating baths, but engineers or chemists who are called upon to assist the electroplater should pay attention to all of these points and determine if possible the optimum conditions for any given class of work.

Specifications and Tests

The usefulness and durability of any plated coating such as zinc or nickel depends upon a number of factors, among which may be mentioned the thickness, distribution, permeability, adhesion and hardness. Unfortunately it is very difficult to measure any of these properties directly. The total amount of metal coating upon a surface may be determined by suitable stripping methods, and the **average thickness** computed. Zinc coatings can be readily removed by the use of hydrochloric acid containing antimony chloride, which latter substance gives rise to the deposition of antimony upon the steel as soon as all of the zinc is dissolved and thereby prevents action of the acid upon the steel.

It is more difficult, however, to secure any solution which will remove nickel quantitatively from steel. For this metal, therefore, it is usually necessary to dissolve off the entire coating together with an appreciable amount of the base metal and to determine the nickel content of the solution thus obtained. In any case, by this method of procedure only the average thickness can be computed and no indication is obtained regarding the uniformity of distribution, or the possible porosity of the deposit. The actual measurement of the thickness of the coating by microscopic examination of the cross section is useful in research work, but is entirely impracticable as a basis for regular inspection.

Specification of the average thickness of the deposit does not insure a satisfactory quality; nevertheless, it is desirable within the factory to define and control the average thickness, in order to secure a consistent product. If **uniformly distributed** and free from pin holes it is probable that nickel coatings with an average thickness of 0.0005 in. will meet all ordinary requirements. To produce this thickness will require approximately 10 ampere-hours per square foot; this may be secured by using 10 amperes per square foot for one hour, or 5 amperes per square foot for two hours. The actual thickness of nickel plating in one plant was much less than 0.0005 in., although the engineer in the plant felt quite confident that at least 0.001 in. was used! For ordinary purposes zinc coatings of 0.0005 in. are usually sufficient, although for extreme exposure 0.001 in. is desirable. For a thickness of 0.0005 in. of zinc about 8 ampere-hours per square foot are required. For very accurate work, an allowance should be made on dimensioned or threaded parts for the thickness of the plating.

The methods which have been used for determining **the distribution** of the deposit depend essentially upon treatment with some reagent which will dissolve the coating and will give an indication when the underlying steel is exposed.

The most commonly used test for zinc coatings is the so-called "Preece test" in which the objects are immersed in a neutral copper sulphate solution for successive periods of one minute each until an adherent coating of copper is obtained on any part of the object. Although this method is useful for distinguishing roughly between different samples of similar material, its value is limited by the fact that the rate of reaction of the copper sulphate is influenced by the structure and purity of the zinc coating, and consequently misleading results may be obtained, especially in comparing samples produced by different methods—hot dipping, sherardizing and electroplating. There is need for the development of a similar method for determining at least the relative thickness of nickel coatings.

The **permeability** of coatings may be determined by the use of suitable reagents which will indicate whether at any points the underlying steel is exposed. The most common of these tests is the so-called "ferroxyl" test which is used in various modifications, but in each case depends upon the detection of exposed steel by means of ferricyanide. Thus, if nickel plated steel is treated with a solution containing 1 per cent of potassium ferricyanide and 2 per cent of sulphuric acid, blue spots will appear very quickly at any points where the steel is exposed. This test may also be applied for determining the permeability of coatings of copper, lead, tin or other metals which lie below iron in the electrochemical series, but is not applicable to the testing of zinc-coated steel.

A suitable **corrosion test** may prove more useful in determining the value of protective coatings than any of the specific tests above mentioned. The ideal corrosion test would be based upon exposure to actual conditions of use. Such a test would require, however, so long a period of observation that the results would not be of value in determining the quality of any particular lot of material. In consequence various "accelerated" tests have been proposed. When an accelerated test such as the salt spray or moist air test is used, the question is frequently asked as to the interpretation of the results in terms of ordinary exposure. Any attempts to make such a co-ordination must be only approximate because there is no such thing as "ordinary exposure," as the climatic conditions throughout the country and in different cities vary greatly.

The **salt spray test** which has proven to be especially useful for testing zinc coatings, depends upon the exposure of the articles to air containing in suspension a spray of 25 per cent sodium chloride solution. The articles are examined at frequent intervals and the time when iron rust first appears is taken as an indication of the failure of the coating. Details of this test will be found in Circular 80 of the Bureau of Standards.

In using such a test as the basis of specification for zinc coatings it is customary to state the length of time which the objects must withstand corrosion.

For ordinary usage on automotive equipment it is probable that zinc-coated material which will stand up for two days in the salt spray test will be satisfactory, although for equipment to be used in a marine atmosphere or under particularly severe conditions this time of exposure may be increased to three or four days.

Unfortunately the salt spray test is not well adapted to the examination of nickel coatings since the latter do not exert intrinsic protection of the steel and in consequence if the base metal is exposed at any point corrosion will occur within a very few hours in the salt spray test. Exposure to air saturated with moisture at slightly elevated temperatures has in some cases proven useful for detecting porosity in nickel coatings on steel, but it has no value in determining the thickness of the coating. At the present time there is practically no satis-

(Continued on page 1293)

Methods of Cooling Airplane Engines

Water cooling, as applied to aircraft engines, is far from fully developed. While direct air cooling will improve, water cooling will improve as well. This article indicates the lines along which development may be expected to progress and discusses developments likely to come.

By A. Ludlow Clayden

DESPITE recent advances in the air cooling of aviation engines there seems but small probability of the early abandonment of water cooling and this is the easier to understand when it is remembered that the basic principles of the two systems are identical.

In both cases the heat originates in a small volume, and is applied to a small surface; that is, to the cylinder walls and heads. The problem is to cause the heat to flow away from these points rapidly enough to keep them at working temperature. Air has a low specific heat and to carry off a large quantity of heat from metal, a large volume of air must be brought in contact with it, because air is a very poor conductor and must actually be made to touch the metal if it is to have a cooling action.

In order to utilize an adequate volume of air, the heat from the cylinders must be carried by conduction and "spread" over a larger surface. By adding fins to a cylinder its surface is increased and heat flows from the cylinders into the fins by direct conduction. By adding a radiator to an engine the cooling surface is increased in just the same way, but heat is transferred to the larger surface by the water instead of by direct conduction.

It is mechanically difficult to apply a sufficient increase of surface in the form of fins to a cylinder, and it is particularly difficult to care for the hottest parts such as the exhaust valve seatings, because of the presence of the valve operating mechanism and similar parts. Hence nearly all air cooled engines hitherto made have been forced to employ a lower mean effective pressure than is practicable with water cooling, so as to keep down the maximum temperatures in the cylinder. Allowing for a slight drop in m.e.p., for the weight of the fins and for the need to arrange cylinders radially or in some other unconventional way, means that the advantage of direct air cooling from fins over indirect air cooling from a radiator and a water content is not so great as it at first apparently ought to be.

In comparing air and water cooling it is seldom realized that water cooling as applied to aircraft engines is far from fully developed; that while direct air cooling will improve, water cooling also will improve, and that the weight of a water cooling equipment is a long way from the possible minimum.

F. W. Lanchester in his 1916 paper on engine cooling, which has been so much quoted, states axiomatically almost, that one square foot of radiator surface is necessary per brake horsepower of an aviation motor. This was only between four and five years ago, but to-day plenty of our military aircraft are operating with half a square foot per b.h.p., or even less and the head resistance of radiators has been cut down very greatly also.

It is not the writer's present purpose to go deeply into the subject, but merely to indicate the lines along which development has progressed and may be expected to progress still further. First, it has been discovered that the nose position which was almost always used a short time ago is a poor position from the viewpoint of efficient radiation. Owing to the interference of the propeller the air speed through the radiator on the nose of the fuselage averages around half the speed of the plane itself and is seldom more than 75 per cent thereof. This means that the radiator has to have greater developed surface than if it were subject to the full draft of motion of the plane, because the volume of air brought against the radiator increases almost directly with the speed of travel.

Nor is this all, for it has been found that by selecting proper locations on the side of the fuselage, in the slip stream of the propeller, a radiator can be put where it will be subject to an air speed greater than that of the plane by as much as 25 per cent.

Practically all airplane radiators are built up of thin copper tubes, honeycomb fashion, because this type of core is far the strongest in proportion to its weight at present known. The length of these tubes has to be in proportion to the air speed. With a low air speed the air is heated up a greater number of degrees per inch of travel than at a high speed, of course, and with most nose radiators a five inch tube is long enough to heat up the air to a point where it is so near the water temperature that its cooling value is small. With slip stream positions, tubes nine inches long can be employed and their last inch will be just as efficient as the last inch of the shorter tube in the nose radiator.

Thus for a slip stream radiator we need less total surface, because the air speed is higher, which means that we need less frontal area. Also, because the air speed is higher, we can use a deeper core, which again reduces the frontal area for a required developed area. The resistance to air flow of a 9-inch core is less than twice that of a 4½-inch core, so by using the slip stream position we reduce, first of all the total surface; that is to say the weight, and secondly, the head resistance in a still greater proportion.

Now, of course, the head resistance of a radiator in the high air speed of the slip stream is greater than it would be for the same radiator in the lower air speed around the nose, but this offsets only a portion of advantages gained. A still further offset arises from the fact that the nose of the fuselage can be made of a good stream line contour when there is no radiator, and this reduces the resistance of the airplane as a whole.

Yet another point of importance is that the airplane radiator has to be built large enough to cool the motor during climbing when the speed is low and the power output at a maximum. When altitude has been attained, due to the increased speed and smaller power employed, the amount of radiation needed is greatly reduced. This is cared for, in the case of nose radiators, by mounting shutters in front and closing them for a very large part of the flying time. These shutters increase the head resistance

quite substantially and are therefore a drawback. With a slip stream mounting it is quite possible to arrange a shutter in the form of a door opening outwards from the side of the fuselage and, if the hinge is forward, this door will cover up any desired part of the radiator while presenting a partially stream lined form; so that the power wasted by closing off this part of the radiator is reduced.

There have been several schemes, some of which are apparently satisfactory, for so locating the radiator so that it projects more or less from the side of the fuselage.

Coming back to the pure efficiency of a radiator, it is not generally appreciated to what an extent this efficiency is affected by the speed with which the water flows through it. The total amount of heat which can be dissipated by a given radiator may vary as much as 30 per cent, according to whether the water is flowing very slowly or very rapidly. There are two reasons for this, the most important is that turbulence in the water is necessary if it is to transfer all its heat content to the copper of the radiator, because water is a poor conductor. Secondly, the amount of heat dissipated by a radiator varies directly with the difference between the air temperature and the mean temperature of the radiator.

Taking an example—suppose a hundred pounds of water per minute enters the top of a radiator at 200 deg. and leaves the bottom tank at 150 deg., then the mean temperature of the radiator is 175 deg. and the b.t.u. lost per minute will be 5000. Let us now suppose that the water flows at 500 pounds per minute, then to dissipate the same amount of heat, we shall only need a temperature drop of 10 deg. This would mean that the average temperature of the radiator would be 195 deg. instead of 175 deg. In other words, we should have increased the mean difference between the air and water by 20 deg. Suppose the original radiator was designed to operate with an air water difference of 100 deg., by using the higher water flow we can cut down the size 20 per cent because we would have increased the difference to 120 deg.

The amount of water which will flow through a radiator depends upon the head. In a nose radiator this can only be a few inches. If a powerful pump is used which actually sucks on the radiator, the pressure in the suction line can be reduced to a point where the boiling point of the water will have been reduced enough to cause trouble with steam in the pump. Thus we are very definitely limiting the speed of the water circulation by the available head of water above the radiator. If, now, a radiator is mounted low down on the fuselage, the outlet from the motor can easily be two or three feet above the core, which is enough to give the most rapid flow that can be desired.

Summing up the advantages of slip stream mountings—we get a lighter radiator, a radiator with less head resistance, a radiator containing a smaller weight of water, and a radiator that can be shuttered with but small increase in resistance.

Enough has been said to bring out the point which the writer is anxious to make clear, namely that while air cooling has developed, water cooling has by no means stood still. The very brief summary of the advantages of the slip stream position only touches upon *one* of the ways in which the improvement of water cooling has been made and still is possible. There are many other things which affect it. Engine and plane designers both desire to save weight and to reduce resistance.

Many of them at the present time, through lack of appreciation, are not taking advantage of the fact that the scope for improvement in water cooling is almost as great as in direct air cooling.

Specification of Electroplating

(*Continued from page* 1291)

factory method for determining the quality of nickel coatings and much investigation may be required to develop suitable specifications.

The proper **adhesion** of coatings, especially of nickel, is of importance on parts such as bumper bars, that may be subjected to slight bending or deformation, which will cause cracking or peeling if the coating is not adherent. Upon thin sheet metal it is possible to make simple bending tests to determine the degree of adherence of the coating, but for the actual plated parts it is difficult to prescribe any generally applicable test. Where improper adhesion is suspected, scratching with a knife may be useful in order to determine whether the coating can be peeled off.

The **hardness** or resistance to abrasion is difficult to measure or specify since there are no satisfactory methods of determining the hardness of very thin sheets of metal. It is doubtful, however, whether in most cases the actual hardness of the deposit exerts much effect upon its period of useful service, except where the nickel plated articles are subjected to severe abrasion or to frequent cleaning, perhaps with unnecessarily harsh abrasives. In many respects a relatively soft deposit of nickel is preferable, since it is more readily buffed to a high polish.

Needs and Possibilities for Investigation

From the previous discussion it will be apparent that there **is a great need for** scientific study both of methods of plating and of determining or specifying the quality of the finished products. The satisfactory solution of these problems will require extensive research which must involve not alone laboratory studies but also the co-ordination of the results with plant practice and with service conditions. For a number of years investigations upon electroplating have been carried out at the Bureau of Standards with the co-operation of members of the American Electroplaters' Society.

The work thus far conducted has been of restricted scope, however, owing to the limited funds available and to the fact that much of the work has been conducted with reference to the specific needs of the government departments. At present a movement is on foot to secure more direct co-operation and actual financial support from manufacturers interested in electroplating in order that these investigations may be conducted more actively. The Research Extension Division of the National Research Council is co-operating in a plan to bring about greater support for this work. **Those engaged in or interested in the automotive industry will no doubt lend their efforts to the support of this plan for extension of research in electrodeposition, a field which has so many commercial applications.**

TECHNOLOGIC Paper No. 170, "Pyrometric Practice," issued by the Bureau of Standards, is now available. The publication has already been adopted as a text for teaching pyrometry in several universities. Copies may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., which publishes a list of other useful technical papers.

Present Problems of Marine Motor Design

The marine engine designer faces many problems not met by the automobile engineer. Tendency is to reduce number of models. Propulsion and flexibility are important unsolved problems. This article discusses present problems and points to future developments.

By William B. Rogers, Jr.*

IN comparison with the motor boat engineer, the automobile designer has had a pretty straight and well-defined path to follow. The early motor cars, pioneer vehicles of the present great industry, were truly "horseless carriages." So, too, is the most modern of cars. The wheelbase of the present motor car is not very different from that of the old-time barouche; the tread is the same. This must be the case from the character of the roads. If cars were to be built much longer there would be difficulty in negotiating turns, and if they were made even slightly wider, passing would be impossible on many roadways, and there would be trouble in getting through rough and rutty places which still exist in the remote regions.

So even the smallest and the largest chassis are relatively close together as to size, and the motors which drive cars do not cover a great range of weights, powers and dimensions. It has been possible therefore for automobile engineers to concentrate upon a pretty well-defined problem, to work out standards, to perfect detail, to effect refinement throughout the motor car.

The term motor car pictures a very definite thing to every man, woman and child throughout the civilized world. But a motor boat! If a friend should invite you to take an afternoon run in his motor boat, would you have any way of knowing whether you were going out in a 14-ft. glorified skiff or in an 80-ft. or 100-ft. cruising yacht? And the little 14-footer might be powered with a tiny single cylinder, two-cycle 2-hp. motor giving it a speed of 6 miles an hour, or equipped with a light-weight, high-speed 30-hp. motor capable of driving the planing hull at 25 miles an hour or more. Likewise, thinking about the 80-ft. yacht, she might be driven by a heavy-duty, slow-turning oil-burning motor, running at about 240 r.p.m. and weighing several tons, or the yacht might be of the express cruiser type, equipped with a couple of 200-hp. high-speed motors turning the propellers 1400 or 1500 r.p.m. and weighing less than 1500 lb. for each motor.

The very nature of things makes the marine field as much broader than the motor car field as the expanse of the waters is broader than the roadway. And another thing that we must remember is that the marine motor operates under full load all the time. Resistance of the water is constant at a given speed, except in the case of a hydroplane, and even in these boats the load is practically constant.

Ten years ago many of the marine motor manufacturers tried to build a range of models which would enable them to meet the requirements of as many types and sizes of boats as possible. It was then not unusual for the marine motor manufacturer to produce a line of motors comprising from twenty to fifty models. To be sure there would be a one, a two, a three, a four and possibly a six-cylinder, all of the same bore and stroke. But each of these motors would be an individual job as to base, manifolds, crankshaft, oiling system, etc., only the actual cylinders being identical. There are still several marine motor manufacturers who build thirty or more models.

The present tendency, however, is all the other way. Marine motor manufacturers, beginning about six years ago, just prior to the war, began to appreciate the advantages arising from concentrating upon fewer sizes. Several, indeed, have gone so far as to build one size only, a model designed to provide power for boats of a popular kind and size, so that demand would be assured. It is needless to dwell upon the advantages of this tendency; the great economies in production through proper shop equipment to turn out the fewer models, etc.

In the beginning the two-cycle motor was in the ascendancy in the marine field. That was when the average motor boat was a small craft and the average marine motor developed from 3 hp. to 10 hp. In these sizes the two-cycle motor still retains its popularity, not alone for pleasure boats, but especially for powerplants for small work boats, such as those used by fishermen of the New England Coast, Chesapeake Bay and the Great Lakes. The two-cycle motor is practical, particularly in single-cylinder and two-cylinder types, because its small first cost, its simplicity and the fact that lubrication can be accomplished effectively by mixing oil with the gasoline in the fuel tank compensate for the somewhat greater fuel consumption and the less easy starting of a two-cycle as compared with the modern four-cycle. The two-cycle motor has a real field in marine service, and because of its having been restricted to the smaller sizes it has become pretty well standardized.

Standardization Efforts

This is not the case with four-cycle marine motors. Through the Motor Boat Division of the Society of Automotive Engineers, however, much good work in the direction of standardizing marine powerplants has been accomplished and is being accomplished. The standardization of such features as carbureter flanges, mountings for electrical equipment, shaft tapers, etc., will simplify the problems of the marine motor designer and manufacturer.

About three years ago the writer, with a number of others concerned with the motor boat field, reached the

*Managing Editor, Motor Boat.

conclusion that to effect anything worth while in the industry, the situation must be attacked basically: That before marine motors and marine equipment in general could be standardized; before marine motors could be built in quantities by production methods, motor boats themselves must be standardized. By standardization in this sense, I mean developing boat models of popular size and type, both cruisers and runabouts, that can be built as stock jobs and sold in quantities as complete, ready-for-service craft.

Already a great deal has been accomplished in this direction. There are at the present time about thirty boat-building organizations which turn out standard stock models, and the number is increasing steadily. In another year or two, I believe, the majority of motor boats built in the United States will be stock models. When that is the case, the marine engineer will have a much more definite range within which to work. He will know the motor sizes upon which he can concentrate his energies with profit, and will be able thus to confine his efforts to the refinement and improvement of marine motors in the same general way in which the engineer in other automotive lines has worked with such remarkable results.

Propulsion Problems

There is another problem, or rather another series of problems which confront the marine engineer which fortunately for the automobile engineer never arise in his work. That is the matter of propulsion. In a motor boat installation all features of hull design and powerplant, including, of course, the propeller itself, are naturally correlated. The heavy hull designed for slow speed, such as that of a motor houseboat or a tug, must be powered for greatest efficiency with a heavy, slow-turning motor. The reason is that a high-speed motor, turning the propeller at high revolutions, would waste power tremendously through slip of the screw propeller.

To be able to determine the proper installation of power for a boat we must know all the factors: the form of hull, the speed for which it is designed, the weight and—at least approximately—the surface resistance. With this data available we can determine the proper power, the correct size of driving shaft, the size of the propeller as to diameter and pitch—the advance of each revolution of the screw, etc.

A nice engineering problem enters into the designing of every properly constructed motor boat, and that is a prime argument in favor of the standardization of motor boat models. It is, of course, no greater engineering task to design a complete model for duplication by the hundreds than it is to plan a single boat of the same characteristics.

Flexibility

Here is another problem that the marine engineer has been called upon to work out: The boat and its power installation have been designed for a certain efficient running speed, under full load. In the case of most motor boats it is impractical to provide for anything other than direct drive, because of mechanical complications, and losses of power where gear drives are employed to reduce or increase propeller speed with relation to the speed of the motor. But take the case of a motor boat of the cruiser class designed to make somewhere around 12 miles an hour. At times it will be desirable to operate this boat at speeds as low as 3 or 4 miles an hour, as in the case of fishing with trolling lines, when maneuvering and so on. The usual boat is equipped with a reverse gear giving direct drive forward, a neutral or idling position and driving at 60 to 85 per cent motor speed when in reverse.

Since the operator will not always desire to drive the boat at its maximum speed, we must have flexible motors, and the problem is to design powerplants which can be throttled over as great a range as possible without the danger of stalling or causing backfires. A number of devices have been perfected which accomplish this result quite well, but flexibility is still one of the problems which must be met by the marine engineer, notwithstanding the great improvements in carbureters during the past few years. The successful marine motor designer must study with the utmost care such matters as manifold design, lubrication which will be as effective at low speeds as at high speeds, gas speeds, the heating of the firing mixture, etc.

In the light of these things it is to be expected that the manufacturer of marine motors, having built a line of motors which have given satisfactory service over a period of years, will go about making changes slowly and will be cautious in attempting anything radical.

Cooling Difficulties

There is one feature which seems on the surface to make the task of the marine motor engineer comparatively simple, and that is the matter of cooling. In a boat there is always plenty of water for the circulating system, and all we need is a pump of some kind to force the water through the jackets. We can even use part of the discharged cooling water to help cool and silence the exhaust. Still, even in this apparently simple feature we have a problem, for the average motor boat operator will persist in running his motor too cool for efficient results. The use of a temperature indicator is growing more common in motor boats, and this instrument, in connection with means of regulating the supply of water to the circulating system makes it possible to run a marine powerplant at the temperature where maximum efficiency is obtained—if the operator will do it. The effect of temperature upon motor efficiency is not yet fully appreciated in the marine field.

The growing use of the Diesel and the so-called semi-Diesel and surface ignition powerplants has brought a new set of problems for the marine engineer. Motors of this class are especially suitable for commercial installations and their development is linked with the growing appreciation of the importance of water transportation of freight.

An Aluminum-Copper Alloy

A NEW copper aluminum alloy known as Tsungani, which differs in physical characteristics from previous copper aluminum alloys in many respects, is being produced by the Alloys Motor Parts Mfg. Co. The manufacturers claim a tensile strength of over 21,000 lb. per sq. in., and a Brinell hardness of 80 to 90. The coefficient of expansion is .000008, much closer to that of cast iron than other aluminum alloys, according to the claims of the manufacturer. Piston clearances of .00055 to .00075 in. per inch of diameter of piston have given good results with this alloy, it is stated. Other claims are to the effect that the metal will not adhere or tear, even if the motor should be run dry or overheat, and that it will take a high polish in wearing. The material has been used for piston rings, for piston packing for steam engines, and also in air-cooled aviation engines. The pistons up as high as 7 in. in diameter have been manufactured from the material and it is claimed that there are now 700 cars in operation using the material.

Problems of the Front End Drive in Automobiles

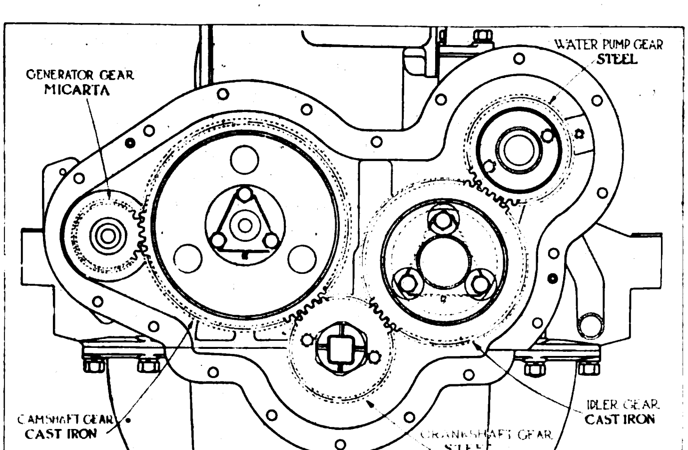
Problems of silence, accuracy of timing and frequency of replacement are presented to the engineer in connection with front end drives. Most stock engines are equipped with helical gears, but some are adaptable to chain gears as well. Present and future trends are discussed here.

By J. Edward Schipper

ENGINEERS whose high standing and long experience in the automotive industry entitle their opinions to respect, state that the front end drive of an automobile engine is still an unsolved problem; perfection has not been reached. The problem still presents difficulties and uncertainties which result in compromise designs to secure the best all-around results. This is not surprising when it is considered that some of the most difficult engineering problems must be solved in arriving at a design which will give the best satisfaction.

Silence, accuracy of timing, absence of replacement necessity, are the prime requisites in the front end drive, whether it be gear or chain, or a combination of the two, or some other method. Under these broad heads, however, there are some problems to be considered which involve the closest study of material and manufacture, as well as design as affected by the layout of the parts to be driven.

To make a brief survey of the situation as it stands to-day in passenger car practice, out of 125 models considered, 81 per cent have helical gear front end drives. Sixteen per cent have chain, 2 per cent spur and 1 per cent other means. Since half of these 125 models are assembled cars, however, this does not give an exactly accurate picture of the situation. Of the 60 models using engines manufactured by the car makers themselves, 20 models, or 33⅓ per cent, are using chain drive, and 40, or 66⅔ per cent, are using helical gears. This neglects the spur and worm gear which are employed on one or two models and which need not be considered in this study. The Ford car, of course, employs spur gears, this being a straight cost proposition, and while on a production basis it would appear as a considerable factor from a general engineering study, it need not be considered.



Layout of timing gears on Buda stock engine which employ steel gears for the crankshaft and water pump, cast iron for the idler gear and camshaft gear and Micarta for the generator gear.

The stock engines made by Continental, Lycoming, Herschell-Spillman and others are all equipped with helical gears. In other words, no assembled cars are using the chain front end drive at the present writing, because none of the stock engines are so put out. There are a few of the stock engines, however, which are being so arranged that the timing gear drive may be adapted either to chain or helical gears, and it is probable that within the next year or two some of the assembled cars will be using the silent chain in place of the helical gears.

In a great majority of instances, those using the helical drive employ alternating cast iron and steel gears. These work together with far less resonancy than steel against steel and at the same time the wearing qualities are apparently very desirable. This steel and iron layout at the present time outnumbers all other types of front end drive, and while the tendency is drifting toward the chain and toward compressed fabric gears, it still remains in the ascendancy on a percentage basis.

Forged Duralumin gears in place of cast iron are being used very successfully by the Continental Motors Co. and by Marmon. The advantages of Duralumin are its good bearing qualities, non-resonance, and particularly that the rate of expansion of the Duralumin gear is the same as that of the gearcase, and consequently, the center distances do not alter when the motor becomes warm. The Continental company states that this is a very appreciable factor in maintaining the silence of the front end drive. The characteristic property which distinguishes Duralumin from other aluminum alloys is that it can be forged. It can be hardened and materially strengthened by quenching from a high temperature, and its properties can be further improved by aging at room temperature.

Duralumin contains upward of 90 per cent. aluminum; 3 to 5 per cent copper; 0.4 to 1 per cent of magnesium and 0.4 to 1 per cent of manganese. It has a specific gravity of 2.8 as compared with 7.8 for steel. The alloy has good bearing properties, as shown by tests, where for shaft speeds exceeding 700 r.p.m. and loads exceeding 200 lb. per sq. in., the friction is less than with babbitt bearings. As regards resistance to fatigue, Duralumin is said to be superior to mild steels when stressed below its elastic limit. The timing gears are made from drop forged blanks. The fact that the pitch line contact of the gears is maintained works for silence, whether the engine is hot or cold, and where weight is a factor, there is, of course, a gain made by the use of this alloy. It is very probable that the use of Duralumin gears will increase.

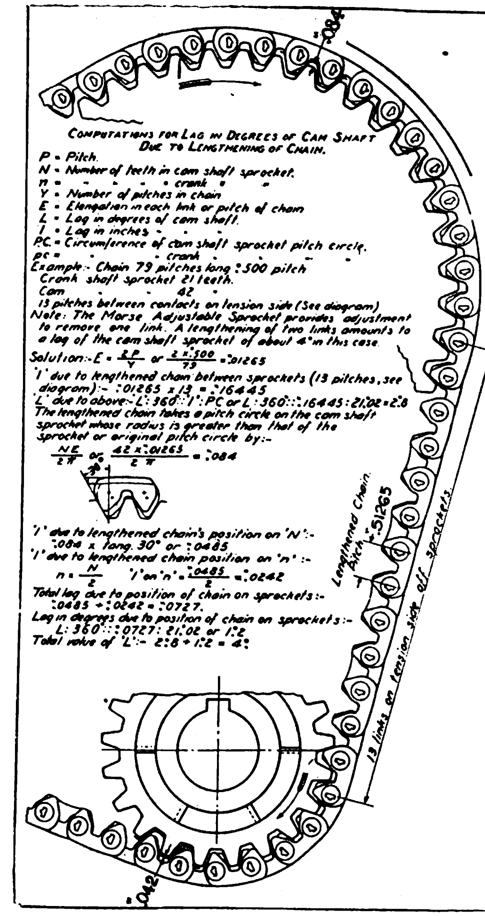
It is of interest to note that as a mark toward the tendency toward chain drive and toward the use of special material such as compressed cotton or Bakelite Micarta for the helical gear drive, the newer designed cars are using to a large extent either of these two methods. The LaFayette, Lincoln, new Packard single six, and the new Studebaker light six are all using silent chain drive. The 1921 Buick, Sheridan, Paige, C. H. Willis and DuPont cars are among the new designs using fabroil gears, which are a special compressed, spirally wound cotton type made by the General Electric Company.

So far as engineering opinion in the country goes, it is very apparent that matters stand about equally divided between the improved types of helical gear front end drive and chain front end drive for passenger car usage where silence is just as important a factor as long life. From a life standpoint, there is, of course, nothing to be said against the wide face spur or bevel type gear, and for truck practice it is very likely that this is going to remain practically universal. Demand for silence, however, introduces some factors which necessitate additional care.

In the consideration of chain front end drive, there are a number of matters to be given weight which experience during the past few years have shown to be of the highest importance, if economical maintenance is to be secured. There have been installations of chains which have proven expensive from the owner's standpoint. On one particular make of car, it was found necessary on early installations to recommend a replacement of the chain at the end of every 10,000 miles. This chain necessitated other work being done, which practically always ran the owner's bill to about $50.00. This expenditure of $50.00 every 10,000 miles means one-half cent per mile for chain maintenance, which is altogether out of proportion and not to be tolerated in any good design. If this proportion of expense of maintenance were to be multiplied by all the parts in the engine, the owner would find his upkeep bills far out of proportion to the service rendered. Happily, however, it has been found possible to materially reduce this by proper design considerations.

The Morse Chain Co., whose installations are used in several passenger cars, provides three nominal widths for the front end drive of high speed engines. These are, 1 in.; 1¼ in. and 1½ in., all ½ in. pitch. In the layout of the chain drive, either an even or odd number of teeth may be used in the sprockets, an odd number of links in the chain such as 51, 53, 55, etc., is required, however. The maximum number of teeth permissible in the crankshaft sprocket is dependent on the engine speed at the normal running speed of the car. In other words, the ratio in the rear axle and the diameter of the road wheels largely control the maximum number of teeth permissible in the crankshaft sprocket. On the ordinary car, it is undesirable to use more than 24 teeth in the crankshaft sprocket, which provides 1 ft. of chain speed per revolution per minute of the engine. For silence, it is undesirable to use fewer than 18 teeth in the crankshaft sprocket. This, of course, means 36 teeth in the camshaft sprocket to secure the half time. A driven sprocket is permissible with as few as 14 teeth, but not less. The recommendation of the Morse company is that all sprockets of less than 31 teeth should be made of low carbon steel; that is, from 10 per cent to 20 per cent carbon O. H. carbonized and hardened 1/32 in. deep. Sprockets of more than 30 teeth can be made of high carbon steel, heat treated, semi-steel casting, or of a very good grade of cast iron.

Another one of the fixed rules in connection with the Morse chain and generally applicable to all chain installations is that it is undesirable to drive any chain with less than 90 per cent chain contact on any of the driven



Layout of typical three-wheel, Morse silent chain drive, showing computation of camshaft lag due to lengthening of chain.

sprockets, and not less than 100 deg. contact on the driving sprockets.

The importance of proper adjustment means cannot be exaggerated in the installation of the chain drive. To secure the full efficiency of the chain and to reap the advantages, particularly as far as silence is concerned, some means of taking up the normal stretch must be provided. An accessible chain adjustment equal to one full link must be provided, and it must be remembered that this adjustment should be accessible or it will not be given the attention necessary. There are several forms of chain adjustments, the most suitable means depending upon the type of layout. For istance, on a triangular drive where the three points of the triangle are made up by the crankshaft, camshaft and generator sprocket, a very accessible and satisfactory adjustment may be provided by the use of the S. A. E. standard generator flange. This is shown in the S. A. E. handbook, Vol. 1, pages B-17 and B-18. Each flange mounting size is provided in this standard with a pilot for locating in a bored hole when used with a gear drive, and with slotted holes to allow for adjustments when used with chain drive. In the latter case, the hole in the gearcase should clear the pilot.

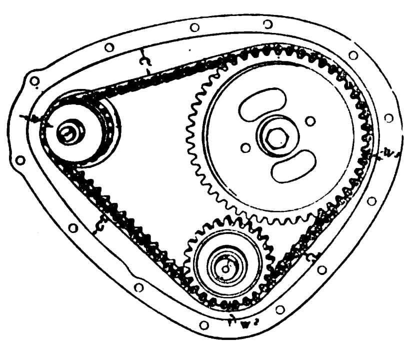
When the triangular drive is used with fixed shaft centers, the Morse Chain Co. provides an adjustable sprocket which has been used successfully on the Packard, Winton, Haynes, Jeffery and other cars. This adjustable sprocket is illustrated and will be described in detail hereafter. Other chain companies have adjustment features which will be described below.

In designing the adjustment, the amount provided should be such that the slack taken up in the chain is equal to a full link plus 10 per cent, or .55 in. A caution which is given in connection with idlers is not to use an idler sprocket for taking up chain slack unless the idler is designed to consume sufficient power to prevent the idler from playing in the chain, as a free idler sprocket

in the front end of an engine is bound to cause a marbly noise.

The Morse adjustable sprocket, which is illustrated on page 1299, is designed to facilitate adjustments of the chain on engines where it is not possible to move one of the shafts. Referring to the illustration, it will be noted that the sprocket, instead of being mounted on the shaft, is mounted on a bearing which is eccentric to the shaft. The chain rotating the sprocket rotates the shaft by means of a connecting universal coupling of the Oldham type. The bearing on which the sprocket is carried is mounted in the case, concentric with the shaft, and by rotating the bearing, the sprocket is moved, thus adjusting the chain. This type of adjustment is applicable to any type of drive.

A question which frequently arises in the minds of engineers is the amount of clearance to allow between the back of the chain and the gearcase. In laying out clearance, the minimum below the crankshaft gear and above the camshaft gear on a triangular layout should be the pitch plus 1/8 in., or since 1/2 in. pitch is universal, 5/8 in. clearance is desirable. Where there is an adjustment, the clearance between the back of the chain and the case at the generator or adjustable sprocket should be



Typical three-wheel Morse silent chain drive showing recommended case clearance.

P = Pitch of chain or 1/2 in.

Wheel (front top of tooth)
$W^1 = P + 1/8$ in. + Adjustment = 15/16 in.
$W^2 = P + 1/8$ in. + 5/8 in.
$W^3 = P + 1/8$ in. + 5/8 in.

Chain (from top of chain)
$C^1 = P \times 2\frac{1}{2}$ in. = $1\frac{1}{4}$ in.
$C^2 = P \times 3$ in. = $1\frac{1}{2}$ in.
$C^3 = P \times 2 = 1$ in.

Note—C^1, C^2 and C^3 entirely depends on the length of strand.

1/8 in. plus the pitch plus the adjustment, or 15/16 of an inch at this point.

On two sprocket drives where the driven sprocket runs two or more times the crankshaft speeds, and the centers are of a certain distance which depends on the balance of the motor, the chain is liable to have a whip which tends to shorten its life considerably, and, in fact, to increase vibration throughout the entire engine. This whip is due to a synchronized vibration originating in the engine and picked up by the chain, when the speed, weight and length of the chain become synchronized with motor vibration. A compensating sprocket can be used to break up this vibration and prevent the whip.

Unless adjustments as outlined are provided, the chain will eventually jump the teeth of the crankshaft sprocket, due to the gradual lengthening which occurs, because of the slight wear in the joints. Where the design of the chain is such that gravity tends to draw both fans of the chain away from the crankshaft sprockets and the contact is less than 130 deg., the chain is apt to jump and throw the engine out of time. Shoes on the case are provided in some installations to cause noise when the chain becomes loose enough to be apt to jump. This warns the operator and makes him adjust the chain and take up the slack before it can jump from the sprocket.

The layout of sprocket centers is, of course, of primary importance in designing a chain drive. In designing triangular layouts on new engines, it is highly desirable that a chain specialist be consulted before a center distance is adopted, and engineers should consult with the chain makers and allow their engineering departments to assist on the original layout, in order to secure the best results.

Installations of the Link Belt chain show some particularly interesting features of front end drive practice. One of the features in connection with some of the Link Belt installations is the highly successful use of the automatic idler as employed on the Mercer and Brewster cars. The feature of the automatic idler for taking up wear in chains as used on the engine is not new, but heretofore has proven unsuccessful because there was a certain point in the speed of an engine where the automatic idler had a tendency to vibrate excessively, causing considerable noise. The automatic idler, as arranged by the Link Belt Co., is claimed to absolutely be free from vibration at any speeds.

The Link Belt Company has recently placed on the market a new type of front end drive chain, which has taken about 10 yr. to develop. This chain is known as the unit chain, because in it the liner type of bushings used in all previous types of Link Belt silent chains have been eliminated. This has also eliminated two points of wear at each articulation. Another feature of the chain is that it presents practically a solid contact with the tooth of the wheel on which it travels, and thus allows oil to form a silencing pad between the tooth of the wheel and the chain. It is claimed that, regardless of the speed, this chain produces merely a very dull, metallic click, which totally disappears when the chain is encased.

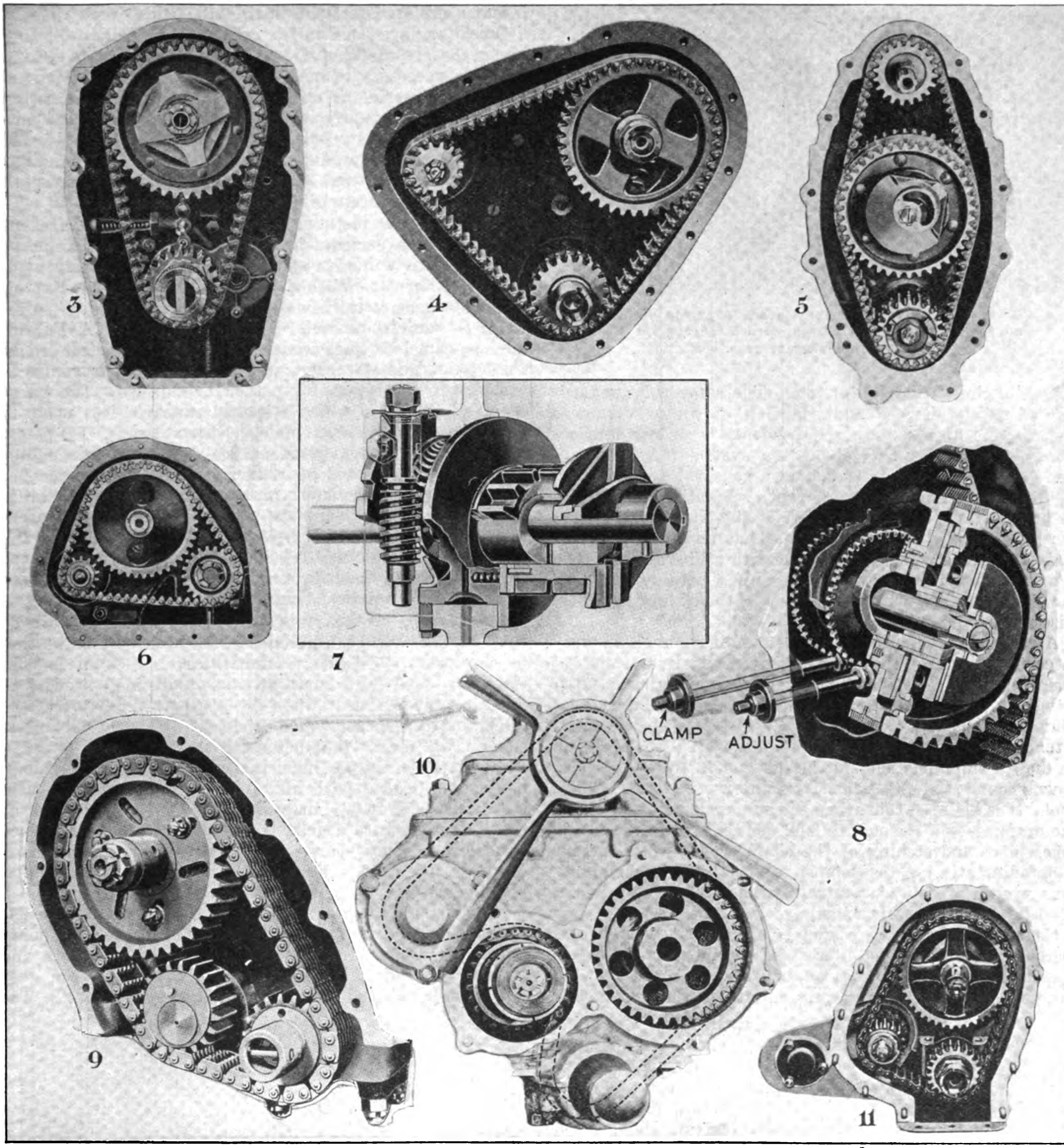
Another feature of this particular chain is the spacing of the links. The spacing is determined by integral parts of the link, and it is impossible for any particular joint to be tight. Tests on the final form of this chain have been carried on for practically two years, and several chains are said to have run for a distance equal to 48,000 to 50,000 miles in engines, yet the stretch is under 0.02 in.

The outstanding factor of the Whitney silent chain is the special cylindrical joint designed to insure long wear. It is claimed that the joint wearing area is a more important feature than the tensile strength of the chain, as the factor of safety is so high that the breaking of chains in service is very rare.

The joint of the Whitney chain is shown in the illustrations herewith. Short, hardened steel bushings are used, which fit tightly at each end into regular toothed, inside links, while the two toothed links in the center turn freely on the bushing. The links which fit the bushings tightly are designated "tight hole links" and are forced on the bushings under very heavy pressure. The two center links which turn on the bushings are designated "loose hole links." A length of chain comprising these two styles of links assembled with the bushings is designated a "B" unit. For the smaller pitches, the separate links are 1/16 in. thick, so that each unit is 1/4 in. wide. These units are placed side by side to make up the desired width of chain. Hardened nickel steel rivets of the proper length secured at one end to outside links are passed through the bushings into another outside link and riveted in place. This construction, it will be seen, gives for each joint four bearing surfaces made up entirely of hardened steel, and it is upon this joint construction that the claims for the wearing qualities of the chain are made.

Two general styles of Whitney chains are at present on the market. One is the side guide type, which has guide plates along each edge of the chain. In this construction, the outside unit, designated as "A" unit, is made up of one tight-hole guide plate and one tight-hole inside link fitting the bushing tightly, with a loose-hole link turning on the bushing between them. This makes a unit 3/16 in. wide, 1/8 of which is on the sprocket teeth, while 1/16 in., the guide plate, is outside the sprocket.

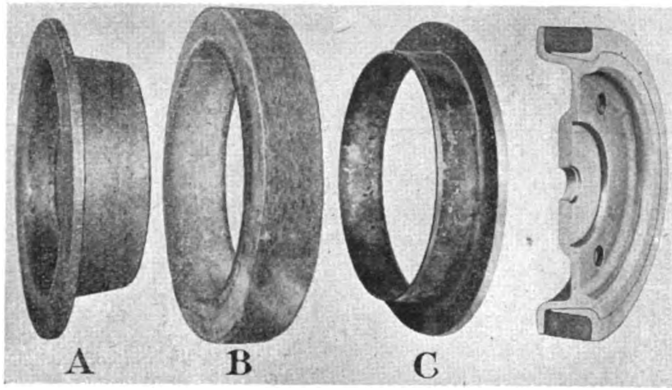
The other style of Whitney chain has a single guide plate in the center which runs in a groove provided in the sprocket. In this case also a special unit is used, so constructed that any desired width may be obtained by combining it with the proper number of regular "B" units.



(3) Morse chain installation with two sprockets, showing eccentric adjustment used on LaFayette car.
(4) Typical Morse triangular drive applied to four and six cylinder engines where the camshaft is on the left and the accessory shaft on the right.
(5) Silent chain drive applicable to eight-cylinder engine utilizing Morse patented double adjustment on the camshaft.
(6) Typical Morse triangular drive applied to four and six-cylinder engines with the cam and accessory shaft on the right side.
(7) Morse single adjustment usually applied to accessory shaft and essential where the shaft contains two or more units and cannot be moved to take up chain slack.
(8) Morse double adjustment adapted to eight-cylinder engines containing two loops of chain. The adjustment is applied to the camshaft.
(9) Link Belt silent chain drive in the front end of a Mercer engine with automatic idler adjustment. The idler wheel runs loose on an eccentric bushing with an internal adjustment spring.
(10) Link Belt installation on Brewster, driving camshaft, fan shaft, and auxiliary shaft, with idler adjustment on back.
(11) Whitney chain front end drive on eight cylinder engine, showing chain drive to camshaft and generator shaft.

The center guide style of silent chain in the ½ in. pitch has been most commonly adapted for use in front end drives. The links are made of alloy steel, heat treated. The holes in each link are reamed to size and the faces of the links where they engage the sprocket teeth are milled to a smooth surface located accurately with reference to the holes.

The type of chain used for the front drive does not materially affect the spacing of the sprockets and the layout of the auxiliary drives such as generator, water pump,



Parts of Fabroil automobile gear. A. Drop forged hub. B. Cotton filler. Drop forged shroud at C. Sectional view of gear.

magneto, timer, distributor, etc. The same rules regarding adjusting devices and selection of center distances apply. One of the main requirements is proper lubrication, and whatever the lubricating system in use, an oil lead should be provided to deliver a constant stream of oil to the inside of the chain. A vent or breather should also be provided at the highest point of the chain case, unless the highest part of the chain case has an opening to the main crankcase which is provided with a liberal vent. The sprockets should be cut with cutters and hobs approved by the chain company which is to provide the chains, as otherwise unsatisfactory operation may result.

A recent investigation of the causes of rapid chain wear in certain parts of the country brought to light some interesting facts. For instance, it was found that in Birmingham, Ala., the life of the chain was noticeably shorter than in other parts of the country. Investigation disclosed a tendency for the etching of the pins. This was found to be due to sulphuric acid in the oil, and in tracing it back it was found that this came from the use of benzol in the fuel. It is believed that when the sulphuric acid content in the crankcase oil is equal to 0.02 per cent., galvanic action takes place and etching of the chain occurs while the car is standing still. A teaspoonful of slack lime in the crankcase would, of course, neutralize the oil, but this is not good for the engine bearings.

Gears of compressed cotton or fabric cut with helical teeth have excited the interest of engineers for several years. There are hundreds of thousands of these gears in use, and they are proving very satisfactory in practically

SIZES OF FABROIL GEAR

Pitch	Teeth	Outside Diam. in Ins.	Angle	Pitch	Teeth	Outside Diam. in Ins.	Angle
9	72	8.942	25 deg. 25 min. 00 sec.	10	63	7.2	25 deg. 50 min. 53 sec.
10	72	7.7	16 deg. 15 min. 30 sec.	8	54	7.414	19 deg. 34 min.
8½	60	7.737	19 deg. 45 min.	10	52	5.8	21 deg. 47 min.
9	60	7 84	28 deg. 54 min.	10	72	8.45	29 deg.
8–10	54	7.7	25 deg. 23 min.	6.28	42	7.383	19 deg.
8	56	7.75	21 deg. 2 min. 24 sec.	10	66	7.399	23 deg. 30 min.
10	72	7.95	21 deg. 42 min. 55 sec.	8½	54	7.235	24 deg. 51 min.
10	66	7.368	23 deg.	10	72	8.013	22 deg. 51 min. 00 sec.
10	66	7.503	25 deg. 21 min. 40 sec.	10	62	7.088	25 deg. 50 min. 32 sec.
8	54	7.734	18 deg.	10	32	7.000	19 deg. 45 min.
10	72	8.211	26 deg.	8	40	5.75	24 deg. 36 min.
9	72	8.942	23 deg. 26 min.	10	66	7.69	28 deg. 14 min.

all installations. The working portion of the Fabroil gear, which is the trade name of the compressed cotton gear sold by the General Electric Co., is cotton, which is held highly compressed between steel shrouds or end plates. The cotton receives a vacuum-oil treatment, which acts as an initial lubrication. These gears have been in use now for over eight years, and about twenty manufacturers of passenger automobiles are now using them. They are generally furnished in the form of gear blanks, finished ready for tooth cutting. The Fabroil gear is generally used as a camshaft or an idler gear and the sizes specified by different users are contained in the tabulation herewith.

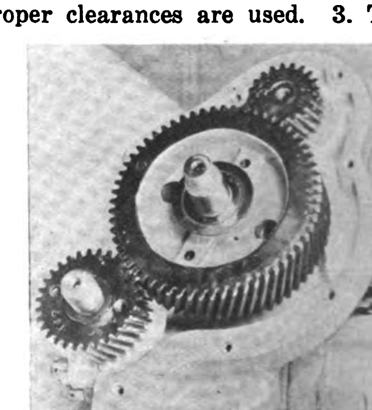
Steel forgings used in the construction of Fabroil timing gears are made of L section in order to provide the strength necessary to hold the cotton portion in compression. By a series of operations the fibres of the cotton are made to assume positions closely paralleling the outline of the tooth profiles, alternate layers crossing to parallel opposite profiles. This produces a triangular bridge truss structure, developing the maximum strength and wear resistance without sacrifice of elasticity.

Generally, the teeth of the timing gear train are cut spirally, and experience has shown that a spiral angle of about 20 deg. will give smooth operation with only moderate end thrust. With a large spiral angle the Fabroil gear would be greatly weakened, but the 20 deg. spiral angle is said to be well within safe limits. A Fabroil idler or camshaft gear works well against the steel crankshaft gear, and this combination has been approved by a great many engineers for passenger car use. The latest series of Buick, in which a special endeavor was made to quiet the timing gears, employs Fabroil gears. On a test made on a Buick six-cylinder 1920 model, with the motor run at constant speed of 1220 r.p.m., or 25.24 miles per hr., a wear of only 0.002 in. was found in 30,000 miles of running. The gears are cut with 10.240 pitch teeth having a 20 deg. spiral angle, the Fabroil face being 1¼ in., and the metal face 1⅛ in. The gears are lubricated by drilling a ½ in. hole in the wall above the shelf used to retain oil for lubricating the camshaft bearing.

Lubrication of the front end drive, whether chain or timing gear, has been given a great amount of attention by engineers. On the National car, the chain is continuously oiled by a small stream of oil, a great deal of oil being thrown on it when the pressure regulator in the oiling system opens, which it does at about 10 lb. pressure. This means that after the car gets up to a speed of about 15 miles per hour the entire front of the chain housing is flooded with oil. The National company uses a Morse chain of 1½ in. width.

On Peerless cars a gear front end drive has been used for a great many years. For several years the Peerless company has used a Fabroil camshaft gear, for the following reasons:

"1. It is the simplest construction known. 2. The use of the spiral gear to a large extent eliminates gear noise. However, with the combined use of the spiral tooth and Fabroil gear, noise is practically eliminated if the gear is properly cut and proper clearances are used. 3. The



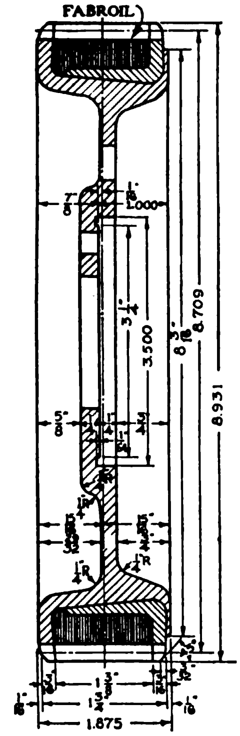
Fabroil timing gears employed on Buick 1921 car.

gears are certain to give correct timing and not to jump a tooth occasionally, as may happen with other methods. 4. No adjustments are necessary. 5. Vibrations which occur at critical speeds do not show themselves in the way of noise or hammer. Furthermore, there is no crit-

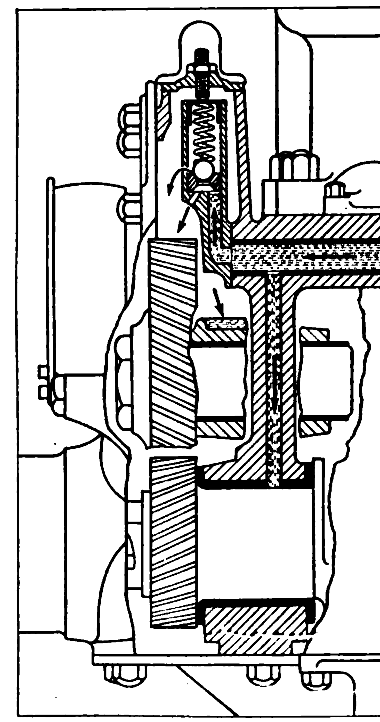
ical speed in the gears at which they may vibrate. 6. While fitting of the gears requires close work in the factory and entails careful attention, the job when passed is good for thousands of miles without any expenditure for adjustment or upkeep."

The Apperson company uses a cast iron gear on the camshaft and a drop forged steel gear on the crankshaft. The pitch diameter of these gears is 6¾ and 3⅜ in. The teeth are cut with a ten pitch cutter. The angle of spiral is 27 deg. 16 min. The normal circular pitch is 0.3141 and the lead is 41.144 in. right hand spiral. The Apperson installation mentioned employs only two gears in the gear train, the crankshaft pinion and the camshaft gear vertically above it, as this is an eight-cylinder engine. On truck engines, this practice of using steel against iron is practically universal. There noise is not such a factor and is a secondary consideration to life. In passenger car practice, silent operation is most essential and for this reason another factor enters the problems, namely, resonance of the timing gearcase.

The search for non-resonant materials for timing gearcases has not developed anything which is very much superior to cast iron. Aluminum, when properly ribbed, is not bad. Most engineers, however, agree that cast iron is superior from a resonance standpoint, even though heavier. The use of the solid web in the idler gear in place of spokes has also been found to reduce sound to some extent. Sources of vibration, however, cannot always be foreseen, and sample engines often show too much resonance in the timing gear train and gearcase in spite of precautions taken to guard against this trouble. Practically all designers have had some experience with unexpected noises developing at this point, and many amusing stories are told of the tuning fork effect of certain types of timing gearcase covers. With practically all other noises in the engine almost completely subdued this timing gear problem is assuming great interest to all engineers concerned in the development of quiet engines.



The Peerless camshaft gear is of Fabroil with a steel hub.



Method of lubricating timing gears on Continental engine. In addition to the oil leads to the timing gears, excess oil from the overflow passes back to the crankcase over the faces of the timing gears, so that at higher speeds they are copiously lubricated.

Problems and Possibilities of the Aluminum Piston

(*Continued from page* 1266)

become somewhat loose when the piston is hot, owing to the higher expansion of the aluminum as compared with the iron or steel bush. If the fit becomes too loose, then "hammering" and consequent wear is likely to result. From this point of view, the "cast in" bush is to be preferred. Here the "fit" is between hot aluminum and comparatively cold iron, and subsequent shrinkage leaves the light alloy casting under an internal tensile stress around the bush. This must not be permitted to become unduly high, otherwise the casting may crack. So long as this is avoided, however, the presence of such a stress is a desirable feature, since the heating of the piston then merely releases the stress and still leaves the bush tight in its place. Allowing the piston pin simply to "float" directly in a simple hole machined in a boss of the aluminum alloy casting has also been tried, but it is doubtful whether the bearing surface thus obtained is large enough. There is some reason to think that aluminum alloys afford a good bearing surface for moving steel parts, but it is necessary that the working pressure should be kept very low. If the piston pin were large enough—or were given an increased diameter at the ends, therefore, the simple "direct" construction would probably prove quite satisfactory.

Although it cannot be claimed that the whole subject of the aluminum alloy piston has been exhaustively treated in what has here been said, it is hoped that the leading points have been dealt with to a sufficient extent to enable those designers and constructors interested in the matter to follow it up further and to form their own opinions. Whether the aluminum alloy piston has "come to stay" in the automobile engine is still a matter for personal opinion. That it does allow of the construction of an engine of higher efficiency cannot be doubted, and since reduction of weight in the automobile necessarily implies the use of a more efficient power unit, there is some reason to think that on this ground there is an important future for the light alloy piston. Some advanced thinkers regard it as being but the first step to an "all aluminum" engine or even an "all aluminum automobile," and there can be no doubt that both cylinder castings and connecting rod forgings of light alloys have been successfully used. It will be well, therefore, for progressive automobile designers and engineers to bear the future possibilities of light alloys very carefully in mind.

THE situation of the petroleum industry in Rumania is reported to be such that its prosperity is greatly endangered. For a long time the majority of the wells have been exploited with the aid of foreign capital. This exploitation has practically been put to an end by the refusal of the Rumanian Government to permit the exportation of the petroleum except for domestic needs. Moreover, by a recent decree the Government is trying to create a monopoly of the transport of petroleum, with the object of later transferring this monopoly to a private corporation. It is evident that under these conditions foreign capital will not be interested in further development of these oil fields.

American and British Practice in Clutch Design

A paper in which the advantages and disadvantages of various types of clutches are discussed and the merits and demerits of many design features are pointed out. Notes on the theory of design and a tabulation of dimensions, pressures, capacity, etc., of many makes are also given.

By Herbert Chase[1]

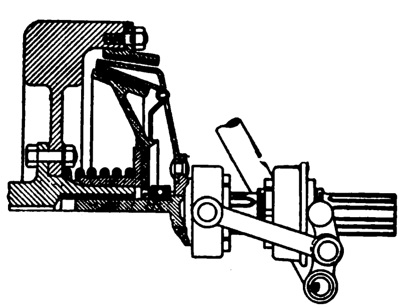
THE objects of this paper are to (*a*) set down in convenient form for reference purposes particulars concerning American and British[2] practice in clutch design, (*b*) compare the advantages and disadvantages of various types of clutches and (*c*) give some notes on the theory of design without attempting a comprehensive treatment of the numerous factors involved in this theory. The descriptive portion deals almost entirely with clutches used on passenger cars and trucks, but some of the clutches described are applicable to other automotive uses. The notes on the theory of design apply in general to all automotive clutches. The clutches considered can be divided into the four general classes of cone, single plate, multiple disk and shoe or band types.

The Cone Type

The cone type was used almost exclusively for many years for both passenger cars and trucks. It still is used very widely by Continental European and British builders, and has a considerable number of advocates in this country. It is simple in construction and can be made light enough to be brought quickly to rest when changing gear, at least in moderate capacities. In certain forms it is not expensive to manufacture and is fairly reliable; but, for a variety of reasons, it has steadily lost ground in this country and is used to-day by less than 8 per cent of car and 6 per cent of truck builders. In England over 60 per cent of car chassis and nearly 80 per cent of truck chassis still have cone clutches. It should be borne in mind that nearly all British builders make their own clutches, and that the average torque transmitted is much lower than it is in this country because British engines are smaller and, in the average case, of rather higher speed than American engines. Preference for the cone type in Europe is ascribed by some to simplicity and lower cost of production when the quantity is small. There are some who say that the cone type is ideal when properly constructed, and one British writer[3] contends that if the same ingenuity had been expended on the cone type as on the plate and disk types the first named would have proved so cheap, simple and satisfactory that other types would be considered expensive luxuries.

The chief failing of the cone type has perhaps been due to the fact that, as frequently constructed, the full pressure of the spring comes into action immediately upon engagement of the friction surface, thus causing the clutch to grab or pick up its load suddenly. To some extent at least this can be avoided by a variety of means. Among the simplest of these is the placing of subsidiary springs under the facing, so that the whole of the facing is not engaged simultaneously. A dashpot, similar to that shown in Fig. 1, also can be used, but this precludes sudden engagement which is sometimes necessary. Another expedient is to arrange two or more springs so that they come progressively into action on the cone during the period of engagement. Practice in respect to the angle of the cone varies widely, from 10 to 16 deg. in British types. The sharper the angle used, the lighter is the spring pressure required to carry a given load with a given diameter and nature of surface. The clutch is likely to grab when the angle is made too fine, while a fairly wide angle tends to prevent grabbing but requires a heavy spring. The advantages of both are said to be realized in the construction shown in Fig. 2, in which a double cone

Fig. 2—Double cone clutch



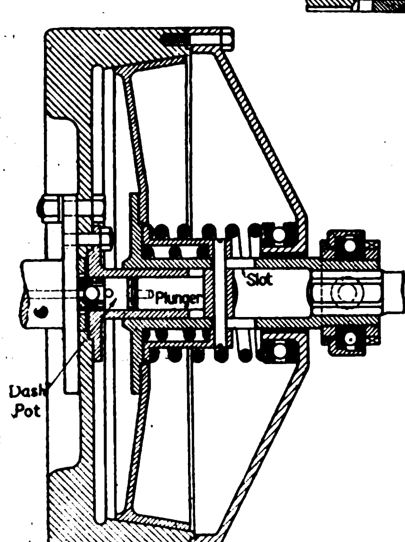


Fig. 1—Cone clutch with dashpot

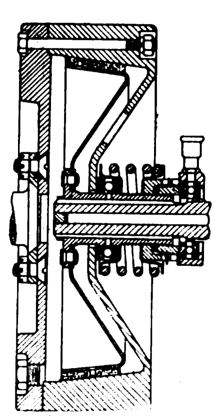


Fig. 3—The 10-hp. Humber clutch

[1]This paper, prepared originally for exclusive use in the Engineering Number of AUTOMOTIVE INDUSTRIES, was accepted for and presented at the Semi-Annual Meeting of the Society of Automotive Engineers. A few slight revisions have been made in the text and table presented in printed form at the meeting.

[2]The data and most of the particulars regarding British clutch practice were furnished by M. W. Bourdon, to whom acknowledgment is hereby made.

[3]See a paper entitled Developments in Transmission by Capt. S. Bramley-Moore presented before the Institution of Automobile Engineers and published in the Journal of the Society of Automotive Engineers for April, 1921.

is employed. The wide angle surface engages first, while the narrow angle face coming later into engagement furnishes sufficient friction to carry the full load without slip.

Not many years ago all cone clutch facings were made of leather, which often becomes hard and sometimes glazed due to slipping on engagement. The clutch then either fails to carry the load or grabs until the facing is treated with oil. Too much oil lowers the friction coefficient enough to bring about slipping and fullers' earth must then be applied to prevent slipping. Annoyance of this kind caused prejudice against the cone type and has favored the development of other types. To-day, asbestos fabric is employed frequently for cone, as well as for other clutch facings. Cone clutches are sometimes allowed to run in oil, as in the case of the Humber clutch shown in Fig. 3. This keeps the facing material, which is leather in this case, relatively soft and pliable but of course decreases the friction coefficient and, other things being equal, requires the use of a stronger spring.

To facilitate gear changing, it is desirable to decrease the moment of inertia of the driven member attached to the transmission; hence, its weight and diameter should be kept as low as possible. Some consider American practice superior to the British in this respect and say that gear changing is easier on the American cars, but this may be due partly to other factors. To minimize weight, either pressed steel or aluminum is employed for cone clutches. In some cases, as in the Clement-Talbot clutch shown in Fig. 4, the friction facing is attached to the female driving member instead of to the driven member, and the driven member is thus further lightened. This practice is said to have not been universally successful, due to difficulty in attaching the facing satisfactorily. In some cases facings are made and secured in segments, rather than in one piece, when they are carried by the driving member. The builder of the British Phoenix cars has followed the practice for many years of using an aluminum cone running in oil and bearing directly on the cast iron flywheel. Phoenix cars are of small size, but the practice has apparently been successful, for it is followed even in the latest and largest 18-hp. model of this maker.

Not all cones are of the conventional form, fitting directly into the flywheel. Some are of the so-called inverted type, such as the Humber, shown in Fig. 3, and are pushed forward toward the flywheel to disengage them. In this case a separate ring is required between the clutch and the flywheel proper. Nothing appears to be gained over the conventional type, unless it be in the compactness realized by placing the spring between the flywheel and the clutch. Nearly all springs used in clutch construction are either helical or volute types under compression. In many cases a single heavy spring centrally located is used, but two or more, equally spaced around the circumference near the periphery of the clutch are often employed. An exception is the Thornycroft clutch illustrated in Fig. 5, which employs two laminated leaf springs, one on each side of the axis. These are fastened to the flywheel rim at each end by bolts, and make contact at the center with the ball thrust bearing. The thrust of the engaging spring is usually taken by the flywheel clutch unit; that is, the two or sometimes the clutch alone are self-contained, and no thrust is transmitted to external members except on disengagement. This is not true, however, in the case of the Daimler car, which has an exterior spring attached to the chassis frame applying pressure to the clutch and flywheel which must be taken up on the crankshaft. This construction is, of course, very much out of date.

So far as British practice is concerned, it appears that there is not much to choose between well made cone and plate types. Their respective merits are so nearly the same that even experienced users accept either type without question. In other words, the type of clutch used is not a selling point in England. This can hardly be said to apply in this country, where perhaps the cone type has not been developed to the same extent as in British practice. The unsatisfactory performance of the cone type in some instances, and other factors, have led to the development of other types here, notably the multiple disk type, which has advanced further and is more widely used in this country than in Great Britain or Continental Europe.

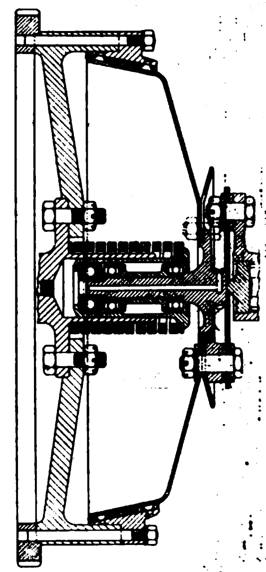


Fig. 4—The Clement-Talbot clutch.

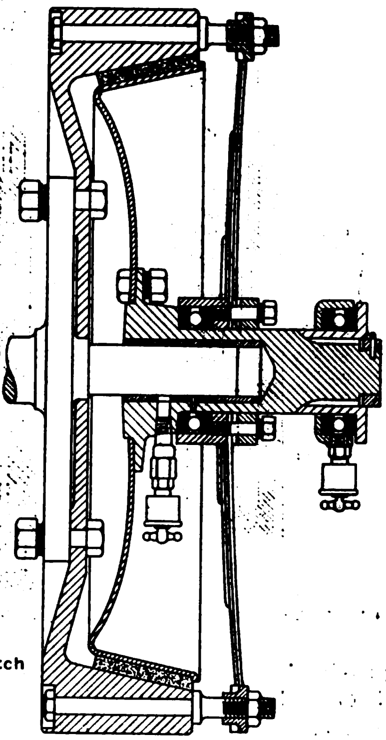


Fig. 5—The Thornycroft clutch

The Single Plate Type

The single plate type of clutch is used widely in both this country and Europe. When well made and properly adjusted, it is smooth acting. It is of simple construction and can be made with few parts; consequently it lends itself to economical production in quantity. As compared with the cone and the multiple disk types, heavier spring pressure is required to carry the same torque; hence, if the same linkage is used, the pedal pressure necessary to disengage the clutch is greater, unless a much larger diameter of plate is employed. For this reason multiplying levers are employed in the throwout mechanism, and many different arrangements of levers are used in plate clutches of different makes. In some cases the levers are attached to and rotate with the driving member, while in others external leverage, aside from that on the pedal lever, is employed.

Figs. 6 to 13 show plate clutches using multiplying throw-out levers. Some of these are employed on trucks and some in passenger car service. A somewhat different design of lever is employed in all of these eight clutches. In the case of the Autocar, Fig. 6, the Dennis, Fig. 7, and the Napier, Fig. 8, adjusting screws which can be backed off as the facings wear are provided on the levers. The Bristol, Fig. 9, the Halley, Fig. 10, the Mack, Fig. 11, and the Austin, Fig. 12, appear to have no provision for adjustment within the clutch itself. On the Arrol Johnston, Fig. 13, the spring pressure can be varied by turning the threaded spring caps, but the levers are non-adjustable. In all of these eight clutches three or more springs, equally spaced in a circle having a radius

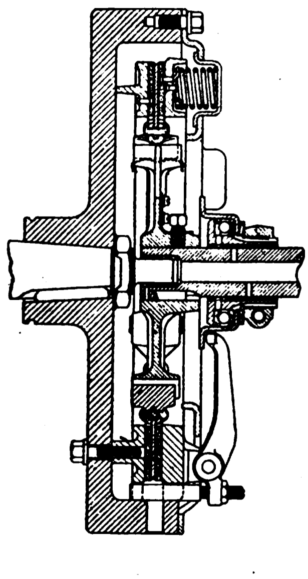


Fig. 6—The Autocar clutch.

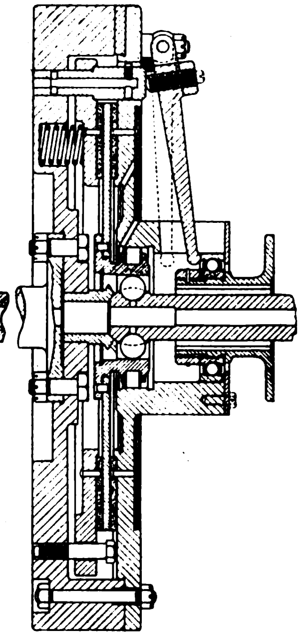


Fig. 7—The Dennis 2-ton clutch

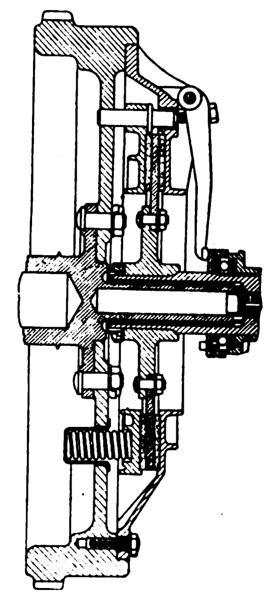


Fig. 8—The 40 to 50-hp. Napier clutch.

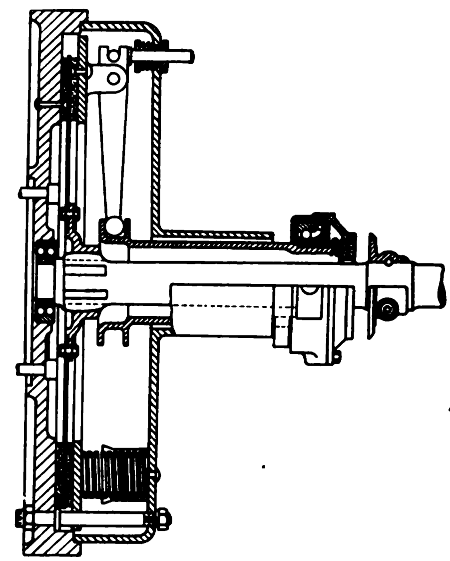


Fig. 9—The Bristol 4-ton clutch

approximately equal to the mean radius of the friction disk or disks, are employed. These are so-called "direct acting springs," since their pressure acts directly upon the friction surfaces and not through levers, as in the types that will be described later. As the facings wear, the springs become somewhat longer and their pressure decreases correspondingly, but the increase in the length is usually small and, if the spring is properly proportioned, the decreased pressure is still within the capacity factor of safety allowed.

With the single plate type, the unit pressure on the friction surface usually is high and, since the slip with its consequent abrasive action which takes place during engagement and disengagement occurs as a rule only on two faces, the wear on these surfaces is relatively rapid. This disadvantage of the single plate type is minimized by making the disk of as large an area, and consequently as large in diameter, as is feasible; but, when the diameter is large, the inertia of the driven member becomes great and gear changing more difficult. To minimize the weight and inertia of the driven disk, it usually is made fairly thin and the friction surfaces are, as a rule, carried on the driving members. The thin plate is noticeable especially on the Bristol clutch shown in Fig. 9. In some cases, however, so thin a section has been employed that the heat caused by slipping has resulted in warping the plate enough to require its renewal. High temperatures are often reached when, as in traffic driving, slipping occurs frequently. Heat can radiate but slowly from plates so fully enclosed.

The Mack clutch illustrated in Fig. 11 is designed so that the driven friction disk only is clamped between the two driving members. It is carried by a light steel plate, but is riveted to this plate at points nearer to the center than the bearing surface. This arrangement, no doubt, adds somewhat to the moment of inertia, but it has the advantage of requiring only a single disk of friction material which takes the wear on both sides. Furthermore,

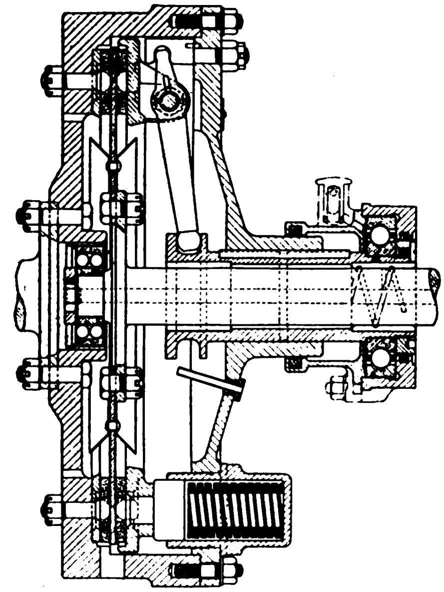


Fig. 10—The Halley 3½-ton clutch

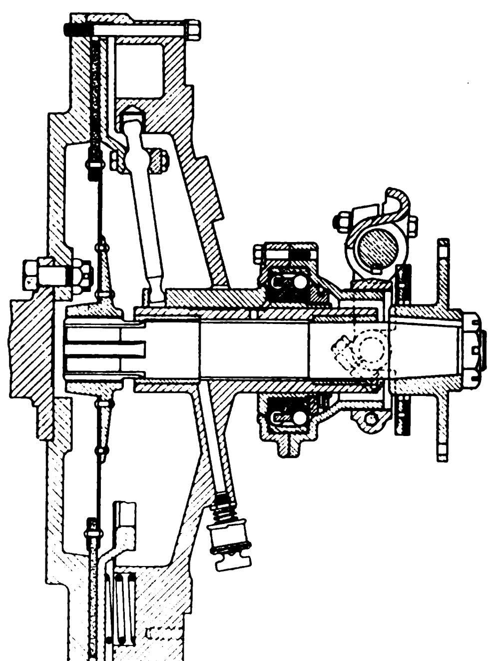


Fig. 11—The Mack clutch

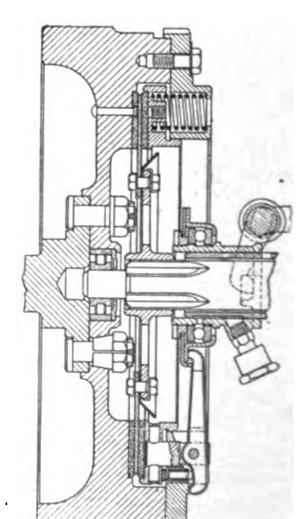


Fig. 12—The 20-hp. Austin clutch

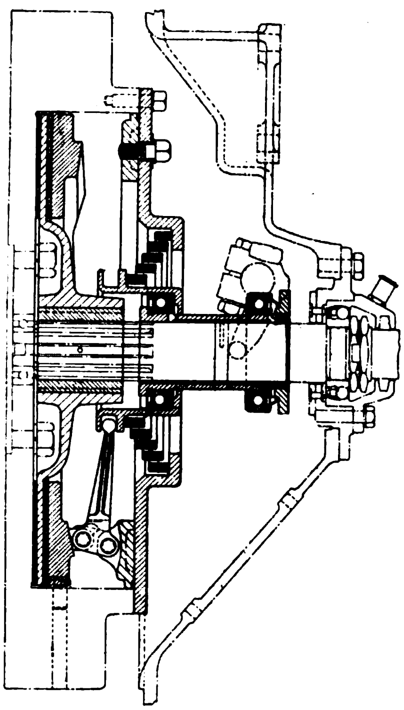


Fig. 14—The Borg & Beck clutch

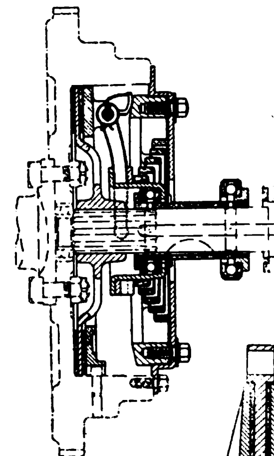


Fig. 15—The Hoosier clutch

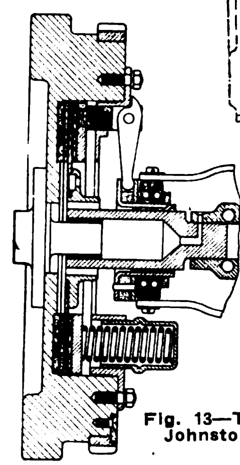


Fig. 13—The Arroll Johnston clutch

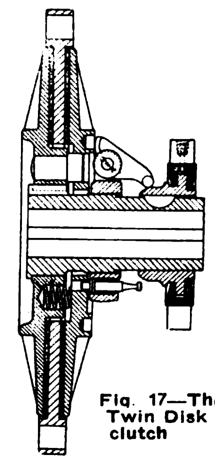


Fig. 17—The Twin Disk clutch

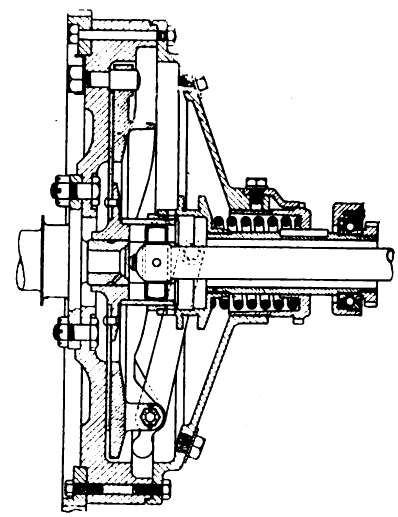


Fig. 16—The Rover clutch.

as wear occurs, the rivet heads never bear on the metallic friction surface as in most other constructions after considerable wear takes place. In this way the useful life of the friction disk is much increased. A somewhat different type of single plate clutch widely used in this country is shown in Figs. 14 to 16. This type employs a single spring placed co-axially with the clutch itself and arranged so that the pressure of the spring on the facings is multiplied by lever and toggle devices. The advocates of this type claim the advantage of uniform pressure at all points on the friction surface, which, they contend, is not secured when separate direct acting springs are employed. This advantage is, however, dependent upon having the same size and fit on the various bearing parts involved, as well as on equal wear; hence, there is some question whether a more uniform pressure is obtained in reality than is secured by properly calibrated sets of springs acting directly on the friction faces. One disadvantage resulting from the use of levers to multiply spring pressure is the fact that the motion of the long end of the lever due to wear on the facings is multiplied in the ratio of the lever arms. If this ratio be 5 to 1, wear of 1/16 in. on the facings means a 5/16-in. extension of the spring. In some designs this amount of motion will involve sufficient reduction of pressure to permit slipping and, since a motion of the throw-out sleeve of about ½ in. is usually allowed, it is necessary with this type to adjust with relative frequency. Hence, clutches of this type are, as a rule, provided with means for quick adjustment.

In the Borg & Beck clutch shown in Fig. 14 adjustment is made by turning the ring on which the toggle levers are carried, thus causing the inner ends of the toggles to bear sooner on the helical surfaces provided on the thrust ring. The toggle ring is then locked in place by two cap screws passing through the cover plate. In the Hoosier clutch, illustrated in Fig. 15, a similar adjustment is made by turning the threaded adjusting ring, which is then locked by cap screws in a manner similar to that used in the Borg & Beck clutch. The release sleeves used in these two clutches are attached to and turn with the driven member, while the collars against which the toggle levers bear at their inner ends turn with the driving member. This necessitates the use of an extra bearing between the two, which is not required in most other constructions. The facings in these two clutches are allowed to float; that is, they are not attached to either the driving or the driven members. Since no rivets are required, the facings can be used without renewal until nearly worn through.

The earlier types of multiple disc clutch ran in oil and used alternate disks of bronze and steel. With the exception of the Phoenix cars which, as stated above, use aluminum cone clutches running in oil and bearing on the cast iron flywheel, few other metal-to-metal clutches are used to-day. One of these is the Rover, shown in Fig. 16, which has a single phosphor bronze plate running in oil between two cast iron surfaces. Levers which multiply spring pressure on the friction surface are employed as in the case of the last two clutches mentioned, but these are not of the toggle type in which a certain wedging action occurs. The use of oil, of course, reduces the coefficient of friction, and this necessitates greater pressure than would be required otherwise. Other disadvantages encountered when disk or plate type clutches run in oil are cited under the head of multiple disk clutches. In the case of the Rover clutch the torque transmitted is only that of an engine of 12-hp. rating; hence, it would seem to be possible in a clutch of the proportions shown to work with a large factor of safety, and this is no doubt the case, for the clutch is said to work very well in practice. The Rover clutch is designed for use with a separate transmission; hence a universal joint is employed at its center. The disengaging sleeve is keyed to the driving member and therefore rotates with it. Through this sleeve passes the shaft of the universal joint which, of course, turns with the driven member; but, since this shaft does not touch the sleeve, no bearing is required between them and the thrust of the spring is taken against the casing direct. This makes the extra bearing used in the Borg & Beck and the Hoosier types unnecessary. Spring pressure can be varied by turning the threaded sleeve, against which it

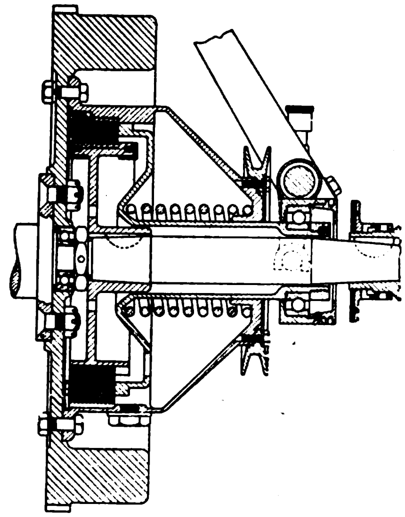


Fig. 18—The Vauxhall clutch

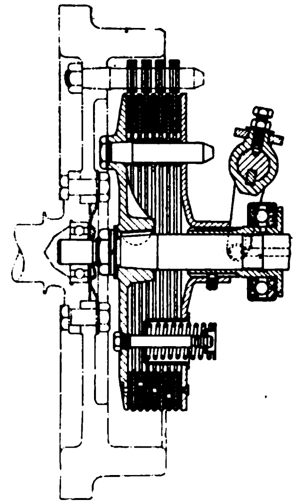


Fig. 19—The Hupmobile clutch.

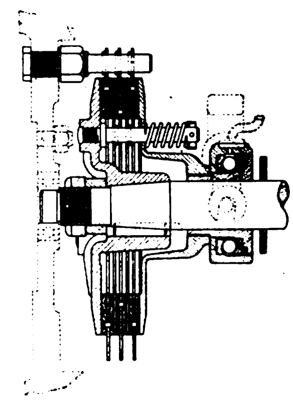


Fig. 20—The Detlaff clutch

bears, in or out of the conical housing. The bronze driven member apparently wears so little that no other adjustment is required.

A variation of what is essentially a single disk type of clutch is shown in Fig. 17. This is known as the Twin Disk clutch and has a pair of driven but only one driving plate, thus reversing the usual single plate arrangement and materially increasing the weight and inertia of the driven member. No engaging springs are used in the clutch. It is of the locking toggle type and consequently must be positively engaged and disengaged. For this reason it is not suited to or intended for use on automobiles or trucks, but can be used in some tractor applications. It is adjusted easily by disengaging the spring retained pin projecting from the threaded toggle carrier ring, and then turning this ring until the pin falls into another hole on the driven member.

The Multiple Disk Type

The multiple disk clutch is regarded by many American engineers as the best of all types for both passenger car and truck service, as is evidenced by the fact that it is used on nearly all of the more expensive cars produced here. This type of clutch has apparently been developed to a higher degree here than in Europe, while these other types, as previously pointed out, have seen the greater development. Partly for this reason, the multiple disk type is not used widely either in Great Britain or in Continental Europe, although some car builders there use it with evident satisfaction. The multiple disk type of clutch in most forms is more expensive to manufacture than other types, hence, its use has been more general in the higher priced cars. It is used, however, in many low or moderate priced cars, in the Ford and the Dodge cars for example, and is not inherently expensive to produce.

The earlier types of multiple disk clutch were of the metal-to-metal variety and used either all hardened steel disks or alternate disks of steel and bronze, or steel and copper. Some clutches of this type are still used, such as the Vauxhall, which is shown in Fig. 18. With this construction it is necessary for the clutch to run in oil. This permits a smooth engagement but the use of oil results in more or less trouble, for satisfactory operation of this variety of multiple disk clutch depends upon having both the correct viscosity and the proper quantity of lubricant. Too much or too viscous lubricant will tend to prevent proper engagement and consequently cause slipping, and will tend also to make adjoining disks adhere when disengagement is required, thus causing the clutch to drag and render gear changing difficult. Lubricant which is of too low a viscosity or is present in too small a quantity is apt to result in grabbing or cutting of the plates.

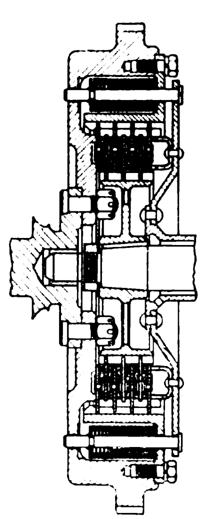


Fig. 21—The clutch used on the Packard single-six car

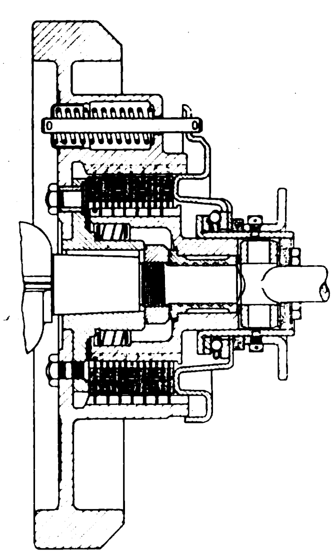


Fig. 22—The clutch which is used on the Reo passenger car

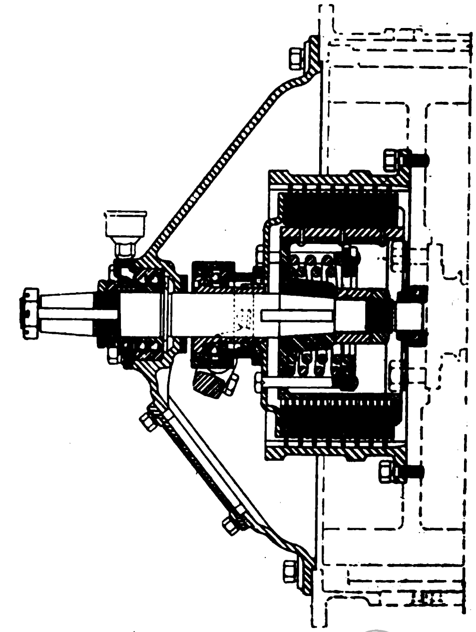


Fig. 23—The G. M. C. truck clutch

When oil is used the coefficient of friction is, of course, very much reduced, and in consequence many more plates are necessary for a given pressure and diameter to carry a given torque than when dry disks are employed. In consequence, the clutch which runs in oil is, for the same capacity, usually more expensive and heavier than the dry multiple disk type. For these reasons a great majority of the multiple disk clutches used to-day have disks of steel, with alternate disks faced with asbestos composition; these disks run dry, and are frequently not enclosed. Clutches of this type prove highly satisfactory in service when well constructed and properly proportioned. They are smooth in engagement, require practically no attention throughout the life of the facings, which last, as a rule, from 20,000 to 50,000 or more miles of car operation, and then are replaced easily. This type of clutch is compact and, since the driven members are light and of small diameter, gear changing is facilitated. While the number of parts used is greater than in other types, most of these are duplicate stampings, easily and cheaply made; hence, the cost of production need not be high and the clutch is readily made in a self contained easily removable unit. The large friction surface obtainable in multiple disk construction makes for long life, and the large number of surfaces permits the use of relatively light spring pressures and consequent easy action. In some cases fairly heavy springs and a small number of disks are employed without apparent advantage, except perhaps in the matter of cast.

Two distinct classes of multiple disk clutch are recognized in the American trade; the pin type, in which the drive or torque is taken through pins attached to the driving and driven members, and the gear tooth or key type, in which gear teeth, keys or their equivalent take the drive. The Hupmobile clutch shown in Fig. 19 and the Detlaff clutch illustrated in Fig. 20 are examples of the pin type. The Detlaff company makes also a gear type that is not shown here. It will be noted that the driving disks engage with driving pins, usually three in number, attached to the flywheel, while the driven disks engage with similar pins carried on the rear driven member which is, in turn, keyed or splined to the driven shaft connected to the transmission. In the Detlaff clutch the driven pins also carry the engaging springs, but in the Hupmobile design the springs are on separate pins, making a more compact layout, but adding extra parts. The friction facings in one case are riveted to the driving plates; in the

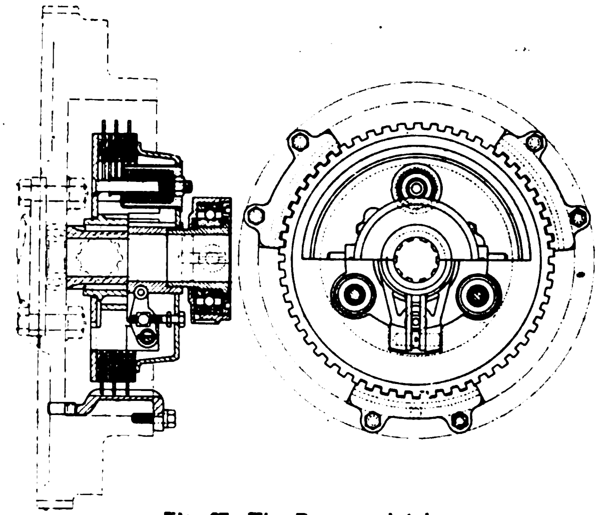


Fig. 27—The Browne clutch

other they are riveted to the driven plates, adding, it would seem, unnecessary weight to the driven unit. In most if not all cases the pin type of construction is less expensive and probably somewhat lighter than the gear or disk type, but it has one rather serious disadvantage as ordinarily constructed; it is apt to become noisy when wear takes place, because the holes in the disks through which the driving and driven pins pass cannot be made to fit the pins tightly, owing to the fact that the disks must be free to slide upon the pins and that the disks must be free to expand under heat, and consequently must have sufficient clearance to allow this expansion. Since the hole is either somewhat elongated or of larger diameter than the pin, only line contact between the two is possible without deformation or wear. Since the disks are relatively thin and the pressure due to torque is considerable, wear does take place and chattering frequently results when the clutch is disengaged.

Efforts to minimize wear are frequently made by providing larger bearing surface. This is done in the Detlaff design by punching the holes with a lip turned outward. In the Hupmobile clutch bushings are attached to the disks at the driving pin holes, but none are provided at the driven pin holes where, of course, the torque and pressure are greater. However, so long as round pins are employed, only line contact is theoretically possible. In some cases more than three pins are used, increasing the number

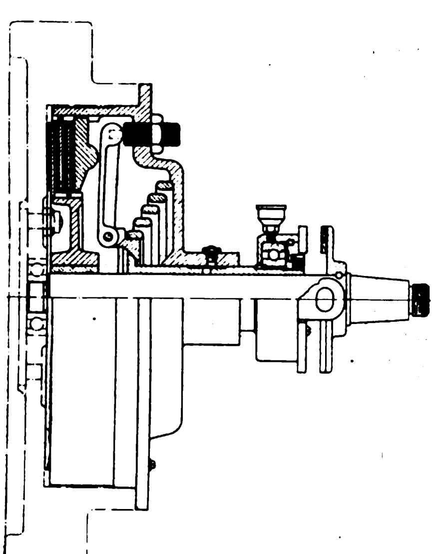


Fig. 24—The Hilliard clutch

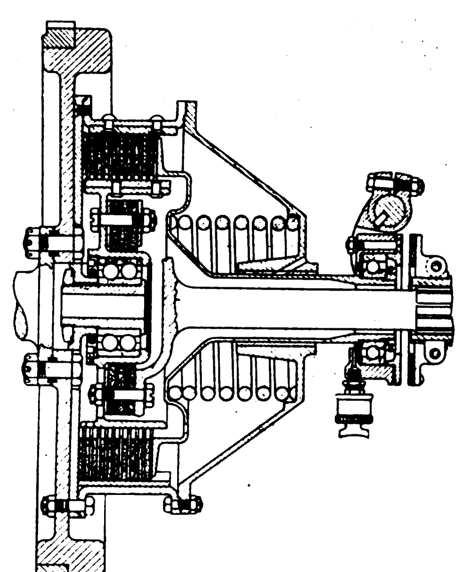


Fig. 25—The Locomobile clutch

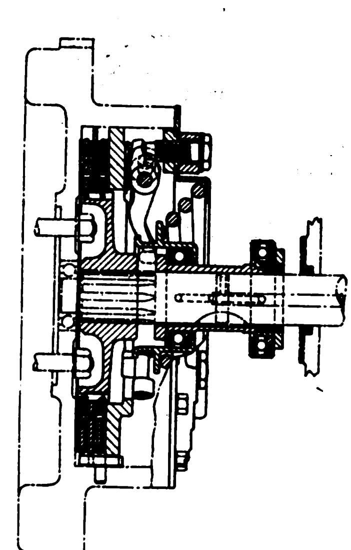


Fig. 26—The Merchant & Evans clutch

and total area of contact surfaces between pins and disks.

The gear or key type clutch goes another step further in this direction by increasing the number and area of the contact surfaces still more. Examples of the gear type of construction are the Packard, shown in Fig. 21; the Reo, in Fig. 22; G.M.C., in Fig. 23; and the Hilliard, in Fig. 24. The Locomobile clutch shown in Fig. 25 is an example of the key type, while the Merchant & Evans clutch in Fig. 26 is a combination of gear and key construction. The Browne clutch shown in Fig. 27 uses a straight side tooth on the driving disk, while the driven disks bear on substantial cast lugs. In clutches of these types an external driving ring, which can be an integral part of the flywheel, and an internal driven drum generally are employed. As a rule, the ring has either internal teeth cut therein or keys usually secured to its internal surface by rivets. The driving plates are formed to mesh with the ring teeth or keys, with sufficient clearance to slide freely in an axial direction. The drum has teeth or keys cut in or attached to its external surface, and these teeth, meshing with corresponding teeth or recesses in the driven plates, transmit the torque to the driven shaft to which the drum is splined or keyed.

The disks will bear equally on each tooth when well cut gear teeth are employed, thus reducing the unit pressure and wear as compared with the pin type. In the key type each key will bear equally over the full area of the notched surface of the disk, when properly made. Since the number of bearing surfaces can be made large, the aggregate surface is considerable and the unit pressure is much decreased relatively. In the Browne clutch shown in Fig. 27 the key type construction is carried a step further without using keys. The driving plates have straight side teeth which mesh with similar teeth broached in three separate gear segments attached to a standard S. A. E. flywheel rim, while driven plates have a large bearing surface on flat faced lugs cast integrally with the driven spider. The segments are stampings easily and cheaply produced in quantity; their use makes it unnecessary to use an expensive ring gear with internally cut teeth. Both the gear and the key types are apt to be less noisy than the pin type, but in general they are more expensive and are therefore used, as a rule, only on the more expensive and higher powered cars and trucks. They are better suited than the pin type to carrying a large number of plates and usually are able to transmit a higher torque. It will be noted that practice varies considerably in respect to the number of disks employed, the method of applying spring pressure and the location of the springs.

Since the torque capacity of any plate or disk clutch is directly proportional to the product of the number of surfaces between driving and driven members, the total pressure on the surfaces and the mean radius of the surfaces, it is evident that, for a given torque and mean diameter of clutch, the greater the number of disks is, the less is the pressure required and the less wear there is on the facings; the reverse also is true. The Merchant & Evans Co., which makes the clutch shown in Fig. 26, advocates the use of a small number of disks and therefore employs relatively heavy pressure. To get this without excessive pedal pressure, resort is had to levers that multiply the spring pressure. In so doing, a construction is employed similar to that used in the Borg & Beck and in the Hoosier plate designs shown in Figs. 14 and 15. In fact, the clutch shown in Fig. 26 might be termed a two plate type and is subject to the same disadvantages cited in connection with Figs. 15 and 16, since it requires an extra bearing and relative frequency of adjustment, but for the same diameter it has a larger wearing surface than the two types with which it is compared.

The other multiple disk clutches shown employ a large number of disks and, with the exception of the Hilliard clutch, which in some cases runs in oil and uses multiplied spring pressures, have direct acting springs giving lower total pressures on the friction surface than other types. In the G. M. C. truck clutch shown in Fig. 23, two centrally located springs are employed. In this case the outer end of the clutch shaft is carried in a ball bearing supported by a bell housing attached to the crankcase. This latter is conventional American practice where a separately mounted amidship transmission is used.

The Locomobile clutch shown in Fig. 25 is unconventional in that the double row ball pilot bearing is carried on a spigot extending from the flywheel, whereas this bearing is usually recessed within the flywheel, and in that it incorporates within the clutch a fabric universal joint. From this joint the driven shaft extends through a tubular extension of the pressure plate, but does not touch the latter. No bell housing is necessary in this case, although a separate amidship transmission is used. A single central spring is employed. Another rather unconventional construction which incorporates a universal joint as a part of the clutch unit is that of the Reo clutch shown in Fig. 22, in which the crankshaft is extended well beyond the clutch where a plain pilot bearing supports a block type universal at the end of the shaft connecting clutch and transmission. The ball thrust throw-out bearing is placed between the driving pressure plate and the driven throw-out collar, no other bearing being required between the two. Pressure is applied by three springs carried within the flywheel and equally spaced around the circumference of the pressure plate. There are six driven plates and only a relatively light spring pressure should be required.

The clutch used in the latest model of Packard passenger car is shown in Fig. 21. This is of the more or less conventional design used in connection with unit power plants. There are but three driven plates; hence, heavier spring pressure is required than would be necessary with more plates and the same torque. This pressure is supplied by four springs carried between the driven drum and the flywheel. An external multiplying linkage is employed between the clutch and the pedal to decrease the pedal pressure required to disengage the clutch. A plain pilot bushing is used within the crankshaft flange. The Browne clutch shown in Fig. 27 is one of the most recent designs of multiple disk clutch. While it deviates but little from conventional practice it incorporates several refinements in detail which indicate thorough appreciation of the problems involved both in use and in manufacture. For example, multiplying levers are used to decrease the throw-out pressure, which makes for light pedal pressures without external multiplying linkage, but the springs are direct acting and proportioned so as to require no adjustment during the life of the facings. The springs are contained within a pressed metal cup and carried on a thin metal tube which is turned over at its ends to prevent the spring from attaining its free length when the spring bolt nut is removed. The length of the tube is such as to enable the nut to catch a few threads on the bolt before seating on the spring. This greatly facilitates assembling, especially when the clutch is dismantled in a repair shop for the renewal of facings.

Adjustment is seldom required in the multiple disk type of clutch with direct acting springs, and then is made usually by turning up the nuts on the spring bolts. In the Browne clutch another and very convenient adjustment is provided. The multiplying throw-out levers each carry a threaded bolt with two heads. The outer head projects through a slot in the cover plate, and is adjusted to bear on the plate. The inner head bears on the inner surface of the cover plate when the clutch is disengaged.

As wear takes place in the friction disks the plate moves inward, leaving the bolt heads projecting above the surface. When they are seen to project about 3/16 in., they are simply screwed in until they again bear on the plate and the clutch is then again in adjustment. Such adjustment is required only once or twice during the life of the facings. Allowing all the bolt heads to bear on the plate assures uniform adjustment of the levers.

The Band-and-Shoe Types

Since band-and-shoe types of clutch are little used in automobile and truck applications, no special effort has been made to collect designs of this character, but one of the shoe type known as the Pfeiffer clutch is shown in Fig. 28. This consists of two semicircular shoes covered with asbestos fabric and arranged to engage the inner surface of the flywheel rim under influence of the spring and toggle mechanism shown. The action is somewhat similar to that of an internal expanding brake. The friction surface is fairly large and, since it is disposed at a rather large radius, the clutch should have high torque capacity with the multiplying linkage shown, even though the spring used be light. The weight and inertia of the driven member are considerable, however, and therefore gear changing will not be facilitated, while somewhat frequent adjustment of the toggles would doubtless be necessary on account of the large multiplication of pressure employed. Clutches somewhat similar to external band brakes have also been used in automotive vehicles, but these are seldom seen to-day and are therefore not described.

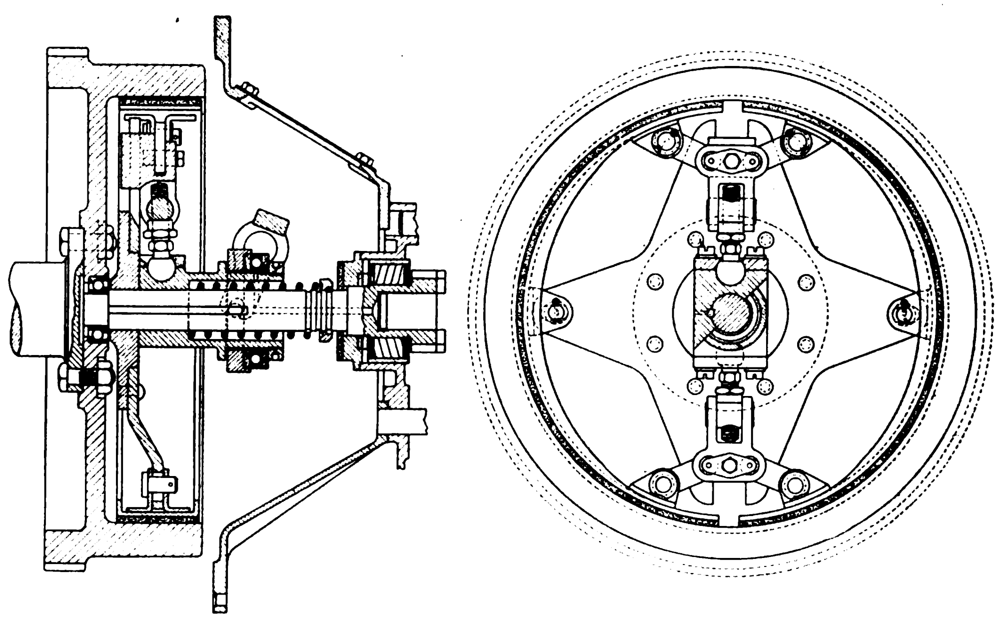


Fig. 28—The Pfeiffer shoe type clutch

Details of Design

All clutches require some type of bearing which will take the thrust imposed by the throw-out mechanism in disengaging. Ball thrust bearings are frequently employed. These are relatively cheap and give satisfaction when not required to carry radial as well as thrust loads, especially if the construction is such that they run only when the clutch is disengaged. When radial loads are imposed, either radial or angular contact ball bearings are usually employed. These types are somewhat more expensive than the straight thrust type, but are much better suited to carry radial loads; in fact, the straight thrust type is seldom recommended, although it is sometimes used when the radial load is light. It is then apt to become noisy and wear eccentric grooves.

When the thrust bearing is enclosed by a casing which is held against rotation by trunnion pins bearing upon the throw-out lever, which is a construction that is employed frequently, the bearing runs continually when the clutch is engaged and the engine is turning over. Although the load under these conditions is light, the continual running, frequently at high speed, inevitably causes wear, even though lubrication is facilitated with this construction. A design preferred by many engineers is that in which the bearing does not run continuously. The throw-out levers or ring are arranged to clear the thrust bearing except during the periods of disengagement, which are relatively very short as compared to the periods of engagement. When so arranged the bearing wears longer if properly lubricated, and even then requires but little lubricant. In fact, it is generally enclosed and packed with light grease which lasts in numerous cases for many months or even years of operation. In unit powerplants whose service is heavy and continuous, provision is sometimes made for lubrication by oil from the transmission by using a hollow clutch shaft drilled at a point near the bearing. If desired, the pilot bearing can be lubricated in similar fashion, but means to prevent excess oil from reaching the clutch facings are necessary; otherwise, in the dry type of clutch, slipping will occur. The pilot bearing, usually carried in a recess in the flywheel or crankshaft flange, is frequently of the radial ball type, but plain or oilless bushings are often used. The pilot bearing requires little lubrication, but is sometimes lubricated by oil seepage from a porous wicking plug, one end of which is supplied with oil under pressure in the hollow crankshaft of the engine. The driven members of some clutches, especially those of the cone type, are carried on spigots or extensions of the crankshaft. Usually, they have plain bushes, but ball bearings are used in some cases.

It is customary to provide a clutch brake to reduce the speed of rotation of the driven clutch members on disengagement and facilitate gear changing. This is usually in the form of a disk of small diameter arranged to bear on a flange or collar attached to the throw-out sleeve, and in general is made of fiber or asbestos composition. The brake disk is fastened to the gearbox as a rule, in the case of unit powerplants, or to the bell housing when a separate gearset is employed, but it is sometimes allowed to float on the clutch shaft between the thrust bearing and some flatfaced stationary member. The clutch brake is of course more important with clutches having heavy driven members with considerable inertia than with lighter driven members, and is not essential in some types, especially the multiple disk type in which the floating driven members are light and of small diameter and decelerate rapidly, due perhaps to a degree of dragging which is not, however, sufficient to cause the difficulties which a more positive dragging incurs. In plate and disk clutches it is necessary to provide means whereby the driven members shall be free to float in an axial direction on disengagement, even after some wear takes place. In some designs small relief springs are arranged to give more positive disengagement, but these are not essential except perhaps in some designs in which plate or disk runs in oil, which may cause adhesion under certain conditions.

Table of Specifications of Various Clutches

Figure Number	Name, Model and Nationality of Car, Truck or Clutch[4]	Number of Cylinders Bore and Stroke, in.	Maximum Engine Torque, lb.-ft.	Dry or in Oil	Facing Material[7]	Maximum Diameter of Facing, in.	Minimum Diameter of Facing, in.	Width of Friction Face, in.	Angle of Cone, deg.	Area of each Friction Face, sq. in.[8]	Number of Wearing Faces of Friction Material	Total Area of Wearing Faces of Friction Material sq. in.[8]	Mean Radius of Friction Face, in.[9]	No. of Driving Members[10]	No. of Driven Members[11]	Number of Springs[12]	Total Spring Pressure, lb.[13]	Total Pressure on Friction Face, lb.[14]	Pressure per Sq. In. of Friction Surface, lb.[14]	Torque Capacity of Clutch when New, lb.-ft.[15]	Ratio of Maximum Torque Capacity of Clutch to Maximum Torque of Engine	Pedal Pressure Required to Disengage, lb.[18]	Drive Taken by[19]	Are Multiplying Levers or Toggles Used?[20]	Means of Adjustment[21]
	Cone Type																								
4	Clement Talbot, 15 Hp. (E)	4-3 1/8x5 1/8	.....	Dry	Fabric	12 7/8	11.82	2.28	11	88.00	1	88.00	6.17	1	1	1	400	2,100	23.90	......	......	....	Univ.	No	None
..	Clement Talbot, 25 Hp. (E)	4-4 x5 1/8	.....	Dry	Fabric	14 9/16	13 3/8	2.28	11	101.00	1	101.00	6.98	1	1	1	500	2,630	26.00	......	......	....	Univ.	No	None
..	Commer, 2 Ton (E)	4-4 x4 3/4	.....	Dry	Leather	15 1/2	14 1/2	2.00	14	117.70	1	117.70	7 1/2	1	1	1	130	537	4.60	126	......	24	....	No	Spring Bolts
..	Commer, 3 1/2-5 Ton (E)	4-4 1/2x5 1/2	.....	Dry	Leather	17 1/8	16 1/8	2 1/2	11	130.60	1	130.60	8 5/16	1	1	1	220	1,160	8.90	220	......	40	Univ.	No	Spring Bolts
..	Dennis, 3-4 Ton (E)	4-4 1/8x5 11/16	.....	Dry	Fabric	17 3/8	15 7/8	3 1/2	12	183.00	1	183.00	8 5/16	1	1	(3)	285	1,380	7.50	208	......	58	Univ.	No	Spring Bolts
..	Guy, (P) 20 Hp. (E)	8-2 11/16x4 11/16	.....	Dry	Fabric	15 3/8	14 3/8	2 3/8	12	111.00	1	111.00	7 1/16	1	1	(4)	160	770	6.90	......	......	35	Univ.	No	Spring Bolts
..	Guy, 2 1/2 Ton (E)	4-4 x5 1/2	.....	Dry	Fabric	17 1/16	15 7/8	2 1/2	16	130.60	1	130.60	8.30	1	1	(4)	160	580	4.50	......	......	60	....	No	Spring Bolts
..	Hartford, (C) (A)		.....	Dry	Leather	15 3/4	14 5/8	2 5/8	12 1/2	125.00	1	125.00	7 11/32	1	1	1	225 to 350	1,040 to 1,620	8.30 to 12.90	......	......	....	Univ.	No	Adj. Spring
3	Humber, 10 Hp. (E)	4-2 9/16x4 3/4	.....	Oil	Leather	9 7/8	9 7/16	1.77	14	55.50	1	55.50	4.83	1	1	1	280	1,155	21.00	50	......	30	Keys	No	Spring Nut
..	Humber, 16 Hp. (E)	4-3 1/8x5 1/2	.....	Oil	Leather	11.82	11 1/4	1.58	14	57.20	1	57.20	5 11/32	1	1	1	245	1,015	17.70	92	......	30	Univ.	No	....
..	Maudesley, 3 Ton (E)	4-4 1/2x5	.....	Dry	Leather	19 7/8	18 3/4	2 9/16	12 1/2	155.00	1	155.00	9 11/32	1	1	1	600	2,775	17.90	......	......	25	Univ.	No	None
..	Oakland, (P) (A)	6-2 11/16x4 3/4	.....	Dry	Leather	12 9/16	......	1 1/2	11	57.00	1	57.00	6.00	1	1	(4)	260	1,370	24.00	137	1.3	15	....	No	None
..	Sunbeam, 16 Hp. (E)	4-3 1/8x5 11/16	.....	Dry	Leather	14 1/8	13 1/16	2 3/8	12	101.00	1	101.00	6.80	1	1	(4)	300	1,450	14.40	100	......	50	Univ.	No	Spring Bolts
5	Thornycroft, 3 Ton (E)	4-4 1/2x6	.....	Dry	Fabric	18 7/8	17 5/8	3.00	10	172.20	1	172.20	8 9/16	1	1	2	300	1,730	10.00	375	......	18	Univ.	No	None
..	Vulcan, 16 Hp. (E)	4-3 1/8x5 1/8	.....	Dry	Fabric	14 3/4	13 3/8	2 3/4	15	121.50	1	121.50	7.03	1	1	(3)	290	1,120	9.30	186	......	40	Univ.	No	Spring Bolts
	Single Plate Type																								
13	Arrol Johnston (E)	4-3 1/8x4 3/4	.....	Dry	Fabric	8 3/8	4 11/16	1 21/32	....	37.80	4	151.20	3.26	2	1	3	900	900	23.80	100	......	60	Splines	Yes	Spring Caps
12	Austin, 20 Hp. (E)	4-3 3/4x5	.....	Dry	Fabric	11 7/8	8 1/2	1 11/16	....	54.00	2	108.00	5 3/16	2	1	3	900	900	16.70	....	......	28	Splines	Yes	None
6	Autocar, XXI-F (T) (A)	2-4 3/4x4 1/2	90	Dry	Molded	12 3/4	9 1/2	1 5/8	....	56.80	2	113.60	5 9/16	2	1	8	800	800	14.10	187.5	2.08	50	Keys and Gear Teeth	Yes	Screws on Levers
..	Autocar, XXVI-Y (T) (A)	4-4 1/4x5 1/2	185	Dry	Molded	12 3/4	9 1/2	1 5/8	....	56.80	2	113.60	5 9/16	2	1	8	1,440	1,440	25.30	338	1.83	50	Keys and Gear Teeth	Yes	Screws on Levers
..	Borg & Beck, M (C) (A)	....	.....	Dry	Fabric	7 3/4	5 1/4	1 1/4	....	25.00	4	100.00	3 1/4	2	1	1	225 to 325	.....	80 to 110	80 to 100	......	....	Keys and Splines	Yes	Rotation of Toggle Mounting Ring
..	Borg & Beck, DX (C)(A)	....	.....	Dry	Fabric	9 5/8	6 3/4	1 1/2	....	38.00	4	152.00	4 1/16	2	1	1	225 to 325	.....	50 to 70	120 to 170	......	....	Keys and Splines	Yes	Rotation of Toggle Mounting Ring
..	Borg & Beck, GX (C)(A)	....	.....	Dry	Fabric	11 3/4	8 1/4	1 11/16	....	52.00	4	208.00	4 13/16	2	1	1	225 to 375	.....	35 to 55	150 to 240	......	....	Keys and Splines	Yes	Rotation of Toggle Mounting Ring
..	Borg & Beck, RGX (C)(A)	....	.....	Dry	Fabric	11 7/8	7 1/4	2 1/4	....	67.00	4	268.00	4 3/4	2	1	1	225 to 375	.....	25 to 40	150 to 240	......	....	Keys and Splines	Yes	Rotation of Toggle Mounting Ring
14	Borg & Beck, JX (C) (A)	....	.....	Dry	Fabric	13 7/8	7 3/4	3	....	101.00	4	404.00	5 3/8	2	1	1	225 to 375	.....	20 to 30	210 to 310	......	....	Keys and Splines		Rotation of Toggle Mounting Ring
9	Bristol, 4 Ton (E)	4-4 1/2x3 3/4	.....	Dry	....	11 3/8	8 1/4	1 9/16	....	48.16	2	96.32	4 29/32	2	1	(3)	1,000	1,000	20.70	....	......	35	Spline	Yes	Screw on Toggle Fulcrum
7	Dennis, 2 Ton (E)	4-4 1/8x5 11/16	.....	Dry	Fabric	13	8 1/16	2 9/32	....	76.83	2	153.66	5.36	2	1	(3)	1,236	1,236	8.90	16	......	64	Univ.	Yes	Screws on Toggle Levers
10	Halley, 3 1/2 Ton (E)	6-3 1/2x6	.....	Dry	Fabric	15 1/8	11 3/16	1 31/32	....	81.50	2	163.00	6.57	2	1	(3)	1,230	1,230	15.10	238	......	53	Spline	Yes	None
..	Hoosier, K1 (C) (A)	....	.....	Dry	M or F	7 13/16	5 1/16	1 3/4	....	25.00	4	100.00	3 5/16	2	1	1	400	.....	252.00 Max	120	......	....	Keys and Splines	Yes	Threaded Ring
15	Hoosier, K5 (C) (A)	....	.....	Dry	M or F	9 7/8	6 13/16	1 1/2	....	40.20	4	161.00	4.17	2	1	1	400	.....	60.00 Max	200	......	....	Keys and Splines	Yes	Threaded Ring
15	Hoosier, K6 (C) (A)	....	.....	Dry	M or F	11 7/8	8 1/8	1 3/4	....	58.90	4	236.00	5.00	2	1	1	400	.....	70.00 Max	300	......	....	Keys and Splines	Yes	Threaded Ring
..	Lauth, (C) (A)	....	.....	Dry	....	13 1/4	9 1/4	2	....	70.00	4	280.00	5 5/8	2	1	1	.....	.....	....	....	......	....	Keys and Splines	Yes	....
11	Mack, AC (T) (A)	4-5 x6	250	Dry	Fabric	19	13	3	....	151.00	2	302.00	8.00	2	1	9	1,035	1,035	6.90	....	......	....	Splines	Yes	None
8	Napier, 40-50 Hp. (E)	....	.....	Dry	....	10 1/16	6 13/16	1 3/4	....	47.80	4	191.20	4 11/32	2	1	(3)	.....	.....	....	....	......	....	Splines	Yes	Screws on Levers
16	Rover, 12 Hp. (E)	4-2 15/16x5 1/8	.....	Oil	Bronze	10 5/8	6 3/8	2 1/8	....	57.60	2	115.20	4 9/32	2	1	1	.....	1,740	30.20	90	......	30	Univ.	Yes	Spring Caps
17	Twin Disk, A (C) (A)	....	.....	Dry	Either	11 1/2	5 1/2	3	....	80.10	2	160.20	4 1/4	1	2	None	.....	.....	25 to35	456	1.83[17]	....	Pins	Yes	Threaded Lever Yoke
	Multiple Disk Type																								
27	Browne, (C) (A)	....	.....	Dry	Molded	7 7/8	6 1/8	7/8	....	19.20	6 to 14	115 to 268	3 1/2	3 to 7	4 to 8	3	450	450	23.40	275 to 640	1.67[17]	....	Teeth and Lugs	Yes	Screws in Levers
..	Detlaff, H (C) (A)	....	.....	Dry	M or F	8 3/8	6 1/2	15/16	....	22.00	6 to 18	132 to 396	3 21/32	3 to 9	4 to 10	3	300 to 375	300 to 375	14 to 17	249 to 747	2.50[17]	....	Gear Teeth	No	Spring Bolt
20	Detlaff, L & J (C) (A)	....	.....	Dry	M or F	7 7/8	5 3/8	1 1/4	....	26.00	6 or 8	156 to 208	3 5/16	3 or 4	4 or 5	3	300 to 375	300 to 375	11 1/2 to 14 1/2	225 to 300	2.50[17]	....	Pins	No	None
..	Essex, (P) (A)	4-3 3/8x5	.....	Oil	Cork	......	......	....	....	......	8	......	....	4	5	3	.....	.....	....	....	......	....	Pins and Gear Teeth	No	....
..	Fuller, GCL (C) (A)	....	.....	Dry	M or F	8	6	1	....	22.00	14	308.00	3.50	7	8	1	350	350	15.90	196	......	....	Pins	No	None
23	G. M. C., (T) (A)	4-4 1/2x6	203.0	Dry	Molded	8 3/8	6 1/4	1 1/16	....	14.50	16	232.00	3.66	8	9	2	320	320	22.00	....	......	33	Gear Teeth and Keys	No	None
24	Hilliard, XDA (C) (A)	....	.....	Either	Molded	10 3/4	6 3/4	2	....	55.00	4	220.00	4 3/8	3	2	1	380	1,900	34.50	630 or 787[16]	......	....	Gear Teeth	Yes	Screws on Cover Plate
..	Hilliard, S-6 (C) (A)	....	.....	Either	Molded	12	8	2	....	63.00	6	378.00	5.00	4	3	1	375	1,875	30.00	709 or 997[16]	......	....	Gear Teeth	Yes	Screws on Cover Plate
..	Hilliard, S-8 (C) (A)	....	.....	Either	Molded	12	8	2	....	63.00	8	504.00	5.00	5	4	1	375	1,875	30.00	1,155 or 1,418[16]	......	....	Gear Teeth	Yes	Screws on Cover Plate
..	Hoosier, K19 (C) (A)	....	.....	Either	M or F	7 1/8	5 3/8	7/8	....	17.00	4	68.00	3 1/8	3	2	1	400	.....	....	205	......	....	Keys and Splines	Yes	Threaded Ring
..	Hoosier, K20 (C) (A)	....	.....	Either	M or F	9	6 1/2	1 1/4	....	30.00	4	120.00	3 7/8	3	2	1	400	.....	....	300	......	....	Keys and Splines	Ye	Threaded Ring

Multiple Disk Type (Concluded)

Figure Number	Name, Model and Nationality of Car, Truck or Clutch[4]	Number of Cylinders Bore and Stroke, in.	Maximum Engine Torque, lb.-ft.	Dry or in Oil	Facing Material[7]	Maximum Diameter of Facing, in.	Minimum Diameter of Facing, in.	Width of Friction Face, in.	Angle of Cone, deg.	Area of each Friction Face, sq. in.[8]	Number of Wearing Faces of Friction Material	Total Area of Wearing Faces of Friction Material sq. in.[8]	Mean Radius of Friction Face, in.[9]	No. of Driving Members[10]	No. of Driven Members[11]	Number of Springs[12]	Total Spring Pressure, lb.[13]	Total Pressure on Friction Face, lb.[14]	Pressure per Sq. In. of Friction Surface, lb.[14]	Torque Capacity of Clutch when New, lb.-ft.[15]	Ratio of Maximum Torque Capacity of Clutch to Maximum Torque of Engine	Pedal Pressure Required to Disengage, lb.[18]	Drive Taken by[19]	Are Multiplying Levers or Toggles Used[20]	Means of Adjustment[21]
..	Hudson, (P) (A)	6-3½x5	.....	Oil	Cork	....	....	....	....	......	16	......	....	8	8	1	......	......	......	......	......	....	Pins and Gear Teeth	No	
19	Hupmobile, (P) (A)	4-3¼x5½	111.5	Dry	Fabric	9⅝	7⅜	1⅛	....	30.80	8	246.40	4¼	4	5	6	270	270	8.77	......	......	....	Pins	No	Notched Sprg Bolt
..	Lexington, (P) (A)	6-3¼x4½	.....			....	....	....	....	......	....	......	....	....	....	....	270	270	......	......	......	....	Gear Teeth	...	......
25	Locomobile, (P) (A)	6-4½x5½	283.0	Dry	Molded	10¾	8¼	1¼	....	37.30	10	373.00	4¾	5	5	1	285	285	7.64	356	1.28	....	Keys	No	None
..	Mack, AC (T) (A)	4-4 x5	133.0	Dry	Fabric	8 7/16	6¼	1 3/32	....	25.10	12	301.20	3.68	6	7	2	320 to 340	320 to 340	12.80 to 13.60	......	......	....	Keys and Gear Teeth	No	Spring Bolts
..	M. & E., 8U (C) (A)	....	.....	Dry	Fabric	7 3/16	5 3/16	1	....	19.50	4	78.00	3 3/32	2	2	1	100	468	24.00	280	......	....	Keys and Gear Teeth	Yes	Screws on Cover Plate
26	M. & E., 10U (C) (A)	....	.....	Dry	Fabric	9 3/16	6 5/16	1 7/16	....	35.00	4	140.00	3⅞	2	2	1	150	665	19.00	500	......	....	Keys and Gear Teeth	Yes	Screws on Cover Plate
..	M. & E., 12U (C) (A)	....	.....	Dry	Fabric	11 3/16	7 3/16	2	....	57.70	4	231.00	4 11/32	2	2	1	200	925	16.00	700	......	....	Keys and Gear Teeth	Yes	Screws on Cover Plate
..	M. & E., 12HD (C) (A)	....	.....	Dry	Fabric	11 3/16	7 3/16	2	....	57.70	6	346.00	4 11/32	3	3	1	250	1,096	19.00	1,000	......	....	Keys and Gear Teeth	Yes	Screws on Cover Plate
21	Packard, (P) Single 6 (A)	6-3⅜x4½	140.0	Dry	Molded	8	6	1	....	22.00	6	132.00	3½	4	3	8	400	400	18.20	......	......	20	Gear Teeth	No	Spring Bolts
..	Packard, (P) Twin 6 (A)	12-3 x5	238.0	Dry	Molded	8	6	1	....	22.00	12	264.00	3½	6	7	1	400	400	18.20	......	......	22	Keys	No	Spring Bolts
..	Packard, 2 Ton (T) (A)	4-4 3/16x5½	168.0	Dry	Molded	8	6	1	....	22.00	10	220.00	3½	5	6	1	490	490	22.30	......	......	25	Keys	No	None
..	Packard, 3-5 Ton (T) (A)	4-5 x5½	210.0[6]	Dry	Molded	8	6	1	....	22.00	14	308.00	3½	7	8	1	490	490	22.30	......	......	25	Keys	No	None
22	Reo, (P) (A)	6-3 3/16x5	238.0[6]	Dry	Fabric	6⅜	5⅛	....	....	13.84	13	180.00	2.94	7	6	3	240	240	17.30	......	......	....	Gear Teeth	No	None
18	Vauxhall, (P) (E)	4-3¾x5½	.....	Oil	Bronze	8½	7 7/16	11/32	....	13.34	22	294.00	3.98	11	12	1	90	90	6.70	150	......	17	Gear Teeth	No	None
..	Warner, K19 (C) (A)	....	.....	Dry	....	.....	.....	....	....	20.05	8 to 18	164 to 369	....	4 to 9	5 to 10	3	270 to 405	270 to 405	13.20 to 19.70	140 to 315	......	....	Gear Teeth	No	Spring Bolts

Shoe Type

Figure Number	Name	Bore and Stroke	Max. Torque	Dry or in Oil	Facing Material	Max. Diam.	Min. Diam.	Width	Angle	Area each Face	No. Wearing Faces	Total Area	Mean Radius	Driving Members	Driven Members	Springs	Total Spring Pressure	Total Pressure on Friction Face	Pressure per Sq. In.	Torque Capacity	Ratio	Pedal Pressure	Drive Taken by	Levers or Toggles	Means of Adjustment
..	Pfeiffer, (C) (A)	....	.....	Either	Fabric	13	13	2½	....	49.50	2	99.00	6.50	1	2	1	300	.....	......	......	......	....	Pins and Rivets	Yes	Lengthen Toggle

[4] (*A*)—American, (*C*) Clutch, (*E*)—English, (*P*)—Passenger Car and (*T*)—Truck.
[5] Figures are for 3-ton truck.
[6] Figures are for 5-ton truck.
[7] Bronze indicates bronze plate without facing material. *M*—Molded asbestos composition and *F*—Woven asbestos fabric.
[8] Areas given are computed from the diameter and width without any allowance for rivet holes or depressions for other holding devices.
[9] Figures given are the arithmetical mean radii.
[10] Figures given include the flywheel or members attached rigidly thereto, taken as one member when the friction face bears upon the flywheel or the rigidly connected member.
[11] Figures include only members which transmit torque directly from driving members; a driven member made up of two or more pieces is considered as one member, and driven members such as levers and throw-out sleeves which do not transmit torque *directly* from driving members are not included.
[12] Figures in parentheses are uncertain.
[13] When two figures are given, the clutch maker furnishes springs giving either pressure, or some intermediate pressure.
[14] Figures are presumed to be the maximum pressures when the clutch is new and properly adjusted. When toggles are used to multiply the spring pressure, any slight alteration in the position of the toggles, due to wear or lack of adjustment, can make marked variation in total or unit pressure.
[15] In some cases these figures indicate the actual or computed maximum torque capacity, and in others "safe" or "recommended" capacity. In some cases the manufacturer makes clutches of different capacity than the model listed, or will vary the capacity to suit conditions by a variation in the number of discs, friction material or spring pressure.
[16] The first figures are the capacity when arranged to run in oil and the others are the capacity when used dry.
[17] This figure corresponds to the manufacturer's recommendation. Other figures in this column are actual ratios employed presumably with the clutch new or in perfect adjustment.
[18] Figures in this column are the actual pressures used or reported used by the respective manufacturers.
[19] Univ.—Universal joint. In nearly all clutches the driven members, and in some types the driving members also, must be allowed a certain free axial motion upon release, and some member such as keys, splines, gear teeth or pins which transmit torque and at the same time allow axial motion are therefore provided and these members are listed in this column. The pin or block of the universal joint frequently performs this function, especially in the case of cone clutches.
[20] Data in this column refer to levers which rotate with and form a part of the clutch, and not to non-rotating throw-out levers external to the clutch.
[21] Data in this column refer to adjusting means within the clutch. External adjusting means are often provided but not referred to here.

Some details of spring construction have already been discussed, but a few items in this connection remain to be considered. The space allowed for springs and the desirability of compactness in design make it necessary in most cases to use rather short springs. These are often too stiff; that is, for a small change in length, the pressure change is considerable. The result is that wear on the friction surface decreases the pressure enough to cause slippage. This condition can often be bettered by a change of spring section and material without variation in overall dimensions or, in other words, by an intelligent design of the spring. In many cases the springs are mounted so that the decreased pressure occasioned by wear can be compensated by a simple adjustment but, with the direct acting spring, this adjustment is not necessary if the springs are designed properly and if the capacity of the clutch is correct in relation to maximum engine torque. When several springs are used it is desirable to have them of uniform strength and flexibility, adjusted to give equal pressure to prevent unequal wear and cocking or binding upon release, and with smooth action engagement, but reasonably satisfactory operation is sometimes obtained in spite of failure to comply closely with these general rules. Some clutch makers prefer a single centrally placed spring, claiming that it gives a more uniform pressure; but this is dependent upon other factors than the spring. This is indicated by the construction used in the Hilliard clutch shown in Fig. 24, wherein a spherical bearing-surface is provided between the pressure ring carrying the multiplying levers and the throw-out sleeve, with the intention of insuring equal pressure at each fulcrum point on the pressure plate. Multiple springs are often recessed within the flywheel or placed in pockets of pressed metal in the annular space between the disk facing and the hub. This gives a neat external appearance, reduces windage, facilitates enclosure and minimizes danger of injury when the clutch is turning.

It is not my intention to discuss the theory of clutch

design at length, but rather to comment briefly on certain simple basic factors which must be well understood before an intelligent design can be laid down. The maximum torque capacity of any clutch is given by the equation

$$T = PNrf$$

where

T = the maximum torque capacity in pound-feet
P = the total pressure on the friction surface in pounds
N = the number of engaging surfaces
r = the mean radius of the friction surface in feet
f = the coefficient of friction

Concerning the pressure factor, it is possible theoretically to build a clutch of any desired capacity by simply increasing the pressure on the friction surface, but there are practical limits beyond which it is impracticable to go. A 60-lb. pedal or throw-out pressure is about the maximum permissible, except perhaps in certain truck applications. For comfort in driving, 30 lb. is considered the permissible maximum pressure by some designers, while lighter pressures are desirable in cars intended for ladies' use. It is general practice among American car and transmission manufacturers to use a pedal measuring about 11 in. on the long arm and from 1½ to 2½ in. on the short arm which actuates the clutch. This gives an average leverage of 5.5 to 1. With this ratio and a maximum pedal pressure of 60 lb., the pressure on the short end would be 330 lb., but this pressure should preferably not exceed 165 lb. A compound reduction by links and levers or cams external to the clutch can be employed, but this involves extra parts which are not required otherwise. If direct acting clutch springs are to be employed, a pressure of 165 lb. is not sufficient to prevent slippage with the average engine unless the number of friction surfaces or the mean radius of the surface is increased unduly. Two alternatives are employed, so far as the clutch proper is concerned, (*a*) the use of levers to increase the pressure on the friction surface and (*b*) the use of wedging action to increase the pressure on the friction surface. The advantage and disadvantage of each method has been pointed out in the discussion of the various types of construction.

By reference to the illustrations and to Table 1 it will be seen that many clutch designs in which direct acting springs are employed involve the use of much greater total pressures than 165 or even 330 lb. To decrease the pressure required for disengagement, levers of various forms are incorporated within the clutch. This makes possible the use of a single plate or of fewer disks without involving the chief disadvantage of levers which multiply spring pressure. From the foregoing it will be seen that there are several methods of varying the factor P in the capacity formula and thus varying directly the clutch capacity, but it should be borne in mind however that, other things being equal, the wear on the friction face is proportional to the unit pressure on the surface; hence it is an advantage to keep the unit pressure low.

An inspection of the capacity formula shows immediately that the capacity of a clutch is directly proportional to the number of friction surfaces engaging. When floating disks are employed between driving and driven members, slip is divided between the two faces; hence, but one face is considered in determining the factor N in the formula of capacity. It is possible to double the capacity of a single plate clutch by simply adding a second plate and a friction ring. The advantage of the multiple disk type in this respect is obvious. In this type it is possible to adapt the same clutch to engines of different capacity readily by merely changing the number of plates. The number of plates used will determine, at least to some extent, the ease of engagement or how gradually the full load is picked up upon engagement of the clutch. Increasing the number of plates and decreasing the spring pressure increases the "softness" of engagement and facilitates starting without sudden shock or undue strain on the mechanism.

For practical purposes the mean radius of the friction surface can be taken as equal to one-half the sum of the maximum and minimum radii. The torque transmitted obviously increases as the distance from the center to the point of application of pressure increases, and in direct proportion to this distance; hence, a large clutch diameter is desirable so long as the inertia of the driven member is not too great. The maximum diameter is controlled, however, largely by the size of the flywheel and by the cost of construction, which increases considerably with size. For a given outside diameter of friction surface, the mean radius can be increased by using a narrow facing, especially on plate and disk clutches. Although this decreases the area of surface, practical experience has shown that, within certain limits, a narrower facing wears longer than a wide facing. This apparently is because of the greater uniformity of wear over the entire surface, due no doubt to the fact that the rubbing speed at the outer diameter of a wide annular surface is much greater than at the inner diameter.

Coefficient of Friction

Since by definition the coefficient of friction between two surfaces is the ratio obtained by dividing the force required to slide one surface over the other by the pressure on the surface, it is evident that, as applied to clutches, the coefficient is the ratio of the maximum torque each surface can carry to the total pressure on that surface. The coefficient varies greatly with the nature of the surface and its condition, especially with respect to lubrication. Between smooth metal surfaces wetted with oil, it is about 0.07. Woven asbestos fabric on smooth steel gives an average coefficient of about 0.3, but this varies considerably with wear, the temperature and the nature of the impregnating material used in the manufacture of the fabric. If the impregnating material contains paraffin or other substances which, under the influence of heat, act to some extent as lubricants, the coefficient will decrease as the temperature rises, so that a clutch which performs well when cool sometimes starts suddenly to slip when it has become heated by the slipping that always occurs on engagement. Frequently, repeated engagements such as occur when driving in traffic or careless handling during periods when the clutch is intentionally allowed to slip, sometimes raise the temperature to 500 deg. fahr. or higher; hence, the facing material must be capable of withstanding this temperature and the factor of safety as regards capacity should be sufficient to permit operation even with the reduced coefficient at high temperature. The friction coefficient of woven linings is known to vary through a wide range. One engineer who has made tests with woven facings reports coefficients varying from 0.27 to 0.38. It is considered good practice to use a clutch that has a normal torque capacity when new of 1.6 to 2 times the maximum torque of the engine, although some engineers state that smoother action results when the torque capacity of the clutch is only slightly in excess of that of the engine.

A clutch that will carry a given maximum torque indefinitely when once fully engaged will not always pick up this load without slipping for a relatively long period during which excessive heat is generated. One investigator states that experiment has shown, in the case of multiple-disk clutches at least, that a desirable softness of engagement is secured without undue heating by a clutch that will slip from 50 to 60 revolutions when suddenly assuming full load, and that this slip is obtained

when the maximum load carried averages 70 per cent of the total load that the clutch will carry without slip when fully engaged. Within the last two or three years, facings of molded asbestos composition have come to be used widely. They are said to have a friction coefficient of 0.5 and to be more durable than other facing materials. They are of uniform texture, can be made in quantity to close tolerances and do not require a joint secured with wire staples such as is generally employed with the woven fabric. It should be noted that the coefficient of friction is independent of the area of contact surface. For this reason a narrow facing under a given pressure will carry the same torque as a wide facing having the same mean radius, but the unit pressure will of course be greater on the narrower facing. This will tend to cause greater wear, but the wider surface, as pointed out, does not always wear longer because of the greater difference in speed at inner and outer diameters. The ideal condition in this respect is approached most closely by the use of a number of relatively narrow surfaces, thus giving a large total area, a consequent long life and a more gradual picking up of the load, without causing wide differences in speed between the various parts of the contact surface.

In Conclusion

From the foregoing analysis of factors entering into the capacity formula, it will be seen that torque capacity can be made to vary by changes in each of the four factors involved. In other words, the same torque can be obtained by a great number of combinations. The best combination is that which gives the longest life, requires the least attention, is the smoothest in engagement, has the lowest inertia and is the least expensive to manufacture. For passenger car use at least, the multiple disk type seems to fill best the greatest number of these conditions, but it is evident from the number of other types used that engineers are far from being agreed on this point. In this connection it is worthy of note that there is wide variation in multiple disk clutch design. When the price must be kept as low as possible, the number of plates is usually reduced to the minimum and the pressure on the discs is increased; but when the cost is secondary to the smoothest action on engagement, the number of plates is increased and the pressure reduced, at the same time prolonging the life of the facings by adding to the total wearing surface.

The data given in the table have been gathered from a variety of sources and no claim is made for their absolute accuracy. Many of the dimension figures were obtained by scaling blueprints and, consequently, they may vary slightly from the actual dimensions used. It will be seen, however, that practice varies so widely in many particulars that the comparisons afforded by the figures given are close enough for practical purposes. It is the hope and belief of the author that the data and drawings collected here will prove useful to engineers who are called upon to design clutches or to make a selection for a given purpose from among the various types of clutch available.

Some Production Problems Which Influence Design

(*Continued from page* 1260)

3. When pieces are to be chucked for turning, boring or threading operations it is an advantage to do as many operations as the machine will admit of doing without rechucking.

4. Close tolerances tend to increase production difficulties and slow down production.

5. Stampings and screw machine parts are in general the least expensive parts to make, providing the quantity is large enough to offset the cost of dies and machine set-up.

6. Die castings are in general cheaper than sand castings when the quantity is large enough to cover cost of dies and machine work is to be minimized.

7. In some instances it is cheaper to use, at a higher price per pound, a soft or more easily machined metal in place of a harder and slower machining metal—for example, aluminum in place of cast iron—for certain applications, because of greater ease and speed in machining.

8. Other things being equal, it is desirable to design a piece in such a way that the machine work can be completed with one setting in one machine.

9. It is sometimes cheaper in quantity production to purchase or build a special machine tool to do a given job than to attempt to adapt the design to existing tool equipment.

10. It is in general desirable to consider in design the adaptability of the piece to good and economical types of jigs and fixtures. Much expense can often be saved by providing suitable bosses or other locating points, or by changes in form which facilitate clamping in jigs, centering in chucks, etc.

11. Similar parts used for similar purposes can often be made identical by the exercise of reasonable ingenuity, with consequent saving in tool equipment, parts stock, material supplies, etc. Spring brackets used on the right and left side of the car, or for front and rear springs can often be made interchangeable instead of right and left.

12. Use of standard forms of fittings, such as clevices, bolts, etc., is nearly always economical, not only in first cost, but in securing ready interchangeability, use of standard tools, decrease in stock parts, etc.

13. In design the stresses imposed during manufacture of the piece must be considered, since distortion during machining or heat treatment may cause poor fit or rejection in assembly.

can be prevented by clamping or application of pressure during quenching or cooling operations.

When a new company is starting on the design of a car to be produced in quantity or is organizing for production in a large way of some important unit, the design may well be quite different from that which would be laid down for a company already in business with equipment that must be utilized for the purpose. In the former case equipment especially adapted for the most modern and rapid production methods can be purchased from stock makes or specially designed and built for the purpose, while in the latter case certain limitations are inevitable which may or may not prove a real handicap. The intensive and rapid development of machine tools in the past few years has, however, worked a revolution in production methods, so that the manufacturer whose equipment has not been kept up to date may well consider the relative advantage of continuing production with old equipment and retooling to enable him to realize the advantages of the most modern equipment. When the quantity warrants, even well-equipped manufacturers are in many cases designing and building or having built for them tools devised especially for rapid and accurate production of given parts. Such tools minimize labor and handling costs and insure more accurate work than might otherwise be secured only by more elaborate arrangements.

Fits, Tolerances and Heat Treatments Applied in Production

A valuable collection of data covering actual practice employed by many manufacturers in the production of all parts used in a heavy truck. The same fits, tolerances and heat treatments are applicable in the production of parts for passenger cars, light trucks and other automotive vehicles.

By C. T. Bates

THE data given in this article cover the practice employed in many plants in the production of parts for the Class B Military Truck developed for the United States Army by a committee of prominent American engineers. It will be recalled that the design incorporates many of the best points used in the design of American heavy duty trucks. **The data can, to a great extent, be applied to general automobile as well truck construction and should serve to give the industry practical information in relation to the various fits, clearances machining tolerances and heat treatments necessary to produce a machine thoroughly practical in every particular.**

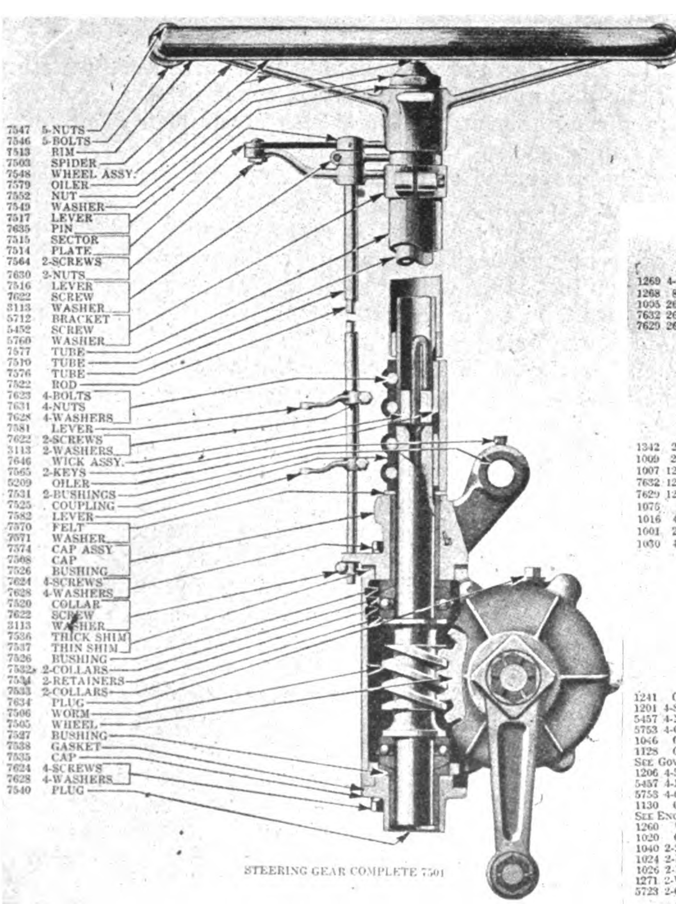
These data are the result of years of experience of many engineers and production men in this country and have been thoroughly proven by the production of thousands of trucks. They apply particularly to a truck of five tons capacity having a chassis weighing 8500 lb. and an engine developing 48 hp. at 1000 r.p.m.

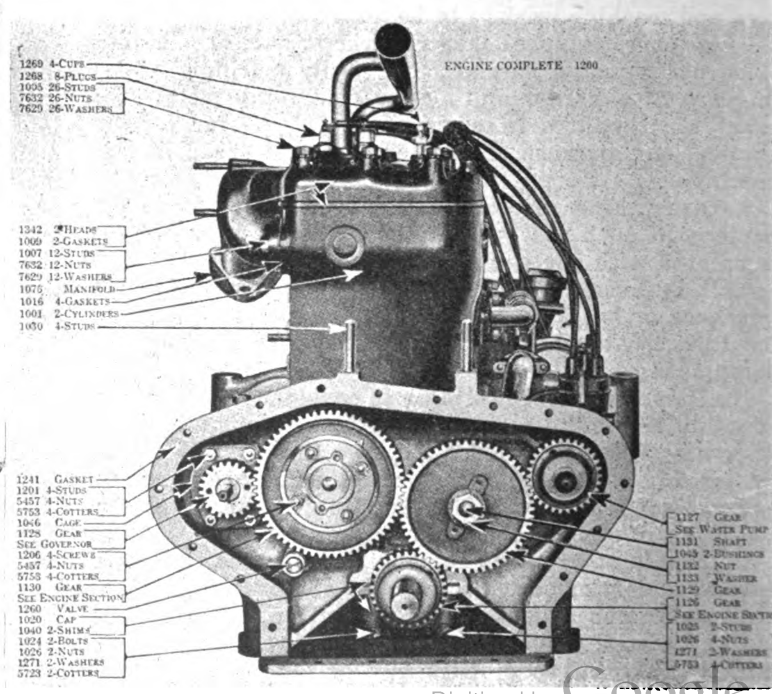
The machining limits in many cases are close, but it has been found in practice that the results obtained in the assembly and performance on the road more than make up for the slight extra cost involved in working to close limits. The material and heat treatments herein specified are such as to give the best results it has been found possible to obtain.

Engineers frequently desire to know what is practical in the way of material, heat treatment, machine limits and the various running or press fits for certain parts. Such information could heretofore often be obtained only by prolonged tests and experiments which frequently entailed serious delays and an expenditure of much money. The various books on the theory and design of automobiles, motor trucks and parts have given for the most part information of a general nature and have omitted much specific information which is essential to practical production in the shop. This article gives much data intended to fill this gap.

General Description of Truck Units

The following is a brief description of the various motor truck units to which these data relate.





STEERING GEAR DATA

7506—WORM

O. D., 2.515-2.510; P. D., 2.125
Left hand
Double thread, 29 deg.
Ratio 10½ to 1
Lead 1⅝
Angle 13 deg., 41 min. 35 sec. Pitch, .8125
Width of tool nose, 272
Root diameter, 1.651
Whole depth of tooth (4329 theoretical) (.429-.432 actual)
Addendum (.1961 theoretical) (.192-.195 actual)
Carbonize worm 1/32 of an inch deep to show 70-80 sclerescope, heat treat shank to show 30 minimum sclerescope sand blast after hardening.

7505—WORM WHEEL

Left hand
Ratio 10½ to 1
Number of teeth, 21
Throat diameter, actual, 5.808-5.798
Root diameter, 4.957
Curvature radius, .866
Face angle, 68 deg.
Circular pitch, .8125; pitch diameter, 5.431
Cutting angle, 13 deg. 41 min. 35 sec.
Whole depth of tooth, .433 theoretical; actual, .421-.426
Carbonize wheel 1/32 deep to show 75-90 sclerescope on top of teeth. Heat treat shank to show 30 minimum sclerescope, sand blast after hardening.
Sides of teeth to be file hard. Wormshaft taper end 1 inch taper per foot, Chamfered corners of same 1½ inch taper per foot.
Worm included angle 68 deg. (gear tooth)
Radius of tooth on P. D., 1.062; radius top of tooth, 1.023; radius centers, .177 apart. Center line of worm wheel to center-line of worm 3.778. (Gears). Center line of cases, 3.779-3.777

SPRING DATA

FRONT SPRING	REAR SPRING
Length, 44 in.	Length, 58 in.
Width, 3 in.	Width, 4 in.
Thickness of plates, 1st and 2nd. ⅜ in, bal. 5/16 in.	Thickness of plates, ⅜ in.
Number of plates, 12	Number of plates, 20
Deflection, 5⅜ in to 5 in. at 2600 lbs.	Deflection, 8½ in. to 9 in. at 5900 lbs.
Material, alloy spring steel	Material, alloy spring steel
Brinell, 364 to 444	Brinell, 364 to 444
Elastic limit min., 160,000 lbs.	Elastic limit min., 160,000 lbs.
Tensil in trans. test, 160,000 lbs.	Tensil in trans. test, 160,000 lbs.
Cold bend before fracture, 90 deg.	Cold bend before fracture, 90 deg.
C. L. to C. L. length full load allowance may be P. or M. ⅛, 1/16 each side of center bolt	C. L. to C. L. length full load allowance may be P. or M. ⅛, 1/16 each side of center bolt
Parallelism of eyes, double SAE required	Parallelism of eyes, double SAE required

ENGINE DATA

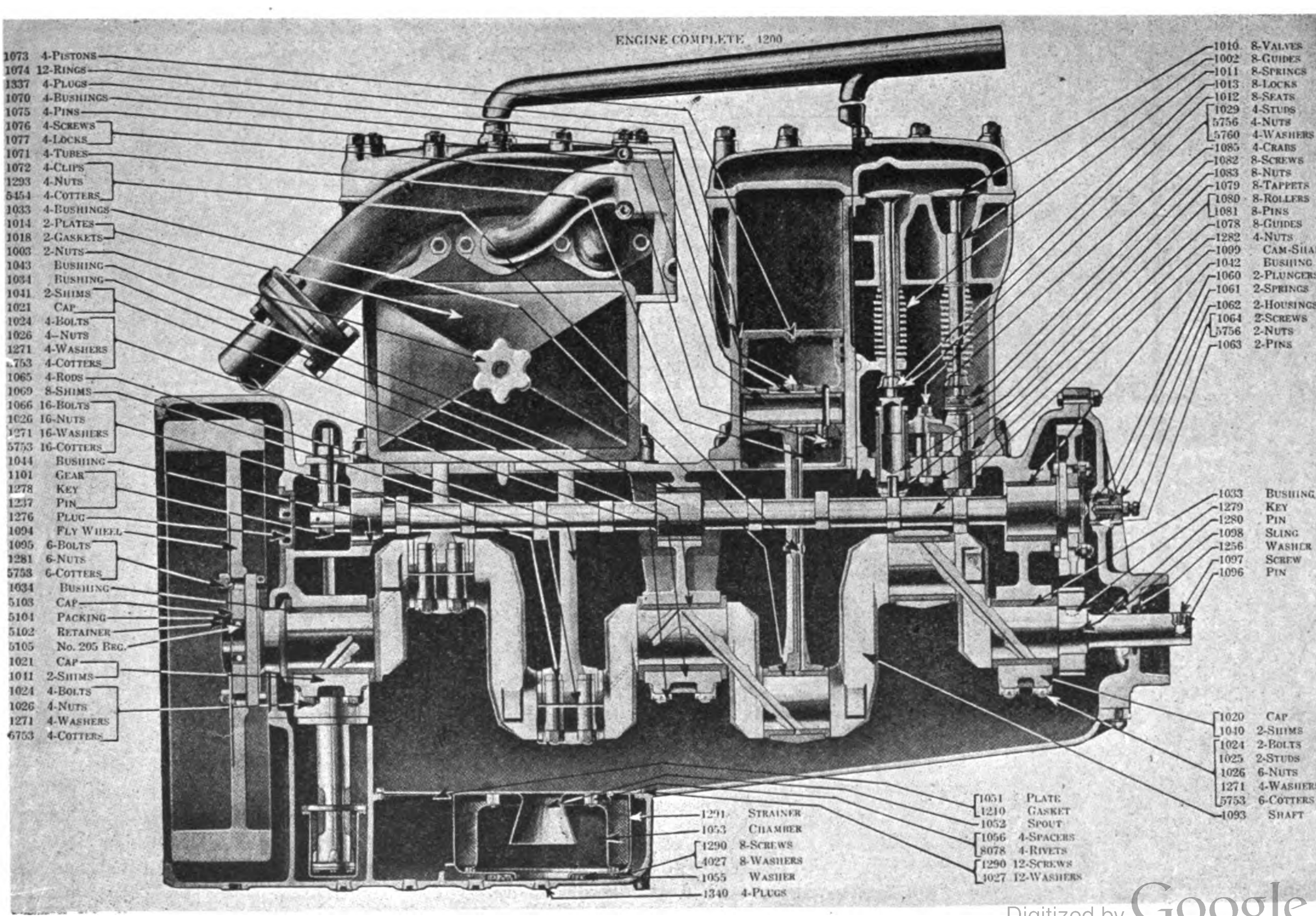
Valve Timing	Inlet	Exhaust
Open	Past top 15 deg.	Before bottom 45 deg.
Closes	Past bottom 35 deg.	Past top 5 deg.
Lift	11/32 in.	11/32 in.
Valve diameter O. D.	2⅜ in.	2⅜ in.
Seat angle	45 deg.	45 deg.
Exhaust or inlet throat diameter	2⅛ in.	2⅛ in.
Exhaust or inlet valve clear diameter	2⅛ in.	2⅛ in.
Base circle clearance	.005	.005
Tappet roller diameter	.9385-.9355	.9385-.9355

Hold "exhaust closes" and "inlet opens" to P. or M. ⅛ in. on flywheel.
Hold "exhaust opens" and "intake closes" to P. or M. ¾ in. on flywheel.
Scleroscope hardness, minimum minutes, 65-70 desired on cams. and bearings.
Material SAE 1020 carbon .15-25; manganese .040-.060; phosphorus .045; sulphur .05, case harden.

Cylinders parallel within .003.
Cylinders bore not over .001 excentric or .002 taper.
Cylinders hydrostatic test 60 lbs. cold finished with studs in place.
Cylinders wall thickness 3/16 in.
Cylinders water jacket 5/16 in.
Crankshaft and crank pin bearings tolerance for length between shoulders +.002 – .000 in.
Crank pin center to shoulder out of center ±.005 in.
Crankshaft allowance for grinding 1/32 in. on diameter.
Crankshaft forging allowance for finish ⅛ in. all around on finished surfaces.

TIMING GEAR DATA

O. D.	R. or L. H.	Teeth	P. D.	Cir. P.	Nor. Cir. P	Nor. Dia. P.	Ld. of Helix	Tl. Dpth. Tooth	Angle Tooth with Axis
3.972 3.970	Crankshaft L. H.	30	3.750	.3927	.3491	9	22.8742	.2397	27 deg. 15 min.
6.972 6.970	Idler gear R. H.	54	6.75	.3927	.3491	9	41.1735	.2397	27 deg. 15 min.
3.972 3.970	Pump and mag. gear L. H.	30	3.750	.3927	.3491	9	22.8742	.2397	27 deg. 15 min.
7.722 7.720	Camshaft gear L. H.	60	7.50	.3927	.3491	9	45.7484	.2397	27 deg. 15 min.
2.972 2.970	Generator gear R. H.	22	2.75	.3927	.3491	9	16.7744	.2397	27 deg. 15 min.



TRANSMISSION GEAR DATA

	Maximum Pitch Radius Not Over	Not Under	Out of True Limit (Con-cen-t'c'ty)	Sclero.	Brinnell	P. D.	No. of Tth.	Pitch	Type of Tooth	O. Dia.
5517	Main drive gear 1.899	1.892	.006	72-78	3-3.3 MM	3.800	19	5-7	20 deg. Inv.	4.080 4.085
5565	First speed sliding 4.399	4.390	.006	72-78	3-3.3 MM	8.800	44	5-7	20 deg. Inv.	9.030 9.035
5564	Second speed sliding 3.599	3.591	.006	72-78	3-3.3 MM	7.200	36	5-7	20 deg. Inv.	7.480 7.485
5562	Third and fourth sliding 2.699	2.692	.005	80-90	3-3.3 MM	5.400	27	5-7	20 deg. Inv.	5.680 5.685
5531	Countershaft drive gear 4.099	4.092	.005	80-90	3-3.3 MM	8.200	41	5-7	20 deg. Inv.	8.480 8.485
5533	Second speed countershaft gear 2.399	2.392	.005	80-90	3-3.3 MM	4.800	24	5-7	20 deg. Inv.	5.080 5.085
5532	Countershaft third speed gear 3.299	3.291	.006	80-90	3-3.3 MM	6.600	33	5-7	20 deg. Inv.	6.880 6.885
5591	Reverse idler gear (large) 2.399	2.392	.005	80-90	3-3.3 MM	4.800	24	5-7	20 deg. Inv.	5.080 5.085
5591	Reverse idler gear (small) 1.599	1.592	.005	80-90	3-3.3 MM	3.200	16	5-7	20 deg. Inv.	3.480 3.485

Transmission gear holes allowance for grinding, .010 in.
Transmission gear shaft allowance for grinding, .020-.025 in.
Transmission gear forgings allowance for finish $\frac{1}{16}$ in. all around.

WORM GEAR DATA

REAR AXLE

6224—WORM SHAFT
Threads, 4 R. H.
Linear pitch, 1.1562
Pitch diameter, 3.265
Lead, 4.625
Lead angle, 24 deg. 20 min.
Full depth of thread, .723
Addendum, .3352
Dedendum, .3878
Normal pitch, 1.0535
Pressure angle 30 deg.
Normal pressure angle 27 deg. 44 min.
Outside diameter (grind) 3.936-3.934
Angle between teeth, 60 deg.
Thickness of tooth at pitch diameter line .5781
Root diameter, 2.4894

Material, 3120 SAE
Carbonize $\frac{1}{4}$ deep heat treat to 1550 and quench draw to 700 (whole shaft)
Treatment from rear end to forward bearing shoulder, submerge in lead at 1400 and quench, draw to 350 deg.
Sclerescope from rear end to forward bearing shoulder 70 to 85
Sclerescope from forward bearing shoulder to front end 40 to 50.

6222—WORM WHEEL
No. teeth, 38 right hand
Pitch, 1.1562
Pitch diameter, 13.985
Throat diameter, 14.625
Lead, 4.625
Lead angle, 24 deg. 20 min.
Addendum, .3352
Dedendum, .3878
Normal pitch, 1.0535
Pressure angle, 30 deg.
Normal pressure angle, 27 deg. 44 min.
Make normal tooth thickness at pitch line .5355 to allow for back-lash
Make radius on points of hob teeth .084 and at root of teeth .168

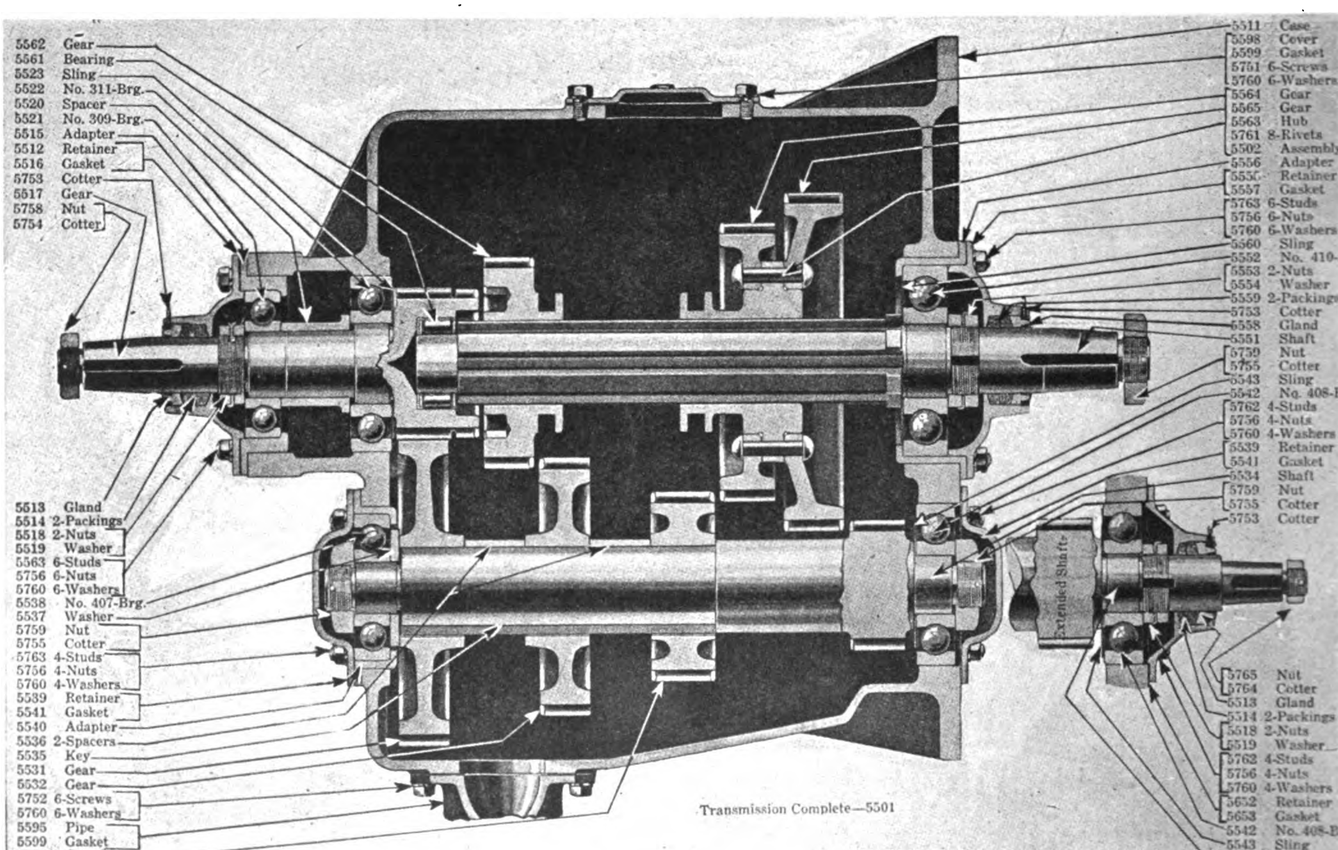
Material—make from best grade gear bronze. Tensile strength 35,000 to 40,000 at least. Copper 89; tin 11. Brinell 70 to 95. Chill castings.

6208—GEAR AND CASE CENTERS
Carrier centers 8.627-8.623
Worm and worm wheel centers, 8.625

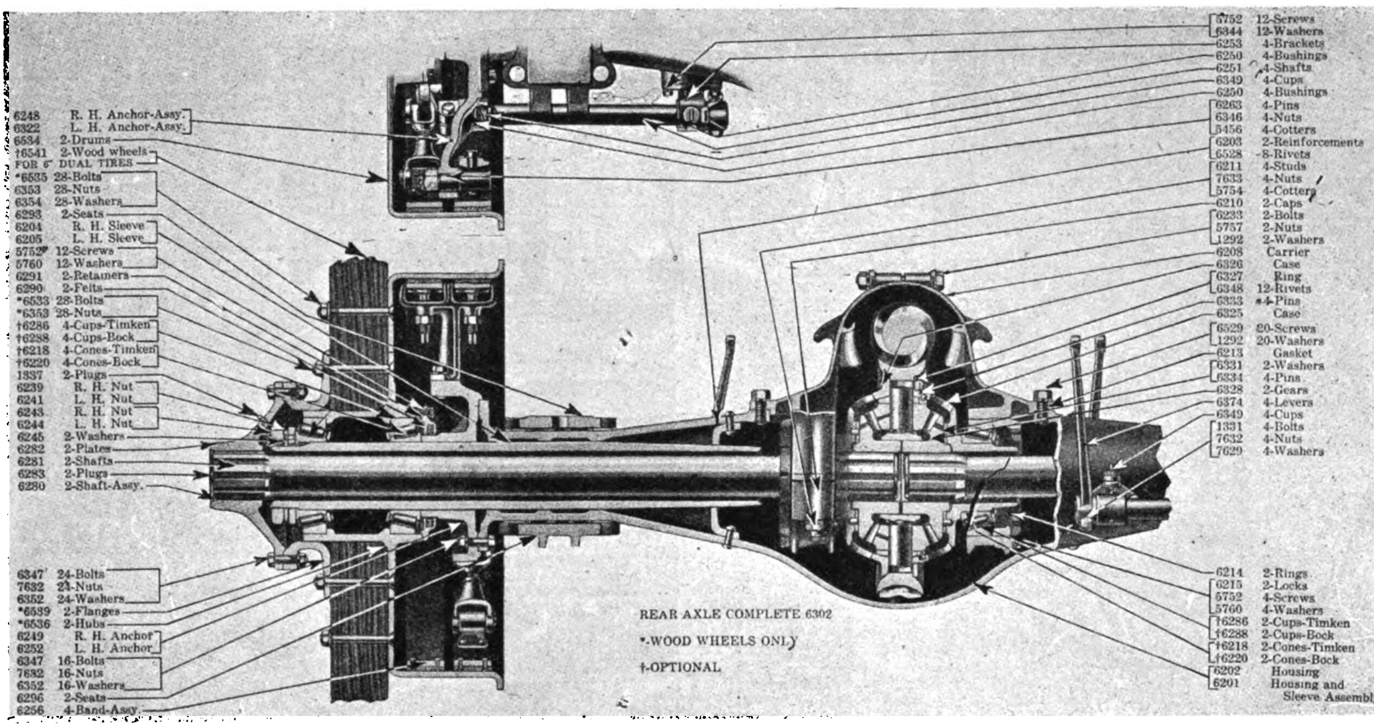
Engine—The engine is of the four-cylinder heavy duty L-head type. The cylinders are cast in pairs and have removable heads. The crankshaft is of the conventional three bearing type with integral flange at the rear to which the flywheel is bolted. The camshaft has integral cams, runs in three bronze bearings and is driven by a train of helical gears in the front of the crankcase. The connecting rods are of the four-bolt type. The piston pin is held fast in the piston by a screw threaded into the piston pin boss and extending through the pin into the top side of the boss. The oiling system is of the full force feed type, the oil being circulated by a gear pump, located in the bottom of the crankcase, to the crankshaft bearings through tubes cast in the case. It is then forced through the crankshaft to the connecting rod bearings and thence through tubes attached to the connecting rods to the piston pins. The normal pressure at 1000 r.p.m. is 15 lb. per sq. in.

Gearset—The transmission is located amidship and is of four-speed selective construction driving direct on fourth speed. It is supported at three points with trunnion at the front end. Its construction is conventional throughout.

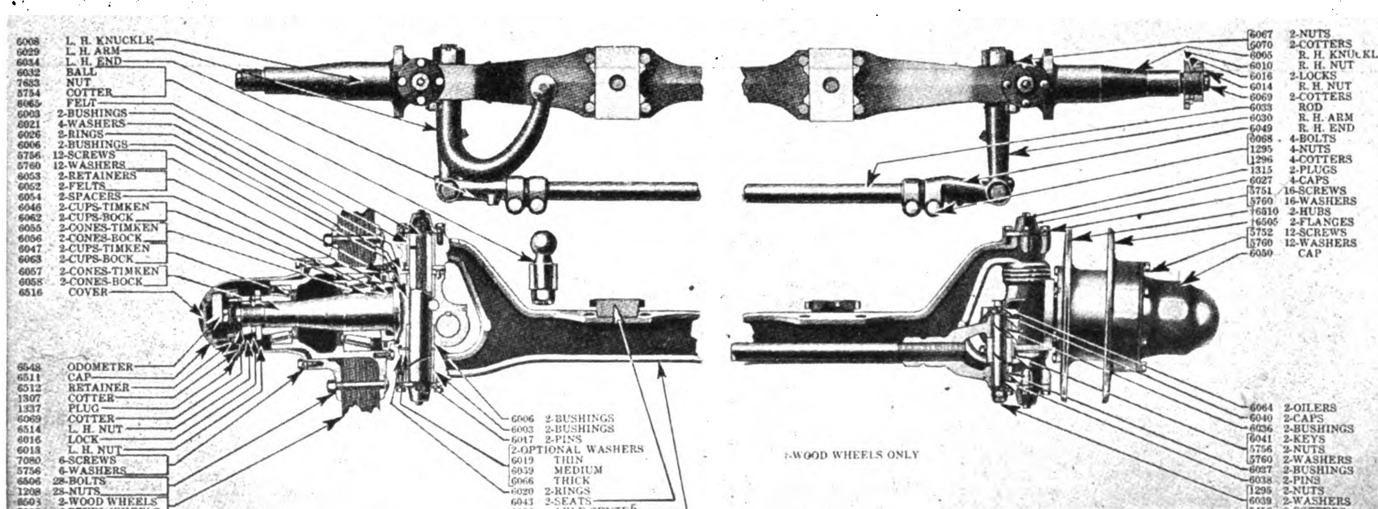
(*Continued on page* 1326)



Transmission Complete—5501

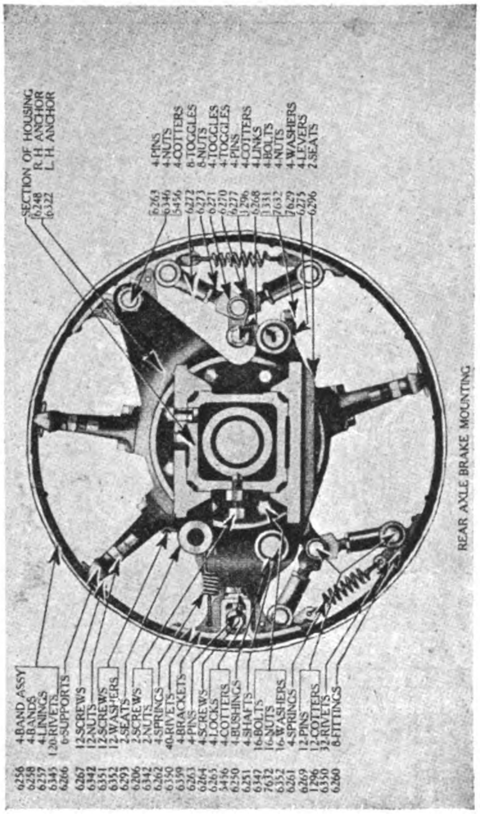


FRONT AXLE COMPLETE 6060

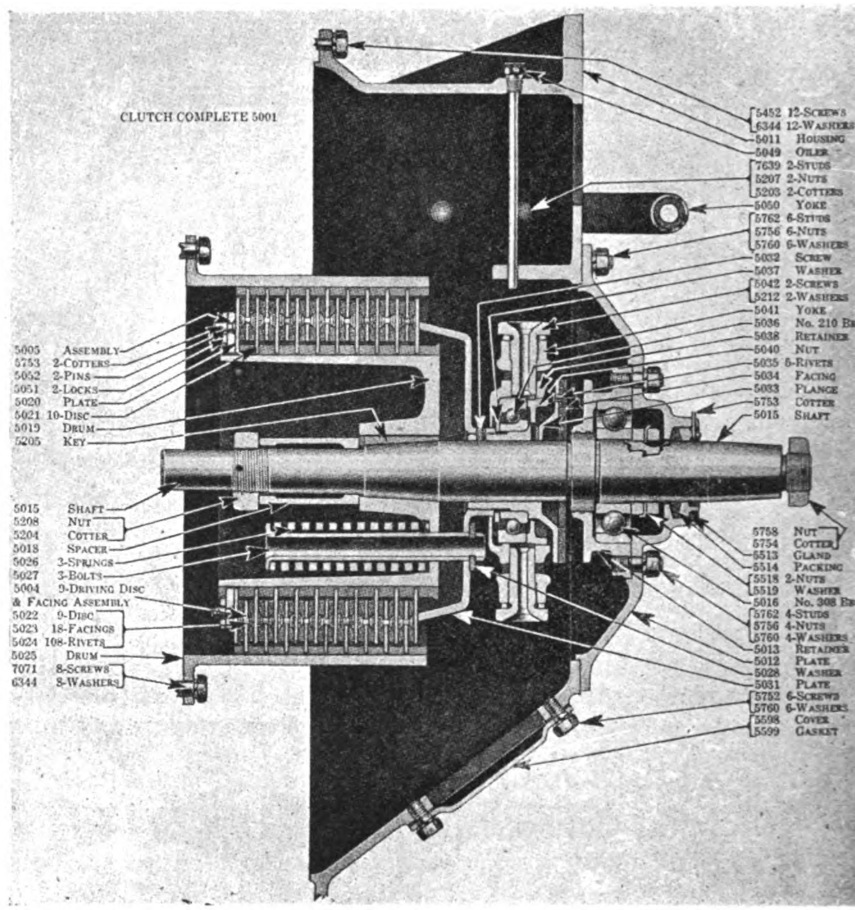


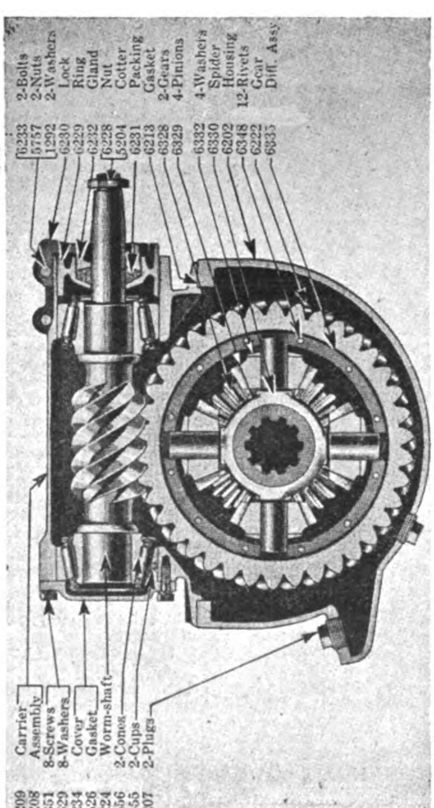
Sheet Steel Specifications

Use		Commercially Known	Requirements
Mud pans, muffler shells	Bessemer or open hearth black steel sheets	One pass cold rolled and box annealed	High finish or extra deep drawing properties not necessary. Should be free from detachable scale, cracks, rust, etc.
Motor hoods, mud guards	Open hearth steel sheets	Full pickled, full cold rolled and re-annealed	Smooth, dense and highly polished surface suitable for two coat dip enameling on one side, not dead soft but sufficiently so that 20 gauge or lighter will bend over itself without signs of fracture. Defects such as cracks, roll marks, waves, dents, buckles, pits, blisters, scratches, rust, etc., not permitted
Parts requiring deep drawing properties but not high finish	Open hearth steel sheets	Extra deep drawing hot rolled steel, pickled and oiled	Should be free from detachable scale, cracks, blisters, rust, etc.
Body panels (drawn)	Open hearth steel sheets	Deep drawing full pickled, full cold rolled and re-annealed	Should have a smooth surface absolutely free from any injurious imperfections, extremely high lustre not required. Drawing properties should be sufficient to meet the requirements as shown by the drawings. Defects such as cracks, waves, dents, buckles, pits, blisters, scratches, rust, etc., not permitted
Body panels (plain)	Open hearth steel sheets	Full pickled, full cold rolled and re-annealed	Extra drawing properties not required; should have smooth surface free from cracks, waves, dents, buckles, pits, blisters, scratches, rust, etc.
Gasoline tanks	Open hearth steel sheets	12 lb. long terne sheets	Sheets with moderate number of small blisters, pits or turned corners will be rated as seconds and should not exceed 25% of the number of prime sheets. Sheets should be uniformly coated with 75% lead and 25% tin. Analysis of coating on 20 sq. in. area should show not less than 0.35 oz. per sq. ft.
Small drawn and embossed stampings	Open hearth steel strips	Hot rolled strips, pickled and oiled	Strips should be free from detachable scale, cracks, blisters, rust, etc.
Small parts requiring deep drawing but not a high finish	Open hearth steel strips	Deep drawing hot rolled steel, pickled and oiled	Strips should be free from cracks, blisters, rust, etc.
Small ordinary drawn and embossed stampings requiring good finish	Open hearth steel strips	Cold rolled strip steel	Strips should have smooth surface free from cracks, blisters, rust, etc.
Brake bands, shims, etc.	Full cold rolled open hearth steel strips	Hard cold rolled strip steel	Strips should have clean, smooth surface free from scale, cracks, blisters, rust, etc.



REAR AXLE BRAKE MOUNTING





Fits Employed for Various Parts

Fit numbers at the left, such as 1, 2, 3, and 4, indicate the class of fit as follows: No. 1—Press fit; No. 2—Running fit; No. 3—Clearance fit; No. 4—Shrink fit.

UNIVERSALS

Part No.	Fit No.	PART				MATERIAL
5861	1	Universal yoke bushing	1.253	1.252	(grind)	1020 SAE
5865		Universal joint yoke—bore	1.2505	1.2495	(ream)	1040 SAE
5871	2	Universal joint cross pin	.874	.873	(grind)	1020 SAE
5861		Universal yoke bushing bore	.876	.875	(grind)	1020 SAE
5860	2	Distance between faces of cross	3.372	3.371	(grind)	1020 SAE
5865		Distance between faces of yoke	3.376	3.374		1040 SAE
5854	2	Propeller shaft splines—top of keys	1.748	1.747	(grind)	1040 SAE
5865		Yoke keyways—bottom	1.750	1.749	(broached)	1040 SAE
5865	3	Yoke keyways—top	1.422	1.417	(broached)	1040 SAE
5854		Prop. shaft splines keyway	(No bottom milled radius)			
5854	2	Prop. shaft splines—width	.271	.268	(grind)	1040 SAE
5865		Yoke keyways—width	.275	.273	(broached)	
	3	Universal yoke stub shaft	2.267	2.264	(turn)	1040 SAE
		Universal dust cover	2.273	2.268		Steel stamping

FRONT AXLE

Part No.	Fit No.	PART				MATERIAL
6003	1	Steering knuckle pin bushing	1.8765	1.8755	(grind)	1020 SAE
6002		Front axle pin bushing bore	1.8750	1.8735	(ream)	1035 SAE
6036	1	Cross rod yoke pin bush.—upper	1.126	1.125	(grind)	1020 SAE
6034		Cross rod yoke bore—upper	1.125	1.124	(ream)	1025 SAE
6038	3	Cross rod end pin—in arm	.884	.883	(grind)	1020 SAE
6030		Steering arm	.886	.884	(ream)	3130 SAE
6017	2	Steering knuckle pin	1.497	1.496	(grind)	1020 SAE
6003		Steering knuckle pin bushing bore	1.500	1.499	(grind)	1020 SAE
6038	2	Cross rod yoke pin	.884	.883	(grind)	1020 SAE
6036		Cross rod yoke pin bushing	.886	.885	(grind)	1020 SAE
6510	3	Front hub—diameter	6.250	6.244		Malleable iron
6505		Front hub flange—bore	6.255	6.252		Malleable iron
		Camber of front wheels	2° toe in $\frac{1}{16}$ inch			

Fits Employed for Various Parts—*Continued.*

Fit numbers at the left such as 1, 2, 3 and 4 indicate the class of fit as follows: No. 1—Press fit; No. 2—Running fit; No. 3—Clearance fit; No. 4—Shrink fit.

ENGINE

Part No.	Fit No.	PART		MATERIAL
1099	2	Cam shaft	2.124 2.123 (grind)	1020 SAE
1042		Cam shaft bushing	2.124 2.125 (ream)	26 SAE
1073	2	Piston—top land	4.732 4.728 (grind)	Cast iron
1001		Cylinder	4.7515 4.7495 (grind)	Cast iron
1073	2	Piston—second land	4.740 4.736 (grind)	Cast iron
1001		Cylinder	4.7515 4.7495 (grind)	Cast iron
1073	2	Piston—third land and body	4.746 4.745 (grind)	Cast iron
1001		Cylinder	4.7515 4.7495 (grind)	Cast iron
1075	2	Piston pin	1.375 1.3745 (grind)	1020 SAE
1070		Piston pin bush	1.3752 1.3748 (ream in ass.)	26 SAE
1073	3	Piston ring groove—width	.251 .250 (turn)	Cast iron
1074		Piston ring—width	.2487 .2497 (grind)	Cast iron
1074	3	Piston ring diameter compressed	4.750 (grind)	Cast iron
		Piston ring gap	.006 .008 (in place)	
1065	3	Connecting rod—width upper end	2⅛ P or M .010	1035 SAE
1073		Piston—between bosses	2⅜ P or M .010	Cast iron
1079	2	Valve tappet	1.1245 1.124 (grind)	1114 SAE
1078		Valve tappet guide	1.126 1.125 (ream)	Cast iron
1081	2	Valve tappet roller pin	.500 .4995 (grind)	Dr. rod or 1020 SAE
1080		Valve tappet roller hole	.502 .501 (grind)	1020 SAE
1080	2	Valve tappet—roller width	.495 .493 (grind)	1020 SAE
1079		Valve tappet—roller slot	.500 .497	1114 SAE
1081	3	Flat end tappet roller pin	.246 .245	Dr. rod or 1020 SAE
1078		Slot in valve tappet guide	.251 .250	
1010	2	Valve stem	.434 .433 (grind)	3140 SAE
1002		Valve guide bore	.4375 .437	Cast iron
1058	3	Motor front support trunnion	5.000 4.999	Cast iron
2901		Engine front support	5.002 5.001	DFS
1105	2	Water pump shaft	.751 .750	1020 SAE
1108		Pump shaft bushing	.753 .752	26 SAE
1086	2	Oil pump drive shaft	.500 .498	CRS
1088		Oil pump shaft bushing—lower	.503 .502 (ream)	26 SAE
1086	2	Oil pump drive shaft	.500 .498	CRS
1087		Oil pump drive shaft bracket	.502 .501 (ream)	26 SAE
1122	2	Oil pump shaft—proper	.500 .498	CRS
1118		Oil pump body	.5015 .5005 (ream)	Cast iron
1093	1	Crankshaft	2.000 1.999	1045-OH
1126		Crankshaft gear	1.999 1.998 (ream)	1035
1002	1	Valve guide	.8765 .876	Cast iron
1001		Guide bore in cylinder	.8745 .8755 (ream)	Cast iron (SAE)
1042	1	Camshaft bushing	2.502 2.501 (turn)	25 SAE
1019		Cam bushing bore—crank case	2.5005 2.4985	Aluminum SAE-31
1111	1	Pump drive shaft	1.1255 1.1245 (grind)	1045 OH
1115		Fan drive pulley	1.1245 1.1255 (ream)	Cast iron
1105	1	Water pump shaft	.751 .750	1020
1104		Water Pump Rotor	.751 .750 (ream)	26 SAE
1075	2	Piston pin	1.375 1.3745 (grind)	1020 SAE
1073		Piston pin hole	1.3745 1.375 (ream)	Cast iron
1076	3	Piston pin lock screw	.290 .280	3130 SAE
1075		Piston pin hole	.281 .2805 (ream)	
1076		Pin lock screw tip	.2805 .2795	
1073		Piston tip hole	.2815 .2805 (ream)	
1070	1	Piston pin bushing	1.628 1.627 (turn)	26 SAE
1065		Connecting rod	1.625 1.624 (ream)	1035 SAE
1111	1	Pump drive shaft	1.2505 1.2495 (grind)	1045-OH
1127		Pump drive shaft gear	1.250 1.249 (ream)	1035 SAE
1111	1	Pump drive shaft	.7505 .750 (grind)	1045-OH
1117		Pump coupling flange	.7505 .7495 (ream)	1114 SAE
1108	1	Pump shaft bushing	1.065 1.064 (turn)	26 SAE
1103		Water pump cover	1.063 1.062 (ream)	Cast iron (SAE)
1086	1	Oil pump shaft—drive	.500 .498	CRS
1089		Oil pump gear—driven	.500 .501 (ream)	1114 SAE
1122	1	Oil pump shaft—proper	.500 .498	CRS
1120		Oil pump gear—driver	.500 .501	3130 SAE
1034	1	Crank shaft bushing	3.002 3.000	Babbitt lined bronze
1019		Crank case	3.002 2.998	Aluminum SAE-31
1065	1	Connecting rod—lower end	2.876 2.874	1035 SAE
1033		Connecting rod bushing	2.876 2.874	Babbitt lined bronze
1102	3	Water pump body	6.000 6.002	Cast Iron (SAE)
1103		Water pump cover	5.997 5.998	Cast Iron (SAE)

ENGINE

Part No.	Fit No.	PART		MATERIAL
1093	2	Crankshaft	2.500 2.499 (grind)	1045-OH
1034		Crankshaft center bearing	2.502 2.501 (ream in place)	Babbitt lined bronze
1093	2	Crankshaft center bearing—lgth.	4.067 4.057 (grind)	
1034		Crankshaft center bearing—bush.	4.002 4.000	Babbitt lined bronze
1093	2	Crankshaft rear bearing—length	4.003 4.000	
1034		Crankshaft rear bearing—bushing	4.002 4.000 (.006 giv. in prac.)	Babbitt lined bronze
1093	2	Crank pin diameter	2.375 2.374 (grind)	1045-OH
1033		Crank pin bearing diameter	2.377 2.376 (ream)	Babbitt lined bronze
1093	2	Crank pin—length	3.000 2.998 (grind)	
1033		Crank pin bearing—length	2.998 2.997	
1019	3	Crank case bell housing	21.127 21.123	Aluminum
5011		Clutch case snap ring	21.125 21.121	Aluminum

TIMING GEAR TRAIN

Part	Crank Case Centers	Gear Centers	Material
1126 to 1129	5.250	5.250	1126 is 1035—1129 is semi-steel
1129 to 1127	5.250	5.250	1127 is 1035 SAE
1129 to 1130	7.125	7.125	1130 is cast iron SAE
1130 to 1128	5.125	5.125	1128 is 1035 SAE

CLUTCH

Part No.	Fit No.	PART		MATERIAL
5015	2	Clutch shaft	1.497 1.495 (grind)	SAE6120, 3120, 3320, 2[illegible]
5033		Brake flange	1.501 1.499 (ream)	1025 SAE
5012	3	Clutch housing end plate	9.249 9.247	Aluminum SAE-31
5011		Clutch housing	9.252 9.250	Aluminum SAE-31
5025	3	Clutch driving drum	11.500 11.496	Cylinder iron
1094		Flywheel drum recess	11.503 11.500	Cast iron SAE
5022	2	Clutch driving disc	8.773 8.768 (pitch dia.)	CRS
5025		Clutch driving drum	8.805 8.800 (pitch dia.)	Cylinder iron
5019	2	Clutch driven drum	6.205 6.200 (O. D.)	Malleable iron
5022		Clutch driving disc	6.265 6.255 (inside dia.)	CRS
5022	2	Clutch driving disc—O.D.	8.9687 (P. or M. .010)	
5025		Clutch driving drum—root of teeth	9.0364 9.0314	Cylinder iron
5019	2	Clutch driven drum	5.999 5.994 (pitch dia.)	Malleable iron
5021		Clutch driven disc	6.023 6.018 (pitch dia.)	CRS
5042	3	Clutch trunnion screw	.623 .621 (grind or polish)	CRS
5038		Clutch release brg. retainer hole	.626 .624 (ream)	Malleable iron
5022	3	Clutch disc rivet hole	.1560 (P. or M. .010)	
5024		Clutch disc rivet	.1560 (P. or M. .010)	Copper

SPRINGS

Part No.	No.	PART		MATERIAL
7038	1	Front spring rear bracket bushing	1.129 1.127 (ream in place)	26 SAE
7034		Front spring rear bracket	1.125 1.124 (ream)	Steel casting
7224	3	Front spring shackle bolt	.872 .871 (grind)	1020 SAE
7226		Front spring shackle bolt hole	.873 .872 (ream)	1025 SAE
7415	3	Rear spring front bracket pin	1.243 1.241 (grind)	1020 SAE
7035		Rear spring front bracket	1.247 1.246 (ream)	Steel casting
7409	1	Rear spring rear shackle bushing	2.004 2.002	26 SAE
7408		Rear spring shackle—rear	2.000 1.998 (ream)	Steel casting
7416	3	Rear spring rear shackle pin	1.243 1.241 (grind)	1020 SAE
7408		Rear spring shackle pin bore	1.247 1.246 (ream)	Steel casting
7224	2	Front spring shackle bolt	.872 .871 (grind)	1020 SAE
7207		Front spring eye bushing hole	.876 .872 (ream in place)	26 SAE
7416	2	Rear spring shackle pin	1.243 1.241 (grind)	1020 SAE
7298		Rear spring front eye bushing hole	1.252 1.247 (ream in place)	26 SAE
7403	2	Rear spring shackle bar	1.746 1.744 (grind)	1114 SAE
7409		Rear spring shackle bar bush. hole	1.7500 1.7485 (ream in place)	26 SAE

Fits Employed for Various Parts—*Continued*

Fit numbers at the left, such as 1, 2, 3 and 4, indicate the class of fit as follows: No. 1—Press fit; No. 2—Running fit; No. 3—Clearance fit; No. 4—Shrink fit

TRANSMISSION

Part No.	Fit No.	PART			MATERIAL
5534	1	Transmission countershaft	2.1315	2.1305 (grind)	3320 SAE
5531		Countershaft gears	2.130	2.129 (grind)	2320, 3320, 2345, 3350 SAE
5592	1	Idler gear bushing	1.628	1.627 (turn)	26 SAE
5591		Reverse idler gear	1.625	1.624 (grind)	2320, 3320, 2345, 3350 SAE
5593	3	Reverse idler gear shaft	1.249	1.248 (grind)	2320 SAE
5511		Reverse idler gear shaft bore in case	1.250	1.249 (ream)	Aluminum SAE-31
5551	3	Trans. main shaft—top of keys	2.245	2.240 (grind)	2320, 3320, 2345, 3350 SAE
5562		Trans. sliding gears—key bottoms	2.290	2.310 (broach)	2320, 3320, 2345, 3350 SAE
5551	3	Trans. main shaft—bottom of keys	1.9105	1.9085 (grind)	2320, 3320, 2345, 3350 SAE
5562		Trans. sliding gears—key tops	1.913	1.912 (grind)	2320, 3320, 2345, 3350 SAE
5551	2	Trans. main shaft—key width	.556	.553 (grind)	2320, 3320, 2345, 3350 SAE
5562		Trans. sliding gears—keyway	.564	.560 (broach)	2320, 3320, 2345, 3350 SAE
5571	2	Trans. shift forks—bottom jaws	2.770	2.760	1025, 1035 SAE
5562		Shift fork groove diameter	2.750	2.745	2320, 3320, 2345, 3350 SAE
5571	2	Trans. shift fork—thickness	.433	.429	1025, 1035 SAE
5562		Trans. shift fork groove—width	.438	.436 (grind or polish)	
5563	3	Sliding gear hubs	3.875	3.8735 (grind)	1020, 2345 SAE
5565		Sliding gear hub hole	3.862	3.860 (grind)	2320, 3320, 2345, 3350 SAE
5593	1	Reverse idler gear shaft	1.247	1.246 (grind)	2320 SAE
5592		Reverse idler gear bush.—bore	1.251	1.250 (ream)	26 SAE
5571	3	Trans. shift fork bore	.861	.860 (ream)	1025, 1035 SAE
5578		Trans. shift fork rod	.8595	.8585 (grind)	1020, 1010 SAE
7037	3	Trans. front hanger—bore	6.006	6.004	
5511		Trans. front trunnion	6.000	5.998	

GEAR DATA

Part No.	Fit No.	PART			MATERIAL
5511		Gear case centers	6.004	6.000	
5565		First gear maximum pitch diam.	8.780		
5565		First gear minimum pitch diam.	8.798		
5534		Countershaft gear max. pitch d.	3.198		
		Countershaft gear min. pitch d.	3.184		
5534		Add other gears			

STEERING GEAR

Part No.	Fit No.	PART			MATERIAL
7529		Jacket bushing—upper	1.872	1.871 (tin and sweat in place)	26 SAE
7577		Jacket tube	1.875	1.873 (ream-steel tube)	16 B. W. G. (.065)
7526	1	Upper housing cap bushing	1.877	1.876	26 SAE
7508		Upper housing cap bore	1.875	1.873 (ream)	Malleable iron
7531	1	Pedal shaft bushing	1.253	1.251	26 SAE
7508		Pedal shaft bushing bore in cap	1.250	1.248 (ream)	Malleable iron
7526	1	Steering column shaft bush. O. D.	2.3145	2.3135	26 SAE
		Housing bore—column bushing	2.3125	2.3105	Malleable iron
7510	2	Steering column shaft	1.468	1.466 (grind) 3/8 inch wall	Seamless steel tube
7529		Jacket bushing—upper	1.471	1.469 (ream)	26 SAE
7510	3	Steering column shaft	1.479	1.477 (grind) 3/8 in. wall	Seamless steel tube
7525		Steering column coupling	1.482	1.480 (ream)	DFS—malleable iron
7508	3	Upper housing cap	2.9985	2.996	Malleable iron
7504		Main housing bore	3.000	2.9985 (ream)	Malleable iron
7506	2	Worm shaft	1.5145	1.5135 (grind)	1020 SAE
7526		Upper housing cap bushing bore	1.516	1.515 (line ream)	26 SAE
7656	2	Pedal shaft	1.000	.998	CRS
7531		Pedal shaft bushing bore	1.003	1.001 (line ream)	26 SAE
7509	3	Steering gear housing cover (pr.)	6.124	6.122	Malleable iron
7504		Steering gear housing bore	6.125	6.123	Malleable iron
7505	2	Worm wheel shaft	1.996	1.997 (grind)	1020 SAE
7554		Worm wheel bushings bore	1.999	2.000 (ream in place)	26 SAE
7523	2	Spark tube bushing O. D.	.380	.378	Brass tubing
7521		Spark tube bore	.375	.374 (ream)	16 BWG steel tube
7522	2	Throttle rod	.3135	.3115	CRS
7523		Spark tube bushing bore	.316	.315 (ream after press)	Brass tubing
7521	2	Spark tube	.505	.495	Steel tubing
7515		Sector bracket	.510	.505 (ream)	Malleable iron
7505		Worm gear thickness	1.625	1.622	
7544	2	Washers thickness	187	.185	
7504		Steering gear depth housing	2 000	1.995	

Clearance with low limit case high limit gears = .002 tight.
Clearance with high limit case and low limit gears = 0105 loose

REAR AXLE

Part No.	Fit No.	PARTS			MATERIAL
6204	1	Housing sleeve (print dim.)	4.131	4.129 (selective fit)	3130 SAE
6202		Housing—bore (print dim.)	4.132	4.130 (15 ton pressure)	Cast steel
6204	3	Housing sleeve	4.131	4.129	3130 SAE
6249		Brake anchor—bore	4.132	4.130	1020 or cast steel
6204	3	Housing sleeve	4.123	4.124 (grind)	3130 SAE
6218		Housing sleeve bearing (roller)	4.125	4.126	
6281	3	Axle shaft spline—top of keys	2.988	2.978 (driving flange was shrunk on the axle shaft)	3140 SAE
6282		Axle shaft drive flange—bottom of keyway	3.000	2.998	3130 SAE
6281	3	Axle shaft spline—bottom	2.576	2.573	3140 SAE
6282		Drive flange top of keys	2.571	2.568	3130 SAE
6281	4	Axle shaft spline key—width	.466	.464	3140 SAE
6282		Drive flange keyway—width	.464	.462	3130 SAE
6222	3	Worm gear bore—spline top	11.650	11.645 (generated)	See page 1316
6325		Differential case tongue side—spline bottom	11 631	11.622 (generated)	1020 or steel casting
6222	3	Worm gear bore—spline bottom	11.786	11.769 (generated)	See page 1316
6325		Differential case tongue side—spline top	11 758	11.755 (generated)	1020 or steel casting
6326	3	Diff. case recess side counterbore	10.376	10.375	1020 or steel casting
6325		Diff. case tongue side fit in counterbore	10.276	10.375	1020 or steel casting
6326	1	Differential case recess side fit in counterbore	11 768	11.766	1020 or steel casting
6222		Worm gear counterbore	11 766	11.764	See page 1316
6326		Differential case recess side width to shoulder	7443	.7243	1020 or steel casting
6325		Differential case tongue side width	.752	.750	1020 or steel casting
6222		Worm gear hub thickness	1.503	1.500	See page 1316
6328		Differential side gears and washers assembled in case	5 490	5.456	Make allowance of plus or minus for pinch fit of cases on gear.
6325 6326		Dist. between faces in case	5.508	5.504	
6330	3	Differential spider pin diameter	1.375	1.373 (grind)	2315 SAE
6325		Spider pin hole in housing	1.376	1.375	1020 or steel casting
6330	2	Differential spider pin diameter	1 375	1 373 (grind)	2315 SAE
6329		Differential pinion—bore	1 379	1 377 (grind)	2315 SAE
6330	2	Differential spider bore	4 255	4 253 (grind)	2315 SAE
6328		Differential side gear hub	4 249	4 247 (grind)	2315 SAE
6224	3	Worm shaft diameter	2 5635	2 5630 (grind)	3120 SAE
6556		Worm shaft bearing diameter	2 5630	2 5640	
6281	3	Axle shaft differential end—spline top	2 988	2 978 (grind)	3140 SAE
6328		Side gear splines—bottom	3.005	2.995 (broached)	2315 SAE
6281	3	Axle shaft differential end—spline bottom	2 576	2 573	3140 SAE
6328		Side gear spline—key tops	2,581	2.579 (grind)	2315 SAE
6281	2	Axle shaft differential end—key width	.466	.464	3140 SAE
6328		Side gear keyway—width	.471	.467	2315 SAE
6203	3	Worm gear carrier step	15 995	15.998	Malleable iron
6202		Axle housing bore	16.000	15.994	Cast or pressed steel
6263	1	Brake anchor pin (press)	1.127	1 126 (turn)	3120 SAE
6248		Brake anchor pin hole	1.125	1.124 (ream)	1025 or cast steel
6202	3	Rear axle housing flange	9.252	9.249	Cast or pressed steel
6248		Brake anchor casting recess	9.257	9.253	1025 or cast steel
6536	3	Rear wheel hub	7.998	7.992	Malleable iron
6539		Rear wheel hub flange bore	8.004	8.000	Cast steel
6282	3	Rear axle shaft drive plate	9 250	9.245	3130 SAE
6539		Rear wheel hub flange—recess	9.257	9.252	Cast stee
6251	2	Brake shaft	1.252	1.248	1020 SAE
6250		Brake shaft bushing—bore	1.262	1.259 (ream in place)	26 SAE
6251		Brakeshaft theoretical top of serration	1.219	1.209	1020 SAE
6251		Brakeshaft theoretical bottom of serration	1.141	1.131	1020 SAE
6251		Brakeshaft serration top	1 203	1.205	1020 SAE
6251		Brakeshaft serration bottom	1 145	1.147	
6251		Angle of serrations	9 degrees		
6374		Lever theoretical top of serration	1.143	1.141	1035 SAE
6374		Lever theoretical bottom of serration	1.221	1.219	1035 SAE
6374		Lever serration top	1.153	1.151	1035 SAE
6374		Lever serration bottom	1 211	1.209	1035 SAE
6374		Angle of serrations	9 degrees		
6250	1	Brake shaft bushing (press)	1.502	1.501	26 SAE
6263		Brake shaft bushing bore in brake anchor	[illegible]	1.497	1025 or cast steel

Heat Treatment of Parts

The steel numbers and heat treatments (designated by letter) used in the following table refer to the Society of Automotive Engineers Steel Specifications, except in the case of steel No. 1040, which is a special steel for propeller shaft parts and has a carbon content of 0.35 to 0.45 per cent with 0.40 per cent desired. Otherwise the composition of steel 1040 is the same as that of No. 1035 S. A. E. steel. Full information regarding S. A. E. steels and heat treatments is given in Vol. 1, S. A. E. Handbook.

Part No.	Part Name	Requirements on Drawings: Steel No.	Hardness: Brin.	Hardness: Scler.	Heat Treatment	Revised Requirements
1005-V	Stud, cyl. head	3130			Heat 1575. Quench. Reheat-1000. Cool slowly	32-40 scle. SAE ht. "H"
1010-V	Valve	3140		40 min.	Harden	40-50 scle. SAE ht. "H"
1024-V	Bolt, main brg.	3130			Heat treat	32-40 scle. SAE ht. "H"
1025-V	Stud, front main brg.	3130			Quench and draw	32-40 scle. SAE ht. "H"
1026-V	Nut, conn. rod bolt	3130			Heat treat	None
1028-V	Stud, cyl. hold down	3130			Heat treat	32-40 scle. SAE ht. "H"
1065-X	Conn. rod	1035		35-40	SAE ht. "D"	32-40 scle. SAE ht. "H"
1066-V	Belt, conn. rod	3130			Heat treat	32-40 scle. SAE ht. "H"
1075-V	Piston-pin	1020	470	70-80	Carb. 1/16 in.	SAE ht. B (Carb. 1/16-3/64)
1079-V	Tappet, valve	1114		75 min.	Case harden	75-80 scle. carb. 3/64-1/16
1080-V	Roller, valve tapp.	1020		80 min.	Case hard 1/16	80-90 scl. SAE ht. "B" (carb. 1/16-3/64)
1081-V	Pin. valve tapp. roll	DR. PD		70-80	Harden	80-90 scle. SAE ht. "B"
1082-V	Adj. screw, valve tapp.	Per bar		75 min.	Case harden	(Carb. 3/64-1/16) threads soft
1083-V	Lock nut, valve tapp.	1114			None	None
1089-V	Dr. gear, oil pump	1114			Case hard. 1/64-1/64	Use SAE 1020 scle. 70-80 SAE ht. "B" carb. 1/64-3/32
1093-Y	Crankshaft	1045		38-42	SAE, ht. "H"	38-45 scle. SAE ht. "H"
1095-V	Bolt, flywheel	3130			Heat treat	32-40 scle. SAE ht. "H"
1099-Y	Camshaft	1020		65-70	Case harden	SAE ht. "B" (Carb. 3/64-1/16) 65-70 scle. on cams and bearings
1101-V	Gear, oil pump drr.	1020		70 min.	Case hard 1/16-3/32	70-80 scle. SAE "B" (Carb. 3/64-1/16)
1120-V1	Gear, oil pump drr.	3130			Ht. tr. bar	32-40 scle. SAE ht. "H"
1123-V	Stud, oil pump idlr.	CRS			Case harden	None
1126*-W	Gear, crankshaft	1035			Heat treat	32-40 scle. SAE ht. "H"
1127*-W	Gear, pump and mag.	1035			Heat treat	32-40 scle. SAE ht. "H"
1131-W	Shaft, idle gear	1020		75 min.	Case harden	Use SAE 1045. 40-50 scle. SAE ht. "A"
1134-W	Shaft, generator	1045		40-45	SAE ht. "H"	None
1146-V	Disk, governor	Stpg.			Carb. 1/32-1/16	None
1160-V	Adj. screw, gover.	CRS		50-60	Case harden	Carbon end to produce hardness
1208-V	Nut, plain	1114			None	None

Part No.	Part Name	Requirements on Drawings: Steel No.	Hardness: Brin.	Hardness: Scler.	Heat Treatment	Revised Requirements
1304-V	Washer, gov. thr. brg.	1020		80 min.	Case hard. 1/32-3/64 SAE ht. "H"	5-85 scle. SAE ht. "B" (carb. 3/64-1/16)
1484-X	Lever, gear shif.	1025			Draw at 1000	None
1495-V	Bolt, clutch spr.	3130		33-38	SAE ht. "H"	None
1572-W	Clip, rear spr.	2320		45-50	SAE ht. "H"	None
1573-W	Clip, front spr.	2320		45-50	None	None
1612-X	Ring, worm gear					
	Retaining	1035		32 min.	SAE ht. "H"	None
1613-W	Lever, brake	1035	200-220		Heat 1510-1530	1-heat to 1600, 1b. 20m.
					Quench in oil	Quench in water
					Draw at 850-900	3—draw at 950, 1b. 20m.
2326-X	Yoke, prop. shaft Sleeve (front)	1040		35-44	SAE ht. "P" cool slowly	1. Heat 1525 plus or minus 10 2. Reht. 1425 plus or minus 10 Quench in oil. 4. Draw to hardness
2327-V	Shaft, prop, shaft stub	1040		70-90 on splines 40-50 on neck and shoulder	Heat 1425 plus or min. 10 Quench splined end in water; whole piece in oil.	None
2328-W	Yoke, prop. shaft plain (front)	1040 L		30-40	Heat 1525 plus or min. 10 Cool slowly. Reheat 1425 plus or minus 10. Quench in oil. Draw to hardness.	None
2330-V	Flange, prop. shaft, compan. (front)	1040		35-44	SAE ht. "P"	1. Heat 1525 plus or minus 10. 2. Cool slowly. 3. Quench in oil. 4. Draw to hardness
2331-X	Yoke, prop. shaft, flange (front)	1040		35-44	SAE ht. "P"	1. Heat 1525 plus or minus 10 2. Cool slowly. 3. Quench in oil. 4. Draw to hardness
2333-V	Journal, prop. shaft (front)	1020		70 min.	Carb. at 1650 plus or minus 10. Cool in box. Ht. to 1575 plus or minus 10. Quench in oil. Reht. to 1425 plus or minus 10. Quench in water.	None
2338-V	Bolt, prop. shaft flange (front)				Heat to 1525 plus or minus 10. Quench in oil. Ht. to 1350 plus or minus 10. Quench in oil. Ht. to 750 plus or minus 10. Cool slowly	None
2344-X	Yoke, prop. shaft sleeve (rear)	1040		35-44	SAE ht. "P"	1. Heat 1525 plus or minus 10. 2. Cool slowly. 3. Quench in oil. 4. Draw to hardness
2345-X	Yoke, prop. shaft plain (rear)	1040		30-40	Ht. 1525 plus or minus 10. Cool slowly. Ht. to 1425 plus or minus 10. Quench in oil. Draw	None
2351-V	Journal, prop. shaft (rear)	1020		70 min.	Carb. at 1650 plus or minus 10. Cool in box. Ht. to 1575 plus or minus 10. Quench in oil. Heat to 1425 plus or minus 10. Quench in water.	None

Heat Treatment of Parts—Continued

Part No.	Part Name	Requirements on Drawings				Revised Requirements
		Steel No.	Hardness		Heat Treatment	
			Brin.	Scler.		
	Bushing, prop. shaft journal (rear)	1020		70 min.	Carb. at 1650 plus or minus 10. Cool in box. Ht. to 1575 plus or minus 10. Quench in oil. Ht. to 1425 plus or minus 10. Quench in water	None
2353-X	Yoke, prop. shaft flange (rear)	10:0		35-44	SAE ht. "P"	1. Heat at 1525 plus or minus 10. 2. Cool slowly. 3. Heat to 1425 plus or minus 10. 4. Quench in oil. 5. Draw
2354-V	Flange, prop. shaft compan. (rear)	1040		35-44	SAE ht. "P"	None
2355-V	Shaft, prop. shaft stub (rear)	1040		70-90 on splines 40-50 on neck and shoulder	Heat 1425 plus or minus 10. Quench splined end in water. Whole piece in oil	None
2305-W	Cran'. starting	1025			SAE bt. "H"	None
2512-V	Jaw, st'rtg. crank	1020		50 min.	Carb. jaws 1/32-1/64	None
K2816-V	Screw, hex. head	1114			None	None
3306-V	Gage, valve tappet	Tool steel			Tempered	None
3508-V	Spindle, fan	3130			Ht. tr. bar	32-40 scle. SAE ht. "H"
4081-V	Cam, generator clutch	2320			Carb. harden, grind	None
4082-V	Shell, generator clutch	1010			Carb. harden, grind	None
4083-V	Plate, generator clutch	Sheet steel			Case harden	None
4085-V	Roll, generator clutch	2320		80 min.	Heat treat	None
4086-V	Plunger, generator clutch	2320			Heat treat	
4039-V	Disk, gen. clutch	C. R. S.			Carb. and harden	None
4279-V	Cam, distributor	C. D. S.		70 min.	Carb. 1/32-1/64 and harden	None
4281-V	Screw, dist. cam.	C. D. S.			Cyn. for 5 min. Quench in water	None
4282-V	Bushing, distr. cam screw	C. D. S.			Cyn. for 5 min. Quench in water	None
4285-V	Lock nut, distr. cont. screw	1114			Case harden, zinc plate	None
4298-V	Shaft, distributor	C. D. S.		70 min.	Carb. 1/32-1/64 and harden	None
5015-W	Shaft, clutch	6120		75-85	Carb. 1/32, double quench	1. Pack threads. 2. Carb. 1/32 at 1650. 3. Cool slowly in carbonising material. 4. Ht. at 1550 15 min. 5. Quench in oil. 6. Anneal and cut keyways. 7. Reht. at 1380-1400 30 min. 8. Quench in oil. 9. Draw at 375 20 min.
5041-X	Yoke, release	1025			Carb. 1/32, harden ball ends	1. Carb. 1/32 at 1650. 2. Cool slowly in carbonising material. 3. Ht. at 1550, 15 min. 4. Quench in oil 5. Anneal all over at 1150. 6. Reht. in lead at 1400, 4 min. 7. Quench in water
5042-V	Screw, trunnion	C. R. S.		70 min.	Carb. 1/64-1/32	None
5043-V	Socket, clutch rel. yoke	C. R. S.		70 min.	Carb. 1/64-1/32	1. Carb. 1/64-1/32 at 1650. 2. Reheat in gas furnace at 1420, 12 min. 3. Quench in oil. 4. Draw in oil at 350, 10 min.
5045-V	Bushing, clutch rel. lever	C. R. S.			Cyanide, harden	1. Ht. in cyanide 8 min. 2. Quench in water
5047-V	Bushing, rel. rocker sht. eye	C. R. S.			Cyanide	1. Ht. 8 min. Cyanide. 2. Quench in water
5252-WS	Latch and rod rev.	C. R. S.		70 min.	Carb. 1/64 min.	1. Carb. 1/32 at 1650, 7 hr. 2. Reheat at 1420, 4 min. 3. Quench in oil. 4. Draw at 325, 10 min.
5253-WS	Latch lever brake	C. R. S.		70 min.	Carb. 1/64 min.	1. Carb. 1/64-1/32 at 1650 for 8 hrs. 2. Reheat at 1420 in lead on end. 3. Quench in oil. 4. Draw at 325, 10 min.
5263-V	Interlock	1020			Case harden	1. Carb. 1/32 at 1650. 2. Reheat in gas furnace at 1400, 10 min. 3. Quench in oil. 4. Draw at 325, 20 min.
5264-V	Pin, inter. guide	C. R. S.			Cyanide	1. Heat in cyanide at 1400, 10 min. 2. Quench in water
5265-X	Lever, gear shift hand	1025			SAE ht. "H". Draw at 1000	None
5270-V	Nut, spoon hinge	Iron or st'l			Cyanide, harden	1. Heat in cyanide at 1400, 8 min. 2. Quench in oil.
5271-V	Latch, reverse	C. R. S.		70 min.	Carb. 1/64 min.	1. Carb. 1/64-1/32 at 1650, 7 hr. 2. Reheat in lead at 1400, 4 min. 3. Quench in oil. 4. Draw at 325, 10 min.
5283-W	Lever, shifting first and second speed	1025		30 min.	SAE ht. "H"	None
5284-W	Lever, shifting third and fourth speed	1025		30 min.	SAE ht. "H"	None
5285-W	Lever shifting reverse	1025		30 min.	SAE ht. "H"	None
5301-X	Lever, brake	1025		30-43	SAE ht. "H"	None
5307-V	Slide, brake lever	C. R. S.			Cyanide, harden	1. heat in cyanide at 1400, 10 min. 2. Quench in oil
5303-V	Sector, brake	C. R. S.			Harden not less than 1/32	1. Carb. 1/32-1/64 at 1650, 7 hr. 2. Reheat at 1410-1420, 12 min. 3. Quench in oil. 4. Draw at 375, 20 min.
5311-V	Latch, brake	C. R. S.		70 min.	Carb. 1/64 min.	1. Carb. 1/32 at 1650, 7 hr. 2. Reheat on end in lead, 4 min. 3. Quench in oil. 4. Draw at 350, 10 min.
K5451-V	Screw, hex. head	1114			None	None
5439-V	Pin, yoke	C. R. S.		70 min.	Carb. and harden 1/32-1/64 min.	1. Carb. 1/32 at 1650, 7 hr. 2. Reheat in gas furnace at 1400, 10 min. 3. Quench in oil. 4. Draw at 350, 10 min.
5517-W	Gear, main drive	2320		80-90	Carb. 1/32-1/64	1. Carb. 1/32-1/64 at 1650, 11 hr. (Pack threads here). 2. Heat all over in sq. gas furnace at 1550, 30 min. 3. Quench in oil. 4. Reheat in lead at 1380-1400, 6 min. 5. Quench in oil. 6. Draw shank in lead at 1380. Draw all over at 357, 30 min.

5531-W	Gear, countershaft	2320	3-3.3 (340-418)	80-90	SAE ht. "G". carb. 3/64-1/16	None
5532-W	Gear, third speed (countershaft)	2320	(340-418) 3-3.3	80-90	SAE ht. "G"	1. Carb. 1/32-3/64 at 1650, 11 hr. 2. Heat at 1550, 6 min. 3. Quench in oil. 4. Reheat in lead at 1330-1400, 6 min. 5. Quench in oil. 6. Draw in oil at 357, 30 min.
5533-W	Countershaft gear, second speed	2320	(340-418) 3-3.3	80-90	Carb. 3/64-1/16 SAE ht. "G"	None
5534-X	Countershaft	2345		72-78 on gear shank	SAE ht. "H"	1. Carb. 1/32-3/64 at 1650, 11 hr. 2. Heat at 1550, 15 min. 3. Quench in oil. 4. Reheat at 1380-1400. 5. Quench in oil. 6. Draw all over at 375, 30 min. 7. Anneal threads in lead
5551-W	Shaft, main	2320		80-90 on spline 40-50 elsewhere	SAE ht. "G". carb. 3/64-1/16	1. Carb. 1/32 at 1650, 11 hr. (Pack threads here). 2. Heat all over at 1550, 35 min. 3. Quench in oil. (Anneal end and cut keyway here). 4. Reheat at 1400, 30 min. 5. Quench in oil. 6. Draw taper at 375
5552-W	Second and fourth speed sliding gear	2320	(340-418) 3-3.3		Carb. 3/64-1/16 SAE ht. "G"	None
5563-W	Hub, first and second speed sliding gear	1020		75-85	Carb. 3/64-1/16	None
5564-W	Gear, second speed sliding	2320	3-3.3 (340-418)	80-90	SAE ht. "G", carb. 3/64-1/16	None
5565-W	Gear, first speed sliding	2320	3-3.3 (340-418)	80-90	SAE ht. "G", carb. 3/64-1/16	1. Carb. 1/32 at 1650, 9 hr. 2. Heat in lead at 1550, 6 min. 3. Quench in oil. 4. Reheat in lead at 1380 to 1400, 6 min. 5. Quench in oil. 6. Draw at 375, 30 min.
5572-W	Fork, rev. shift	1025		30 min.	SAE ht. "H"	None
5573-V	Screw, shift for lock	1020			Carb. 3/64-1/16	None
5576-W	Shifter rod third and fourth speed	1025		75-85	Case harden 3/64-1/16	1. Carb. 1/32 at 1650, 8 hr. 2. Reheat at 1400-1410. 3. Quench in water. Note: Harden above notched only
5577-W	Shifter rod, first and second speed	1025		75-85	Case harden 3/64-1/16	1. Carb. 1/32 at 1650, 8 hr. 2. Reheat at 1400-1410. 3. Quench in water. Note: harden above notches only
5578-W	Shifter rod reverse	1025		75-85	Case harden 3/64-1/16	1. Carb. 1/32 at 1650, 8 hr. 2. Reheat at 1400-1410. 3. Quench in water. Note: harden above notches only
5579-V	Rod—end, shift	1025			Cyanide, harden head only	1. Carb. in cyanide at 1400, 20 min. 2. Quench in water. Note: harden head end only
5583-V	Poppet	1010		60-70	Carb. 1/32 harden	1. Clay pack holes. 2. Carbonize at 1500, 8½ hrs. 3. Cool slowly in carbonizing material. 4. Quench in oil from pots
5591-W	Gear, reverse idler	2320	3-3.3 (340-418)	80-90	Carb. 3/64-1/16. SAE ht. "G"	1. Carb. at 1650, 10 hr. 2. Cool slowly in carbonizing material. 3. Heat in lead at 1550, 15 min. 4. Quench in oil. 5. Reheat in lead at 1380-1400 15 min. 6. Quench in oil. 7. Draw at 375, 30 min.
5593-V	Shaft, reverse idler, gear	2320		75-85	Carb. not less than 1/32. SAE ht. "G"	1. Carb. 3/64-1/16 at 1650, 9 hr. 2. Heat in sq. furnace at 1550, 30 min. 3. Quench in oil. 4. Reheat in sq. furnace at 1370-1380. 5. Quench in water and oil. 6. Draw head to red in lead. Draw all over at 350, 30 min.
K5650-V	Rivet, button head	Soft steel			None	None
5651-X	Countershaft, extended end	2320	3-3.3 (340-418)	80-90	SAE "G", carb. 3/64-1/16	None

K5751-V	Screw, hex. head	1114			None	None
5763-V	Stud, retainer	2320			SAE ht. "H"	None
5806-V	Center block, prop. shaft joint (front)	1035		35-40	SAE ht. "H"	None
5807-W	Flange, prop. shaft jt. camp. (front)	1035		35-40	SAE ht. "H"	None
5808-W	Yoke, prop. shaft jt. flange (front)	1035		35-40	SAE ht. "H"	None
5817-W	Yoke, prop. shaft jt. shrink	1035		35-40	SAE ht. "H"	None
5818-W	Shaft, prop. shaft stub	1035		70-90 spline 40-50 neck	SAE ht. "E"	None
5822-W	Yoke, prop. shaft jt. spline (front)	1035		35-40	SAE ht. "H"	None
5824-V	Bolt, prop. shaft jt. trunnion (front)			60	Carb. 3/64-1/16 min.	None
5828-V	Pin, prop. shaft joint small trun. (front)	1020		80 min.	SAE ht. "B", carb. 3/64-1/16	None
5829-V	Pin, prop. shaft joint small trun. (rear)	1020		80 min.	SAE ht. "B", carb. 3/64-1/16	None
5833-V	Pin prop. shaft joint large trun. (front)	1020		80 min.	SAE ht. "B", carb. 3/64-1/16	None
5838-V	Bolt, prop. shaft flange	2330			SAE ht. "H"	None
5860-W	Center block, prop. shaft joint (rear)	1035		35-40	SAE ht. "H"	None
5861-V	Bushing, prop. shaft joint yoke	1020		80 min.	Carb. 3/64-1/16; SAE ht. "B"	None
5863-W	Yoke, prop. shaft joint flange (rear)	1035		35-40	SAE ht. "H"	None
5864-W	Flange, prop. shaft, jt. comp. (rear)	1035		35-40	SAE ht. "H"	None
5865-W	Yoke, prop. shaft joint spline (rear)	1035		35-40	SAE ht. "H"	None
5868-W	Shaft, prop. shaft stub (rear)	1035		40 min.		None
5871-V	Pin, prop. shaft joint large trun. (rear)	1020		80 min.	SAE ht. "B", carb. 3/64-1/16	None
5873-V	Bolt, prop. shaft joint trun. (rear)	2320		60 min.	Carb. 3/64-1/16	None
5880-W	Yoke, prop. shaft joint shrink (rear)	1035		35-40	SAE ht. "H"	None
5882-W	Shaft, prop. shaft stub (rear)	1035		70-90 spl end 40-50 on neck	SAE ht. "E"	None
5884-W	Yoke, prop. shaft (frt.)	1035		35-40	SAE ht. "E"	None
5886-W	Shaft, prop. shaft stub (front)	1035		70-90 spl. end 40-50 on neck	SAE ht. "E"	None
5888-W	Yoke, prop. shaft (rear)	1035		35-40	SAE ht. "E"	None
5893-V	Bushing, prop. shaft joint yoke (flange)	1020		80 min.	SAE ht. "B", carb. 3/64-1/16	None
6002-Y	Axle center, front	1035	220-250	35-40	SAE ht. "H"	1. Heat at 1550, 2 hr. 2. Quench in water. 3. Reheat at 1000, 2 hr. 4. Cool in oil air

Heat Treatment of Parts—Continued

Part No.	Part Name	Requirements on Drawings				Revised Requirements
		Steel No.	Hardness		Heat Treatment	
			Brin.	Scler.		
6003-V	Bushing, strg. knuckle pin (center)	1020			Carb. and harden	1. Carb. at 1600, 12 hr. 2. Cool slowly in carbonizing mixture. 3. Reht. to 1400, 40-50 min. 4. Quench in water
6005-Y	Knuckle, steering (R. H.)	3130		32-36	Heat 1535-1565. Quench in oil. Draw 1100-1150	1. Anneal before machining at 1550, 2 hr. 2. Heat at 1550, 2 hr. 3. Quench in oil. 4. Draw at 1100, 2 hr.
6006-V	Bushing, strg. pin (in knuckle)	1020			Carb. and harden	1. Carb. $\frac{1}{32}$ at 1650, 12 hr. 2. Cool slowly in carbonizing material. 3. Reht. at 1400, 40-50 min. 4. Quench in water
6009-Y	Knuckle, strg. (L. H.)	3130		32-36	Heat 1535-1565. Quench in oil. Draw 1100-1150.	1. Anneal before machining at 1550, 2 hr. 2. Heat at 1550, 2 hr. 3. Quench in oil. 4. Draw at 1100, 2 hr.
6010-V	Nut, spindle (R. H.)	1020			Cyanide	1. Carb. in cyanide. 2. Quench in water
6011-V	Pin, outer brg. adj. nut	1114			None	None
6013-V	Adj. nut, outer brg. front axle spindle	1020			Cyanide	1. Carb. in cyanide. 2. Quench in water
6014-V	Jam nut, outer bearing (R. H.)	1020			Cyanide	1. Carb. in cyanide. 2. Quench in water
6015-V	Jam nut, outer spindle nut (L. H.)	1020			Cyanide	1. Carb. in cyanide. 2. Quench in water
6016-V	Lock nut, spindle steel stpg.				None	None
6017-V	Pin, strg. knuckle	1020			Carb. $\frac{1}{32}$, harden	75-85 scle. 1. Carb. $\frac{1}{32}$ at 1700, 12 hr. 2. Quench from pot in water
6018-V	Key, strg. knkle. pin	3130			Heat treat	32-40 scle. 1. Heat at 1500. 2. Quench in water. 3. Draw at 1000
6019-V	Washer, strg. knkle. spacing (thin)	1020			Carb. harden	1. Carb. $\frac{1}{32}$ at 1700, 11-12 hr. 2. Cool in carbonizing material. 3. Heat to 1400-1425, 40 min. 4. Quench in oil
6022-V	Washer, knkle thrt.	1020			Carb. $\frac{1}{32}$, harden	File hard. 75-85 scle. 1. Carb. $\frac{1}{32}$ at 1700, 18 hr. 2. Cool with pot. 3. Reheat at 1400, 49 min. 4. Quench in water
6029-Y	Arm, steering (L. H.)	3130		32-36	Heat 1535-1565. Quench in oil. Draw 1100-1150	1. Heat at 1500, 1 hr. 40 min. 2. Quench in oil. 3. Draw at 1100-1150, 2 hr.
6030-X	Arm, steering (R. H.)	3130		32-36	Heat 1535-1565. Quench in oil. Draw 1100-1150	1. Heat at 1500, 1 hr. 40 min. 2. Quench in oil. 3. Draw at 1100-1150, 2 hr.
6031-V	Key, steering arm	Tool steel			Draw to 400-450	1. Heat at 1500, 40 min. 2. Quench in oil. 3. Draw at 800, 30 min.
6032-V	Ball, strg. arm	3120		75 min.	Carb. $\frac{1}{32}$, harden ball	1. Carb. $\frac{1}{32}$ at 1700, 8 hr. 2. Dip from pot in oil. 3. Heat at 1550, 50-60 min. 4. Quench in water. 5. Heat at 1400, 1 hr. 20 min. 6. Quench [illegible] ball in water. 7. Draw shank in lead, one at a time
6033-W	Rod, strg. cross	1020			None	None

Part No.	Part Name	Requirements on Drawings				Revised Requirements
		Steel No.	Hardness		Heat Treatment	
			Brin.	Scler.		
6035-X	Rod—end, cross	1025			Anneal	1. Heat at 1600 for 3 hr. 2. Cool in air
6036-V	Bushing, strg. cross rod—end	1020		75 min.	Carb. $\frac{1}{32}$, harden	1. Carb. $\frac{1}{32}$, 10-11 hr. 2. Dip from pot in water. 3. Heat at 1400, 40 min. 4. Quench in water
6037-V	Bushing, lower steering rod—end pin	1020		75 min.	Carb. $\frac{1}{32}$, harden	1. Carb. $\frac{1}{32}$, 10-11 hr. 2. Dip from pot in water. 3. Heat at 1400, 40 min. 4. Quench in water
6038-V	Pin, strg. rod—end	1020		75 min. after grinding	Carb. $\frac{1}{32}$. harden	1. Carb. $\frac{1}{32}$ at 1700, 10 hr. 2. Dip from pot in water. 3. Reheat at 1400, 50 min. 4. Quench in water
6041-V	Key, strg. cross rod—end pin	3130			Heat treated stock	32-40 scle. 1. Heat at 1500. 2. Quench in water. 3. Draw at 1000
4043-W	Spring seat, fr. axle	1025			None	None
6054-V	Spacer, hub bearing	1025			None	None
6059-V	Washer, knuckle spacing (medium)	1020			Carb., harden	1. Carb. $\frac{1}{32}$ at 1700, 11-12 hr. 2. Cool in carbonizing material. 3. Heat at 1400-1425, 40 min. 4. Quench in oil
6066-V	Washer, knuckle spacing (thick)	1020			Carb., harden	1. Carb. $\frac{1}{32}$ at 1700, 11-12 hr. 2. Cool in carbonizing material. 3. Heat at 1400-1425, 40 min. 4. Quench in oil
6067-V	Nut, strg. arm	1114			None	None
K6068-V	Screw, hex. head	1114			None	None
6155-V	Plunger, reach rod	1010		75 min.	Case harden [illegible]	None
6157-V	Plug, reach rod	1114			Cyanide in bath, harden	None
6204-W	Sleeve, housing (R. H.)	3130		31-34	Heat 1530-1565. Quench in oil. Draw 1200-1300	1. Heat at 1500, 2 hr. 2. Quench in oil. 3. Draw at 1150-1225, 2 hr.
6205-V	Sleeve, housing (L. H.)	3130		31-34	Heat 1530-1565. Quench in oil. Draw 1200-1300	1. Heat at 1500, 2 hr. 2. Quench in oil. 3. Draw at 1150-1225, 2 hr.
6206-V	Screw, housing sleeve retaining	1114		None	None	None
6211-W	Stud, diff. brg. cap	3130		32-36	Heat 1535-1565. Quench in oil. Draw 1100-1500	1. Heat at 1550, 1 hr. 2. Quench in oil. 3. Draw at 1100, 1 hr.
6224-X	Shaft, worm	3130		70-85 thread end	On whole shaft. Carb. $\frac{1}{32}$, heat to 1550, quench and draw to 700	1. Carb. $\frac{1}{32}$ at 1650, 12 hr. 2. Quench from pot in oil. 3. Reheat at 1550, 2 hr. 4. Quench in water. 5. Draw threads in lead at 1400. 6. Draw taper at 850. 7. Draw in oil at 350
K6223-V	Nut, worm shaft	1114			Cyanide	1. Carb. in cyanide. 2. Quench in water
6233-V	Bolt, worm shaft forward bearing	3120	205-240		SAE ht. "H"	1. Heat at 1500, 4-40 min. 2. Quench in oil. 3. Draw at 900, 30 min.
6210-W	Adj. nut wheel brg. (R. H.)	1025			Cyanide 30 min	1. Carb. in cyanide, 30 min. 2. Quench in water
6242-W	Adj. nut, wheel brg. (L. H.)	1025			Cyanide 30 min	1. Carb. in cyanide, 30 min. 2. Quench in water
6243-W	Jam nut, axle brg. (R. H.)	1025			Cyanide 30 min.	1. Carb. in cyanide, 30 min. 2. Quench in water

6244-W	Jam nut, axle brg. (L. H.)	1025			Cyanide 30 min.	1. Carb. in cyanide, 30 min. 2. Quench in water
6245-W	Lock washer, axle al've brg. adj. nut	Steel stpg.			None	None
6249-X	Anchor, brake (R. H.)	1025			None	None
6251-V	Shaft, brake	1020			None	None
6254-V	Spacer, hub brg.	1020			None	None
6253-X	Bands, brake	H. or C. R. S.			None	None
6261-V	Spring, brake band contr.	Sprg. st. wire			Oil temper	SAE ht. "F"
6262-V	Spring, brake band rels'g	Sprg. st. wire			Oil temper	SAE ht. "F"
6263-V	Pin, brake anchor	3120			Heat tr. stock	205-240 brin. 25-42 sclo.
6264-V	Adj. screw, brake band anchor bolt	1114				1. Heat at 1550, 30 min. cyanide square end only. 2. Quench in water. 3. Reheat at 1000, 30 min. (205-240 brin; 32-40 sclo.)
6267-V	Stop and adj. screw, brake band	1020			Cyanide turned end	Carb. in cyanide, turned end only
6268-W	Link, brake toggle	1025			Case harden 1/32	1. Carb. at 1650, 12 hr. 2. Cool slowly in carbonizing material. 3. Reheat in lead at 1400. 4. Quench in water
6269-V	Pin, brake toggle link	1020		70 min.	Carb. 1/32, harden	1. Carb. 1/32 at 1650, 12 hr. 2. Cool slowly in carbonizing material. 3. Reht. in lead at 1400. 4. Quench in water
6270-V	Toggle, brake, male (narrow fork)	1025			Case harden holes	1. Carb. 1/32 at 1700, 11-12 hr. 2. Cool in carbonizing material. 3. Reheat in lead at 1400. 4. Quench holes only in water
6271-V	Toggle, brake, male (wide fork)	1025			Case harden holes	1. Carb. 1/32 at 1700, 11-12 hr. 2. Cool in carbonizing material. 3. Reheat in lead at 1400. 4. Quench holes only in water
6272-V	Toggle, brake (female)	1025			Case harden holes	1. Carb. 1/32 all over at 1700, 11-12 hr. 2. Cool in carbonizing material. 3. Reht. in lead at 1400. 4. Quench hole only in water
K6273-V	Jam nut, brake toggle	1114			Cyanide	1. Carb. in cyanide, 30 min. 2. Quench in water
6274-W	Lever, brake	1035	200-220	35-40	Heat 1510-1530. Quench in oil. Draw at 850-900	None
6277-V	Lever, brake exp. pin	1020		70 min.	Carb. and harden. Draw taper in lead	1. Copper plate taper only. 2. Carb. 1/32 at 1700, 14 hr. 3. Cool in carbonizing material. 4. Reht. in lead at 1400 40-50 min. 5. Quench in water. 6. Cool taper in air
6281-X	Drive, shaft	3140	300-330		Heat 1485-1515. Quench. Draw at 800-850	1. Heat at 1530, 2½ hr. 2. Quench in water. 3. Reht. at 1000. 2 hr. 4. Cool in air
6282-X	Plate, drive	3130	205-230	32-36	Heat 1535-1565. Quench in oil. Draw 1100-1150	1. Heat at 1550, 2 hr. 2. Quench in oil. 3. Draw at 1100-1150, 2 hr. Brin. 205-230
6206-W	Gear, diff. side	2320		80-85	None	(Unknown, bought outside)
6307-V	Gear, diff. comp.	2320		80-85	None	(Unknown, bought outside)
6308-V	Gear, diff. inter.	2320		80-85	None	(Unknown, bought outside)
6309-V	Pin, diff. comp. gear	2320			Pack, harden, grind	1. Carb. 1/32 at 1700. 2. Quench from pot in oil. 3. Reht. at 1400. 4. Quench in water. 5. Draw in oil at 350

6310-V	Pin, diff. inter. gear	2320			Pack, harden, grind	1. Carb. 1/32 at 1700. 2. Quench in oil. 3. Reht. at 1400. 4. Quench in water. 5. Draw in oil at 350
6311-V	Pin, diff. dowel	1095			None	None
6314-X	Ring, diff. worm wheel	1025			None	None
6315-V	Bushing, diff. body	1020			Harden	1. Carb. 1/32 at 1700. 2. Cool in carbonizing material. 3. Reht. at 1400. 4. Quench in water
6316-V	Bushing, diff. flange	1020			Harden	1. Carb. 1/32 at 1700. 2. Cool in carbonizing material. 3. Reht. at 1400. 4. Quench in water
6317-V	Pin diff. flange bush.	1095			None	None
6318-V	Washer, diff. side gea	1020			Harden, grind	1. Carb. 1/32 at 1700. 2. Cool in carbonizing material. 3. Reht. at 1400. 4. Quench in oil
K6319-V	Washer, diff. comp. gear	1020			Harden, grind	1. Carb. 1/32 at 1700, 11-12 hr. 2. Cool in carbonizing material. 3. Heat at 1400-1425, 30-40 min. 4. Quench in oil
K6320-V	Washer, diff. inter. gear	1020			Harden, grind	1. Carb. 1/32 at 1700. 2. Cool in carbonizing material. 3. Heat at 1400. 4. Quench in oil
6328-X	Gear, diff. bevel side	2315		75-90	Carb. 1650. Quench in oil. Heat 1325-1350. Quench in oil. Draw to hardness	None
6329-W	Pinion, bevel side	2315			Carb. 1650. Quench in oil. Heat 1325-1350. Quench in oil. Draw to hardness	None
6330-X	Spider, diff.	2315		75-90 File hard	Carb. 1650. Quench in oil. Reheat to 1325-1350. Quench in oil. Draw in oil at 350	1. Carb. 1/32 at 1650. 2. Quench in oil direct from pot. 3. Reht. in sq. gas furnace at 1370, 30 min. 4. Quench in water. 5. Draw at 375, 30 min.
6331-V	Diff. side gear thrust washer	Stl. stpg.			Pack harden 1/32	1. Carb. 1/32 at 1650, 8 hr. 2. Reht. in sq. gas furnace at 1400, 20 min. 3. Quench in water. 4. Draw at 375, 20 min.
6332-V	Washer, diff. thrust	1020		File hard	Pack harden 1/32-1/16	1. Carb. 1/32 at 1650, 8 hr. 2. Reht. in gas furnace at 1400, 15 min. 3. Quench in water. 4. Draw at 350, 15 min.
6333-V	Pin, thrust washer	Drill rod			None	None
6393-V	Nut, jack shaft end (rear axle)	3130			Ht. tr. stock	None
6500-V	Bolt, front hub	1025		30 min.	SAE ht. "H"	1. Heat at 1600, 40-50 min. 2. Quench in water. 3. Draw at 900, 30 min.
6513-V	Pin, odom oper.	1114			Cyanide short end	1. Carb. short end in cyanide. 2. Quench in water
6521-Y 6522-Y	Hub, worm gear	3130		32-36	Heat 1535-1565 Quench in oil. Reheat 1100-1150. Cool slowly	None
6533-V	Bolt, rear axle hub	1025			None	1. Heat at 1600, 40-50 min. 2. Quench in water. 3. Draw at 900, 30 min.
6535-V	Bolt, brake drum	1025			None	None
7203-W	Clip, front spring	2320		45-50	SAE ht. "H"	None
7204-V	Nut, front spring clip	3135		40 min.	Quench 1535-1565 in oil. Draw 800-1000	None
7224-V	Bolt, shackle	1020		80 min.	Carb. 1/32-1/16	None

Heat Treatment of Parts—Continued

Part No.	Part Name	Requirements on Drawings				Revised Requirements
		Steel No.	Hardness		Heat Treatment	
			Brin.	Scler.		
7383-W	Hook, towing (R. H.)	1035		38 min.	SAE ht. "H"	None
7384-W	Hook, towing (L. H.)	1035		38 min.	SAE ht. "H"	None
7401-W	Lunette	1020			Anneal after forging. Heat 1450-1500. Quench in oil	None
7402-V	Pin, rear spring front bracket	1020		80 min.	Carb. $\frac{1}{32}$-$\frac{3}{64}$	None
7305-W	Clip, rear spring	2330		40 min.	Quench in oil at 1535 to 1565. Draw at 900-1000	None
7407-V	Nut, rear spring clip	3135			Quench in oil at 1535-1565. Draw at 800-1000	None
7414-V	Pin, rear spring shackle	1020		80 min.	Carb. $\frac{1}{32}$-$\frac{3}{64}$	None
7505-X	Worm wheel, and shaft (steering)	1020		75-90 top teeth 30 min. shank	Carb. wheel $\frac{1}{16}$. Heat treat shank	1. Carb. $\frac{1}{32}$ all over at 1650, 11 hr. 2. Heat all over in sq. gas furnace at 1600, 45 min. 3. Quench in oil. 4. Reht. head only at 1420, 30 min. 5. Quench in water. 6. Draw shank at 1150, 10 min. (cool in air). 7. Draw all over at 350, 30 min.
7506-W	Worm (steering)	1020		75-90 top teeth 30 min. shank	Carb. worm $\frac{1}{16}$. Heat treat shank	1. Carb. $\frac{1}{32}$ at 1650, 11 hr. 2. Heat in lead at 1600, 20 min. 3. Quench in oil. 4. Anneal worm part in cyanide. 5. Cool in air. 6. Reht. at 1420, 20 min. 7. Quench in water. 8. Draw end at 1200. 9. Draw all over at 350, 30 min.
7507-W	Steering arm	3130		35-45	SAE ht. "H"	1. Heat at 1550, 30 min. 2. Quench in oil. 3. Reht. at 1150-1200, 45 min. 4. Cool in air
7532-V	Collar, thrust, outer	3120			Case harden	None
7533-V	Collar, thrust, inner	3120			Case harden	None
7542-V	Pin, Ratchet	Drill rod			Harden	1. Heat in sq. gas furnace at 1400, 10 min. 2. Heat on plate, 30 min. 3. Quench in water. 4. Draw at 425, 20 min.
7544-V	Washer, worm wheel thrust	1010			Case harden	1. Carb. $\frac{1}{32}$ at 1650, 7½ hr. 2. Cool in carbonizing material. 3. Heat in furnace at 1400, 10 min. 3. Quench in oil. 4. Draw at 350, 20 min.
7602-V	Pin, yoke end	C. R. S.		70 min.	Carb. $\frac{1}{32}$-$\frac{3}{64}$ harden	None
7677-V	Pin, brake equal lever	1114		70 min.	Carb. $\frac{1}{32}$-$\frac{3}{64}$, harden	None

Class "B" SAE 1114 Steel Parts Which May Be Made of Commercial Screw Stock.

Part No.	Name	No. Req'd
1261-V	Oil relief valve body	1
1248-V	Dowel, magneto	2
1287-V	Dowel, oil pan	2
1172-V	Handle, oil gauge	1
5756-V	Nut, accelerator pedal stop	1
1293-V	Nut, connecting rod oil tube clips (Castle)	4
8223-V	Nut, dis. set screw lock	1
7632-V	Nut, expansion pipe packing flange	3
1334-V	Nut, fan spindle clamp	1
7632-V	Nut, fan bracket stud	4
5756-V	Nut, fan spider screw	4
5756-V	Nut, gear case cover	16
5457-V	Nut, generator shaft bearing cage (Castle)	4
1255-V	Nut, governor rod tube lock	1
1286-V	Nut, governor rod joint ball stud	2
1286-V	Nut, governor rod lock	1
5756-V	Nut, inlet to expansion manifold stud	4
5756-V	Nut, oil pan screw	32
5756-V	Nut, thrust plunger stop screw	2
5756-V	Nut, water pipe stud	8
1286-V	Nut, water pipe coupling flange	2
1329-V	Nut, taper fan adjusting screw	1
1322-V	Nut, taper coupling flange	3
1322-V	Nut, taper water pump rotor	1
1283-V	Nut, taper oil pump drive shaft	2
7607-V	Screw, accelerator pedal stop	1
5752-V	Screw, breather	2
5751-V	Screw, coil	2
7080-V	Screw, fly wheel cover	2
1637-V	Screw, gas feed pipe clip	1
1316-V	Screw, governor lever spindle	1
5752-V	Screw, oil pump body	4
5751-V	Screw, oil pump drive shaft bracket	1
1415-V	Screw, oil pump drive shaft bracket cover	1
5752-V	Screw, pump shaft housing cover	3
1309-V	Socket, governor rod ball joint	2
1201-V	Stud, generator shaft bearing cage	4
1311-V	Stud, governor rod ball joint ball	2
1008-V	Stud, water pipe	8
1768-V	Body, oil relief valve	1
1752-V	Handle, oil gauge	1
1331-V	Screw, expansion pipe packing flange	3
1136-V	Screw, fan adjusting	1
7080-V	Screw, fly wheel cover	2
1338-V	Screw, fan spider	4
1637-V	Screw, gas feed pipe clip	1
1207-V	Screw, gear case cover	16
1416-V	Screw, generator set	1
5752-V	Screw, governor adjusting spring cage	2
5752-V	Screw, governor lever housing	3
1316-V	Screw, governor lever spindle	1
1285-V	Screw, magneto coupling flange	4
5201-V	Screw, oil pan, long	32
5752-V	Screw, oil pan, short	6
5752-V	Screw, oil pump body	4
5751-V	Screw, oil pump drive shaft bracket	1
1415-V	Screw, oil pump drive shaft bracket cover	1
1285-V	Screw, pump coupling flange	2
1324-V	Screw, pump cover	8
5752-V	Screw, pump shaft housing cover	3
1277-V	Screw, rear bearing filler block	2
1064-V	Screw, camshaft and idler thrust plunger stop	2
1082-V	Screw, valve tappet adjusting	8
1327-V	Screw, water pump bracket cap	4
5752-V	Screw, water pump tee	2
1309-V	Socket, governor rod ball joint	2
7597-V	Stud, accelerator pedal	1
1030-V	Stud, fan bracket	4
1201-V	Stud, generator shaft bearing cage	4
1311-V	Stud, governor rod ball joint ball	2
1007-V	Stud, intake and expansion manifold	12
1194-V	Stud, intake to expansion manifold	4
1029-V	Stud, valve tappet	4
1008-V	Stud, water pipe	8
1079-V	Tappet valve	8

Fits, Tolerances and Heat Treatments Applied in Production

(*Continued from page* 1316)

Front Axle and Steering Gear—The front axle is of I-beam design with Elliott type steering knuckles fitted with taper roller bearings in the wheels only. The king pins are held fast in the knuckles and turn in bushings fitted in the axle yoke. The steering gear is of the conventional fore and aft worm and gear type, fitted with ball thrust bearings, the gear having a full circumference and the spark and throttle control being on the outside.

Clutch—The clutch is of the dry multiple disk type and has 19 plates, of which 9 are faced with woven asbestos fabric. The clutch is enclosed by a bell-housing bolted to the crankcase.

Universal joints are of the yoke and cross type and are enclosed in a pressed steel casing. The propeller shaft ends are splined and welded into the tubular propeller shaft.

Rear axle is of full floating type with the worm gearing, the differential being of the bevel gear type with four pinions. Taper roller bearings are used. The axle shafts are splined on both ends, one end sliding into the splined differential gear and the other end shrunk into the driving flange. The worm gear is provided with splines cut on the inner circumference and fits over the differential case, which is also splined. This construction is employed to relieve the bolts which clamp the worm gear to the differential case from shearing strain.

A RESOLUTION has been moved in the British House of Commons to give protection to certain "key" industries, the maintenance of which on a definite scale of magnitude is regarded as being in the national interests. The list of industries includes magnetos, metallic tungsten, ferro-tungsten, and manufactured products of metallic tungsten, and compounds of thorium, cerium, and the other rare earth metals, and all synthetic organic chemicals. The proposal is that on all these articles an ad valorem duty of 33⅓ per cent shall be imposed. A similar duty should, it is suggested, be placed upon other articles which may be offered for sale in the United Kingdom at prices below the cost of production or at prices which by reason of the condition of currency are below the prices at which similar goods could be profitably manufactured in the United Kingdom.

IN planning the Forum department for the Engineering Number of AUTOMOTIVE INDUSTRIES, a goodly number of engineers were asked to contribute. In each case a question was suggested, but it was made plain to the engineer that his most advanced thought was requested. As was the desire in the planning, a number of the contributors have entirely ignored the question sent to them, and have written the thought uppermost in their minds.

The Engineering Staff of AUTOMOTIVE INDUSTRIES believes that this presentation of engineering opinion is unique for this field of thought. Our hope is that the discussion will not end here. The Forum is—as it always has been—open to the thought in the industry. Further discussion of the points presented here—or others the reader may have in his mind—is invited. Such a discussion, whether it is a presentation of opinions or the asking of questions, is the most profitable kind of co-operation. The door is open to each reader.

We invite you to participate in the feast of divergent opinion we have prepared with the help of the automotive community:

The Next Step in Engine Design

Elimination of Throttling Under Light Loads

Editor, AUTOMOTIVE INDUSTRIES:

In my opinion the most logical step in rendering automobile engines more efficient under average working conditions is to eliminate throttling and low compression under light loads, just as was done with steam engines during the development of that industry.

History will repeat itself. For seventy years steam engines rejected the steam at boiler pressure, then Watt introduced complete expansion and, with a few other minor improvements, obtained four times the power per pound of coal.

For twenty-five years automobile engines have been releasing the burning gases of the working stroke at less volume than was compressed, rejecting more than 40 per cent of the heat units to the exhaust.

For over 100 years steam engines were governed by throttling the intake with a butterfly valve, reducing the initial pressure and efficiency with the load.

Ever since the birth of the automobile engine, always too large for the average load, its output has been controlled by the braking effect of throttling the intake, thereby lowering the compression and the thermal efficiency.

Complete expansion in an internal combustion automobile engine is more practicable than in a steam engine, because we have no cylinder condensation to contend with, yet builders of auto engines have been and are still vying with each other to see which can get the most horsepower per unit of piston displacement when volumetric efficiency has nothing to do with the output per unit of fuel consumed.

As the average working condition of the automobile engine is from one-fifth to one-quarter of its full capacity, it must be designed to give a higher efficiency at these loads.

A complete expansion cycle, developing 30 per cent thermal efficiency at full load, permits of increasing the compression and decreasing the fuel content as the load becomes lighter, thereby eliminating the braking effect of throttling and the thermal losses of low compression.

The automobile industry is in a rut, worn deep by continually following primeval practice of throttling the gases during the induction stroke to control the speed and output, thereby turning into useful work, during the average load, but one gallon of gas for every ten put into the fuel tank.

Such a policy may have been permissible when fuel cost less than maintenance and automobiles were taxed according to their piston displacement.

Now, however, it would be most unwise to design and build engines along the customary and standard lines if better thermal efficiency is desired, and twenty-five years of high volumetric but low thermal efficiency should not be extended or prolonged in this progressive age, especially now that our fuel consumption is approaching nature's supply.

C. E. SARGENT.

Research in Vaporization

Editor, AUTOMOTIVE INDUSTRIES:

Answering your letter, in which you ask the following question: What do you regard as the next logical step in rendering automobile engines more efficient under operating conditions? I would answer as follows:

A proper device for furnishing a thoroughly vaporized mixture to the cylinder at a relatively low temperature and a combustion chamber which will burn this mixture entirely free from knocks at all loads and speeds and with higher compression ratios than possible at present; namely, 4½-1 and above without the use of dopes.

The next step is an engine which will handle any fuel by the use of dopes with high air-cycle efficiency and high combustion efficiency, which, combined, mean high thermal efficiency.

We do not feel a satisfactory vaporization system has yet been produced to furnish a proper mixture to the cylinder with 440 degrees end point fuels under vary-

ing conditions of speed, load and rapidly changing demands of load and speed.

The reason this has not been accomplished is because there has been too little real research and too much experimental development, without the groundwork of true research as a guide.

We expect to attack the problem along this line.

H. L. HORNING,
Waukesha Motor Co.

Refinements in Engine Design

Editor, AUTOMOTIVE INDUSTRIES:

In reply to your question, "What changes in passenger car engine design do you advocate to render these engines more economical under average operating conditions?" one may almost answer "None." Refinements in design, "Yes." Better construction, higher mechanical efficiency, higher compression ratios as soon as the average commercial fuel will permit, and particularly such refinements in design and such care in assembly that the frequency and the cost of overhaul will be reduced at least 50 per cent. By such means maximum brake thermal efficiencies might be increased from the present 20-25 per cent to a possible 30 per cent, and the upkeep cost indefinitely reduced.

However, the most important immediate possibilities of economy involve engine design only indirectly. The major economies which might be realized may be stated as follows:

(a) In unburned fuel (too rich mixtures), aggregating perhaps 25 per cent of the total fuel cost.

(b) Elimination of mechanical losses by the operation of engines at the optimum speed and load. An ideal transmission system (if it existed) could save 15 to 25 per cent of present fuel consumption and perhaps cut in half the cost of upkeep of engines.

(c) A general reduction in weight of cars would reduce the total cost of automobile transportation, now estimated at an average of about 12 cents per car mile, almost in proportion to the reduction in weight. In general, if average cars weighed half as much, the population could afford to use nearly twice as many of them.

These economies cannot be realized if attempted with any sacrifice of comfort and convenience on the part of car users, or with any great increase in complexity of mechanical construction.

(a) Fuel waste is the net result of many causes, chief of which is perhaps the necessity of some sort of manual adjustment of the fuel supply for starting and warming up the engine with the grade of fuel which must be used. The average driver cannot possibly learn to maintain an economical fuel adjustment and, in fact, would not take the trouble even if he knew how (and it takes much trouble with the average car). Unburned fuel will continue to pollute the air until carbureting and manifold systems can be developed which adjust themselves for temperature of the air and the engine, at least as well as present systems do for speed and load, and do it without the care or the interference of the average driver.

(b) The power absorbed in the engine under average driving conditions about equals that required to drive the car. With present types of transmission this cannot be greatly reduced with cars that will satisfy the driver. An ideal transmission should allow the engine to operate always at nearly full load and at a speed which would furnish the power required, adjusting this speed automatically to meet the demands for power. Such a transmission would not only save fuel, but might be much more comfortable to drive, but it does not exist. Why not find a way to solve this problem?

(c) Any reduction of car weight must be accomplished without sacrifice of comfort. The ratio of sprung to unsprung weight and the ratio of car weight to maximum load cannot be reduced without sacrifice of comfort unless spring systems are improved, or other means found to maintain comfortable riding qualities.

H. C. DICKINSON,
Physicist, Bureau of Standards.

The Next Step in Engine Efficiency

Editor, AUTOMOTIVE INDUSTRIES:

In your letter of April 28, you ask me what I regard as the next logical step in rendering automotive engines more efficient under average operating conditions.

My answer would be: Increased compression, or rather expansion, leaner mixtures, and lower friction losses. However, in stating this I am keenly aware that the statement is almost worthless without some words about the way to attain these ends.

Stratification, doping, turbulence, multiple spark plugs, admixture of inert gases, finally the injection principle—all these are means at present being tried out somewhere in the world. The final preponderance of any of these methods will depend as much on the persons backing them as on the value of the methods themselves.

I have reviewed all these things more fully in a bulletin just about to be published by the Engineering Experiment Station of the Ohio State University. To avoid misunderstandings it might be best here to end simply by a reference to this publication.

C. A. NORMAN,
Prof. Machine Design,
Ohio State University.

Trend of Passenger Car Design

Crankcase Dilution and Chassis Lubrication

Editor, AUTOMOTIVE INDUSTRIES:

There are two problems which come to mind that seem to be quite important.

The first is the matter of crankcase dilution, caused by unburned portions of fuel leaking past the pistons and rings and getting into crankcase. This is certainly a big problem, and one which will need solving.

Another problem is to devise a method of properly lubricating chassis parts, such as spring shackles, spring bolts, springs, brake shafts, front axle parts, etc.

At the present time we have the motor, transmission and rear axle worked out to a high degree of perfection from a lubrication standpoint and all out of proportion to the rest of the chassis parts.

Rattles and squeaks are the most frequent cause of cars entering the service station, and this is largely due to the fact that, first, the parts to be lubricated are many in number and often inaccessible, with the result that they do not receive proper attention; second, they are open to the elements, with the result that dirt and water have an opportunity of creeping into the open joints, which is far from a satisfactory lubricating condition.

The writer believes that this problem will be solved, although he is aware of the difficulties to be encountered.

It seems obvious that these parts should be enclosed, so as to exclude dirt, etc., and retain the lubricant and at the same time be lubricated from possibly one or two points accessibly located.

The writer realizes that this is not a new problem, and that various attempts have been made and are being made to solve it. The problem is still with us, and it is an interesting one.

R. S. BEGG,
Chief Engineer, Jordan Motor Car Co., Inc.

Design Improvements Suggested

Editor, AUTOMOTIVE INDUSTRIES:

The question—What is the next logical step in passenger car design and how can it be realized?—may be answered briefly by stating: The adoption of minor improvements which increase the facility with which the owner may maintain his car in good working condition and have it overhauled and repaired when necessary.

The car of to-day is a reliable piece of mechanism and capable of withstanding a surprisingly great amount of neglect and abuse. In the hands of the ordinary driver, the average car will run for at least six thousand miles without much attention, but at some time it is necessary to adjust the valve tappets, steering gear and perhaps the rear axle or perhaps the radiator or its connections need repairs, which are minor matters and do not prevent the car from running. But the motorist of to-day is not satisfied with a car which merely runs and provides transportation; he wants a car which operates smoothly and without squeaks and rattles, and to permit the owner to continue to enjoy and take the full amount of pleasure from the operation of his car is the immediate problem of the engineer. The average operator does not know what his car costs to operate, and doesn't much care, as long as his car gives him that intangible pride of ownership of a sweet-running piece of machinery, which he can keep in this condition for at least two or more years, without an undue outlay of time if he does the maintenance work himself, or without a great expense if he has the work done for him.

The writer has owned and operated a number of cars of various makes and has, in some manner, been associated with the operation and care of a great many more, as well as having designed a few cars which have been successful as regards being the source of profit to their builders, and in all of these cars there have been features which could have been improved if sufficient thought had been given to the details which promote the ease with which they could be properly cared for.

Starting at the front of the car, it is necessary in most cases to do considerable work with the sheet metal parts before the radiator can be removed, and to remove and replace the hose connections unnecessarily great care, patience and persistence must be exercised; otherwise damage to some part will result. Why not have the metal parts attached to the flexible hose connections made easily removable by taking off a few nuts or by unscrewing a simple metal coupling, and why put the bolts which hold the radiator in place in positions where they are so difficult of access? Further, in connection with the radiator, why not provide a deflecting apron behind the fan to direct the dust-laden air coming through the radiator away from the motor compartment toward the ground, instead of against the motor, where the dust will accumulate and where the carbureter will draw in large quantities of foreign matter, which causes unnecessary wear of the interior of the motor? Experience has shown that, with a properly designed cooling system, it is not necessary to have the fan blow the dust-laden air through the motor compartment.

Reverting to the sheet metal work at the front of the car, everyone knows that to remove a front fender or splasher requires more time than is necessary, because of the large number of small bolts or screws necessary to prevent excessive vibration, squeaks and rattles of these parts. Why not securely fasten these sheet metal parts to the frame, independent of each other in such a way that any of the parts can be removed without disassembling any other part? This merely means that each part will be designed or braced to be sufficiently rigid to withstand vibration, without depending on some other sheet metal part to provide the necessary rigidity.

Referring to the motor compartment—very few motors are free from serious oil leaks, even when new. The joints between the valve tappet covers and cylinder blocks leak oil, no matter how tightly the bolts or nuts on the covers are drawn. This defect is due to improper design of the covers, the fastening means, or the packing used, and instead of using one or two nuts in the center of the cover to hold it in place, cap screws along the edges of the plates should be used, because the extra work of removing a few additional easily accessible nuts or screws is not objected to if the motor can be kept exteriorly free from oil, which, with the dust drawn through the radiator, causes the average motor space to become a grimy mess, instead of the clean, neat compartment which it well might be, with pride to the owner and credit to the builder. Another serious source of oil leakage at the motor exists at either end of the crankshaft where it passes out of the casing. Most manufacturers are satisfied to provide an annular space surrounding the end of the shaft, feeling that they have made provision against the escape of oil at these points. Why not put oil-throwing rings on the shaft ends and provide a series of close-fitting annular grooves in the casing, with ample means for draining the oil back into the crankcase before it leaks out on to the road or the garage floor? I think that, judging from the oiled appearance of streets used by numbers of cars and from the appearance of garage floors, a surprisingly large amount of oil is wasted in a manner which is preventable, and by being wasted causes expense far in excess of the value of the oil.

It is possible to dwell at length on possible simple improvements in the design or location or mounting of the parts in the engine space, which will make it easier to properly clean and maintain these parts and be reflected in the increased life and better operation of these parts, but space does not permit of a detailed consideration of the subject at this time.

Briefly referring to other parts of the car, why not eliminate, as far as possible, all necessity for providing oil or grease lubrication of parts, particularly those inaccessibly located under the car? For instance, the use of small, laminated leaf springs, arranged vertically at the ends of the chassis springs, to take the place of spring shackles, which might also be replaced by using flexible fabric materials, such as cotton belting, working in tension to connect the ends of the springs to the chassis. Why not, also, use some form of universal joint, either of the fabric or spring type, to replace the grease throwing type now in common use? Why not have the floor of the body over the rear axle removable, so that lubrication and care of the center part of the axle can be accomplished without the necessity of getting under the car and ruining one's disposition and

clothing? Why not provide felt or other materials to pack openings in gear cases, etc., through which shafts pass, and by experiment determine the best packing material in each place, as well as the best way of providing a suitable means of keeping the joint tight during long periods of use? Using a piece of clock spring, surrounding the packing so as to press it against the revolving shaft, is a simple and cheap means of preventing oil seepage between the shaft and casing. Another source of messiness is where the gear shift rods pass through the ends of the transmission casing. Why not extend the casing, or provide a cover to enclose the ends of the rods, so that the lubricant which always leaks out at this point will drain back into the case?

A great deal of work has been done to improve the operation of the engine, and much has been written about increasing the fuel economy of the engine. This work is appreciated by all, but it seems inconsistent to devote so much attention to the engine and so little attention to the other power-consuming parts of the car. For instance, an investigation will disclose that the majority of cars having brakes which operate efficiently, also lose considerable power due to the dragging of the brakes. It is strange that this should be so, but the fact is that particularly with the foot brake, unless the adjustment of the brake shoes and their operating parts is such as to necessitate a movement of from four to five inches of the pedal pad, the brake will be found to drag. The average operator enjoys driving most when a movement of from two to three inches applies the foot brake, and this movement, with properly designed brakes, is sufficient and does not necessitate more than a nominal amount of force against the pedal pad.

The preceding few examples serve to indicate that a number of little things must be properly thought out and embraced in our car constructions before we can sit back and satisfactorily contemplate the results of our efforts, and I suggest that one of the surest and best ways of improving our cars is for the designer to operate one of his own cars over a protracted period and be compelled to care for it in all respects, including keeping it cleaned, without assistance. Such a policy will serve to familiarize the designer with the amount and nature of the disagreeable work necessary to keep his creation working efficiently and in such a condition that an owner may take pride in its possession and pleasure in its operation.

JOS. A. ANGLADA.

Improving Truck Design

Outside Factors Affect Truck Design

Editor, AUTOMOTIVE INDUSTRIES:

The probable future developments in truck design constitute a subject which it is difficult to treat in other than the most general terms.

The truck is a tool of commerce, its particular function being the transportation of goods. The outstanding feature of merit is its elasticity in use, due to the fact that it operates on the public highways. As a tool of business it must demonstrate its utility by an adequate return on the investment which it represents. Its earning power is affected by (a) its ability to work and (b) the cost of operation. The first item, the ability to work, is governed by design features and by the character of highways over which and the traffic conditions through which it operates. The cost of operation is partly dependent upon the design, workmanship and material employed, and partly upon facilities which are provided for maintenance.

With this brief outline of what I consider fundamentals, I would say that it is my belief that the increased economy of operation of trucks, by increasing the amount of useful work which can be obtained, depends primarily upon the future development of an adequate system of highways, the rearrangement of terminal facilities to eliminate loss of time loading and unloading, and the development and use of special types of bodies, mechanical and otherwise, for specialized application. As these things are accomplished I foresee the opportunity of developing trucks which will be more economical in operation, due to the fact that the size of motors and power plants and chassis can be reduced for a given useful load which will permit of more economical operation.

This same factor will make possible the use of pneumatic tires for larger specific useful loads than is possible at the present time, thus making possible the saving which can be realized in maintenance by the use of pneumatic tires, as well as economies which can be realized due to the larger amount of work which can be done with pneumatic tired vehicles, due to increased speed possibilities.

While mechanical development will undoubtedly proceed along various lines which it is impossible to specifically predict, resulting in simplification of parts with coincident reduction in labor and material cost for maintenance, I am inclined to feel that as a general thing a more thorough and systematic development of facilities for maintenance by large users for their own fleets and by manufacturers and distributors for the use of individual owners can be developed to realize the full benefits from present mechanical constructions. In other words, I feel that present designs are, on the whole, in advance of facilities which are in general existence even though they may be far from an ultimate state of perfection.

I realize that this letter is, as I indicated in starting, lacking in that it does not deal with specific items, but I have purposely refrained from doing this for the reason that there is undoubtedly more than one way along which developments will proceed, and if I should, therefore, deal with any one specific line, I would only be writing advertising copy as to the advantages of my own personal opinions on details.

B. B. BACHMAN,
Autocar Co.

Truck Engine Efficiency

Editor, AUTOMOTIVE INDUSTRIES:

It is rather difficult to pick out any one element in truck design and say arbitrarily that this is the element which is capable of greatest improvement. There are so many possibilities for better trucks along the lines of greater accessibility, easier riding, lighter weight, lower operating costs, etc., that one cannot pick out any one of these features and say that it will do most to bring about an improvement in trucks.

The weakest element in the design of the truck is undoubtedly the engine. Records show that from 80 to 90 per cent of the repairs and replacements on trucks

in service are required by the engine. This would indicate that there would be more possibilities along the line of improvement in engine design than in any other direction.

We must remember, however, that the present-day engine is a decidedly complex machine, combining as it does electricity, electro-magnetism, chemistry and thermo-dynamics, in addition to the highest order of mechanical ingenuity. When one thinks of it, it is really a wonder, as the farmer said, that the "durn thing runs at all." I, therefore, hesitate to criticize the present type of engine, although statistics indicate that the greatest possible improvements must be made in the power plant.

If someone can develop a power plant which will operate at reasonable efficiency under all conditions, and particularly under partial loads, and at the same time simplify the design so that the numerous delicate, highly refined parts and accessories can be eliminated, we will have taken a greater step forward in the design of trucks.

There is one point in truck design which, I believe, has been overlooked or on which, at least, we have not placed sufficient stress. I refer to the necessity of so designing trucks, and passenger cars, too, for that matter, that the shocks on vital parts may be reduced to the very minimum.

A truck is consigned to the junk heap ordinarily because of, first, obsolescence of design; second, excessive wear on vital parts, or, third, the breakdown of vital parts due to fatigue resulting from shock stresses. Certainly not over 10 per cent of the old trucks are scrapped because the design is obsolete.

Engineers are paying a great deal of attention to the use of adjustable bearings, renewable bushings, etc., so that it should be possible to renew a truck almost indefinitely, so far as wear is concerned.

In addition to all this, however, it is very essential that the design of the truck be such that it will accept or absorb shocks without injury to itself. The truck which is built on the rigid basis, with the idea of resisting such shocks, is at a serious disadvantage in this respect. A man jumping into a life-net escapes injury. Another, jumping the same distance onto the pavement, suffers serious injuries. In the former case the shock of landing is cushioned. In the latter it is rigidly resisted. The cushioning principle will help the life of the truck in similar manner.

CHARLES GUERNSEY,
Chief Engineer, Service Motor Truck Co.

Spring Shackle Action

Editor, AUTOMOTIVE INDUSTRIES:

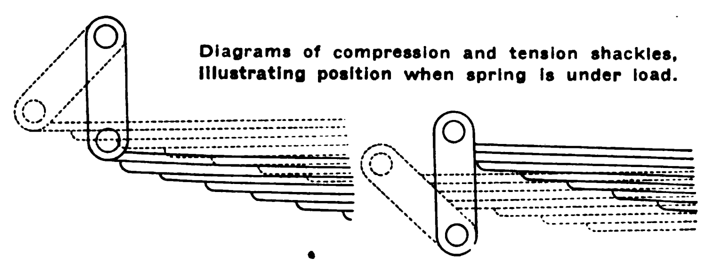
The query covered by your letter is:

"What do you consider the weakest element in truck design to-day and what suggestion have you for remedying it?"

It is exceedingly difficult to point out any one feature of design which represents the weakest point in motor truck design, inasmuch as there is room for so much discussion as to the relative importance of various portions of the chassis and, therefore, the importance of any weakness which might be general in such portions. Also, certain weaknesses which are flagrant in some chassis are not present in others, and so it is not fair to apply such cases to the whole art of motor truck design which can only be applied to a minority of vehicles. Therefore, in presenting one weakness in motor truck design, which I think it fair to say is common to all motor trucks in greater or less degree, one need not necessarily maintain that this weakness is the greatest in the whole structure.

One of the most important elements of motor truck structure requiring improvement at the present time is that of suspension. Good springs are available to those in a position to pay the necessarily high prices, and effective means have been developed for satisfactorily attaching such springs to the axle in a secure and rigid manner, but methods of securing the ends of springs to the chassis frame are generally crude and unsatisfactory.

The vehicle spring operates under distinct limitations. Although it is capable of cushioning the major shocks received from the road, other means are necessary to dampen the vibration not absorbed by the tires which, while of small amplitude, is of high frequency and almost continuous duration. Another limitation of the vehicle spring is that its cushioning qualities depend upon the pressure upon the spring. In light vehicles this pressure is fairly constant, the weight of the load, such as passengers in a touring car or packages in a light delivery car, does not materially change the pressure at the springs, but in motor trucks, particularly of the larger capacities, the load often represents more total weight than that of the entire chassis, and hence the percentage of capacity load carried materially affects pressures on springs. If a spring be designed for normal maximum carrying capacity of the vehicle, it will provide the



Diagrams of compression and tension shackles, illustrating position when spring is under load.

greatest cushioning effect under such conditions, and such conditions only. When running without load, the spring, on the contrary, will show little if any cushioning effect, so that not only are the minute vibrations transmitted direct from the wheels to the frame but the major shocks also.

Various efforts have been made to provide springs or spring systems having a greater range of cushioning ability. For example, some of the large bus operating companies employ springs having two separate groups of leaves, the upper group of small capacity, which provides good cushioning effect for light loads, and a lower group so cambered that it does not come into play until the upper group has deflected for a distance equivalent to a heavier load, whereupon the second set reinforces the first set to provide the requisite cushioning effect for a heavy load.

The dearth of rubber in Germany during the war gave rise to the use of helical supplementary springs instead of the customary shackles in order to absorb some of the vibration incident to the use of steel tires. The German "Gaggenau" have always used helical supplementary springs at the ends of their leaf springs. The use of shock absorbers, supplementary springs and snubbers of various types is very general on touring cars. The Hotchkiss drive has enjoyed considerable popularity in both touring cars and commercial vehicles on account of the superior performance attainable through flexible torque reaction resistance, and also because such suspension decreased the shocks and vibrations resulting from propulsive stresses.

Study of the action of the ordinary spring shackle

reveals the fact that the crank action of the shackle under some conditions has a peculiar binding effect upon the spring. Thus the compression shackle (see cut), when the spring is under load, permits the spring-eye to rise in relation to the frame. The greater the distance, the greater leverage the spring has upon the shackle, so that the return of the spring to its normal shape and the shackle to its normal shackle position is resisted; on the other hand, the tension shackle under the same conditions has this leverage reversed against itself so that the return of the spring to its normal shape is accelerated rather than retarded, since the distention of the spring has a tendency to raise the frame rather than lower it. A study of these actions will reveal that the effect in either case is undesirable, since in the case of the compression shackle the tendency is for the shackle to fall to one side or the other, thereby tending to restrict the return of the spring to its normal shape, while in the case of the tension shackle the effect is to keep the shackle in a position resisting spring action under impact.

The greatest drawback to the spring shackle is the necessity for two wearing parts whose friction is of the disadvantageous type; namely, oscillation rather than rotation. Unit pressures on spring and shackle bolts are excessive for the sizes in which they are ordinarily made, adjustment to compensate for wear is practically impossible and adequate lubrication is not only exceedingly difficult from the mechanical standpoint but most precarious from the human standpoint.

Another serious drawback to the conventional spring shackle is the lack of provision against side thrust; friction and pressure between the jaws of the shackle. Lateral stresses transmitted by the springs to the frame are of considerable moment and take place while the shackles are in motion. These result in wear and this wear leads to play with the attending results of rattling, endwise friction on spring and shackle bolts and admission of dirt and water.

Development of spring shackle design, therefore, calls for the provision of means to dampen the minute but destructive vibrations which the spring transmits to the frame, elimination of the undesirable crank motion of the spring shackle and a means of compensating for the necessary endwise motion of the spring tips without employing oscillating or sliding metallic surfaces requiring lubrication. Developments are now in progress whereby it seems that these ends can be attained by the employment of a yielding enclosure of the spring end composed of a plastic element capable of retaining the spring in general relation to the frame; capable of accommodating itself by deformation to the endwise movement of the spring tips without surface friction; adapted to constraining this endwise motion to a direction parallel with the frame, possessed of dampening properties whereby the vibration from the spring may be insulated from the frame end, not by accumulation into vibration moments of greater amplitude and slower speed, such as is the action of cushioning means, but by converting such vibration into kneading action upon the plastic body, as in solid rubber tires.

From present developments it appears that it is practicable to use rubber for this purpose, there being no necessity for an excessive volume of rubber, inasmuch as the rear spring has two such sections and need not have a greater volume of rubber in both upper cushions greater than the volume of rubber represented by that portion of the tire in contact with the ground; indeed, this volume may be even less, since the weight of the spring itself, the axle and wheel rests upon the tire but does not rest upon the ends of the spring.

This solution of the problem need not necessarily be the sole solution, but is here cited merely to show what possibilities along this line do exist and only await the concentrated attention of engineers to effect a much-needed improvement in this one detail of motor truck construction.

M. C. HORINE,
International Motor Co.

Horse Power and Horse Sense

Editor, AUTOMOTIVE INDUSTRIES:

In an endeavor to tabulate the troubles which were serious in the motor trucks used by the A. E. F. the writer surveyed numerous repair units, overhaul parks and the main reconstruction shops in France. In view of the fact that the A. E. F. at one time had in service approximately 169 different makes of motor vehicles (this figure includes trucks, passenger cars and motor cycles) it will be seen that the survey was fairly comprehensive and included prominent makes of trucks as manufactured in the various allied countries.

A careful analysis of this survey did not show that any particular element gave universal trouble in the various makes of trucks. It was generally found that each make of truck had its particular weakness and that the hard usage in army service brought out this weakness forcibly. The following is a brief list of troubles developed by different American trucks: exhaust valves, push rods, fan studs, motor lubrication, clutch, steering gear, steering arms, springs, axle housings, rear axle bearings, frames, etc. Taken by volume approximately 90 per cent of the troubles were found to be in the various units to the rear of the engine. Lack of attention to details of design and of assembly on the part of American builders was a constant source of trouble.

A comparison of the tractive factors developed in high gear by the average American truck with those developed abroad will show that the American truck has more ability on high gear than its European counterpart. This excessive engine power overstresses and quickly develops any latent weakness in the other elements of the truck and causes trouble. Hence it is the writer's opinion that the weakest element in truck design is paradoxically the engine, which is too strong.

The fault for this lack of balance of design does not lie entirely with the truck engineer, but more often than not is caused by the personal equation of the company for which the design is made.

A truck sales manager not long ago was insisting that cylinders 1/4 in. oversize be installed on a truck which already had good performing ability. He was asked whether he was selling transportation or horse power. The answer came immediately, "Horse power, it's easier."

The public and truck salesmen should be educated not to expect passenger car performance of a truck and the truck manufacturer and engineer should be taught to produce a more balanced design and economical means of freight transportation.

Much can be said against our practice of over-powering trucks, such as maintenance, road damage, etc., but two points stand out clearly. First, the average truck to-day has sufficient power to carry a 100 per cent overload in high gear on hard level pavements. This condition invites overloading on the part of the truck operator and he does overload continually, with the result that every part from the clutch to the tire is a potential source of trouble and the one that fails first is the weak element. Second, as a result of too large an engine a condition exists which is not quite so apparent, but is of the most importance to

the industry at large, i.e., the gasoline wasted by these engines. If smaller engines were used in connection with proper transmission and axle ratios a probable increase of 50 per cent in ton miles per gallon of gasoline could be obtained, which would result in a national saving of fuel. Some of the fuel associations have been advocating this procedure, but so far without apparent results.

The weakest element of truck design might be paraphrased as *too much horse power and not enough horse sense.*

W. T. NORTON, JR.

Fuel Economy and Manifold Development

Heat Regulation in Manifold

Editor, AUTOMOTIVE INDUSTRIES:

More than ever before, the subject of economy, or more technically, efficiency of operation is occupying the attention of all involved in things which have to do with progress.

With the automobile this is caused by more than the mere outlet for the energies of the engineer—it has become imperative not only on account of the apparently diminishing supply of fuel but because of the general tendencies of everyone to retrench.

The problem is difficult not simply because of widely varying characteristics of the fuels available but because of the different conditions under which the engine is required to perform, and in which is included that of climate.

Theoretically a charge should be gotten into the cylinder at the lowest possible temperature if maximum power per unit of weight is desired, but with present day fuels this must be modified by the methods necessary in producing a mixture which is absolutely homogeneous.

Analysis of this will show that whatever modification or compromise in initial charge temperature is effected will be controlled by not only initial temperature of the air and fuel, but the load assumed by the engine as well.

With the two accepted mediums for affecting the temperature of the intake charge each has its advantages and disadvantages.

With water, there is always valuable time lost in arriving at a temperature sufficient to produce proper results, and when this has been arrived at, variation in engine power, unless for fixed amounts and sustained periods, finds itself contending with insufficient heat for large amounts of mixture passing by the throttle or too much for small amounts or possibly vice versa.

In addition, the maximum temperature available is seldom in excess of 180 deg. Fahr., and with the usual commercial forms of transferring heat this is quite insufficient.

Briefly summed up, use of the jacket water not only provides insufficient heat, but the range of variation is too small and the total amount of heat units held in reserve by the jacket water is so great as to make whatever change takes place too sluggish in its action.

It might be possible for some complicated arrangement to control, by means of thermostats and circulating devices, the rate of heat interchange, but a little thought will indicate that the complications involved would more than offset any thermal advantages.

The other commonly resorted to form—exhaust heating—possesses also a disadvantage as to amount of heat available for transfer, but from the other direction, it might be said. Under certain conditions it is far too intense, and in which case it results in cracking of the fuel or raising of the temperature of the intake charge to a point sufficient to offset by a loss in power any gain in thermal efficiency.

The ordinary forms of heating at present in use are not the most desirable because of the fact that there is no fixed relation between amount of fuel, quality of fuel, initial heat in the fuel, and the intake air and the amount of heat to be supplied, and which it will be readily agreed is just as essential of accurate gaging as is the timing of the valves, or ignition, or proportioning of the mixture.

The ultimate aim, then, is some form of heating element for the air or fuel or both, and which shall deliver to these portions an amount of heat sufficient to produce a definite temperature of the whole mixture, and which temperature shall have a definite relation to the amount of charge involved, basing this statement on the assumption that there already exists a definite control of the water jacket temperature.

To accomplish this there must first be an abundant supply of heat of minimum cost and which requirements are covered by the exhaust gases; secondly, a medium easily susceptible to temperature changes in order that the variations may be as rapid as required; and third, a thermostatic device which will establish a definite relation between these variables, and which relation can only be determined for a given type of engine and carbureter by careful dynamometer and road tests.

D. L. GALLUP, Consulting Engineer,
Nordyke & Marmon Co.

Induction Gases

Editor, AUTOMOTIVE INDUSTRIES:

Considerable discussion has been accorded the various methods of conditioning gases entering the combustion chamber of our various motors of to-day; and now that everyone is—or claims to be—fairly well "hot-spotted," it is time to call attention to another factor—that twin companion of misery—proper distribution of induction gases.

Reverting to the history of hot-spot records in the S. A. E. Journals of 1916 and 1917, it will be found that discussion first started regarding the application of heat to induction pipes. It has taken four years to recognize and admit the fact that heat properly applied to induction pipes is beneficial. Let us hope that it does not take a corresponding period to wake up to the fact that even after gases are conditioned the problem of proper distribution is still paramount.

Observation of the various forms of heat applied on induction pipes leads the writer to feel that the proper study and analysis of this problem has not been carried out by various designers, as some applications are clearly nothing more or less than hot induction pipes, which are not within the meaning of the term at all. Hot induction pipes make for soft motors, lack of economy, lack of power and frequent actual operating difficulties. Mr. A. L. Nelson's paper at the mid-winter S. A. E. meeting clearly brought out the factor involved in proper hot-spotting, namely: excessively hot localized stricture of induction gases in such a manner that the heavier or wet content can not pass a given area unless it passes through the medium of the air stream.

The only suggestion I can make in regard to Mr. Nelson's application is that to my way of reasoning, his exhaust is too far from his heated zone and he is not obtaining the hottest exhaust gases possible by this application.

Mr. Nelson states that the use of this device has enabled him to increase his induction pipe area as well as his carburetor sizes. This is very true and is as it should be.

This question of hot-spotting has been brought up at various semi-annual meetings of the S. A. E. and has been discussed and criticized most thoroughly by various members. Those of us who have been consistent users of the hot-spot have fallen back on the fact that, the slight loss in volumetric efficiency due to the induced heat through the hot-spot, is more than compensated for by the increased power obtained through the use of the induced heat from the hot-spot; and that, for the time being, we must rest on the fact until something better has been determined that will be as simple in its application as the hot-spot. Engineers, in general, had best confine their activities along this line and leave the more complex solution of the problem in the hands of specialists who undoubtedly will later on find a way through this maze of difficult carburetion.

The "twin companion" indicated at the opening of this article, that has not received the attention it deserves, has been the distribution of gases. On four-cylinder construction this distribution has been reasonably simple. However, on six-cylinder construction and other multiples thereof, we find this problem of distribution becomes exceedingly complex.

The proper application of the hot-spot at the carbureter branch will get the gas beyond this branch in fairly usable condition. However, the breaking up of the liquid fuel into minute globular particles, which pass into the combustion chamber in the form of fog, does not indicate that the density of this fog-like fuel is uniform in the least. The mass difference of this charge can be well demonstrated experimentally by laboratory means.

In passing such a charge through pipes of various bends, it will be noted that the heavier globular particles suspended in the fog have a tendency to hug either one side or the other of the pipe, at the point of its ejection. Consequently, there is no basis for the assertion that a right-angle pipe will eject a uniform mixture of the fog-like fuel at absolutely right angles to its point of entry into the pipe. Therefore, the application of pipe bends is of great importance, even when combined with the hot-spot system of rupture of fuels. Care must be exercised to so design the entry of the gases into the cylinder block that these heavier elements of our fuel are not thrown toward the end cylinders or toward the center cylinders, as the case may be.

This is particularly true on six-cylinder construction, where a block of three cylinders is served by one branch of the induction pipes. It is usually the practice to favor the two end cylinders with the bulk of the charge, in the hopes that by their increased capacity they will absorb the bulk of the heavy elements without disturbing the general functioning of the motor. These conditions generally result in the starving of cylinders Nos. 3 and 4 to some extent and build up different pressure readings on explosion cycles.

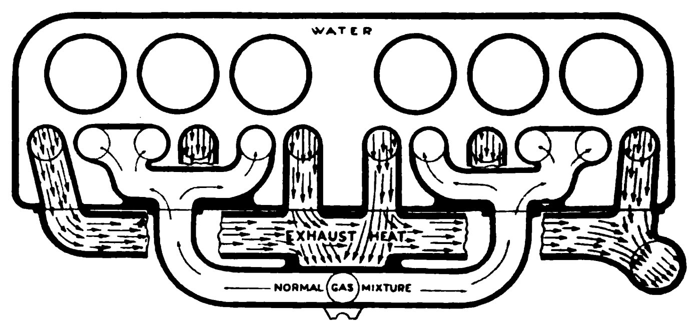
The purpose of the above discussion has been to bring to the attention of engineers the benefit accruing from the so-called ram's horn construction of manifold. Through the use of such manifolds with the ram's horn effect—either up or down—we have been able to introduce the fog-like gas in such a manner as to equally distribute between any one of a group of three on six-cylinder application. In the formation of the intake passage of a group of three on six-cylinder application, it is necessary that the cored passage in the cylinder block be a continuation of the idea involved in the ram's horn manifold.

The advertising manager who seized upon the hot-spot and ram's horn slogan built much better than he knew at the time. Great attention has been given to the hot-spot feature; but the question of proper distribution of gases after passing the hot-spot has, I feel, been sorely neglected.

Another important factor has been overlooked in this battle for efficiency. We are running our engines too cold. When one considers the possibility of air cooling, one must consider that the normal operating temperatures of such motors exceed the operating temperatures of the average water-cooled engine by at least one hundred per cent.

If these things are possible with air cooling, it is also possible that a vast improvement can be made in water cooled construction. Our compressions, fuel density, etc., have been calculated subconsciously with the idea of using water as the cooling medium. This has restricted our pressure requirements on both compression and explosion to that point where the boiling point of water has determined practically the maximum obtainable without the actual breaking-down of our fuel structure.

Even though the above statement has been worked out in theory, facts indicate this is not the ease when looking over the field in a broad manner. We are not even utilizing the benefits to be obtained by taking advantage of the average boiling point of water as a maximum possibility. Most motors under normal operating conditions do not exceed 120° to 140° of heat, whereas the greatest benefit for their particular compression ratios would probably indicate 190° to 200° of heat would be more desirable.



It seems, then, that we have neglected entirely this question of maintaining the highest normal operating temperature to which our engines are designed. Great advantage can be secured by increasing this temperature to the maximum, and through such method of control, by guaranteeing that evaporation will not become a disturbing factor; or some means be instituted to prevent evaporation through the condensation of the cooling medium.

After the hot-spot has done its work of rupturing the tough liquid fuel with which we have to deal to-day, and properly designed manifold has introduced this fuel into the combustion chamber in such a manner that each cylinder draws an equal part of this mixture, it is necessary that this fuel be handled in such a manner in the combustion chamber that the maximum expansion possibilities are obtained from it.

This can only be so by maintaining piston wall and head temperatures of sufficiently high degree that our fuel will not recondense on the surfaces of these parts; but will rebound, so to speak, from these parts on compression—thereby agitating the mass and increasing the speed of the combustion.

Taking the writer's argument as a whole, it is incumbent on the profession to not become so fully absorbed in this question of hot-spotting or conditioning of gases as to neglect the proper distribution of such gases after being conditioned and the treatment of such gases after being distributed.

C. C. HINKLEY,
Hinkley Motors Corporation.

Necessity for Fuel Economy

Editor, AUTOMOTIVE INDUSTRIES:

It is doubtful that there is any one problem that is given more thought by the engineers of the industry to-day than that of economy and every one of its many phases, the principal one of these phases being that of the economy of fuel. The motoring public of to-day has had borne upon them in the last six to ten months the tremendous necessity of economy throughout the entire nation, and immediately brings to the surface the things that have been uppermost in the minds of many engineers for some time to come.

I believe the greatest problem that the automotive engineers have to face to-day is that of producing an automobile or any automotive apparatus that will function with the maximum economy of fuel, lubrication, service upkeep and represent a high second hand value. I am thoroughly convinced that this demand for economy is bringing forward the best efforts of all engineers and we will undoubtedly see in the not too distant future many changes in the designs of many of our most popular automotive vehicle development along the lines of particular fuel economy. Much of the engineering work that was done during the war, particularly on high duty engines for airplanes, tractors and much of the war apparatus, presented an opportunity to the engineers to make some vast strides in cylinder efficiency. This development work is being commercialized by the engineers throughout the industry and its effect is already being felt.

In reference to the question as noted in your letter as to the advantages and disadvantages of a cast iron camshaft bearing, where the bearing is simply a drilled hole in the crankcase compared with a bushed bearing. It is my belief that the bushed bearing is the most satisfactory type as it presents many advantages in manufacture, as well as tremendous advantage in service in the car owner's hands. This is something that will have to be considered more than it ever has been before. We are, however, advocates of the cast iron camshaft bushing. We have used successfully on something over 200,000 engines a cast iron camshaft bushing inserted in the crankcase. While it is necessary to be a little more careful regarding the hardness at the bearings so as to make this bearing smooth, it is without a doubt the most satisfactory camshaft bearing that could be put into an internal combustion engine of multicylinder type.

A. C. HAMILTON, Chief Engineer,
Oakland Motor Car Co.

Economy of Operation Coming

Editor, AUTOMOTIVE INDUSTRIES:

It appears to me that economy of operation will be the next step in passenger car design, and that the gasoline consumption problem is the biggest item under this heading. Eventually economy of fuel may be accomplished by the use of some radically different types of motors or other more or less revolutionary changes, but there will no doubt be an intermediate step which could be made almost immediately.

In view of modern engineering developments, this step, I believe, will be the installation of smaller motors and some transmission device permitting the motor to operate most of the time at or near its maximum efficiency. There may be developed at some time in the future to a practical point what we might call an ideal transmission with an infinite number of speed ratios and a comparatively simple control, but for the present for practical purposes we are almost limited to a four-speed transmission of the ordinary design.

By using a motor of such size that the maximum speed of the car would not be over 45 miles per hour, and by the use of a four-speed transmission it should be possible to increase the mileage per gallon of gasoline by at least 50 per cent very easily. This fact, of course, is well known by automotive engineers, but probably not very generally known by the public, and I feel that when the public really become acquainted with such conditions and when they are ready to make a few practical sacrifices for the sake of economy that this step will no doubt be taken.

It should not be a great hardship for the average driver to have the maximum speed of his car limited to 45 miles per hour, as this is even beyond the legal limit in most communities and much greater speed than can be used with comfort on the greater part of our roads.

There should also be very little objection to more frequent shifting of gears, particularly if the operation were made more simple and convenient by the use of some of the so-called automatic arrangements that are now being developed to a very practical point.

As a general proposition, the buying public gets what it wants, and my opinion is that when it really wants economy and is willing to make some very minor concessions to obtain it, the automobile manufacturers will very gladly and can very easily give it to them.

C. S. POPE,
Chief Engineer, Elgin Motor Car Corp.

Some Interesting Comment on Four Wheel Braking

Disadvantages of Four Wheel Braking

Editor, AUTOMOTIVE INDUSTRIES:

Answering your query in regard to the use of four wheel brakes on high class American cars, I believe the following considerations should be looked into.

There is a possible limit to the retardation of a motor car with respect to the comfort and safety of the passengers. It is no uncommon thing with the quick application of the brakes on two wheels only to have passengers thrown from their seats. It is for this reason that in high class passenger cars easy acting brakes are a requisite, but even with soft or easy acting brakes it is possible in an emergency to retard the car so rapidly and so suddenly that passengers not on their guard may be given a most uncomfortable feeling, if not actually thrown from their seats.

Therefore, it is a question whether the proper amount of braking is not already provided on the standard jobs of to-day, providing the brakes are properly designed and applied. Placing four wheel brakes on a standard high class job would increase the discomfort in driving when brakes were used quickly to the limit and many accidents to passengers, especially children, would result.

The advantages claimed can only become advantages where cars are operated at excessive speeds or at speeds incompatible with the state of the weather or pavement. For sporting cars, racing or record breaking cars, the advantage of the four wheel brake is without question, but in order to demonstrate the advantages a driver immediately has to drive recklessly and at speeds contrary to police regulations and most of the State speed laws.

In most cases four wheel brakes would be much more

difficult to keep in order and adjustment than the present two wheel brakes.

All in all, it seems that the present braking system when properly designed and installed is satisfactory. Why add to complications for the unnecessary?

W. R. STRICKLAND, Chief Engineer,
Peerless Motor Car Co.

Advantages of Four Wheel Braking

Editor, AUTOMOTIVE INDUSTRIES:

Replying to yours of recent date, note your question in regard to whether four wheel brakes would be an advantage for high grade American cars.

From the experiments made, I am rather inclined to believe that they would be an advantage on any car weighing over 2000 lb., provided the front wheel brakes are made in some simple way so as to eliminate the complicated universal joints which are sometimes used.

From the experiments made, I find that it is possible to stop a car equipped with the four wheel brakes in between 50 and 60 per cent of the distance required for only the regular two rear wheel brakes. Also skidding is very materially minimized by the use of the front wheel brakes, provided brakes are properly equalized. If brakes are connected up properly they are a great help in descending a steep hill, as it allows one to cool off one set while using the other.

There is, no doubt, some disadvantage in the use of front wheel brakes, due to the additional cost and to the slight complication necessary and also to the additional weight, but I believe that the disadvantages are more than offset by the advantages. W. G. WALL,
National Motor Car & Vehicle Corp.

Three Is a Crowd in Rear Seat

Editor, AUTOMOTIVE INDUSTRIES:

We have had a car fitted with four wheel brakes in use for the past six months—while this car enables wonderful demonstrations to be given, yet its ability to stop in a shorter distance than our car, equipped with rear wheel brakes only, is obtained at considerable discomfort to the passengers. With only rear wheel brakes properly adjusted and the brakes adequate in size to the car weight, a car can be stopped as rapidly as is desirable.

It is wonderful how quickly a car equipped with four wheel brakes can be stopped—a car fitted in this manner can be stopped in less than half the distance of a car equipped with rear wheel brakes only. Theoretically, this should be impossible, but probably because of the load being thrown on the front wheels there is greater traction on the front wheels than exists in theory, and a car can actually be stopped in less than half the distance with four wheel brakes than it can with rear wheel brakes only, even though rear wheel brakes are powerful enough to lock the wheels. When a car equipped with four wheel brakes is stopped in the shortest possible distance it is extremely uncomfortable for the passengers, and, unless they have something to hold on to, they will be thrown out of the seats very violently. Of course, having four wheel brakes does not necessitate violent application of the brakes, and the advantage then is that a car can be brought to a stop in the usual distance with much less effort on the part of the driver; this is not of very much consequence, as most cars are equipped with brakes that are large enough that they will almost lock the wheels without any excessive effort on the part of the driver. It is always desirable to stop short of locking the wheels.

Another advantage that probably is possessed by four wheel brakes is the life of the brake lining and the length of time that one can run without necessitating readjusting the brakes. If a car is stopped in the usual distance and having double the number of brake drums will, no doubt, double the life of the brakes. This is, of course, desirable, but as to whether this is necessary will depend upon the amount of trouble this gives on a given car.

One other claim is made for four wheel brakes, and that is that a car is not so likely to skid when the brakes are applied on wet pavements. In some cases this is certainly true, in others the driver sometimes loses his control over the front wheels with four wheel brakes, and we have seen cases where cars have swerved very objectionably to the side of the road.

Most four wheel brakes that have come to the writer's attention have been very complicated; in many cases the front springs and front steering pivot axles are unduly stressed. It would appear that these parts should be made much heavier than usual when front wheel brakes are applied.

Body Design

There is another matter in which I believe you could be of much use to the automobile industry by having a discussion in your journal, and that is by advocating that no passenger car should be designed to carry more than two full-grown people on the rear seat. There has been a great demand by the automobile buying public for years for a very wide rear seat that will be quite comfortable for three grown-up people with overcoats and robes. This could be accomplished in the old days, when the chassis was very high from the ground and the body and seats also very high; then the passengers could be accommodated in regard to width by a cushion being carried out sideways over the rear wheel housing, but in the present-day cars, where the chassis and bodies are low, the rear seat must come in between the rear wheel housing, and it is utterly impossible to give comfort for three people if the standard tread of 56½ in. is adhered to.

We firmly believe that the tread should neither be under nor over the standard because of having to so frequently run in ruts; this, therefore, being limited, and the cross section of modern tires being much larger than in the past, makes it quite impossible to obtain a width of rear seat that is adequate for three full-grown people. Provision must always be made for the use of tire chains, and ample clearance must be allowed between the sides of the wheel housing and the wheel to accommodate side sway of the body, and this, when properly taken care of, gives a rear seat adequate for about two and a half people. It makes a much better proportioned car when the width is kept down to accommodate two people in the rear seat, and the spring suspension is a much easier problem.

It is a very rare thing to see a seven-passenger car on the road with seven people in it, and if the springs are adequate to take care of three full-grown people on the rear seat, they will give hard riding when only one or two passengers ride on the rear seat.

It will be quite a boon to the body designer, chassis engineer and the makers of springs if cars of two, four or six passengers were the limit, no seat being made wider than to take care of two grown-up people. If the above facts were brought forcibly before the buying public there might be less demand for wider rear seats than can at present be provided for.

D. FERGUSSON,
Chief Engineer, Pierce-Arrow Motor Car Co.

Weak Elements of Present Tractor Design

Lugs on Wheel Type Tractors

Editor, AUTOMOTIVE INDUSTRIES:

"What do you consider the weakest element in wheel type tractor design to-day, and what suggestions have you for remedying it?"

Hubs, spokes, bearings and, to a certain extent, the rims have received considerable attention in tractors, but it can hardly be said that lugs have had the serious attention they must have before we can call them an engineering solution.

Practically all lugs have been made up to use cheap commercial structural shapes; the methods of attaching and detaching are in need of more study to produce quiet and simple operation and removal. Interchangeable wheels with sets of various type lugs is one solution. On the whole, however, the real question is "A series of correct lugs to meet variable conditions of road and field, designed in such a manner as to use to the fullest extent a minimum tractor weight along with the minimum of energy and disturbance of soil, secure the maximum sensible area of soil contact and still keep within the shear value of the soil."

A reasonable possible slippage should be incorporated in the design at or near the point of maximum drawbar pull on low gear, for the reason that we need a safety slip for the energy when plows strike obstructions which might be considered irresistible.

It would seem that a real research series is necessary to cover the various problems of lug and wheel action. We should know some of the following relations:

1. Bearing areas and pressure distribution of round wheel and caterpillar type treads, standing still and in translation.
2. The proper theoretical form of lug for various general groups of soils to give us the best possible hold on the ground in translation, covering also various soil moisture contents within the range of practical plowing.
3. The relation between weight of tractor and lug penetration of various forms.
4. Friction relation of flat steel tires, weight on axle, wheel diameter of face on various soils, covering various moisture content within practical tractor operating conditions.
5. Soil friction or shear values between flat areas of typical soils.

When we have these relations, and doubtless some others, we shall have gone a long way toward reducing rolling friction and making a tractor more generally efficient.

Another series of problems relates to gear tooth design and efficiencies. We should answer this question: "What form of gear tooth will give us the longest life with a minimum of variation in the transmission of uniform angular velocity?"

We are all aware that new gears, well run in and under sensible load, have very high efficiencies, but this is only during the period that the tooth form and alignment is theoretically correct to transmit uniform angular velocity. As soon as wear takes place in the tooth or bearings, the form changes rapidly above and below the pitch line because of the combination of sliding and rolling contact, so that it seems very desirable to investigate these features of design more thoroughly.

There is little use of our reducing by extreme energy and careful and expensive design the fuel consumption by the 1/100 part of a pound of a given engine, and then throw it away in quantities of horsepower in the transmission wear and tear and translation losses. In other words, let us reduce the tremendous losses between the engine shaft and the drawbar by a detailed study of each intermediate group of frictional losses.

O. B. ZIMMERMAN,
International Harvester Co.

Tractor Adaptability to Field Conditions

Editor, AUTOMOTIVE INDUSTRIES:

If clarifying views on the one weakest element in wheel type tractor design to-day were wanted, I should choose to express myself on lack of adaptability to general field conditions. Much has been written and said about the lack of standardization or uniformity in tractor design and is almost always compared to the nice uniformity and standardization obtaining in trucks and automobiles at this time. According to the automotive engineer whose field has been limited to road vehicles, his prosaic contemporary in the tractor industry has been playing too much with the sand man. Altogether too frequently the vehicle engineer bursts forth in print and in production with a solution (?) of the whole tractor problem.

Let me point out here that the problems to be met by the tractor designer are fundamentally different and more complex than those to be met by the vehicle designer. The tractor designer has a multitude of conditions to meet, each one of which may call for a different basic design for his tractor if he is to meet them each with a separate type of machine, and here is where the vehicle engineer falls down in principle and creates one more type to be added to the already large number of existing types of tractors.

To me the greatest weakness in the present tractor design and the greatest problem to be met lies in the necessity for a machine which will meet the greatest number of conditions. Here the field for mechanical ingenuity is practically unlimited. No single-idea designer will succeed here. A designer must be conscious of all the conditions to be met, and in order to succeed must exercise rare and impartial judgment. The development of any industry is always based more or less upon precedent followed by evolution.

In the early days of tractor development precedent of the heavy steam tractor was followed and unfortunately for the industry is still followed by some large companies.

During the last few years, however, since it has been learned that suitable weight distribution, wheel area and lug equipment will give a tractor a drawbar pull equal to its own weight, there has been a substantial tendency toward something like a uniform type of tractor. Tractor design, however, will never reach such uniformity as is possible in vehicles.

The tractor of to-day has been accepted as a success in the fairer fields, but we still have millions of acres upon which the average type of tractor cannot be called a "howling success." The broad plains of our country have naturally been the ones where tractors were first successful, but as developments go on we always come up against conditions not exactly suited to the prairie type, and due to meeting conditions in the rice fields, sand dunes, swamp lands, hillsides and woods we are continually working toward the more adaptable machine.

The solution of the problem of making a tractor more adaptable to the varying conditions lies in, first, light weight, for light weight is desirable in all the conditions;

second, weight distribution in order to make available at the drive wheels all the power of the engine, and, third, general maneuvering ability which will make possible the successful operation of the tractor on hillsides, in orchards, in sandy land, in peat bog and in the harder gumbo and clay fields. Yours very truly,

R. O. HENDRICKSON,
Vice-President, J. I. Case Plow Works Co.

Traction Rating Variation Causes Injustice

Editor, AUTOMOTIVE INDUSTRIES:

The lack of proper lug equipment for tractor wheels is a decided weakness. For proper lug equipment I would consider a lug that worked fairly satisfactorily under a great variety of conditions which would avoid the necessity of changing the lugs with a change of soil conditions.

Another matter which seems to require attention is that of weight distribution, especially as it affects the slippage and guiding of the tractor. In our tests last season it was noticed that the slippage in tractors of different types, with exactly the same weight distribution and under practically the same conditions, varied materially. This would indicate that possibly there are other elements than the distribution of weight that affects the slippage. The guiding of the tractor is governed almost entirely by proper weight distribution, and in order to carry out effective guiding it is important that this matter should be given proper attention.

If I may add a word of what is considered the weakest element of tractor design to-day, I would say it is the wide variation of tractor rating. In our tests last year of 65 tractors we found that the ratings varied from 20 per cent below to 50 per cent above the actual maximum horsepower on the belt. This is too great a variation and works an injustice to all manufacturers.

OSCAR W. SJOGREN,
Chairman of Department of Agricultural Engineering, University of Nebraska.

Increasing Battery Life and Satisfaction

Factors of Original Battery Installation

Editor, AUTOMOTIVE INDUSTRIES:

In the earlier days of the automobile, there were two elements of the car which competed for the dubious honor of being the shortest lived, viz., the tires and storage battery. Both the tire manufacturers and the storage battery concerns have made wonderful improvements in their construction, so that now it is possible to obtain at least two or three seasons' use out of both tires and storage batteries.

Unfortunately, the battery problem is much more complicated than the tire problem, because the average driver carries spare tire equipment, and, even if he should not, it is possible, at the expense of small annoyance, to remove a flat tire and drive on the rim to the nearest small town or country garage, where he will usually find ample equipment to get him out of his trouble with very little delay. Should his battery fail, however, at a critical time, it may be impossible even to get the car started, and, on account of the almost universally adopted practice of storing the battery away in an invisible and sometimes inaccessible location, the owner is tempted to forget completely the very existence of his battery until such time as it ceases to function.

As previously stated, it is possible, by taking advantage of the latest improvements in battery design, to obtain several years' satisfactory service, but, on account of the very fact that a storage battery is tucked away out of sight, it has been the subject of what someone has called "Purchasing Department Engineering." Batteries have frequently been selected more on the basis of their first cost than that of the "most miles per dollar," which one of the tire companies has adopted as a slogan.

To show what this means to the owner, it might be well to take a typical example of two batteries submitted for a given installation. One might have a normal life of, say nine months, and cost the car manufacturer a certain basic price which we will arbitrarily say is $20. Another battery can be purchased for, say, $30, which would have a life of at least three years.

Now, let us see what happens in the first case. The owner purchasing the car with the lower-priced battery gets satisfactory service for the nine months, at the end of which time he must buy a new battery, for which he pays, not the same price as the car manufacturer, but a retail price which would be (in proportion, probably) $40. If he gets nine months' service out of this battery and repeats the operation, at the end of the three years he would have expended $120 for storage batteries, and be in exactly the same place as the owner of the other battery, who has so far not had to make any expenditure at all. Of course, you might say that at the end of his first period he might have bought a higher priced battery, and, from then on, had long life and satisfactory battery service; but the tendency is, as a rule, to install a battery of characteristics equivalent to the one originally used.

It is readily apparent from the above that the car manufacturer in saving $10 on the first cost of the car has placed the user under an expenditure of many times this sum.

In all justice, it must be admitted that the storage battery manufacturers themselves are to a certain extent responsible for this condition, because they have permitted, and in some cases advocated, the use of batteries with very thin plates and separators which showed very superior performance and characteristics on bench tests, but which, in order to meet these very tests, had to have the element of durability sacrificed.

Three requirements which most purchasing agents and some engineers have set up as a mark to shoot at are the three words, "small," "light" and "cheap," and the element of service has not been given its proper consideration. There are notable and gratifying exceptions to the practice, however, as I have in mind a certain car which carried complete electrical equipment in the year 1912, and on which (at the latest calculations) at least 30 per cent of the original batteries are still in service.

The location of the battery is of great importance; probably the best place ever found is on the running board, or in the space between the running board and frames so that it is in plain sight and easily accessible. But, on account of the universally desired clean running boards, the battery has been shifted to various locations in the body or chassis—some of them fairly satisfactory, but more often extremely unfavorable.

I have seen a battery located right alongside a hot exhaust pipe, under the floor boards, where it was necessary to use a screwdriver to take screws out of floor boards to get at the battery. The location alone was responsible

for considerable evaporation due to heat, and the irksome job of getting at the battery made the addition of distilled water, when required, a very rare occurrence, with the result that this installation gave very unsatisfactory service to say the least.

Another case of a two-door sedan—the battery was located on the chassis under the front floor boards, and only a human snake could get at it. The result, of course, was that it got attention only when something failed to work. The production engineer at the motor car plant wanted a battery installation, which was the same for all types of bodies, and gave but casual thought to battery accessibility.

However, as this whole proposition gets to be better understood, and the vital importance of a satisfactory storage battery to the service which the car can give becomes better understood, I believe there will be such co-operation between the manufacturers of storage batteries, electrical equipment and motor cars in the way of original specifications, battery location, both as regards accessibility and freedom from engine and exhaust line heat, road dirt, etc., that we can expect wonderful improvement in the general all-around service of this much abused piece of apparatus.

W. A. CHRYST,
Chief Engineer,
Dayton Engineering Laboratories Co.

Battery Satisfaction

Editor, AUTOMOTIVE INDUSTRIES:

We suggest the following in answer to the question, "What should car manufacturers do to render storage battery installations more satisfactory and to increase battery life?"

1. Location of the battery where it is easily accessible.
2. Battery should be placed in a container which will keep out all dust and moisture.
3. Battery compartment to be large enough to block the battery in with corner blocks and also have hold-down rods which can be easily removed when it is necessary to take the battery out of the compartment.
4. Battery leads should have enough slack in the cables to prevent any pull on the battery post which would cause the post to break.
5. All battery terminals should be thoroughly tightened with bolts and nuts and then covered with vaseline or some suitable grease to prevent the acid spray from causing corrosion.
6. Sufficient clearance should be allowed in all battery compartments to permit any standard make of battery to be used as a replacement on an automobile. This is especially true where a battery with an increase in height may be purchased by a car owner if he desires to use a battery of increased capacity over the one furnished him by the car manufacturer.
7. In the location of the battery, allowance should be made for the battery to use a type which is mechanically the best that can be built. The end to end assembly of the battery makes a very long case and very often necessitates the use of bolts to hold the sides of the battery box together.
8. Car manufacturer should see that a battery that is placed on a car has not been allowed to stand around in stock for any length of time. The car owner should be permitted to receive as new a battery as possible.

A very desirable method of doing this is to purchase a bone dry battery from the battery manufacturer and keep this in stock up until the time it is necessary to place it on the car, or better, ship the same bone dry battery with the car to the car owner.

9. The car owner should be given all the information in regard to the care of the battery and instructed to register his battery immediately at a battery service station.

It would be very desirable if the car manufacturer would keep a record of some kind which would give the serial number of the battery which is shipped on a car with his own car serial number. This would lead to better cooperation between the battery manufacturer and the car manufacturer and would result in more satisfaction to the car owner.

WILLARD STORAGE BATTERY CO.

Engineering Problems of Present Importance

Increased Compression Ratios

Editor, AUTOMOTIVE INDUSTRIES:

In reply to your letter of April 28, I consider you made a good guess in suggesting that I write about "increased compression ratios." My views on this subject sum up as follows:

(a) The degree of compression used in present day automotive engines is the principal deciding factor in the power output and fuel consumption of an engine of given speed;

(b) At the present time, the nature of our fuel is the largest deciding factor on the degree of compression which can be used;

(c) Given a fuel which will make possible the use of compression ratios of 6 or 7 to 1, we are certain of great gain in power and economy in all types of automotive engines;

(d) I believe the use of such high compressions with fuel giving no detonation or preignition, will not be materially harder on existing engines than the use of present compression ratios with present fuel, in spite of the fact that a much higher b. m. e. p. will be maintained;

(e) There is now much waste of fuel due to running automotive engines with "rich" mixture mainly for the purpose of reducing detonation, although few people have thought of it in that way;

(f) We must make non-detonating fuel universally available as soon as possible, for then only can we use high compression pistons in our engines and feel that we are running somewhere near as economically as we know how to, and begin to think of our old enemy carbon and his exciting influence on detonation, as a friend and an insulator conserving our dearly bought fuel;

(g) By the proper use of available benzol supplies, a large percentage of our present automotive engines could be run on fuel better suited to their present compression ratios but, unfortunately, where benzol is used, it is frequently used in proportions of from 50 to 100 per cent, whereas from 20 to 30 per cent is all that is really needed with present compressions; to permit the use of much higher compressions, the General Motors Corporation has made wonderful strides in finding compounds which, when added to fuel in exceedingly small percentages, make them satisfactory for use in engines of even 71 compression ratio.

In addition to the foregoing, I believe the most important automotive problems are: all-metal, internally braced aircraft; carbureters giving "leaner" mixtures through the throttle range, and air-cooled engines.

In the all-metal airplane, I see a type which will require less maintenance and will last longer, therefore, presumably, making it cheaper, and I know of much good work progressing along this line.

Referring to air-cooled engines, I believe that much could be accomplished by the use of composite cylinders using thick sections of aluminum to cool the combustion chamber and valves; this is based on my experiments at McCook Field with large bore, high compression aviation engine cylinders.

Regarding the carbureters, we have found by experiment that many existing carbureters fall far short of giving desirable air fuel ratios at certain throttled positions, and it has been found that this can be largely overcome, at least in aircraft use, by modifying the types.

GEO. E. A. HALLETT,
Captain, Air Service, Engineering Division,
McCook Field.

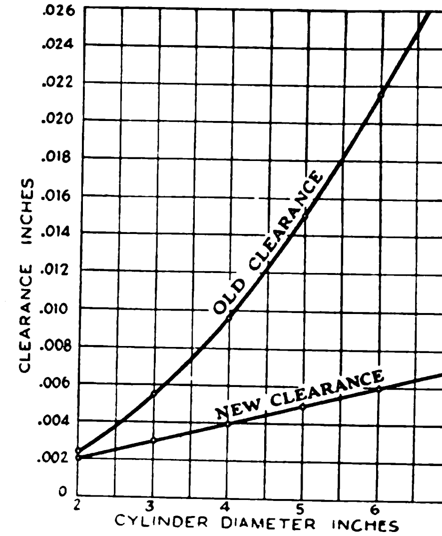


Fig. 4

Recent Developments in Aluminum Pistons

Editor, AUTOMOTIVE INDUSTRIES:

During the past year the aluminum piston has undergone a great development. The advantages due to the light weight and high heat conductivity of aluminum have long been realized, and aluminum pistons have been used with considerable success by many manufacturers. The casting in permanent molds, the development of a suitable alloy, the heat treatment of the castings are all developments of aluminum pistons of several years' standing. The one objectionable feature which has at times made trouble in the operation of aluminum pistons has been the fact that it was necessary to run them with a greater clearance than was the case with the cast iron piston. This was due to the greater coefficient of expansion of aluminum as compared with cast iron. In order to insure the best operation of an aluminum piston it is necessary that the skirt be fitted with as close a clearance as possible. The clearance of the ring lands makes very little difference as long as it is sufficient to prevent them from touching the walls of the cylinder.

Recent experiments have proven that the temperature of an aluminum piston skirt is not high enough to account for the amount of clearance which it has been necessary to give these pistons in the past. The head temperature, on the other hand, is much higher than that of the skirt. The expansion of the skirt may be divided into two parts: (1) the thermal expansion, that is, the increase in size due to the increase in temperature of the skirt; (2) the mechanical expansion due to the thermal expansion of the head, that is, the head being so much hotter than the skirt expands more, and this sets up a sufficient force to pull the skirt with it. It would be ideal to entirely separate the head from the skirt. Since this is not possible the next best thing to do is to separate the head from the skirt on the thrust faces only, and take care of the expansion in the direction of the pin by making use of a vertical slot or by relieving the piston on the side. Both have been successful. Fig. 1 shows a design embodying the vertical slot. When a vertical slot is used it must be placed on the low thrust side. Fig. 2 shows a piston in which only the head is separated from the skirt on the thrust faces and the expansion in the direction of the pin is made harmless by a relief. Fig. 3 operates in a similar manner to the piston shown in Fig. 2, but is not relieved to the same extent as the former. The extra clearance in the direction of the pin is obtained by grinding the piston oval, the shorter diameter being in a line with the pin.

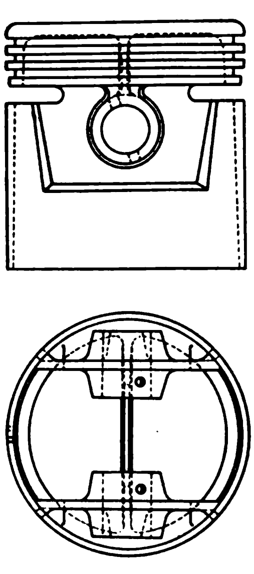


Fig. 1

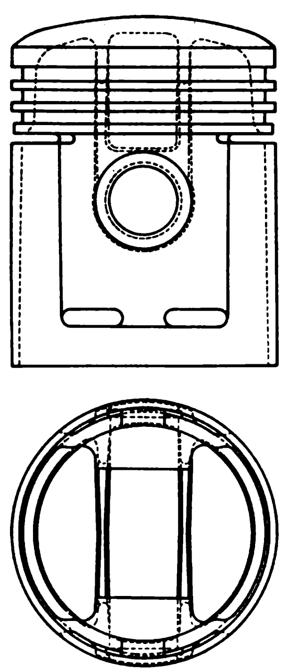


Fig. 2

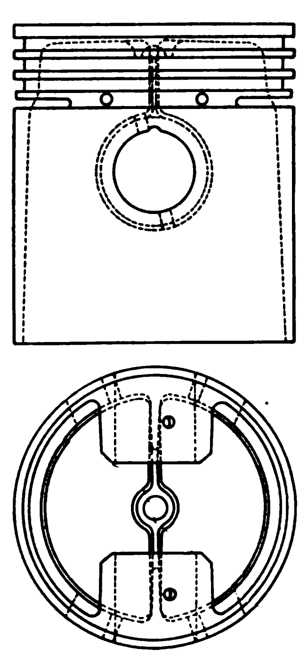


Fig. 3

Piston Clearances

All troubles of which aluminum pistons have been accused can be laid to the clearance. As explained above, this has been taken care of in the design of the piston. The curve of Fig. 4 is of interest, since it shows both the new clearance and that formerly required by aluminum pistons. The new clearance, which is the one to be used for all new designs, is 0.001 in. per in. diameter.

Oil Pumping

Experience has taught us that in order to eliminate oil pumping it is necessary that the relief on the piston pin side of the piston be either very generous and provided with a large outlet, or that the fit be made fairly close, just enough so the pis-

ton will not stick on these sides. Figs. 1 and 2 are examples of the large clearance on the sides, while Fig. 3 is an example of the latter type. The theory of this seems to be merely this: That we must either allow space for the oil so small that if all the oil passed into the combustion chamber it would be harmless or we must make it large enough so that the weight of the volume of oil will be greater than the capillary action and the oil will drain back into the crankcase rather than work its way up into the combustion chamber. It is very difficult, if not impossible, to draw a line between a clearance that is just large enough and one that is just too large. This can be determined only by experiment.

The slots separating the head from the thrust faces, besides making harmless the head expansion, must also function as a drain for the oil. As regards the former function the width of the slot is immaterial, but in order that it may act as an oil drain it is necessary that the slot be made of considerable width.

Wear

Piston wear is largely a function of piston material and of piston and cylinder finish. Aluminum pistons cast in permanent molds wear better than sand cast ones. If both the cylinder and piston have a smooth finish and the lubrication is ample, wear will be negligible. Of the several ways of finishing pistons and cylinders, grinding seems to be the best one.

FERDINAND JEHLE, Engineer,
Aluminum Manufacturers, Inc.

Use of Hollow Section Parts

Editor, AUTOMOTIVE INDUSTRIES:

There are many questions involved in the use of hollow section parts in an automobile, and each should be considered very carefully before proceeding to the general use of such a design.

The drilling of a hole in the center of a camshaft cannot be objected to from the standpoint of weakening the part unless the hole is extremely large or not machined accurately. In the writer's experience the use of such a hole has been more as an oil carrier than as a means of lightening the shaft. Rigidity is an important item in a camshaft, and it is also an advantage to have a camshaft as large as possible. The saving of weight is, of course, an item if the camshaft is extremely large, but the average shaft is of such a size that the drilled hole does not remove enough weight to make this a serious argument in favor of the drilled camshaft.

The drilled crankshaft presents several problems which should be considered very carefully. The elimination of weight in a rotating part, such as a crankshaft, is undoubtedly an advantage under most every condition. It is, however, extremely important that such drilled holes be accurately machined and as nearly concentric as possible with the finished bearings or crankpins, as an out of center condition will weaken the shaft at various points and may lead to considerable trouble if not watched carefully. Here, again, careful study must be made of the drilling of the crankshaft in such a way that the rotating weight will be removed and still not weaken the shaft to such an extent that vibration might result. To illustrate, the drilling of a large hole through the center of the shaft through all the main bearings might make that shaft subject to extreme twisting under stress, where the drilling of the same hole in the crankpin would weaken the shaft comparatively little and at the same time remove the weight desired. There is perhaps a best combination of crankshaft strength and reciprocating weights, and this should be determined, if possible, by careful experiment.

The use of tubing for propeller shafts is beyond any question a very good practice, and especially is this true due to the general use of seamless steel tubing which, of course, is accurately made as to the thickness. The elimination of weight in this part is further very advantageous, as it eliminates the whipping to a large degree.

The writer questions the advisability of using hollow axle shafts for the simple reason that the only apparent reason for such design is the elimination of weight. In order to make use of a hollow shaft, the shaft itself must be larger in order to obtain the strength desired, and the consequent larger bearings and the larger bearing retainers will more than balance the weight saved in the shaft itself. Furthermore, it is not possible to save any weight by drilling an axle shaft, excepting in the full-floating or semi-floating type of axle, where the outer end is large enough to allow the drilling of a hole in the center of the shaft.

G. L. MCCAIN,
Chief Engineer, Saxon Motor Car Corp.

Aircraft Engineering Ahead of Business Phases

Editor, AUTOMOTIVE INDUSTRIES:

Aircraft engineering is well ahead of the business of transportation by air. Apart from fighting machines, the engineer, be he plane or motor man, can only guess at the requirements. Of course, the greatest handicap to the extension of the use of airplanes is the necessity for extensive landing facilities. If, without sacrificing existing qualities, it were possible to produce machines which would rise and alight vertically or at an angle of 45 degrees, the use of aircraft would receive the greatest imaginable stimulus.

Because the landing difficulties are greatly increased, the writer is inclined to believe that the development of very large airplanes is premature. Ships cannot be built bigger than the available docking facilities. Aircraft of the present day are amply safe and are easy enough to fly, but on and near the ground they are still awkward, and such danger as is run in their use is almost wholly due to their poor maneuverability when in confined quarters. Of course, a machine which will move vertically or almost vertically has long been an inventor's dream. The writer believes that enormous improvements in engine and plane construction of the past few years have made the realization of this dream entirely possible.

A. LUDLOW CLAYDEN.

Cast Iron for Camshaft Bearings

Editor, AUTOMOTIVE INDUSTRIES:

Answering your communication of April 28 requesting opinion on current engineering problems, there are many which at this time are worthy of serious consideration. I will, however, confine my discussion to the question of cast iron camshaft bearings.

Cast iron as a material for camshaft bearings is unquestionably satisfactory. The relative merits of the bearing within the crankcase itself, as compared with a separate bushing, can only be logically discussed from the standpoint of service. There are no particular difficulties with the integral bearing with the possible exception that

adequate oil ways for the distribution of oil, particularly with splash feed, cannot be readily put in, and this may lead to a small percentage of scrappage as a result of the bearing seizing if the fits are not well maintained.

Considered from the viewpoint of service, it is, to my mind, necessary to provide replaceable bearings in any wearing part of the engine. This though we have carried to the extreme in the new designs of truck motors which we are now building, service and ease of replacement being of paramount importance.

A. A. BULL,
Chief Engineer, Northway Motor & Mfg. Co.,
Divn. General Motors Corp.

The Engineering Side of Industrial Relations

Thoroughly Interested Workers

Editor, AUTOMOTIVE INDUSTRIES:

I have been very much interested for a good many months back in the series of articles contributed by Mr. Tipper on factory human relationship, management, etc., and feel that if these articles are read and thoughtfully assimilated, they cannot help but be beneficial to the manufacturing establishments of America.

Peak production is what all manufacturers are after, and to my mind one of the most important principles to be sought in securing it is the securing of active harmony and contentment in the plant.

Peak production can, of course, be obtained in several ways, one of these being the adoption of driving and possibly coercive tactics on the part of the Chief and sub-executives. Providing the chief and sub-executives have, collectively, enough mental power to more than offset the collective mentality of all the workmen, peak production can without a doubt be attained and kept up, just so long as the mental ability of the chief executive and subordinates keeps above the collective mentality of the entire lot of workmen.

The average workman, however, who works with his hands is just as much of a human being as the bulk of the executives, and if "the big club," or other coercive tactics are used, the workmen generally resent it and are continuously endeavoring to figure out some way of outwitting the bosses. If, on the other hand, the workmen can be convinced primarily of the absolute fairness of the executives and can be brought to the attitude of working with the bosses, instead of for them, it generally happens that the mental effort which the workmen have been putting into ways, means and methods of beating the executives to it, will be put in on ways, means and methods of increasing their productivity, with the result that peak production is secured through the combined willing effort of both the executives and the workmen.

There is no question, I believe, in anybody's mind but what the cumulative effort of a big mass of humanity, working absolutely together, is far better and more productive than the cumulative effort of one relatively small mass and another one relatively large, engaged in a tug of war.

I have visited, during the past fifteen or twenty years, a great many of the manufacturing plants and have a good many times run across some of the higher class workmen on the train, or in other places, who have sometimes been exceedingly free in expressing their opinion or opinions, regarding certain manufacturers, some opinions being very complimentary and others and for other manufacturers, being very much the opposite of complimentary. Without doubt some of the non-complimentary things said were not founded on actualities, but were due to a distorted vision or opinion, engendered by a virtual physical collapse due to the high pressure and long hour requirements of their particular manufacturing institution.

There is a limit to the number of hours during which a workman can put out the best that is in him. He will work longer hours, with less fatigue, if he is thoroughly interested, contented and satisfied, than he can if he is not. On the other hand, no matter how well interested, contented and satisfied he is, there are physical limitations to be taken into consideration, and from my own knowledge, based on experience, it would seem that somewhere between nine and nine and a half hours is the limit that the average contented individual can put in and at the same time give the best there is in him.

J. W. DECON,
General Manager,
Fairfield Manufacturing Co.

Men and Systems

Editor, AUTOMOTIVE INDUSTRIES:

I have read a number of Mr. Tipper's articles and have found them very stimulating and full of suggestions.

Mr. Tipper has evidently made a comprehensive study of the questions involved in manufacturing relations, and writes forcibly, clearly and intelligently concerning these problems. I have no doubt that, directly and indirectly, they have had a large influence in directing and moulding opinion.

The most important problem in all manufacturing and commercial relations is the human problem. System is necessary to efficiency, and, other things being equal, the business which is run on a well-thought-out plan will undoubtedly be most efficient; but no system, however efficient, will avail unless it is worked by men who are both capable and loyal; so that the question of most importance in any organization is the quality of its man-power. This applies all along the line, from the chief executive down to the least skilled employee.

Better industrial relations will be the result of better human relations. A part of the service rendered by Mr. Tipper has helped to make the above fact clear and has no doubt resulted in quickening and directing thought along this line.

C. H. LIPPINCOTT,
Manager, Co-operative Department,
Studebaker Corporation.

Following Leaders

Editor, AUTOMOTIVE INDUSTRIES:

Will you permit me a little space to express my highly favorable opinion of the articles of Mr. Tipper. Although I am not in the business, I have noted them for a considerable period and they seemed to me to invariably contain suggestions which have the ring of good common sense.

The situation which has developed between capital and labor is a thoroughly unnatural one. The contest, not necessarily acrimonious but preferably friendly, should have been between the several organizations making up a business, each unit of which would have been made up necessarily of component parts of capital and labor.

The vast majority of men seek for heroes and for leaders, and far from being hostile or jealous they are enthusiastic and ready to follow beyond reason and to accept less

than their due share in an enterprise in which all are concerned.

The attitude of organized labor to-day is the fruit of many years of a selfish and provocative attitude on the part of capital.

It would seem almost axiomatic that any organization whose employees from the lowest to the highest felt loyal to it, and a personal pride in its success must have the advantage over similar bodies whose employees regarded it as an alien and at times a hostile body. In such an organization there would not be the constant change of personnel and the consequent waste, and the concern would have the advantage of all the invention of which its employees might be capable.

To arrive at this result would seem to require no specially complicated process. Fair wages based on the ability to pay, a willingness on the part of those in control to make clear to their employees the justice of the wage scale and also the desire of the management to have the advice and suggestions of everyone connected with the business on all points where it could be helpful, an evident interest on the part of the management to secure the maximum well-being of all concerned, which would include a friendly settlement of the number of hours of labor, which might and probably would be different in different departments, on the theory that what produced the best results financially without undue fatigue was to the common interest of all, and perhaps, as much as anything else, an insistence by the management on that courtesy to everyone employed which recognizes the dignity of his fellow man.

There would seem to be no reason, at least with American workmen, why such a program should not eventually produce a working force heartily pledged to the success of the organization and with a feeling of loyalty to it which would carry it through lean years as well as years of success.

The presence in trade unions of a large number of workmen connected with organizations so managed would have a wide effect on the character of the union and an increasing number of organizations following such a program would force into line others who would find themselves unable otherwise to successfully compete.

There is nothing Utopian about the foregoing. The success of business in the United States as compared with some other countries is based on the ability of its business men to pull together and to repose confidence in each other in common enterprises, and there is no reason why an extension of the same admirable policy should not produce equal if not greater results when the executive heads of business and manufacturing enterprises make common cause with their workmen.

The automobile industry seems to be one of such great size that any attitude toward the labor problem which was taken up by it would have great influence in all lines of industry, particularly if it proved to be advantageous. The large majority of its employees are men of intelligence and more or less skill and might therefore be expected to respond more readily to a change of attitude as above suggested.

CHARLES E. MANIERRE.

Weight Factor in Truck Performance

Editor, AUTOMOTIVE INDUSTRIES:

It seems evident to me that the attainment of a substantial reduction in weight along with a sustained performance, that is reasonably good, constitutes the next logical step in design necessary to create economy and satisfaction in the hands of the user.

In its present stage the motor truck of two-ton capacity and under is, or has been, designed to meet solid tire requirements with relatively low speeds and the variation in weights of trucks of a given capacity are as high as 50 per cent. It is certainly very plain that an owner of an extremely heavy one and one-half ton truck cannot expect the mileage from his fuel and tires that can be had by an owner of a truck weighing 50 per cent less and having the same capacity. The problem then resolves itself into one of making the light truck maintain its initial performance and to stand up against abuse. Quite contrary to opinions occasionally rendered, it has been my experience that the advantage in this respect does not always lie with the heavy vehicle, especially not where a rather high operating speed is required. In this respect the element of flexibility in the general design seems to contribute much toward preventing fracture, whereas a design supposedly rigid is only relatively so and quite often center strains at a weak point and where safe stresses are exceeded.

In making a saving in weight, a sort of compound advantage is gained in that a lighter truck requires less maximum torque to accomplish a given activity which, carried further, means a lighter engine to do the work, and this makes possible again a saving in fuel and tires. Thus it is highly important that we get started around this circle in the right direction. This can be done by the use of high grade materials which do not always cost the manufacturer more, thanks to the difference in their weights, by taking advantage of the saving made possible by pneumatic tires. Simply applying pneumatic tires to a truck does not necessarily mean a saving in any respect other than probably in the maintenance of the truck; whereas if the many factors that are so much different where pneumatic tires are used are taken into consideration in designing the vehicle, many real advantages can be placed in the hands of the owner.

In the matter of performance it is, I believe, highly important to consider not so much a new truck in perfect condition as one which has been in operation for at least thirty to forty thousand miles. For instance, gasoline has changed sufficiently in the last three or four years to actually affect the fundamental design of engines that are required to operate at high temperatures and to produce maximum power. This at one stroke eliminates engines of a design dating back five years or more, with due respect to the merits of such engines.

The intake passages, lubrication system and combustion chamber forms have been particularly affected. Much importance is placed by the writer on the combustion chamber form, as it has been proven by experience that an engine of the older type once considered a very good engine will lose 50 per cent of its power under the above conditions when it has accumulated a deposit of carbon. Whereas an engine with a very compact form of combustion chamber and very good manifold, together with a modern lubrication system, with the same amount of mileage, and as nearly as possible the same amount of carbon deposit, loses less than 10 per cent of its power under the same conditions.

It will always be found that when the weight is decreased and the performance improved as outlined, the average operating speed with a capacity load will automatically rise and apparently without any ill effects on tires or economy.

FLOYD F. KISHLINE, Engineer,
Graham Brothers.

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The Engineering Number

AGAIN we hand to you the Engineering Number of AUTOMOTIVE INDUSTRIES. We believe that this is the best of the series of Engineering Numbers and that a place exists for it. We hope that it will, to an extent, fill this place.

There are features of this number that are different from those of the past. Indeed, the entire character of the Engineering Number has changed since its inception. The editorial staff is guided by its sense of need, rather than by precedent. One feature to which we would invite your attention is the series of articles on design. We have covered here some points with which every design engineer is familiar, but we hope to have presented these in a new way—in a way that meets the present status of the industry. There is one factor in this series that is not generally considered in engineering, that is the importance of the human element in the factory to engineering practice.

Also, we would suggest that much good can come from a consideration of the Forum, which comprises an unusual presentation of opinions from men who rank high in automotive engineering. The industry cannot help but benefit when these men speak frankly and their opinions are given consideration. We hope that this expression of opinion will be continued. This is our invitation to you to carry on.

No attempt here is made to discuss the contents of this number. There are articles of research character and also original theory—something new and something old, and, we hope, something for good of the industry.

The Fuel Problem Still With Us

LET no one be deluded into thinking that the decline in price of gasoline during the past nine months is an indication that the fuel problem has been solved, or that the supply of gasoline at present prices will continue indefinitely with abundance regardless of demands. The price of gasoline, in common with other commodities, responds to the law of supply and demand, though for reasons known to the oil producers it did not increase in price as rapidly as other commodities or even other petroleum products during the war.

The demand for gasoline is controlled largely by the number of cars in operation and the average distance each car is operated. The number of cars in existence is increasing, though the use in the average case has been somewhat curtailed during the present period of business depression. For these reasons the demand for gasoline and, consequently, the production of this commodity has fallen off, but this is distinctly a temporary condition, and one which will change rapidly as conditions return to normal in the business world.

The need for building cars that are more economical in fuel as well as oil consumption and in other ways conserving the fuel supply of the country continues. In other words, the fuel problem is still with us, though temporary conditions may make it appear less pressing. Fortunately, much research looking toward its solution has been prosecuted or is in progress. A review of what has been accomplished and some suggestions for future research and development are contained in the lead article of this number of AUTOMOTIVE INDUSTRIES. We recommend that engineers and executives who have to do with the design and production of automotive apparatus study this article and the reports of investigations upon which it is based, with a view to comparing the performance of their own products with that of apparatus incorporating such improvements as the various experimenters quoted have found desirable.

It pays to pause occasionally and take stock of developments brought to light by others in similar lines of endeavor. Comparisons are not odious when we profit by the knowledge gained in making the comparison.

Those who have contributed to the sum total of information calculated to aid in solution of the fuel problem, as well as those who have supported, encouraged and made available in printed form the results of investigations in this line, are to be complimented. It is a striking tribute to the value of such institutions as the Society of Automotive Engineers, the Bureau

of Standards and the research departments of our modern industrial organizations. May the good work continue and its results receive the recognition they deserve in more general commercial application!

Outstanding Automotive Engineering Problems

WHAT are the chief problems that confront the automobile and truck engineer to-day? The question is particularly pertinent on account of the present depressed condition of business, which calls for the best efforts of every branch of the industry. The slump in car and truck sales is, of course, in a large measure the result of the general business depression, and can be relieved only in the measure that general business improves. But conditions in the automobile business have undergone a fundamental change in that we have reverted to a competitive basis, and hereafter every engineer will be called upon to do his very best in seeking to meet the demands of the purchasing public.

There are two outstanding problems that claim the attention of the engineer to-day. One is that of better adapting the vehicles or their engines to the use of grades of fuel now on the market, and the other that of reducing the operating cost, so as to enable more people to own passenger cars and to make it possible for the motor truck to compete more successfully with the horse on the farm and with the railroads in short distance freight haulage.

It is not necessary here to dwell at any length on the fuel problem; some phase of it is discussed in almost every issue of this paper, and its importance is fully recognized. On the whole, the fuel problem is not as pressing as the problem of economical operation, because our engines are being successfully run on the quality of gasoline now sold, and, as the stocks of this gasoline are increasing, there is no immediate danger of circumstances compelling a lowering in the quality.

On the other hand, the need for more economical operation is most urgent, more particularly as regards trucks and tractors. In the truck field we have come to a point where the largest apparent market is among farmers. The farm truck is a necessary complement of the farm tractor, for it is only by the acquisition of both that the farmer is enabled to dispense with his horses. But since last year there has been a great drop in the value of horses and a still greater drop in the cost of horse feed, hence the competition of the horse has become very much more severe.

To render automotive apparatus more economical both the first cost and the cost of operation must be reduced. In the endeavor to accomplish this result all the departments of the factory must co-operate. In the manufacture of trucks the most promising policy is undoubtedly that of standardization of models and quantity production. What possibilities this holds out in the way of lowering production costs is well exemplified by the best selling makes of low-priced passenger cars. Standardization and quantity production can be fully as well attained by the assembling plan as by production of the complete truck in a single plant. But in order that the highest economy may be achieved it is necessary that each assembling plant confine itself to one model. The "complete line," of course, has its appeal, especially to the sales department. Considerations of economical production, however, favor the single model, and, in a strongly competitive market, if the purchaser is offered a substantial share of the advantages resulting from standardization of product it should be easier to do a given volume of business with a single model than with a series of models.

The engineer's problem consists mainly in adapting the design of the vehicle to economical manufacture, as well as in designing for economical operation and maintenance. In the selection of materials of construction and of processes of manufacture he must not only keep in mind the functional requirements, but also aim at easy production. Great expectations are sometimes attached to the plan of using individual parts for two or more functions. There is no doubt that material gains often result from this practice, as the construction may be simplified and the weight reduced without serious sacrifice in operating efficiency.

One way by which the industry can be put on a basis of greater economy is by so standardizing parts as to facilitate specialization in their manufacture. Good examples of this plan are furnished by the standardization of wheel hub and truck chassis dimensions by the S. A. E. during the past half year. Truck wheels and truck bodies are practically always manufactured in specialized plants, and the standardization referred to aims at making wheels and bodies interchangeable on trucks of different make of about the same carrying capacity. It will, therefore, enable the firms in these lines to manufacture in quantity—in advance of orders, if need be—and thus cut down production cost.

Automobile development in the past has proceeded along rather conservative lines, and radical innovations have been few and far between. So far as passenger cars are concerned, we can hardly hope to greatly exceed the standards of speed, silence, comfort, flexibility and reliability that have been set by the best modern cars. About all we can hope to do is to make these qualities available at lower cost. Radical departures would be warranted only by extremely urgent demands for increased economy, because such radical changes as, for instance, the abandonment of the Otto cycle engine would undoubtedly involve sacrifices in the way of flexibility, silence and general handiness, and at the present time the great majority of buyers are not prepared to make such sacrifices. Any such radical changes are most likely to come by way of the tractor and truck—fields in which the requirements other than those of economy are less exacting.

THERE is an often used commercial sign which reads, "If you are not pleased tell us, if pleased tell your friends." The editorial staff of AUTOMOTIVE INDUSTRIES would like your opinion, be it favorable or otherwise, of this and other numbers.

Summer Business Outlook Is Good

June Sales Certain to Beat May Record

No Justification for Gloom—Price Stabilization Most Important Factor

By JAMES C. DALTON

NEW YORK, June 13—Justification is hard to find for the gloom which permeates the manufacturing end of the automotive industry at this time. Fundamentally, general business conditions are more stable and the outlook is more hopeful than for more than a year. Ultimate recovery in the automobile field is more dependent now on the general business trend than it has been at any time since deflation began.

The automobile business this month will be better than most manufacturers expect it to be. There is little doubt that June sales will equal those of May and they may approximate those of April. This will be true particularly in lines which have stabilized prices. The result will be, unless production in the last two months considerably outran actual orders, that factories will have to begin turning out motor cars again in a few days. Those which are producing may have to increase their schedules. That seems to be the outlook for this month.

July and August always are the dullest months in the year for the sale of automobiles. The reasons for this condition are obvious and everyone connected with the industry is thoroughly familiar with them. There is no reason to believe there will be any great deviation this season from the normal state of affairs. If there is any it probably will be on the side of an unusually good July business as compared with June.

September Outlook Good

August undoubtedly will follow the usual trend and there will be the perennial slump. Unless all signs fail, sales will pick up the coming of September, and by the middle of that month factory operations should be well under way. There is every reason to believe that general conditions will become steadily more stable and by that time they should be auspicious enough to warrant confidence that the automotive industry will have entered upon a long period of prosperity. There will be no tremendous leaps forward, but the volume of sales should increase steadily each month, with due allowance for the usual seasonal fluctuations and spasmodic ups and downs in different sections of the country.

By mid-September the South and the great agricultural sections of the Middle West will be coming into the market for motor vehicles. The outlook for the farmers and planters is brighter than it has been for months. They probably will not buy in the usual volume before the fall of 1922, but sales resistance among them will be broken.

If there is any lack of stabilization in the industry by that time it will be largely the fault of the manufacturers themselves. In this respect there is a growing feeling of alarm among the dealers, and they make no secret of their apprehension. There are hundreds of dealers who have lost friends and patrons because the makers of the cars they sell issued positive statements setting forth the reasons why it was impossible for them to cut prices and then, only a few days later, announced reductions. This action hurt in lines which had given no guarantees.

Price Cuts Had to Come

Only a month ago manufacturers in Detroit were professing indignation at any suggestion that it might be possible to cut prices. They were pointing to high material costs and unprecedented overhead. Yet everyone who had a real grasp of the trend of economic events knew that price cuts were inevitable.

Dealers are not crying for price reductions. They are vastly more concerned in having prices stabilized. If their manufacturers will take a firm stand on present prices and prove that they are giving value received, the dealers will be entirely satisfied. What they want is to get the price question settled one way or the other for a reasonable length of time so they can take their coats off and go to work without the feeling that they are perjuring themselves every time they tell a prospect there will be no further price adjustments.

The chief concern of far-sighted manufacturers and dealers at this time is that the industry will drift into a situation closely akin to a price war with reductions coming at frequent intervals. Such a condition would be fatal to business for months to come.

Cuts Must Be Genuine

If there are any manufacturers who feel they can make a comparatively small cut now, to be followed by another in the early fall if sales are not satisfactory in the meantime, they are their own worst enemies. They will be serving themselves and the industry best if they make NOW whatever price adjustments they intend to make in the comparatively near future.

Normal conditions never can be restored in the United States until prices are stabilized. This stabilization is approaching in many industries and it is the most encouraging sign of the times. It is what the automotive industry needs

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Sales Continue High in Price Cut Lines

Metropolitan District Finds Prospects in Buying Mood—Deliveries Running Behind

NEW YORK, June 11—There are a good many indications that the New York territory will have a good passenger sales record for June. There is still considerable confusion and some distrust in the public mind over price reductions, but there is increasing evidence that buyers are inclined to accept cuts already made as representative of present day values, based on material and labor costs. Several cars which have had substantial price reductions since the first of May are selling so strongly that the total sales record for May and June will be decidedly respectable, despite the fact that a few of the uncut lines are having a hard time of it.

This week ended with Buick, Studebaker and Dodge Brothers leading in day-to-day sales. Buick and Studebaker have both been selling strongly and their price reductions served to prevent any falling off in business as a result of cuts in competing lines. Dodge had been selling indifferently for some time and dropped off materially when Buick reductions were announced. Then, when the Dodge reduction came this week, sales jumped skyward, and daily sales of the last half of the week are far ahead even of the records made when the Dodge car first made its appearance in New York.

Business Follows Reductions

Marmon, Jordan, Franklin, Oakland, Maxwell, Chevrolet and Ford have had good business since their announcement of recent reductions, and several other cars whose sales picked up, though not so noticeably, are still doing better than they were in May. Several cars which announced price reductions early in May have dropped off considerably from the sales spurts which immediately followed the cuts, but business is better than it was early in the spring.

Salesmen are finding some prospects reluctant to buy because the multiplicity of price reductions spread over a considerable period has created in their minds an impression that still further reductions may be looked for on cars already cut. However, these people are not in the majority.

Studebaker and Buick are both behind on deliveries and some orders have been cancelled and have gone to dealers in other cars, because of this fact. Several other lines also are short of certain

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Factories Oppose Direct Truck Sales

Leaving Out Dealer Declared Bad Policy

Sales Manager Resolution Condemns Practice—Satisfactory Service Impractical

DETROIT, June 13—Voicing unqualified disapproval of the factory to consumer plan of selling motor trucks, directors of the National Association of Motor Truck Sales Managers, meeting here, adopted resolutions pledging aid and cooperation for dealers and efforts to discourage development of the direct sale plan. The attitude of the directors was unanimous, according to Don F. Whittaker, executive secretary of the association. Adoption of the resolution came after the resignation of W. N. Ackerman as director and the Lewis Hall Motors Corp. as a member. Ackerman is general manager of the corporation.

The sales managers declared they are concerned with the interest of the dealer as well as the consumer, the former in seeing that he gets a legitimate profit and the latter prompt and efficient service. The directors took the position that manufacturers, confronted by sales resistance, should endeavor to overcome adverse conditions by readjustment of distribution and dealer organizations and rejuvenation of their sales system rather than by destroying dealer organization and eliminating the real point of contact between the manufacturer and consumer and attempting to operate direct from the factory.

Fred Glover, general manager of the Timken Detroit Axle Co., G. W. Yeoman, vice-president of the Continental Motors and others were invited to address the meeting and presented their views. Following the lengthy discussion, the resignation of Ackerman and the election of J. F. Bowman, sales manager of Garford to succeed him, the resolution was adopted. It provides that:

Would Keep Tried Methods

"Whereas certain procedure has promoted the best interests of manufacturers and certain sales policies have shown tangible and definite results, the association will not indorse or approve any sales and service plan which will take from motor truck dealers profits to which they are entitled, realizing that such methods ultimately will be to the detriment of the consumer in that they will seriously affect proper servicing."

The resolutions further declare that the association will aid and support dealers in efforts to give prompt and efficient service, possible only through direct contact between dealer and consumer, and will discourage the factory to consumer method of merchandising trucks in the belief that the plan is impractical in that satisfactory service cannot be rendered without resulting in injury to the industry and great detriment to interests of dealer and consumer.

The development of plans for standardizing location of truck chassis numbers to prevent fraudulent practices of unscrupulous persons in dealing with finance companies, the determination to investigate the used car clearing house with a view to advocating its extension all over the country is shown to be successful and plans for giving further assistance to the National Automobile Dealers' Association in securing the united support of truck dealers and full cooperation in eliminating improper sales and discouraging sales to persons not financially responsible, were taken up and acted upon following action on the direct selling plan.

Hall Official Asserts "Sales Not Camouflaged"

DETROIT, June 13—After receiving from the board of directors of the National Association of Motor Truck Sales Managers a note informing him that they had adopted a motion "protesting against indiscriminate selling of motor trucks to fleet owners direct from the factory," W. K. Ackerman, vice-president and general manager of the Lewis-Hall Motors Corp., sent the following reply to Don F. Whittaker, the executive secretary:

"Yours of the 11th ultimo, 'PROTESTING AGAINST INDISCRIMINATE SELLING TO FLEET OWNERS AT A DISCOUNT AS BEING THOROUGHLY SUBVERSIVE TO THE BEST INTERESTS OF THE MOTOR TRUCK INDUSTRY' and requesting that such policy be discontinued, received. In reply, would state that, inasmuch as the policy of selling direct to fleet owners has been definitely decided upon by us and will be continued by us, not indiscriminately, as you state, but with due respect to the prospects' standing, the only graceful procedure on the writer's part is to tender his resignation, for immediate acceptance, as one of the board of directors and to discontinue this company's membership to the N. A. M. T. S. M.

Sales Efforts Like Others

"This company and the writer are proceeding along sales efforts not unlike other manufacturers, the only difference being that we are not camouflaging our dealer in any way, yourselves nor ourselves, and have been frank, honorable, above board, and in the open in our efforts so as to in no way represent ourselves to our associates in any way other than what we really are. As to

(*Continued on page* 1356)

Carolina to Impose Tax on Car Makers

Will Assess Manufacturers, Resident and Non-Resident, $500 Under 1917 Act

RALEIGH, N. C., June 13—The State license tax of $500 on manufacturers of automobiles stands in spite of the opinion of the United States Supreme Court to the effect that Section 72 of the North Carolina revenue act of 1917, relating to the tax, is unconstitutional. This is the opinion of State Assistant Attorney General Frank Nash, after learning of the Supreme Court decision.

The 1917 act contained two provisos, making the tax only $100 on certain manufacturers. Those that came under the provisos were manufacturers paying taxes on plants in the State, and those that invested three-fourths of their assets in State bonds, or municipal bonds of the State.

These two provisos the Supreme Court held unconstitutional as discriminatory against non-resident manufacturers. Anticipating such an opinion as a possibility, the Legislature of 1921 incorporated a provision in the revenue act that if any part of any clause or section of the revenue act should be declared unconstitutional the remainder of the clause or section should remain in force. Under this provision the decision then simply has the effect of raising the tax on the State manufacturers to $500, and not of nullifying or lowering the tax on outside manufacturers.

Suit which resulted in the Supreme Court decision was brought by the Bethlehem Motors Co. and the National Motor Car & Vehicle Co.

Greenfield Tap and Die Buys Machine Plants

GREENFIELD, MASS., June 14—Directors of the Greenfield Tap & Die Corp. have voted to purchase the entire capital stock of the Greenfield Machine Co., manufacturers of cylindrical and universal grinders, and the Morgan Grinder Co. of Worcester, Mass., manufacturers of internal grinders. These two companies, together with the machines now produced by the purchasing company, will constitute the machine divisions of the Greenfield Tap & Die Corp. Both plants will be operated as at present.

There will be no changes in the organization of the plants. Ralph L. Morgan will continue as president and Charles E. Hildreth as general manager of the Morgan company, and E. F. Smith as president of Greenfield Machine Co.

Chandler at $1785, Back to 1913 Basis

All Open Car Models to Sell at Old Price—Cleveland Also Cut

CLEVELAND, June 13 — Chandler Motor Co. made sweeping price reductions here to-day that placed the Chandler price at $1,785, back where it was in 1913. At the same time the price of the Cleveland which is made in a factory where there is much Chandler money, was cut to $1,295.

The Chandler company up to the present had continued prices which it said were warranted by improvements made in the car since 1913. The price reduction coming at this time, is to increase production and to stimulate interest in the two cars.

The 1913 5-passenger Chandler sold at $1,785, the 1921 7-passenger touring car, effective at once, is selling at the same figure. The car has been constantly developed in the last eight years. It also has been enlarged and refined and the management said that the car of to-day would have sold for twice its present price in that earlier day. Production methods and scientific management enables the company to put the improved car on the market at its present price.

The Chandler schedule of prices follows: Seven-pass. touring, $1,785; 2-pass. roadster, $1,785; 4-pass. roadster, $1,785; 4-pass. dispatch car, $1,865; 7-pass. sedan, $2,885; 4-pass. coupé, $2,785; limousine, $3,385.

The price of the Cleveland on Sept. 1, 1920, was $1,645. The new price effective at once is $1,295 for both the 5-pass. touring car and the 3-pass. roadster. The 5-pass. sedan will sell for $2,295 and the 4-pass. coupé for $2,195.

COLUMBIA BATTERY REDUCED

CLEVELAND, June 13—The National Carbon Co. has put into effect a reduction of approximately 20 per cent on Columbia dry batteries. The price cuts vary somewhat in different sections of the country because of freight differentials but 20 per cent represents a fair average of the cut.

COMMERCE PRICE GUARANTEED

DETROIT, June 16—The Commerce Motor Truck Co. has notified its dealers that present prices on 1921 models of Commerce trucks are guaranteed for the remainder of this year and that if any changes are made before Jan. 1, rebates will be given either to dealers or purchasers.

CITY BANS ASSEMBLED TRUCKS

NEW YORK, June 16—Manufacturers of assembled trucks are awaiting with much interest the result of an inquiry into the purchase of trucks by the city last year which will be made by the legislative committee investigating municipal affairs. It is understood that when bids were asked on these trucks it was stipulated that "it is the intention of these specifications to describe what the city terms as a manufactured and not an assembled gasoline motor driven truck." It was stipulated that any company bidding must have in operation in the United States at least 100 trucks each of which had run 75,000 miles and that it must have a parts stock in New York valued at not less than $60,000.

15,000 Orders Ahead at Willys Factories

TOLEDO, June 15—John N. Willys, president of the Willys-Overland Co., here to-day with Vice-President Walter P. Chrysler to attend a banquet tendered to Vice-President Charles B. Wilson by former associates from Pontiac, Mich., declared that the factory here is being flooded with orders by dealers in all parts of the country.

Willys said there were 15,000 unfilled orders on hand now and that preparations were being made to put on extra shifts to turn out the cars.

Scripps-Booth Adds Six-Cylinder Line

DETROIT, June 13 — Scripps-Booth has added a new six-cylinder model to the present line, this being equipped with a Continental Red Seal 7R engine, 3¼ x 4½ in. The prices of the present model B series, which will be continued, and the new model F series, follow:

	F Series	B Series
5-passenger touring	$1,490	$1,295
3-passenger roadster	1,470	1,275
5-passenger sedan	2,375	2,100
4-passenger coupe	2,350	1,950

The new model ranges from $195 to $400 higher than the present model. Production of the new model is under way and demonstrators are being delivered to dealers this week and next. Among the other specifications are: General Motors approved axles, Borg & Beck clutch, 7-in. frame, 115-in. wheelbase, 32 x 4 cord tires.

BUICK TO BRING OUT "FOUR"

DETROIT, June 10 — In connection with the Buick announcement of its revised prices, attention has been called to the fact that no changes will be made in the sixes for 1922; that is, the 1921 series will be carried through the 1922 season without any changes whatever. The Buick company, however, will announce a four-cylinder car in August.

TRUCK RECEIVER APPOINTED

NEW ORLEANS, June 14—Motley Lewis of the A. M. Lockett Co. has been appointed receiver for the New Orleans Motor Truck Mfg. Co.

White Truck Prices Reduced $200 to $500

Five Ton Model at $4500 Back to Pre-War Rate—Others Virtually So

CLEVELAND, June 13—Price reductions on all models of White trucks, effective immediately, put the 5-ton model back to the 1914 price and other White models so close to the pre-war figures that, the company declares, in view of improvements to the product, they also are virtually at pre-war levels.

Following are the revised chassis prices f.o.b. Cleveland.

5 ton	$4,500,	was $5,000
3½ ton	4,200,	was 4,500
2 ton	3,250,	was 3,450
¾ ton	2,400,	was 2,600

WILSON TRUCK CUTS PRICE

DETROIT, June 13—A substantial reduction in the prices of all models of Wilson motor trucks is announced by the J. C. Wilson Co. Four sizes of trucks are made by this company and the reductions in prices range from $380 on the 1½-ton model to $755 on the 5-ton truck. The new and old prices follow:

	OLD	NEW
1½ tons	$2650	$2270
2½ tons	3300	2825
3½ tons	4300	3685
5 tons	5275	4520

These price reductions go into effect at once.

HARVESTER TRUCK DOWN

CHICAGO, June 11—The International Harvester has cut prices on its heavy duty motor truck as follows: One-ton truck from $1,850 to $1,750; 1½-ton $2,050 to $1,850; 2-ton truck from $2,400 to $2,100; 3-ton truck from $2,800 to $2,400; 5-ton truck from $4,500 to $3,600. A 25 per cent reduction on cab bodies, tops and other accessories is also announced.

BESSEMER TRUCK CUTS PRICE

GROVE CITY, PA., June 10—Price reductions ranging from $400 to nearly $1,000 are announced by the Bessemer Motor Truck Co. The 1-ton truck has been reduced from $1,700 to $1,395; the 1½-ton from $2,445 to $1,995; the 2½-ton from $3,285 to $2,595; and the 4-ton from $4,485 to $3,495. Prices are f.o.b. factory.

GARFORD PLANT COMPLETED

LIMA, OHIO, June 13—The Garford Motor Truck Co. has completed a modern progressive assembly plant and office building. The new unit brings the factory floor space up to 14 acres and will more than double the production capacity. The building, two stories high, is constructed of concrete, steel and glass. The assembly division is 420 ft. x 100 ft.

PRICE CHANGES IN CURRENT MODELS

Car	Model	Old	New
Allen	Tour.	1395	1385
	Sedan	2395	2195
Beggs	Road. & Tour.	1885	1775
	Coupe	2785	2675
	Sedan	2885	2775
Birch	Road. & Tour.	1695	1595
Bour Davis	Road.	2585	2385
	7-Pass.	2565	2385
Brewster	Road.	7900	7000
	Tour.	9000	7000
Buick	41-47 Road.	1795	1495
	Tour.	1795	1525
	Coupe	2585	2135
	Sedan	2895	2435
Chalmers	Road. & Tour.	1795	1545
	Coupe	2595	2295
	Sedan	2745	2445
Chandler	Road. & Tour.	1930	1785
	Coupe	2930	2785
	Sedan	3030	2885
Chevrolet	490 Road.	795	635
	Tour.	820	645
	Coupe	1325	1185
	Sedan	1375	1195
Cleveland	Road. & Tour.	1465	1295
	Coupe	2375	2195
	Sedan	2475	2295
Climber	4-Road.	1550	1450
	4-Tour.	1550	1385
	6-Road.	2750	2250
	6-Tour.	2750	2250
Columbia	Road.	1945	1795
	Tour.	1995	1795
	Coupe	2895	2495
	Sedan	2895	2595
Cunningham	Prices on application		
Dixie Flyer	Tour.	1595	1445
	Coupe	2570	2295
	Sedan	2570	2345
Dodge	Road.	1235	935
	Tour.	1285	985
	Coupe	1900	1585
	Sedan	2150	1785
Dort	Road. & Tour.	1215	1115
	Coupe	1865	1685
	Sedan	1995	1835
Elgin	Tour.	1775	1495
	Coupe	2795	2395
	Sedan	2795	2395
Essex	Road.	1595	1445
	Tour.	1595	1445
	Coupe	2100	1950
	Sedan	2450	2300
Ford	Road.	395	370
	Tour.	440	415
	Coupe	745	695
	Sedan	795	760
Franklin	Tour.	2700	2550
	Road.	2800	2650
	Coupe	2950	2850
	Sedan	3850	3650
Gardner	Road. & Tour.	1195	995
Hudson	Tour.	2400	2250
	Coupe	3275	3125
	Sedan	3400	3250
Hupmobile	Road. & Tour.	1685	1485
	Coupe	2725	2400
	Sedan	2800	2485
Jordan	M Road.	2650	2250
	Tour.	2650	2250
	Coupe	3700	3300
	Sedan	3700	3300
Kissel	Coupe	3875	3375
	Sedan	3875	3375
Lafayette	Road. & Tour.	5625	4850
	Coupe	7200	6250
	Sedan	7400	6500
Lincoln	Road.	4600	4300
	Tour.	4600	4300
	Coupe	5750	4950
	Sedan	6000	5400
Marmon	Tour.	5000	3985
	Town car	6800	5400
	Coupe	6150	4875
	Sedan	6600	5275
Maxwell	Tour.	995	845
	Coupe	1595	1445
	Sedan	1695	1545
Mitchell	Road. & Tour.	1750	1490
	Coupe	2800	2590
	Sedan	2900	2690
Monroe	Road.	....	....
	Tour.	1440	1295
	Coupe	2400	2075
	Sedan	2500	2175
Norwalk	Tour.	1285	1135
Oakland	Road. & Tour.	1395	1145
	Coupe	2065	1815
	Sedan	2065	1815
Overland	Road. & Tour.	895	695
	Coupe	1425	1000
	Sedan	1475	1275
Paige	6-66 Tour.	2895	2875
	Coupe	3775	3755
	Sedan	3850	3830
Piedmont	4-30 Tour.	1395	1270
	6-40 Tour.	1795	1495
Pilot	Road.	....	....
	Tour.	2285	....
	Coupe	3600	3350
	Sedan	3600	3400
Raleigh	Road & Tour.	2750	2250
	Coupe	3600	3100
	Sedan	3700	3200
Saxon	Tour.	1675	1495
	Coupe	2475	2295
	Sedan	2475	2295
Scripps-Booth	Road.	1545	1275
	Tour.	1545	1295
	Coupe	2215	1950
	Sedan	2295	2100
Seneca	Road.	1185	1045
	Tour.	1185	1045
Sheridan	Road. & Tour.	1685	1485
	Coupe	2565	2060
	Sedan	2765	2360
Studebaker	EH-50 Road. & Tour.	1750	1585-1635
	Coupe	2650	2450
	Sedan	2750	2550
Templar	Road.	2885	2385
	Tour.	2885	2385
	Coupe	3785	3185
	Sedan	3785	3185
Wasp	Tour.	6500	5500
Willys-Knight	Road.	2195	1895
	Tour.	2195	1895
	Coupe	2845	2550
	Sedan	2945	2750

Exchange Drop Halts Sales to England

Progress Toward Equalization of Rates Set Back—British Seek Tariff Protection

LONDON, May 30 (By Mail)—Up to the time of the most recent slump in sterling exchange, the gradually ascending value of the pound, as expressed in dollars, was evening up conditions of competition and restoring the American car and tire import trade to something like pre-war times. The 33 per cent tariff on imported cars is likely to be continued for some time, but he would be a bold man who would predict its duration. A very strong undercurrent of opposition to the anti-dumping legislation makes its passage far from certain. The principle of production never has been presented to the electorate for a vote.

A renewed effort is being made to have tires included in the import tariff, and to that end propaganda is being carried on by the British Rubber Tire Manufacturers Association, Inc. Some of the fallacies contained in a booklet prepared by the association are too apparent to need comment. In fact, the argument fails at its source because in the main, apart from certain inaccuracies in quoting exchange rates and in statements on wages in the foreign tire industry, it lumps the import trade as a whole and does not differentiate between the favorable conditions of the exchange as it concerns the American tire importers and the very unfavorable state of the exchange for the European tire importers to Britain.

So far as the British automobile trade is concerned, the trend is steadily toward even lower prices. About 90 per cent of the cars on the market are down from 20 per cent to 25 per cent on the February rates. This does not take into consideration the American "sixes" and large "fours" which have slumped badly and have been cut to almost clearance rates. The downward trend is likely to be continued because of the reduced cost of materials and lower wages. The wage factor should be a ruling one because it was used to justify the advance in prices, and the argument must react under the present conditions.

Demand for Economy Cars

Moreover, the trend is certainly toward lighter cars, that is cars lighter on fuel and tires but not "light" in the category of runabouts weighing in the neighborhood of 1000 lb. This latter class is taboo to the real motoring public. This includes the family man who needs a roomy car at the price of a Ford, but not a copy of it. Such a car would sell at $1,500. One selling at $1,250 would find a good market even without the starter and certain embellishments.

The middle priced car seems to be passing out of vogue here, possibly with the result of increasing the number of top grade cars. In this connection it is interesting to note that one of the super-British cars is likely to lose some of its best customers for the reason that profiteers and newly rich are rushing into the market for this make, and as they come in the British gentry goes out. As a consequence, it is stated, certain high grade French cars, which had a small sale before the war, are again in demand by the "old rich." Certain high grade American cars are sharing this field.

Much interest has been aroused here by the decision of Angus Sanderson dealers to subscribe $185,000 toward the fund needed to refinance the company. This would be only a fraction of the new money necessary, but the offer of the dealers denotes the trend toward co-operation between the manufacturing and sales trade.

It is held that the dealer who has a monetary stake in the production of a car has a greater natural incentive to push sales than his neighbor who is only a dealer first and last.

British Make Bid for Canadian Farm Market

NEW YORK, June 13—Increased production of British agricultural machinery and tractors through the cultivation of foreign markets is being urged in England as a means of bringing prices to a level that would permit successful competition with foreign-made products, according to information just received from London.

In this connection, the report says, arrangements have already been made to produce one well-known British tractor on a large scale and market it in Canada on a systematic plan. Canada is the world's largest market for tractors, and up to the present it has been practically controlled by the United States, and the selling scheme of this British tractor will be planned especially to meet American competition.

A branch factory will be established in Montreal with an adequate stock of spare and repair parts, and special arrangements will be made for service, a factor which has been more or less negotiated by British firms in the Canadian market.

British Apathy Losing South American Market

LONDON, May 27 (By Mail)—A South American correspondent of the (London) Times Trade Supplement sounds a warning to the British automobile trade concerning the race for the South American market. He says local republics complain of British apathy and contrast it with live methods of Germans and Americans. Brazil imported last year 24,475 cars of which Britain sent only 586. Venezuela and Chile says the same and both want automobiles. Venezuela in particular wants motorcycles. The Argentines want trucks and farm tractors capable of hauling four, six and eight plows.

Paris Show Requests Exceed Palais Space

Exhibitor List Far Exceeds Former Figures—American Cars Get Space

PARIS, June 4 (By Mail)—More than 800 applications have been received for space in the French automobile show which will be held in the Grand Palais from Oct. 5 to 16, this constituting a record, for previous shows have only united between five and six hundred exhibitors. Not only is the number of firms higher than usual, but the amount of space requested breaks all records, being so great that the Grand Palais, which is believed to be the biggest building in the world under a single roof, has become insufficient. As the management has need of about 3500 square yards of additional space, it is probable that two buildings will be used.

It is not known whether an existing building can be found, or whether a temporary building will be erected on the Esplanade des Invalides, which is only separated from the Grand Palais by the bridge across the River Seine. Probably trucks and agricultural tractors will be put in the overflow building, thus leaving the Grand Palais for passenger cars and automobile accessories.

The Paris show is widely international, and will comprise all but late enemy manufacturers. Although American firms do not get first choice, they will be well represented, and all the firms united in General Motors will have stands. The Paris Show management objects to the report circulated in America to the effect that Americans are shut out of the Paris exhibition. It is pointed out that while American firms are made to select positions after European makers, they are always assured space on the floor of the main hall. This, it is declared, is in contrast to the policy of New York and Chicago shows, in which foreign firms cannot exhibit.

The Paris international exhibition will be preceded by a national show at Berlin from Sept. 23 to Oct. 2, and will be followed by the London show in November and Brussels show in December.

TO FLY MAILS TO BAHAMAS

WASHINGTON, June 13—Providing a subsidy of 5000 pounds sterling per year for the purpose of carrying mails between Nassau, Bahamas and Miami, Fla., an act has passed its first reading in the Bahamas House of Assembly by which concessions are given to the Bermuda & West Atlantic Aviation Co., a British limited organization with registered offices in London. Advice to this effect has been conveyed to the Bureau of Foreign and Domestic Commerce through Consul Lathrop. It is expected that the hangar and repair shops constructed by the company will be open to the airplanes of all nations on reasonable terms.

Cuban Sales to Open in Coming 6 Months

Look for Biggest Automotive Year in 1922—Sugar Crop Brings Improvement

NEW ORLEANS, June 13—Movement of the new sugar crop in Havana, and a general clearing of the entire commercial and financial horizon throughout Cuba, has worked great improvement in the automotive industry in that island, according to Julio R. Bannatyne and Julian Fierros, president and treasurer of a large automobile and accessory selling company in Havana.

"The automotive industry in Cuba," said Bannatyne, "was one of the first to begin its recovery from the period of depression in business from which the island has been suffering for about eight months. Trade in general is becoming more active, but we, as well as we thought we knew conditions, were surprised at the rapidity with which the automobile, truck, tractor and accessory sales 'picked up' at the first indication of general commercial and financial improvement.

"I do not mean to say that normal business conditions have been restored, but the movement of the new sugar crop and the easing up to some extent by the banks on loans, has made money easier. The Cuban planters seem to realize fully the great aid offered them by the use of trucks and tractors, and the increased efficiency in business they get from passenger cars, so that much of the first money received for the sugar crop went into extensive purchase of automotive vehicles.

"All business, including the automotive industry, is being conducted on sounder, more conservative lines, and is establishing itself on a more substantial basis than it had before, so that in reality a great benefit accrued to all commercial undertakings in Cuba as a result of the period of depression, and especially to the automobile-selling industry, which, for some months of prosperity prior to the depression, simply 'ran wild.' We look forward to the last half of 1921 as much better than the first half, and to all of 1922 as the best year we ever have had in the automotive industry."

Philippines to Impose Special Taxes on Cars

NEW YORK, June 13—Every person engaged in the importation or manufacture of passenger cars, motor trucks, tires or parts will pay an annual tax of 20 pesos and a sales tax of 5 per cent if a bill to be presented in the Legislature of the Philippine Islands next October becomes effective. This bill evidently is based on Title IX of the United States Revenue Act of 1918, including virtually the same provisions.

The principle of Title IX, however, has been recognized by the U. S. Senate as being based on war conditions. Senator Penrose, the chairman of the Senate Finance Committee, in the hearing on May 23, 1921, said:

"There are several witnesses here to-day who want to be heard on the so-called sales or luxury tax. Perhaps this is hardly the time to discuss this matter, as the committee is very familiar with all of the arguments from the consideration of the last revenue bill. Of course, the gentlemen called upon to pay these taxes were prompted by patriotism and the desire to win the war, which in these times of peace do not exist, and many of them very properly and fairly desire to be relieved."

Australian Tire Market Reported Overstocked

WASHINGTON, June 13—The Australian market for tires is heavily overstocked, writes Trade Commissioner A. W. Ferrin. Two large Australian factories which now supply over half of the demand are contemplating an expansion which they claim will enable them to make all the tires Australia requires. All tire companies, including American, have cut prices. The new tariff imposes a duty of 40 per cent on pneumatic tires, while the loss in conversion of Sterling into dollars gives an even higher protection of local tires. Some believe that the importation of tires into Australia will eventually cease and that the only solution is to establish branch factories in Australia, to escape the burdens imposed on the imported tire. It is stated to be the expressed intention of the Australian government to encourage foreign manufacturers to establish Australian plants in the interest of Australian labor.

Berliet Continues Work Pending Tax Decision

PARIS, June 1 (By Mail)—The Berliet Automobile Works at Lyons, France, are not closed down, as a cable report having appeared in AUTOMOTIVE INDUSTRIES might lead readers to suppose. According to a communication received from the Berliet company, this firm applied to the French courts for the benefits of the law providing for transactional arrangements. This is a kind of moratorium for firms in temporary financial difficulties by reason of the transfer from war to peace conditions. This moratorium was necessary pending the settlement of a dispute with the French inland revenue authorities in reference to payment of the excess war profits tax. In the meantime the Berliet factory is continuing in operation and is producing passenger cars, trucks and tractors.

LITTLE RECEIVER RESIGNS

DALLAS, TEXAS, June 13—R. C. Ayres has been appointed receiver for Little Motor Kar Co., succeeding Everett S. Owens, who resigned. Judge W. F. Whitehurst said assets were about $200,000 and outstanding stock $1,000,000.

Australia Looks for Good Selling Season

Emergence from Drought Brings Optimism—Goods in Warehouses Retard Business

SYDNEY, AUSTRALIA, April 30 (By Mail)—The motor car industry in Australia is optimistic that the approaching season in Australia will be a good one, this optimism being based on the fact that for many years it was proven that after a long severe drought, such as Australia is just emerging from, there have been 3 or 4 good years in succession.

With such a prospect of the future it is possible for a perceptible improvement to take place in the next 6 months. Industrial matters in Australia will take a turn for the better. The prolonged shipping strike which has been an annual affair for the last 3 or 4 years, has turned out so badly for the strikers that it may be many years before they think of precipitating a similar situation.

The coal situation is improving and developments in many industries are encouraging. In the steel industry two large companies are getting into full operation. The rubber mills are at capacity. Australian wool is still unsold, but there is hope of getting rid of a large percentage of the last wool clip at a moderate price. A certain section of the agricultural territory has money available for the purchase of automobiles, but they are holding off in anticipation of a fall in price.

Unfortunately the Australian banks are short of money due to the heavy importations that have been made in many lines, as well as automobiles, and the banks blame this for the present money shortage. Importations were so heavy in the first 7 months of 1920, and prices so high, that great volumes of funds have been tied up. The following figures give some conception of this: Thus in textiles the importations in the first 5 months of 1920 were $135,000,000, as compared with $35,000,000 in the corresponding 5 months of 1919.

Imports in 1920 Heavy

In a few other industries the figures for these periods are: Machinery, including automobiles, $72,000,000, as compared with $43,000,000; rubber goods $9,000,000 as compared with $4,000,000; manufactured goods of wood $15,000,000, as compared with $4,000,000, glass and earthenware $7,000,000 as compared with $2,000,000; paper $16,000,000 as compared with $8,000,000. Thinking in totals this makes $360,000,000 of imports in the first 5 months of 1920 as compared with $165,000,000 in the corresponding months of the previous year, or a difference of $200,000,000.

The banks have had to finance these imports and are naturally compelling importers to restrict their operations from abroad until such time as the present goods in warehouses valued at $200,000,000 have been turned into cash.

June Sales to Equal Early Spring Months

Falling Market for Business to Continue for Long Time—Buyers Study Values

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more than anything else. There are many persons who are able to buy and want to buy who will not buy unless they are convinced they can't get the goods they want considerably cheaper in the near future than they can now.

All forecasts of prosperity for the automotive industry must be predicated on the understanding that there will not be periodical price revisions. Business will be done on a falling market for a long time to come, and the retail prices of automobiles will gradually decline, but there is no sense in readjusting them oftener than once a year. When readjustments are made there should be concerted action by the manufacturers, and the atmosphere should be cleared in a fortnight rather than have the period of uncertainty continue for two or three months, thereby unsettling trade.

It should be remembered, also, that purchasers are giving greater attention to values than they have in the past three or four years. They want their money's worth, and the manufacturer who can convince them they are getting it will do a better business in the long run than the competitor who cuts prices and takes value out of his product.

Plants Hold Output Close to Actual Sales

DETROIT, June 13 — Employment figures for the last week show an increase of but 124 men over figures for the previous week in 79 industries in Detroit, including practically all automobile plants. Twenty-seven factories are operating on reduced schedules, employing 20,312 men an average of 31 hours a week.

The employment situation in the State as regards automotive plants is not as bad as in Detroit. Good business and splendid prospects are reported by the Michigan Brass & Iron Works at Lansing in a statement by T. E. Hackett, secretary-treasurer. The plant now is on a 55 per cent production basis and everything points to an increase shortly.

The Lansing Foundry Co. at Lansing has resumed production on a 40 per cent normal basis following a long period of inactivity. Many orders and inquiries are being received from all parts of the country, new employees have been taken on and plans are being made for steady increase in production and employment during the summer and fall. The plant was closed entirely from Nov. 1 to May 1, and since reopening conditions have improved steadily until the last week it was decided to begin operation on a 40 per cent basis.

Olds Motor Works turned out 142 automobiles last Friday, and daily shipments from that plant are averaging around 125, according to Sales Manager Peasley. The Olds plant still has some orders ahead and will continue on the present schedule between 125 and 150 cars a day indefinitely, according to officials.

Buick and Chevrolet plants at Flint and the Oakland factory at Pontiac are speeding production to meet a sharp increase in demand as the result, factory executives say, of the price cuts. Officials admit frankly the sudden spurt represents an accumulation of orders due to determination on the part of buyers to sit steady until the reduction expected on the car of their choice. Some manufacturers incline to the belief that rumors of price cuts, even before the first announcements, demoralized the market and stopped buying at a time when the normal spring business should have been at its height, and predict a steady demand throughout the summer.

Study Territorial Markets

Factory and sales executives are keeping their ears close to the ground and representatives are touring the various sections of the country seeking to get a definite line on actual conditions that will permit of some definite manufacturing policy. Caution is the watchword and none of the companies are going to be led astray by the present rush of orders reaching nearly all plants. It will be the policy to steer close to shore and confine production schedules to actual orders from dealers based on a careful analysis of their individual territories and their probable requirements from week to week.

Sales Continue High in Price Cut Lines

(*Continued from page* 1346)

models and there have been some cancellations, the public showing little patience with delays when it is possible to obtain a second or third choice car.

Reports from the motor vehicle office of the Secretary of State at Albany indicate that the April sales figures will prove much larger than was expected when the month ended. Compilation of registration is always considerably behindhand and there was a big rush of registration during the last ten days of May. It was said to-day that the May sales record for ten counties in and around New York, which, it was thought, would fall considerably below April probably would equal it and might exceed it. It was also reported from Albany that registrations so far in June were running ahead of any other June in the history of the department.

TOOL PRICES GUARANTEED

BALTIMORE, June 13—The Black & Decker Mfg. Co. has notified its distributors that present prices are guaranteed until the end of the year. The company states that the total increase in the prices of all its products since 1914 has been only 38 per cent.

Ford Records Fall in Production Drive

All Departments Working at Highest Capacity — Knock-down Shipping Now Used

DETROIT, June 11—While the Ford plant is breaking records with startling frequency in the matter of car and truck production at Highland Park and the assembly branches, the body plant at River Rouge is busy and to-day is turning out about 1200 sedan and touring car bodies daily. About 2000 men are employed and it is significant that the time per job now is much less than when the body output was less than half what it is to-day, due to increased labor efficiency. The daily average for sedan bodies was increased 24 in May over April, averaging 254 for the greater part of the month. During the same period the output of touring bodies averaged 964, approximately 141 average daily increase in May over April.

The Highland Park plant is absorbing about one-quarter of the daily output from the Rouge body plant, and with the continued daily increase in production, it is expected the body plant soon will be running close to car production at Highland Park. Sedan bodies are being shipped to Des Moines and Kearny, N. J., assembly plants, as are also some touring bodies. Knock-down bodies are being exported to France, Denmark and England.

In shipping, an average of 140 to 170 knock-down touring car bodies are carried in one freight car according to variation in the size of the car. An average freight car accommodates about 110 knock-down sedan bodies. These bodies are complete ready to be assembled, painted and trimmed. Heretofore shipments were made by placing about 6 built-up bodies in a car. Conservation in shipping space and more efficient loading by means of knock-down methods has increased the car capacity from 6 to more than 100.

June Holds May Schedule

All departments of the Ford company are working full time—three eight-hour shifts—and there are to-day 43,000 men on the Ford payroll. Highland Park, during May, turned out an average of 4032 cars daily, and that will be kept up through June. On May 11, 4096 cars and trucks were turned out and six days later a mark of 4107 was reached. May 20 a new high mark of 4144 was made. This made the eighth time in 20 working days that production records were broken.

Of interest in connection with Ford activities is the remarkable increase in demand reported from the Ford branch in Halifax, Nova Scotia. Great strides in the sale of Ford trucks are being made there, and the enclosed cars also are said to be in demand in that territory. About 40 per cent of the business during the past year was enclosed jobs.

T. W. Warner Resigns as G. M. C. Executive

Will Join Durant as Vice President—Zimmerschied Takes Over Duties

NEW YORK, June 13—Thomas W. Warner has resigned as vice-president and general manager of the Muncie Products Co. and the Toledo Chevrolet Motor Co., divisions of the General Motors Corp., to become vice-president of Durant Motors, Inc. His impending retirement from the General Motors organization and association with Durant was forecast in AUTOMOTIVE INDUSTRIES, May 26.

The T. W. Warner Co. and the Warner Corp. at Muncie, Ind., of which Warner is now president, will be kept independent units but will be associated with Durant Motors in the manufacture of transmissions, steering gears and other parts for the new cars. Warner will retain his residence in Toledo and his stock holdings in General Motors, with which his relations are entirely friendly. In joining forces with Durant, he is renewing an intimate association which has continued for years.

K. W. Zimmerschied, who is at the head of the entire Chevrolet organization, will succeed Warner as president of the Toledo Chevrolet company. The retirement of Warner from General Motors will involve no actual change in management, as Warner has merely been the nominal head of the two companies.

Warner is one of the pioneers of the automobile industry. In 1901 he had a gear factory at Muncie, Ind., which was sold in 1909 when he came to Toledo and started the Warner Manufacturing Co. In 1916 this was merged with the Toledo Chevrolet company, a division of the General Motors Corp., manufacturing transmissions for Chevrolet cars. He organized the Warner Corp. about two years ago. He is rated as a millionaire and his active re-entry into the manufacturing field will add much strength to the Durant organization.

G. M. C. Announces Resignation

NEW YORK, June 14—General Motors Corp. has issued the following statement in regard to the resignation of T. W. Warner:

"The General Motors Corp. announces that K. W. Zimmerschied, president and general manager of the Chevrolet Motor Co., has accepted the resignation of T. W. Warner as president of the Toledo-Chevrolet Motor Co. of Toledo, a subsidiary manufacturing transmissions.

"The corporation also announces that Mr. Warner's resignation has been accepted as president and general manager of the Muncie Products Corp. of Muncie, Ind., one of the units of the Inter-Company Parts Division of General Motors Corp.

"Mr. Warner was not an officer nor a director of the General Motors Corp."

G. M. C. NOW PRODUCING 6000 CARS A WEEK

NEW YORK, June 14—Passenger car production of the General Motors Corp., including all lines, is now running at approximately double the rate of five or six weeks ago when it was around 3000 cars a week. Figuring on a basis of 6000 a week, yearly production would be around 300,000, or 75 per cent of production during the feverish period which followed the armistice.

Orders are running ahead of production at this time and in some of the lines, especially Chevrolet and Buick, there are enough on hand now to make necessary a continuance of factory operations at the present rate for at least a month longer.

Mack Truck Sales Cut Inventories $3,000,000

NEW YORK, June 13—President A. J. Brosseau of the International Motor Truck Corp. has informed the directors "that only an utter collapse in general business in the second half of 1921 will be likely to change the apparent gradual gain in the volume of sales, production and profits to which the company may look forward." Current business is running at a rate equal to 85 per cent of the 1920 figures when gross sales amounted to $34,000,000.

Highly gratifying progress has been made in reducing inventories and in the first four months of 1921 there was an actual reduction of $2,000,000. By June 30 the net reduction will amount to more than $3,000,000. No commitments have been made for incoming raw materials beyond those sufficient to meet current manufacturing requirements. It is expected that by July 1 the finished truck inventory will be down to a normal total based on the present volume of business. This means that manufacturing operations at the three plants will have to be increased soon after July 1 to a rate approximating sales. In order to bring down truck inventories, operations since January have been at a smaller rate than monthly deliveries of trucks.

International Motor Truck continues in the strongest financial condition. It has no bank loans whatever and its cash balance approximates $4,000,000. The company came through March without any losses in net profits and there was a slight margin above depreciation, taxes and all other charges. Business now is running at approximately double the 7 per cent dividend requirements.

DEVELOP NEW TYPE AIR WING

NEW YORK, June 13—A new type of airplane wing which materially increases the limiting flying speeds and carrying capacities of aircraft, has been developed by the Dayton-Wright Co., according to General Manager G. M. Williams.

Germain Quits Olds to Join Ver Linden

Lansing Division of Durant Motors Under Way—Other Officials Make Changes

DETROIT, June 14—L. R. Germain will retire as vice-president of the Olds Motor Works to join Edward Ver Linden in the development of the Lansing plant of Durant Motors. Germain, who is a native of Michigan, grew up in the Olds plant, starting as office clerk 12 years ago. He appeared peculiarly adapted to handling financial problems and rose steadily until he was made comptroller about a year ago and was promoted to the vice-presidency.

Concrete is being poured for the Lansing division of Durant Motors headed by Ver Linden. The first automobile produced by this division will be shown about Sept. 1. Contractors have promised to have the building completed Nov. 1, Ver Linden said, and work in every department of the plant will be under way by Jan 1. Announcement is made of the naming of L. D. Maxson, former purchasing agent for Olds Motor Works, as director of purchases for the Ver Linden division.

Another acquisition by the Durant interests is B. H. Anibal, chief engineer of the Cadillac Motor Car Co., who has resigned to join his old chief R. H. Collins. Anibal joined the engineering department of the Olds Motor Works 12 years ago and went with Cadillac in 1911. He aided in designing the Cadillac on which electric starting and lighting were introduced. He rose from designer to assistant designing engineer in charge of motor design, assistant chief and chief engineer. During the war he represented the Cadillac engineering department at Washington and also was assistant chief engineer of the aircraft division of General Motors.

D. B. McCoy, who returned recently from London where he was representing the General Motors Export Corp., has joined the Reo Motor Car Co. as advertising manager, succeeding W. K. Towers, who goes to Paige as advertising manager. McCoy has had long experience in the advertising field, first with Oakland, then with Olds and finally in the advertising section of General Motors Export Division.

TO SELL GENERAL TRACTORS

MILWAUKEE, June 13—William B. Roys, 103 Gay Building, Madison, Wis., trustee in bankruptcy of the General Tractors, Inc., which owns the stock of the Monarch Tractor Co., Watertown, Wis., has announced that on June 25 at 10 a.m. the entire assets of the corporation will be offered for sale at public auction, at the general offices of the General company in Paulsboro, N. J. The next meeting of creditors will be held June 28 at the office of Charles F. Lamb, referee in bankruptcy, Madison.

Ford Payment Plan Would Extend Terms

Move to Simplify Accounts, Says Purchasing Agent—Not Seeking Advantage

DETROIT, June 15—Reports that the Ford Motor Co. is demanding an extension of 10 days in the discount period and 60 days net credit with the idea of gaining a financial advantage, brought vigorous denial to-day from Fred H. Diehl, purchasing agent. As a matter of fact, he said, Ford is now paying cash for materials. He declared a printed circular sent out simply fixes a definite payment period on all invoices.

"The Ford Motor Co.'s purchases over a month range from $40,000,000 to $50,000,000," said Diehl, "and various supply sources naturally fix their own payment terms. This means thousands of invoices coming into the Ford offices each month, each with its own discount dates and terms. In an effort to simplify this work we designed definite terms for billing materials to the Ford company, fixing discount dates on the 20th of the following month rather than the 15th, as heretofore. We were prompted by no motive save a desire for one set of terms on which to pay.

"As for the 60-day stipulation, that is designed simply to protect the company in the event it should become pinched, and is a consideration to which an institution as large as this is entitled just as much as the 90-day payment period allowed banking institutions in case of emergency. We are not asking anyone to carry a financial load and are in no sense trying to shift the burden. We never expect to have to avail ourselves of the 60-day clause, but think we are entitled to that much protection should an emergency arise. This is a matter entirely between our supply sources who are glad to co-operate with us."

President John Kelsey of the Kelsey Wheel Co., probably one of the biggest Ford creditors, declared there was no truth in reports that Ford was demanding a credit extension. On the contrary, he said, the company is paying cash and has been for three months.

Officials of the Holley Carbureter Co. said the circular from Ford had been received, but was fully understood and not considered in any sense a demand for credit or discount extension.

Bankers declare Ford is paying cash and expects to continue now that overhead has been cut to a minimum, and quick turnover insures ample capital.

Parts Makers Disturbed by Ford Payment Plan

NEW YORK, June 15—The Ford circular has caused considerable apprehension among the parts makers with whom he deals heavily. There is no complaint regarding conditions as they exist at present, but these manufacturers assert that they could not carry the financial burden which would be involved if they were called upon to grant Ford 60 days' credit without refinancing their business, which would be extremely difficult if not impossible under present conditions. They take the position they already have borne more than their share of the burdens of the industry in the past year and that no more can be expected of them.

Complain of Payment Date

There also is considerable complaint because of Ford's arbitrary extension of the payment date to the 20th prox. Some parts manufacturers regard this as more serious than the 60-day clause, for the reason that they probably will have to submit to the one while they would not consent to the extension of the credit period. It is contended that this action on the part of Ford wil give him a substantial sum in interest each month, which rightfully should belong to the companies which supply him.

Acason Truck Company Brings Out Light Truck

DETROIT, June 11—A truck capable of speeds over 30 m.p.h. and having a load capacity of ¾ ton is announced by the Acason Motor Truck Co. It is equipped with a four cylinder 3¾ x 5 in. Acason block engine with three point suspension, rated at 35 hp. at its normal speed. The engine accessories include a high tension magneto, Schebler carburetor, centrifugal governor and built-up radiator with detachable core. A disk type of clutch is fitted and the transmission is a Fuller affording three forward speeds and one reverse. There are three universal joints in the propeller shaft, the center bearing of which is a self-aligning ball bearing. Both axles are of Timken make, the final drive being by worm. The frame is built up of steel channels having a 4-1/16 x 2½ x 3/16 in. section. Semi-elliptic springs are fitted all around. The steering gear is of the worm and nut type and is provided with an 18 in. handwheel. Fuel is carried in an 18-gal. tank under the seat, which latter is wide enough to accommodate three persons. Wood artillery wheels are standard equipment and are fitted with 34 x 5 in. non-skid cord tires. Control levers are located centrally. Equipped with a Westinghouse starter, electric lights, generator, Willard 80 amp.-hr. battery, Motometer, three oil lamps, mechanical horn, jack and tools, the truck sells for $1,650.

GIANT AND SUPERIOR REDUCE

NEW YORK, June 15—Price reductions have been made by the Giant Truck Corp., Chicago, and the Superior Motor Truck Co., Atlanta.

The Giant 1½ ton model is reduced from $2,425 to $2,250; 2 ton from $3,250 to $3,150, and 3½ ton, $4,500 to $4,150.

Superior models now are, 1 ton, $1,650, reduced from $1,800, and 2 ton, $2,600, reduced from $2,750.

Durant Denies Plot to Assist Newberry

Had Nothing to Do With Keeping Employees from Voting for Ford

WASHINGTON, June 13—Emphatic denial was made here to-day before the Senate Committee on Privileges and Elections by William C. Durant, former head of the General Motors Corp., that his political sympathies had influenced the votes of employees in his Michigan factories during the Ford-Newberry senatorial campaign. He insisted that he had nothing to do with the alleged action on the part of the executives in the Buick plant to keep employees at work when it was ascertained that their sympathies were with Henry Ford in the senatorial race.

Durant was questioned closely by Senator Spencer, Republican, of Missouri, and other members of the Senate Committee, who are conducting an inquiry into the disturbed election. The automobile manufacturer stated that he knew Senator Newberry slightly, having met him at the Lotus Club. He declared that neither Senator Newberry nor Paul King, his campaign manager, had directly solicited his financial support.

In response to a specific question as to whether or not he had taken action to prevent factory employees from voting when a canvas of the Flint plant had shown a preponderance of Ford votes, Durant admitted that he had communicated with the manager of the Flint plant to ascertain as to how the men stood, but did not take any other action.

"Did you hear that they prevented the men in the Buick plant from voting?" the witness was asked, and he replied in the negative.

"You got a response didn't you, that the men were for Ford," he was asked.

Durant answered: "I do not remember that."

The witness stated that he did not know that notices were posted in the Buick plant that the factory would close at 3 o'clock in order to allow men to vote.

WILLYS CREDITORS REACH PLAN

NEW YORK, June 16—Committees representing the creditors of the Willys Corp., which have been working since March on a refinancing plan which would be satisfactory to all the interests involved, have reached a practical agreement and an announcement is expected in the near future.

OPPOSE STANDARD PARTS PLAN

CLEVELAND, June 15—Stockholders of Standard Parts Co. have voted down the plan of reorganization proposed by creditors. Both preferred and common stockholders agreed to hold out for an extension of the receivership until the depression is ended.

Congress to Act on Truck Dumping

Permanent Tariff Protection Likely

Danger Is Seen, However, in Wide Open Condition Pending Legislation

WASHINGTON, June 15—Protests by motor truck manufacturers and dealers against the serious effect upon their business which will follow continued re-importation of American-made vehicles from England and France, is having its effect upon Congress. Representative Fordney, chairman of the Ways and Means Committee of the House, has indicated that when the permanent tariff is framed adequate protection will be given the automotive industry by the insertion of a specific clause in the anti-dumping provisions of the measure.

Leaders in the lower house are disposed to recognize the justice of the contention that this competition in the truck field is unfair and the same is true of Senate leaders such as Senators Smoot and Ball.

The truck industry itself and the organizations connected with it were slow to awaken to the seriousness of the situation, and it is no secret that if Congress had been informed of the actual facts some such clause as is now sought might have been included in the anti-dumping provisions of the temporary tariff which was passed a few weeks ago.

Senator Smoot, who was especially interested in the subject and who is thoroughly alive to the essential nature of the truck industry, was unable to get the data he sought from any source he could recognize as authoritative.

No attempt will be made to bar out of the country these American-made trucks, but it is proposed to enact valuation clauses which will put them on a fairly competitive basis. The chief danger now is that so many of them will be brought into the country before the permanent tariff is enacted that it will be a case of locking the barn door after the horse is stolen.

It is expected, however, that the Ways and Means Committee will report the permanent tariff bill in a few days. Practically all legislation is at a standstill pending solution of the tariff.

Townsend Bill Gets Committee Approval

WASHINGTON, June 13—Favorable report was ordered by the Senate Post Office and Post Roads Committee to-day on the Townsend bill to create a Federal Highway Commission and to establish an interstate system of public roads.

Members of the commission would be appointed by the President with the consent of the Senate and receive salaries of $10,000. The annual appropriation of $100,000,000 to aid the states in building roads would be continued with the specification that the sums allocated to the states must be expended on interstate roads.

Army Truck Disposal Deadlocks Law Makers

WASHINGTON, June 14—Disposal of surplus army trucks and other motor vehicles has proved a stumbling block for the Senate and House conferees now considering the army appropriation bill. Congressman Anthony of Kansas and a few supporters in the House are demanding that the House managers stand pat on the House provision which would compel the Secretary of War to sell to the public 10,000 motor vehicles. The Senate managers, however, are apparently unwilling to recede from the amendments adopted by the Senate which made it optional for the Secretary of War to sell or transfer to the Department of Agriculture and the State Highway Commissions surplus equipment.

As the present fiscal year is rapidly drawing to a close, it is essential that conferees reach an agreement at an early date in order that funds may be available for the maintenance of the army. There has been considerable agitation by the organized State highway commissioners in behalf of the transfer provision. Congressman Anthony has led the fight for the immediate sale of all surplus motor equipment contending that the road builders in the various states cannot absorb such equipment as may be transferred hereafter. The sale of equipment at depots controlled by the Motor Transport Corps provoked some uneasiness among dealers for a time.

G. M. C. CONSIDERS BODY PLAN

NEW YORK, June 15—The General Motors Corp. is considering a plan of manufacturing custom built bodies at the plant of the Dayton-Wright Airplane Co. The plant is not large enough to permit quantity body production but it offers excellent facilities for custom work.

SHERIDAN TRANSFER AUGUST 1

MUNCIE, IND., June 15—Actual transfer of the plant of the Sheridan Motor Car Co. recently purchased from the General Motors Corp. by interests headed by W. C. Durant, will not be made until Aug. 1. General Motors will continue production of the present models until that time.

Slough Agents Buy More Trucks Abroad

Find Ready Market Here in Chicago and New York Territories

NEW YORK, June 15—Business in reconditioned army trucks brought back into this country by the Truck Company of America, is reported by officials of the company to be well up to expectations. Arrangements are being made by I. Edward Roskam, one of the officers, now in Europe, for the purchase and shipment of a considerable number more.

The first of the trucks brought back, numbering about 2000, were principally Pierce-Arrow, Mack, Packard, Peerless, White, Riker, Locomobile, Liberty, F. W. D., Nash and E. M. C. These were bought from the Slough Trading Co., Ltd., of London, and it is presumed that the trucks now being bought will be from the same source.

Parts for the trucks are now being brought in, according to Louis Mansbach, an officer of the company. These will total in value about $100,000, and it is probable, he said, that more would be arranged for on Roskam's present trip.

Sales of the reconditioned trucks are principally in the New York and Chicago districts, Mansbach said, though the distribution is extending to all parts of the country except through the South. A Chicago office has been opened at 1515-19 Wabash Avenue, under the direction of Morris Froelich, also an officer.

Additional storage space has been arranged for in New York by the leasing of the old car barns on Tenth Avenue, giving the company a total of about 250,000 feet of storage space.

Ohio Governor Signs Truck Restriction Bill

COLUMBUS, June 15—The Burke bill, which practically excludes from the use of Ohio highways trucks with a capacity greater than 3½ tons, has been signed by the Governor. Great pressure was exerted by automotive interests to have the measure vetoed, but these attempts were futile. The measure forbids the use of roads in the State by rubber tired vehicles weighing more than 20,000 lb. including their load. Another section of the bill permits additional restrictions by municipalities.

Automotive interests contended that the result of the bill would be that 3½-ton trucks would be overloaded and operated at a speed which would wear out the highways faster than heavier trucks with a normal load.

Tire Sales Steady at Akron Factories

Business with Dealers Overcomes Decreased New Car Specifications—Prices Stabilized

AKRON, June 13—Although automobile manufacturers' original equipment tire specifications have been materially reduced since the first of May owing to the drop in buying of automobiles, dealers' tire sales are holding up encouragingly, according to Akron tire manufacturers. Few more men will be laid off in Akron tire factories, it is stated, and production is expected to continue on an even keel until automobile sales are stimulated, when an increase in manufacturers' business is anticipated.

In a statement issued by L. C. Rockhill, general sales manager of the Goodyear Tire & Rubber Co., gasoline consumption, which is regarded as a good indication of how much automobiles are being used, was 17 per cent greater for the January, February and March period of this year than for the corresponding period of last year. February gasoline consumption was 9 per cent lower than in February last year, but March consumption was 35 per cent higher than in March last year, indicating, tire builders say, an increasing use of automobiles which will cause consumer tire sales to hold up steadily.

The Goodyear company reports that more automobile tires were sold to dealers last week than during the corresponding week of last year, and also that the week's business to dealers was larger than during any one week since last September. "This reflects an increased consumer demand and is probably the result of the fact that there has been no appreciable curtailment in the use of passenger automobiles," states Rockhill.

Other Akron companies also report that dealers' sales are holding up substantially. Firestone continues on a production basis of about 17,000 tires a day and anticipates no further retrenchment, officials say. Goodrich, although making office personnel reductions, salary cuts and reducing vacations to a one week limit, is producing 15,000 tires daily and not contemplating any further production reduction.

Fisher Body Earnings Establish New Record

DETROIT, June 16—The report of the Fisher Body Corp. for the year ended April 30 shows net profits after all expenses, losses, interest charges, depreciation and Canadian income taxes of $4,809,948, establishing a new record. Earnings for the previous year were $4,378,000. Net profits and surplus brought forward aggregated $11,205,000 from which $5,316,000 was appropriated for dividends on the preferred and common stock, all of which is owned by General Motors Corp., and on the stock of the National Plate Glass Co., a subsidiary. Current liabilities were decreased by the reduction of bank loans from approximately $13,000,000 to $5,000,000. Current assets included approximately $5,000,000 in cash and an inventory valued at $18,000,000 with an allowance of $1,645,000 for reductions in market value.

Sales Not Camouflaged, Asserts Hall Official

(*Continued from page* 1347)

the fairness to our dealers, would state that we have their written acceptance to our plan by contract or otherwise.

"This decision was arrived at only after careful discussion and due consideration here. As discussed with Mr. Whittaker, the plan upon which we are working to a sales end with the fleet owners is common with other of the largest manufacturers of motor trucks, as is evidenced by the fact that many of the fleet owners now have in their possession contracts with these manufacturers for the sale of motor trucks to them direct from the factory at varying wholesale prices.

"It has been intimated, too, that one of the local manufacturers has withheld membership to our association owing to the fact that one of the members of the board of directors was in favor of a sales policy not in accordance with his line of thought; although we have reliable information that the local concern is proceeding in their local sales without a dealer and on a factory direct plan and at wholesale prices, not only to fleet owners but to general users.

"This company values the work of the Sales Managers Association very highly, and the writer has likewise enjoyed the association of the board members, but, inasmuch as Mr. Hall and the writer, on behalf of the motors corporation, are averse to anything but frankness to our fellow associates and companies belonging to the association, we feel that, with respect to your objections, the only course to pursue is this one of resignation.

"Kindly acknowledge receipt and acceptance."

RECEIVER ASKED FOR IDEAL

CLEVELAND, June 14—Federal Judge Westenhaver has taken under consideration application for a receiver for the Ideal Tire & Rubber Co. with a factory in this city. The receivership petition was filed by the Philadelphia Rubber Tire Co., which asked for an accounting. The tire company asserts it is solvent, able to pay its debts and has a substantial equity for its stockholders provided the property is properly administered.

PERFECTION RECEIVER ASKED

WILMINGTON, DEL., June 14—A bill asking for the appointment of a receiver for the Perfection Tire & Rubber Co. has been filed in the United States Court here by the Southwark Foundry & Machine Co. of Philadelphia.

Moline Committees Work Out Financing

Believe Company Will Show $10,000,000 Over Liabilities After Inventory Write Off

NEW YORK, June 14—Creditors' committees which took over the financial affairs of the Moline Plow Co. some time ago are bringing to a conclusion plans for refinancing the corporation on a new scale after the inventories have been written down. Even at scaled down values to meet present prices for raw materials, finished product and plant, the company should show at least $30,000,000 of assets compared with approximately $20,000,000 of indebtedness.

The company, which manufactures agricultural implements and the Stephens automobile, is controlled by the Willys-Overland Co., which owns slightly more than 82 per cent of the common stock. The interest of the Stephens family in the plow company was taken over by John N. Willys in 1918. The former owners of the company received in exchange preferred stock in Willys companies in the following proportions; Willys-Overland 55 per cent, Electric Auto-Lite Corp. 30 per cent, Curtiss Airplane & Motor Corp, 15 per cent.

The bank and merchandise creditors are represented by the following committee: Frank O. Wetmore, Ralph Van Vechten, Edmund D. Hulbert, C. E. Mitchell, R. I. Barr, E. A. Potter, Jr., Samuel Vauclain, Alfred L. Aiken, Festus J. Wade, C. T. Jaffray and C. P. Coffin. The serial note holders are represented by a committee composed of Ronald M. Byrnes, Samuel L. Fuller, J. Herndon Smith, Harold Stanley and William W. Hoffman, secretary, 55 Wall Street.

The two committees made the following statement:

"The sudden and unprecedented falling off of sales in the autumn of 1920 left the company with an increased debt of $10,000,000 above normal, which is reflected in the corresponding increase in its inventory. The management of the business was changed in September, 1919. Important savings in overhead expenses and improvement in matters of organization were effected during 1920. The slump in business came too quickly to enable the company to reap the benefits thereof or to protect itself against the consequently swollen inventory. A new inventory is being taken and analysis of the company's financial position being made. Even at scaled down values to meet present prices for raw material, finished product and plant, the company should show at least $30,000,000 of assets, compared with approximately $20,000,000 of indebtedness.

"The two committees will do everything in their power to preserve this old and valuable business and to refinance the company on a basis that will enable it to maintain and continue the business and prestige it has enjoyed in the agricultural implement business."

Mason Tire Clears Last of High Rubber

Production from July 1 Will Be on Market Basis—Financial Position Strong

AKRON, June 13—Officials of the Mason Tire & Rubber Co. announce that before July 1 the company will have exhausted completely its supply of high-priced rubber, and will base all future production upon purchases of crude rubber at an average cost of 16 cents a pound. It is claimed that the Mason company is the first major rubber company in the United States to use up its high-priced rubber at such an early date, many companies both larger and smaller still have huge supplies on hand of crude rubber purchased at peak prices last year, while there also are many companies handicapped by contractual obligations providing for future deliveries of crude rubber contracted for at last year's record prices.

The fact that the Mason company is not under contract for future delivery of crude rubber at the peak price, places the company in an exceptionally strong position financially, officials say, and will permit a materially lowered producing cost commencing about July 1. Mason production now is running at 1500 tires a day and plans are being made to increase to 2000 tires daily before the first of next month. About 90 per cent of the entire Mason production is cord tires as the company discontinued the manufacture of fabric tires larger than 30 x 3½ some time ago.

Mason officials report May sales were in excess of sales for the corresponding month of last year and state that present business indicated that June sales will show an increase of nearly 100 per cent over June of last year. Mason was one of the few companies to make a 20 per cent tire price reduction on May 2.

Quick Assets $3,340,000

The company on May 1 had current quick assets of $3,340,000 and $778,000 in current liabilities including $433,000 of bills payable, $323,000 accounts payable, and $22,000 accrued payroll. The company also has in process the absorption of the Mason Rubber Plantations Co., which has about $700,000 of quick assets. A short time ago the company offered stockholders of the Plantations company, the privilege of converting their stock into stock of the Mason Tire & Rubber Co. The company expects to have sufficient stock converted by July 1 to take over the Plantations assets.

According to figures issued by the Rubber Association of America covering operations for the month of April in the United States, during which month about 200,000 cord tires were sold to dealers by the leading 45 tire manufacturers, Mason sales of cord tires to dealers during the period totaled 16,000, or from 7 to 8 per cent of all cord tires sold during that month. A year ago Mason discontinued the manufacture of ribbed tread and smooth tread tires, with the result that the money tied up in tire inventory now is small as compared with companies manufacturing several different types of tires.

Mason sales last year were $7,100,000 and the company is operating on an anticipated sales basis of over $10,000,000 for 1921.

New Light Piston Alloy Is Placed on Market

TACOMA, WASH., June 7—The Alloys Motor Parts Mfg. Co. are putting on the market a new copper-aluminum alloy known as Tsungani, which is claimed to differ materially in its physical characteristics from previous copper-aluminum alloys. The tensile strength is said to be over 21,000 lb. per sq. in., the Brinell hardness from 80 to 90, and the coefficient of heat expansion 0.000008. This latter figure is very much closer to the heat expansion coefficient of cast iron than that of other aluminum alloys, and in casting pistons from this alloy it is, therefore, possible to make the skirt clearance as low as 0.00055 to 0.00075 in, per inch of diameter, it is stated. This alloy takes a high polish in wearing

This material has been used for piston rings and also for steam engine piston rod packing. It has had considerable service in the West and has been used for air-cooled aviation engines. Pistons as large as 7 in. in diameter have been cast from the material.

Fox Motors to Produce Air-Cooled Car in Fall

PHILADELPHIA, June 13—The factory of the Fox Motor Car Co. which is owned entirely by automobile owners, has been completed. The new air-cooled Fox car is expected to appear on the market in the fall. The plant comprises 100,000 ft. of floor space and is being fitted throughout with the most advanced machinery and equipment.

The 5-pass. touring car, with 132 in. wheel base, will be sold for $3,500.

HYDRAULIC TO BUY PLANT

CLEVELAND, June 13—Negotiations have been virtually completed for the acquisition by the Hydraulic Steel Co. of the common stock of the Detroit Pressed Steel Co., manufacturer of pressed steel parts and the Disteel automobile wheel. Stockholders of the Hydraulic company are expected to ratify the purchase at a meeting June 24 and virtually all the stockholders of the Detroit company have approved the merger.

MOVE SAMSON OPERATIONS

JANESVILLE, WIS., June 13—General Motors Corp. is transferring the major part of the Samson truck operation from the Samson works at Flint, Mich., to the vast tractor and implement works operated by the Samson Tractor Co. at Janesville, Wis. Parts will continue to be made at Flint.

METAL MARKETS

HAVING reached the irreducible minimum of activity, the steel industry now has its ears to the ground in an effort to detect from what quarter is likely to emanate sufficient fresh demand to warrant the hope that a revival of buying is in the offing. In striking contrast with the attitude of many steel makers at the time of last year's recession in the automotive industries the effect of the different price reductions in the passenger car field is being keenly and sympathetically watched, and hopes for a turn for the better in the steel market are predicted to a considerable extent upon improvement in the automotive field. This change of heart is all the more noteworthy as the steel industry has reason to find fault with the character of automotive buying in the last few months, whereas, during the heyday period, when it was disposed to make light of the importance of the demand for automotive construction, the steel industry had things pretty nearly its own way. In the last few months, however, hand-to-mouth buying has become so general that specifications had nothing alluring about them, and frequently tonnages that, had they been placed at one time and with one or two mills would have been a life-saver for the latter, were so scattered that they were of little benefit to any producer. The strain under which mill executives have been of late in an effort to maintain operations on even the reduced scale of which the prevailing untoward conditions permit has brought about in the minds of many a decision that, when the turn for the better does finally set in, concessions will be strictly reserved for those buyers who are disposed to assume sufficient in the way of risks to enable producers to operate with a comfortable backlog of orders. In other words, there are those steel manufacturers who are beginning to recognize more clearly the advantages of steady production on a close margin over spasmodic prosperity at fancy prices. Especially among the smaller producers one encounters these days many who have begun to lose patience with the theory that in the steel industry there is bound to be either a feast or a famine. Perhaps the day when the steel industry will be so stabilized as to eliminate the proverbially seven fat and seven lean years may never come, but it must be decidedly gratifying to automotive consumers to know that the psychology of many producers is undergoing a decided change and that, when the industry emerges from the valley of idleness through which it is passing, it will set the good will of buyers, which alone can keep its stacks belching, above the fleeting benefit of high prices.

Pig Iron.—Prices continue to sag slightly under the weight of utter inactivity. Foundry No. 2 could probably be bought at $22 valley and malleable at $22.50.

Steel.—There is no longer a definable market price for any steel product. Every order (of the very few that are being placed) is a law unto itself. Published quotations no longer have any meaning. Take semi-finished steel as an illustration in point. Sheet bars are quoted at $39, and yet a northern Ohio buyer is reported to have been offered several thousand tons at $35. Generally speaking, producers have become as apathetic as consumers. Report from Youngstown has it that the Ford Motor Co. placed an order for 20,000 automobile sheets with a Valley producer at 4½ cents.

Aluminum.—There is not the slightest reawakening of demand from automotive sources.

FINANCIAL NOTES

Studebaker Corp. has reduced its bank loans so that they now stand under $1,000,000. Bank loans a month ago were close to $4,000,000 and Jan. 1 about $8,500,000. Studebaker today has about $5,500,000 in cash on hand. Earnings for the first six months of 1921 will approximate $7,000,000 after all charges and Federal taxes. This is about 70 per cent of the total profits for 1920, and more than $10 a share on the $60,000,000 common stock after providing for the full year's preferred dividend requirements. This represents earnings of more than $7 a share in less than six months.

E. & W. Co., Milwaukee, manufacturing commercial car attachments for passenger car chassis, trailers, shock absorbers, etc., has increased its authorized capitalization from $150,000 to $225,000 preferred stock, plus 4000 shares of common stock without par value.

H. H. Franklin Mfg. Co. has declared a common stock dividend of 50 cents a share payable July 11. Profits for the first five months of 1921 are estimated at $775,000 after taxes. The factory is at 100 per cent capacity.

Gotfredson-Joyce Corp., Ltd., Walkerville, Ont., truck maker will increase its capital stock from $100,000 to $500,000. The company has been building 2-ton and 3½-ton models and will bring out 1-ton and 5-ton models.

Necedah Mfg. Corp. has been incorporated with a capital stock of $200,000 to succeed the Necedah Mfg. Co., at Necedah, Wis., established about a year ago to manufacture electro-generating units, farm lighting plants, etc.

J. I. Case Plow Works has passed the quarterly dividend of 1¾ per cent on its first preferred stock. Three months ago the company passed the dividend on the second preferred stock.

C. R. Wilson Body Co. directors have authorized payment of the regular quarterly dividend of 1¾ per cent on preferred stock. The payment will be made July 1.

Electric Storage Battery Co., Philadelphia, will pay a quarterly dividend of $3 a share on both common and preferred stocks, payable July 1.

Auburn Automobile Co. has declared a quarterly dividend of 1¾ per cent on preferred and $1 on common, both payable July 1.

Kelly-Springfield Tire Co. will pay a quarterly dividend of $1.50 a share on the 6 per cent preferred stock on July 1.

Moon Motor Car Co. has declared a quarterly dividend of 1¾ per cent on its preferred stock payable July 1.

Fisher Body Ohio Co. paid June 10 the quarterly dividend of $2 a share on its preferred stock.

Motor Wheel Corp. paid a quarterly dividend of 2 per cent on the common stock June 10.

INDUSTRIAL NOTES

Gillette Rubber Co. of Eau Claire, Wis., is now turning out 250 cord tires a day, the largest output of this class of goods it has ever attained. Production also includes 400 fabric casings and 1400 to 1500 tubes.

Clark Turner Piston Co., Los Angeles, has appointed Laystall Motor Engineering Works, Ltd., London, as distributors of De Luxe pistons for Great Britain and Ireland.

New Departure Mfg. Co. has removed its Chicago sales office to the Peoples Gas Building, 122 South Michigan Avenue.

Canton Foundry & Machine Co., Canton, Ohio, has moved its New York office to 45 West Eighteenth Street.

G. M. C. Plans Future Use of St. Louis Factories

ST. LOUIS, June 14—C. S. Mott of Detroit, vice-president of General Motors Corp., in a letter to President W. Frank Carter of the St. Louis Chamber of Commerce, writes that the St. Louis plant of General Motors is not for sale at any price and adds that "we expect to make it one of the most active in our organization." The letter is in reply to a query by the Chamber as to the foundation of current rumors that the corporation was planning to dismantle and eliminate its plant here.

"The new management of the General Motors Corp.," the letter says, "is perfectly satisfied with the St. Louis investment, its geographical location, railroad service and labor market. We feel sure you will be pleased with our plans when the time comes to put them into operation."

FINANCE OBENBERGER WORK

MILWAUKEE, June 13—Permission has been given J. F. Gerdis, as trustee of the John Obenberger Forge Co., Milwaukee bankrupt, to borrow $60,000 from the First Wisconsin National Bank for the purpose of financing current production, resumed recently by authority of the Federal court. The Obenberger company has sizable orders from Packard, Nash, Dodge and other passenger car factories, and reinstatements of other orders which were cancelled about eight to ten months ago, precipitating the financial crisis in January this year. The loan is secured by short-term certificates bearing 7½ per cent interest. The First Wisconsin National Bank is one of the largest creditors and is assisting in the rehabilitation of the concern. The liabilities of the Obenberger company are about $1,250,000 and its assets are in excess of $2,000,000.

ONEIDA SEEKS NEW CREDIT

GREEN BAY, WIS., June 15—Directors of the Oneida Motor Truck Co. have submitted to creditors of the company a new proposition which it is asserted will result in a satisfactory adjustment if it is accepted. The company has found it impossible to carry out the tentative agreement made with creditors in April. The new plan is understood to call for a substantial cash payment to creditors.

CANADIAN FORD DIVIDEND

WINDSOR, ONT., June 10—The Ford Motor Co. of Canada has declared its regular annual dividend of 15 per cent.

BANK CREDITS

Written exclusively for AUTOMOBILE INDUSTRIES *by the Guaranty Trust Co, second largest bank in America.*

NEW YORK, June 16—The local call money market eased in the middle of last week, after having maintained, for the first few days, the firmness which had characterized the previous week. The range for call money was 6 per cent to 7½ per cent, as against 7 per cent to 8 per cent the previous week. After opening firm at 7½ per cent on Monday, the rate on call loans declined, until on Friday a uniform rate of 6 per cent was quoted all day. In the latter part of the week, offerings were more abundant, and, it was said, there was a surplus of loanable funds. "Outside" money was available at 5½ per cent. The favorable report of the Federal Reserve System and the offering of treasury certificates of indebtedness and Government short-term notes seem to have created a favorable impression in money circles in midweek. Time funds, however, were still scarce, and quoted rates were unchanged at 6¾ per cent to 7 per cent for all maturities from 60 days to 6 months. As a result, quotations were nominal and transactions few.

Gold holdings in the United States were, on June 1, the largest in the history of the country. On June 1, the total stock of gold was $3,175,037,198. The previous high record was on May 1, 1917, when we held $3,121,887,443. Our gold holdings increased $85,357,416 in the month of May, and $390,202,771 during the first five months of the present year. These holdings have further increased since the first of the month.

The Government crop report issued on June 8 estimates the year's harvest of wheat, oats, rye and barley at 88,000,000 bushels under last year's harvest. The estimate for these combined crops is 2,496,000,000. The estimated wheat crop of 829,000,000 bushels is comprised of 578,000,000 bushels of winter wheat, and 251,000,000 bushels of spring wheat, and allows for an exportable surplus of about 200,000,000 bushels. While there were some crop losses in May as a result of drought and freezing, indications now point to a more favorable wheat crop. Since the Government report was issued, rains and cool weather have contributed toward the filling and maturing of the crop. Present indications also point to one of the largest oat crops in our history, should present conditions and acreage maintain until harvest time.

KELLY CLEARS TRUCK SURPLUS

SPRINGFIELD, OHIO, June 13—Indications are that the plant of the Kelly-Springfield Motor Truck Co. will be forging ahead in good shape within the next sixty days, according to officials at the plant. Eastern warehouses are being freed of the surplus trucks and general demands are increasing. At present the big works is operating with about 30 per cent of its normal force.

MEN OF THE INDUSTRY

E. C. Tibbetts, who has resigned as advertising manager of the B. F. Goodrich Co. after having been with Goodrich for 24 years, has become central western manager for the William H. Rankin Co. He will have headquarters in Akron, and in his new capacity will have direct charge of the Goodrich advertising account with the Rankin agency. E. P. Rowen, another veteran Goodrich employee who has resigned as manager of Diamond tire sales, has been succeeded by E. H. Fitch, with Ralph McPeake named assistant to Fitch. L. A. McQueen, formerly in Goodrich sales promotion work, has been made assistant advertising manager.

Arthur R. Heiskell, who has been connected with Nordyke & Marmon Co. as treasurer for a number of years, and H. G. Shafer, who has been secretary, have been named vice-presidents of the company. H. L. Purdy, formerly assistant treasurer, will succeed Heiskell, and H. H. Rice, formerly sales manager, will take Shafer's place. H. H. Brooks, assistant sales manager, has been promoted to take the place made vacant by Rice and A. J. Rogers, publicity manager for the company, has been promoted to assistant sales manager.

H. M. Rugg, for two years director of the Department of Technical Instruction of the United Y. M. C. A. Schools, has become director of Educational Extension of the Michigan State Automobile School, Inc., Detroit. His new duties involve the sales and promotion work for the school as well as assistance in technical supervision. Rugg was active in training work with the army during the war.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, has been elected president of the Trade Organization Secretaries of New York, which consists of the executive officers of more than 80 trade organizations. The association holds monthly meetings to discuss problems which have to be met by organizations of manufacturers, wholesalers and retailers.

J. H. Newmark, for 11 years with General Motors, recently as advertising manager of the Chevrolet division, has been promoted to assistant manager of sales and will come to Detroit when the Chevrolet organization moves to its headquarters in General Motors building July 1.

Wilis Johnson has been appointed vice-chairman of the appropriations committee of General Motors Corp. His duties will be to handle all matters pertaining to requests for appropriations for capital expenditures from the divisions and subsidiaries of the corporation.

William R. Petze, sales manager of branches for the Splitdorf Electrical Co., has resigned and joined the Sterno Corp. as general sales manager of its automotive accessories division. His headquarters will be at the general offices of the Sterno Corp., New York.

F. W. Warner, former president of the Oakland Motor Car Co., who has remained a director and vice-president of the General Motors Corp. since he relinquished active control of Oakland's affairs, is expected to join the organization now being built up by W. C. Durant later in the year.

S. H. Cunningham, New York branch manager for the Goodyear Tire & Rubber Co., has resigned. Cunningham has moved to Akron, where he announces he will engage in private business in the future. He had been with Goodyear for several years.

William E. Corey, chairman of the board of the Midvale Steel & Ordnance, has been elected a director and member of the executive committee of the International Motor Truck Co. in place of Ambrose Moonell, deceased.

G. C. Jefferson, formerly in the sales promotion department of Oakland Motor Car Co. and later with the W. N. Albee Co., Detroit, has joined the advertising department of Briscoe Motors Corp, Jackson, Mich.

W. G. Bell has resigned as president of the Cleveland Tractor Co. of Canada to become director of sales of Gray-Dort Motors, Ltd., of Chatham. Johnson R. McGee has been named Gray-Dort sales manager.

John D. Hess, Jr., has been appointed manager of pneumatic tire sales for the Firestone Tire & Rubber Co. He has been with Firestone for nine years, latterly being assistant western sales manager.

Dexter C. Hathaway has been appointed assistant sales manager of the McGraw Tire & Rubber Co. He has been connected with the McGraw Cleveland branch for the past year.

Ted Snider, formerly manager of the Cincinnati district of the wheel division of General Motors, is now general factory representative of the Gary Motor Truck Co., Gary, Ind.

C. E. Gordon has resigned as sales representative with the Timken Detroit Axle Co. and has been made general sales manager of the Alena Steam Products Co. of Indianapolis.

C. J. Reilly, for several years connected with Firestone and Akron, as sales representative, has been made sales manager of the Simplex Auto Lock Co., Detroit.

C. E. Pumphrey, formerly sales manager for McGraw Tire & Rubber Co., has been appointed sales manager for the Corona Cord Tire Co., Butler, Pa.

Robert S. Gans has been elected a vice-president of the Raymond Engineering Corp. He will continue in charge of sales and the development of new products.

Oshkosh Tractor Formed to Take Over La Crosse

OSHKOSH, WIS., June 13—As the preliminary step toward the transfer of the works and offices of the LaCrosse Tractor Co., manufacturer of the Happy Farmer tractor, from LaCrosse, Wis., to Oshkosh, Wis., a new corporation styled the Oshkosh Tractor Co. has been incorporated under the laws of Wisconsin. The capital stock consists of $1,500,000 preferred stock and 15,000 shares of common stock without par value. The articles are signed by Harvey P. Rhyner, Milo J. Gilbert, Bart W. Heiss, Edgar Melzer and E. J. Dempsey, attorney, all of Oshkosh.

Oshkosh capital is becoming heavily interested in the new corporation and the present owners of the LaCrosse company will absorb the remainder of the capital. Plans are being prepared for a new factory building. A. D. Paine, who has been Wisconsin distributer of the Happy Farmer tractor for several years, is active in the reorganization.

At LaCrosse the company operates two works, widely separated, with no immediate prospect of a union of the operation. To facilitate production and operate efficiently, it was decided to accept the offer of Oshkosh capital to relocate in that city, provision being made locally for the erection of suitable buildings.

It is expected that the actual transfer of the equipment and stock of the LaCrosse company to the new Oshkosh works will be possible about August 15 or Sept. 1.

Fort Wayne Tire Plant to Be Offered for Sale

FORT WAYNE, IND., June 13—Property of the defunct Fort Wayne Tire & Rubber Mfg. Co. is valued at $273,000 while liabilities approximate $200,000, according to the inventory and appraisal filed with Harry C. Sheridan, referee in bankruptcy, by David S. Vesey, trustee. The date for the sale of the company property has not been set.

The plant is not being operated at the present time. Such manufactured stock as there is on hand has been offered by Vesey at retail sale at prices far below the regular prices of the goods. A plan is now being worked out which, it is hoped, will enable the old stockholders to reacquire the property and start operations. The investigations into the company's affairs conducted by the trustee in bankruptcy lead him to believe that with efficient management the property can be successfully operated even under present business conditions.

DODGE-RACINE TO MOVE PLANT

SHEBOYGAN, WIS., June 13—The Racine Engineering Co., Racine, Wis., manufacturer of the Dodge-Racine tractor-truck, has definitely decided to relocate in Sheboygan, Wis. It is being reincorporated as the Dodge-Sheboygan Co., with a capital stock of $200,000. Temporary quarters are being provided until the construction and equipment of a new tractor plant in Sheboygan can be accomplished. The Dodge design is new and novel, as it embraces a motor truck and farm tractor in one machine, making it adapted for trucking, hauling, cultivating, etc. The machine will be marketed under the trade name of Dodge Universal Truc-Trac.

CONGRESSMAN GOOD RESIGNS

WASHINGTON, June 13—Representative James W. Good of Cedar Rapids, Iowa, chairman of the Appropriations Committee of the House, who has been one of the most insistent members of Congress in urging additional taxes upon motor vehicles, has resigned to take up the practice of law in Chicago. He announces that he cannot afford to continue longer in the public service at the low salary he receives.

Calendar

SHOWS

Sept. 5-10—Indianapolis, Automobile and Accessory Show in conjunction with Indiana State Fair, conducted by Indianapolis Automobile Trade Association, John B. Orman, Mgr.

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Ice ander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Sept. 23-Oct. 2—Berlin, German National Automobile Show, Auspices of German Automobile Mfg. Ass'n and German Automobile Club.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

July 4-9 — Mackinac Island, Mich., Summer Meeting Automotive Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

Equipment Association Plans Increased Sales

CHICAGO, June 13 — A half day's session at the summer convention of the Automotive Equipment Association at Mackinac Island next month will be devoted to discussion of means of developing the channels for retail distribution. Jobber and manufacturer members of the association, at this session, will make an intensive study of resale merchandising with a view to bringing influence to bear to broaden the outlets for the products of the industry.

The first two days of the convention, July 4 and 5, will be given over to meetings of the directors, standing committees and state vice-presidents. Routine work will be taken up at the morning meeting July 6 and in the afternoon there will be meetings of the manufacturers' and jobbers' divisions, presided over respectively by President Robert A. Stranahan and Commissioner William M. Webster. The sales meeting will be held July 7 and on Friday, July 8, the convention will be brought to a close with the morning session.

Members of the association from all parts of the United States and Canada are making arrangements to attend the meeting, a large number planning to go by boat from Buffalo or Chicago.

N. A. C. C. ISSUES TAX BOOKLET

NEW YORK, June 13—The National Automobile Chamber of Commerce has issued a booklet on national taxes showing motorists what they pay in special taxes and outlining the program proposed by the industry in opposition to excise or "stigma taxes." The booklet shows that motorists pay annually $267,000,000 in discriminatory excise taxes.

WISCONSIN BOND RATE HIGHER

MILWAUKEE, June 14—The Wisconsin Legislature has passed and the Governor signed a 6 per cent interest rate provision for county highway bonds. During 1919 many counties bonded themselves for large amounts for the construction of highways under the Wisconsin and Federal aid provisions. The State law at that time fixed interest on the bonds at 5 per cent, and provided the bonds must not be sold for less than par. These limitations during the past two years made it impossible to sell the bonds, as against other securities on which interest returns grew in the tight money market. The new law not only permits future issues of 6 per cent bonds, but enables county boards to issue bonds already voted for issuance, at 6 per cent.

Duesenberg Quits Racing to Build Stock Cars

INDIANAPOLIS, June 14 — L. M. Rankin, vice-president and general manager of the Duesenberg Automobile Co. here, this week said the corporation was leaving the racing game and after the Grand Prix and the Uniontown race its energies would be devoted entirely to the production of stock machines. Any race entries hereafter containing Duesenberg engines will be private mounts.

Duesenberg declares that the company will stick to the eight-in-a-row engine in stock cars. The Deusenberg models will be priced from $5,000 to $8,000 and will include a complete line of open and enclosed models. The body designs are now being perfected.

The company is headed by B. A. Worthington, who is president of the Cincinnati, Indianapolis & Western Railroad and chairman of the industries committee of the Indianapolis Chamber of Commerce. L. M. Rankin, vice-president and general manager, is an executive and sales manager of long experience. F. A. Reilly, secretary-treasurer, is a New York attorney.

WALLACE TO ADDRESS N. I. V. A.

CHICAGO, June 14—An address by Henry C. Wallace, secretary of the Department of Agriculture, will be the feature of the twenty-eighth convention of the National Implement Vehicle Association which will be held in this city Oct. 12-14. It is expected that other speakers of national repute will be secured. To assure accommodations for delegates who desire to be in Chicago the day preceding the opening session, arrangements have been made with the Congress Hotel, convention headquarters, for reservations for the four days.

Fiat Defeats Mercedes in Targa Florio Race

PALERMO, SICILY, May 31 (*By Mail*)—Fiat defeated Mercedes in the first European automobile race open to late enemy countries. The occasion was the twelfth annual Targa Florio 268-mile race around a mountainous course on the island of Sicily. Count Masetti, an amateur, covered this distance on a 300 cu. in. racing Fiat in 7 hr. 21 min, 05 sec., or at an average of 36½ miles, thus winning first prize and breaking all previous records.

A week before the closing of entries the German Mercedes Co. announced that it would take advantage of the open rules to enter this race, and a team was sent comprising three 6-cylinder cars of 105 by 140 mm. bore and stroke, to be driven by Lautenschlanger, twice winner of the French Grand Prix; Seiler, and Gros. No expense was spared to secure success in the race, and in view of the high quality of the cars and the reputation of the drivers, it appeared doubtful if the Italians, who were about thirty strong, could win the trophy.

This race resolved itself into a duel between Seiler, the German driver of the Mercedes, and Masetti on the Indianapolis type Fiat. On the first of the four laps the German led by 19 seconds. At half distance Masetti had worked his Fiat into the leading position with a margin of 2 min. 29 sec. On the third lap the German closed up until the Italian had a lead of less than 1 min., but the Mercedes weakened toward the end, and the Fiat finished with an advantage of 6 min. 11 sec. Compared with track performances, the average looks low, but the race was one of the hardest ever run in Europe, for more than 6000 sharp turns had to be negotiated in the 268 miles, and the only level portion of the course was very rough.

The following is the result of the race:

Masetti, Fiat	(300 cu. in.)	7.21.05
Seiler, Mercedes	(460 cu. in.)	7.27.16
Sivocci, Alfa-Romeo	(274 cu. in.)	7.31.43
Ferrari, Alfa-Romeo	(274 cu. in.)	7.33.45
Forestri, Itala	(183 in.)	7.34.37
Morlandi, Itala	(183 cu. in.)	7.39.34
Minola, Fiat	(183 cu. in.)	7.47.46
Ceirano, Ceirano	(183 cu. in.)	7.59.12
Bergese, Fiat	(120 cu. in.)	8.06.34
Arnone, Ceirano	(183 cu. in.)	8.11.11
Febo, Fiat	(120 cu. in.)	8.36.59

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Team Work Needed in Bucking the Sales Resistance Line

Now that the price question is in eclipse for the time being, there are other important sales questions. Some of those that must be met by the industry are here set forth. These do not call for so much individual action, as action by the industry.

By Clyde Jennings

NOW is the time for all good men to rally to support of the industry. How well most of us remember writing the above line (with a slight difference) when we first attempted to use the typewriter.

And using the typewriter is about like David Harum's low bridge story. Practically every business executive smiles at references to his one-finger speed.

But let us begin on the topic actually under discussion.

The automotive industry has pretty well got the price troubles out of its system. It is now ready to sell the motor cars, if the public can be persuaded to buy, and the public can be persuaded if it is properly approached. There are, however, a number of serious questions now entering into the sale of motor cars that have not been serious in the past. It is in the solution of these problems that the assistance of "all good men" is needed. The questions that will be set forth are not questions for the Maxwell, the Dodge, the Buick, the Cadillac or the Pierce-Arrow to answer. They are questions for the industry to answer.

We all know what the stage setting has been in the past. It has been like this:

Every man, woman and child in the country has had the desire to own a motor car. It was only a question of the prospect getting money enough to buy one or the seller making terms long enough to permit the prospect seeing a chance to get it paid for eventually.

When either horn of this dilemma was met, the signature went on the dotted line and another car was started on its way to the used-car boneyard.

Times change and selling conditions and public opinion change with time. To-day the salesman hears many objections besides that of "I haven't the money." Any salesman to-day will tell you that:

It is easy to find a man who says:

I figure that I can buy a $1,000 car and pay a reasonable upkeep, but I cannot afford to pay $35 or more a month for garage space.

I can probably afford a car and a reasonable upkeep, but traffic regulations in this town are so bad there is no pleasure in keeping a car.

I can afford a car as things are now, but they are talking about raising the license fees and putting more taxes on the cars, and I am afraid.

I am waiting for the car that will go twice as far on the fuel.

I don't want to buy a car just to have it stolen.

My neighbor has a car. He is a safe driver, but the insurance people are making him pay as much insurance as any speed demon, and it's too much.

There are not enough good roads. Where I want to drive, it is a procession, not pleasure driving.

There is too much danger of killing people with a car; too much danger of being sent to jail.

My brother bought a car because he read how economical it was in operation, how silent and many other things. It won't do those things.

I am having troubles enough these days. Why should I buy a car and fight all of the time with repair men. You folks do not take care of your cars.

If we reduce these points a bit further, we get these lines of sales resistance:

Shelter in cities.
Traffic conditions.
Taxes.
Gasoline scarcity talk.
Car thefts.
Insurance abuses.
Highways.
Accident cry.
Foolish publicity.
Poor service.

These are actual lines of resistance in selling cars to-day. The public, according to reports from the men who actually sell the cars, is not much alarmed by the average life of the car and many other things that will, in time, come up for solution.

The public, it appears, is pretty well sold on the utility of the car and its internal combustion engine kindred, and the public has a great desire to own cars. But especially since last July 1, last year, a good many individual sections of the great public have been giving more and more thought to financial problems, as pertains to the individual, and the era of reckless expenditure has ended. It took the industry generally a long time to fully appreciate the individual's increased appreciation of the importance of his own pocketbook, but the recent price adjustments and the change appearing in the subject matter of the advertising indicate that an understanding of the present situation has been finally lodged in the sales mind of the industry.

Shelter

This is a question that can be solved only by proper encouragement to capital. It is very akin to the housing of families—only of less vital importance to the human race and the nation. It is important chiefly to those who have automotive vehicles for sale. The prospective buyer will not make any great exertions on his own behalf. It is the belief of many students of the situation that a proper canvass would show to capital that there is a productive field. Also that a new type of garage is needed. This should be a garage where the flat-resident owner can drive his car and lock it up. City car owners are tired of having tools and other articles left in the cars stolen. The practice of losing these articles and of being ordered to vacate garage space because they buy gas and oil elsewhere is an annoyance that may counterbalance the sense of satisfaction of owning a car.

Traffic

Traffic regulations are far from satisfactory. Generally speaking, in the small city they are too loose and in the large city they are too severe. Someone besides the police sergeant should study traffic needs and regulations. In each city the persons most concerned with the proper use of automotive vehicles should interest themselves to see that the existing regulations are properly enforced.

There was a time when this matter was entrusted entirely to the motor car owner. All are familiar with the present situation. Surely this question is of sufficient importance as a sales resistant to warrant attention. An automotive student recently visited a Massachusetts city. He said sales were at a standstill there because the downtown streets were so full of cars people were disgusted. He did not see the solution, but after some discussion he admitted that a proper enforcement of reasonable parking restrictions would do much to clear the streets. In larger cities parking space where car owners can pay for the service they want is required.

Taxes

This question has been much discussed and much effective work is being done by the Motor Conference Committee and by the N. A. C. C. Legislative Committee. It is only necessary here to say that this work is much too important to be neglected. A foundation of continuing work has been laid and it must be continued.

Gasoline Scarcity Talk

Once we all thought that when the price of gasoline dropped it would end the scarcity talk. But apparently it does not. So many scientists who view time only by geological ages have been writing of the end of the gasoline supply that they have made a pessimist of the ordinary man. There must be some reasonable counter-argument. Some persons who have carelessly read these articles are refusing to buy cars because they believe the supply of gasoline will run out before the car wears out.

There is another view of the gasoline situation that may be worthy of note. That is the small size of the gallons that some retailing machines turn out. This is especially a question where the motor vehicle owner is forced to rent shelter in a public garage, the kind that shelter most of the vehicles owned by apartment house dwellers and even in dwelling houses where no provision was made for a private garage. These short gallons also have a considerable effect on mileage-per-gallon records that owners pass to each other by word of mouth.

Car Thefts

Despite Federal laws and exposures of reward scandals in several of the larger cities, this evil flourishes. It is a serious sales resistant. In some states and cities an effort is being made to solve the problem. The motor vehicle is the most costly article that lends itself readily to theft. The best progress that has been made toward stopping thefts has been made under the encouragement of dealer associations. These efforts have demonstrated that when police and prosecuting officials are properly encouraged and assured of proper criticism in case of failure, and proper support in case of effort and proper credit in case of success that, they can materially change the situation.

Highways

This is not a new subject at all and the work is well under way. Now that the effort is being directed toward definite and well-defined ends, much progress is likely to be made. One important movement in the last year was the decision within the industry to stop the support of all wildcat schemes, which existed primarily to provide some nimble witted man with a job. The unity and earnestness of the industry in this cause is commendable.

Insurance

Ask any car owner about his insurance and you will get a rise out of him. Recently some steps have been taken by the insurance companies to right some of the most

flagrant wrongs, but much injustice still exists. The careful driver to-day feels that he is penalized because of the reckless person over whom he has not the slightest control. He feels that his good record amounts to nothing. Insurance folk are apt to think they have had small co-operation from car manufacturers. As a matter of fact, the insurance folk are having troubles of their own and they are ready to listen to constructive criticism. It is strange, but true, that there are no fundamental statistics on automobile accidents.

Accident Cry

While this article was being written a man who is financially interested in the industry came into the office and incidentally mentioned the "fear of injuring some one" as a great deterrent in his own case as to buying a car. He said that he heard many persons speak of this from day to day. Recent insurance company curves show that the 1921 automobile accident percentage per 1000 population is running higher than the 1920 curve.

Some recent statistics have indicated that the middle-sized cities are the worst offenders in this line. The usual idea is that it is the largest cities, but this idea is probably due merely to the fact that the numbers of those injured run higher, without a proper sense of proportion to population. There is opportunity here for research into the cause, time and place of accidents and then a broad educational campaign. This problem is closely linked with the general safety problems and even more closely linked with the regulation of traffic. At present the entire burden is passed to the driver. Much of it, doubtless, should go to the pedestrian. But accurate figures are lacking.

Foolish Publicity

Too much is promised for the car in hastily written publicity notices that have no object other than getting people to read them. They make all sorts of promises as to silent performance, mileage of gasoline and tires and many other promises that cannot be kept.

Also the public is getting a very queer impression of the sagacity of leaders in this industry because of some of the quotations attributed to them in the public press. Some executives might learn a good deal if they would keep posted as to their published opinions.

Poor Service

It looks a good deal like butting your head against a stone wall to talk about better service being forced by the manufacturers. However, the success of some manufacturers who have begun to take this question seriously is decidedly encouraging. Undoubtedly the Factory Service Managers of the N. A. C. C. are doing a great work. They should be encouraged. As an offset to this, the manager of a large truck factory recently said that he made 10 per cent on his trucks and 25 per cent on his parts. Apparently the only obligation of this manufacturer toward his customers is to use him as a means of making money.

Among the persons who write to Automotive Industries on topics uppermost in their minds is George M. Brown, a pioneer dealer, who wrote recently:

"Several things happened to-day which brought to my mind rather forcibly the general character of the automotive industry, with which I have been associated for many years.

"That there is a strong tendency to a slump in the business is hardly to be denied, and it may not be entirely the price of cars. The upkeep to-day is a very serious factor. The high cost of repairs and the take it or leave it policy, very prevalent now, is not conducive to encourage even the purchase of a low-priced car.

"Years ago, when I was in the automobile business, my great aim was to satisfy my customers, even if the customer was somewhat unreasonable. A week or so ago my car needed new cylinder gaskets. These, on being applied, immediately blew out. On returning to the service station of the car I made a mild kick and was met with the retort, 'We don't make them, we only sell them.'

"I really think that many people are getting tired of a continual holdup because they happen to own a car. It may be necessary for some one to emulate the attitude of Admiral Simms and George M. Cohan and say a few words straight from the shoulder regarding some of the abuses outside the primary factory industry."

There is only one thing about this letter that is not satisfactory; that is that Brown does not give us credit for having hammered along these lines.

There is one thing very certain. With an article to sell like the motor car, a sales campaign that does not take service into consideration will never be a success.

Now this is not in any sense a "blue Monday" effort, nor is it designed to give expression to a grouch. But there is more to selling than naming a price and taking the article bought off of the shelf. No mercantile establishment ever laid the foundation for a fortune by merely wrapping up the merchandise. It is a fact, nevertheless, that a lot of manufacturing companies are started without giving any study to the selling problem. A lot of them start without even looking over the field with a view of possible absorption of the product.

There will be nothing new in this article to good salesmen, but whether the subject on any part of it is new, it is time that there was unity in the effort to meet the condition.

Census Bureau's Summary Concerning Aircraft Manufacture

A PRELIMINARY statement of the general results of the 1920 census of manufactures with reference to aircraft has been issued by the Bureau of the Census, Department of Commerce, furnishing a detailed statement of the quantities and values of the different types of aircraft manufactured during the year 1919, prepared under the direction of Eugene F. Hartley.

Reports were received from 31 establishments engaged in the industry during 1919 showing products for the year valued at $14,372,643, as compared with 16 establishments in 1914 with products valued at $789,872. Of the 31 establishments reporting for the year 1919, 10 were located in New York; 4 in Ohio; 2 each in California, Massachusetts, and Missouri; and 1 each in Connecticut, Indiana, Illinois, Louisiana, Maryland, Nebraska, New Jersey, Pennsylvania, Rhode Island, Washington and West Virginia.

The following is a summary of statistics of the industry for 1919, the "All other products" reported consisting chiefly of airplane parts, engines, and repair work.

Number of establishments	31
Total value of products	$14,372,643
Airplanes:	
Number	432
Value	$3,466,452
Seaplanes:	
Number	230
Value	$4,580,016
Value of work done during year on airplanes and seaplanes not completed	$1,658,670
All other products, including parts and repair work	$4,667,505

Nearly 65 Miles on One Gallon of Benzol

New record is established in French Grand Prix fuel consumption test by Gregoire, Citroen and other small cars, as well as by some larger cars. Nearly all makes entered in 183 cu. in. class and smaller make over 30 m.p.g. Only stock cars were admitted. One Ford makes 38.81 m.p.g.

By W. F. Bradley

NEARLY 65 miles on one gallon of benzol was the record set up by Jean Porporato, driving a two-seater Gregoire light car with a four-cylinder 2.4 x 3.5 in. engine, in the French fuel consumption Grand Prix at Le Mans.

This was not the only record broken, for right along the line, from the small two-seaters of 61 cu. in. piston displacement to the full-sized seven-passenger touring cars, extraordinary figures were shown and old records were broken. There were five classes, of 1100, 1400, 2000, 3000 and 4500 cu. cm. displacement, in which the best performances were Porporato on Gregoire, 64.62 m.p.g.; Milcent, four-passenger open Citroen, 62.03 m.p.g.; Bocchi, four-passenger open De Dion Bouton, 49.09 m.p.g.; Korner, four-passenger open Ford, 38.81 m.p.g.; Artault, four-passenger open Voisin, 36.59 m.p.g.

Each of the forty competitors was given a certain amount of fuel, according to piston displacement, seating capacity, weight and type of body, and all were sent away on a carefully guarded course about 4½ miles round, over which they had to run until the fuel supply was exhausted. The winner could be considered either as the one traveling the greatest distance, or the one showing the highest mileage per gallon. The results were different, according to which method of classification was employed. Thus, Milcent's Citroen went the greatest distance before stopping with an empty tank, but its mileage per gallon was less than that of Porporato's Gregoire. The Ford was first in its class on the basis of miles per gallon, but dropped down to seventh place on the basis of actual distance covered. In the big car class, too, Artault, on the open, sleeve-valve Voisin, was beaten by his teammate Cabaillot with a seven-passenger Voisin Sedan, on the basis of total miles run, for he put up a record of 79.39 compared with 76.84.

Competitors could select their own fuel, and in nearly all cases benzol was preferred to gasoline. Mixtures of gasoline and benzol were not used, and the few who did use gasoline preferred heavy grade to light fuel. Lacharnay equipped the Gregoire car which showed the highest mileage per gallon; Solex furnished the carbureter for the winners in the 1400, the 2000 and the 3000 cc. classes, while the Voisins in the 4500 cc. category had Zenith carbureters modified according to the ideas of the Voisin engineers.

The competition called forth the best work of French engineers and carbureter experts, and although the results obtained are not within the reach of the average automobile owner, they are valuable as an indication of directions in which economies can be made, and they are significant by reason of the improvement over the trials of a year ago. Only stock cars were admitted, but changes could be made when they had in view increased fuel efficiency. For instance, special camshafts and pistons could be used, the timing could be changed, compression increased, ignition and carbureter could be special, there could be electric heating for the carbureter and oil, if desired. It was forbidden, however, to change the type of engine, and if the standard product was an L-head engine it was forbidden to use an overhead valve type.

Speed was not sacrificed to fuel economy, except in a few cases. The big cars ran at 30 to 35 m.p.h., and in

Cars competing in the French fuel consumption Grand Prix

Filling the fuel tank of one of the cars (Voisin) prior to running in the French fuel consumption Grand Prix

the afternoon of the same day, without any adjustments in the meantime, many of them put up speeds of 60 m.p.h. for a distance of about 65 miles.

One of the features of the competition was the tendency to make use of crankcase induction. This was allowed under the rules, and interesting work was done by the Zenith engineers and by Cozette, a French carbureter expert. On a four-cylinder De Dion Bouton sedan, with four passengers, it was possible to get 70 miles to the gallon with a Zenith carbureter and crankcase induction. It is claimed that oil was not actually drawn from the base chamber, but the oily vapor suspended in the chamber was made use of. On a 20-hp. Darracq sedan, with four 3.3 x 5.1 in. cylinders, Cozette covered approximately 36 miles to the American gallon. In this case small quantities of oil were drawn from the base chamber, and after being vaporized in the exhaust manifold were passed into the intake manifold. No data is available to show exactly how much oil was consumed with this arrangement, but the engineers claim that the increase was not excessive. In certain cases, as, for instance, with engines having leaky crankcases, the normal oil consumption is hardly increased at all, for aspiration from the base chamber eliminates most of the leaks.

On the night before the competition the Solex Carbureter Co. protested against crankcase aspiration. Charles Faroux, the technical member of the jury, who had authorized this, withdrew, and allowed the remainder to vote, when a decision was given against allowing any air to be drawn from the crankcase. Zenith replied by withdrawing, thus pulling out of the competition a large number of De Dion Bouton cars and all the Peugeot machines. Cozette decided to remain in, but was put at a great disadvantage by having to modify everything during the night before the trials. A lot of jealous protests were lodged, one being put in against the Peugeots because they were not full width according to the rules. When the cars had been altered, they were protested because they were not stock models.

Arrangements to insure accuracy and prevent cheating were admirable. It was not allowed to use the standard tank, but instead a special receptacle had to be mounted either on the outside of the body, or inside when sedan bodies were used, so that it was always under the view of the observer, and had no hidden pipes. The course was divided into hundred yard sections, with official observers on each, as well as regular troops. After the tanks had been filled the cars were kept under military guard for the night and were pushed out to the starting line, where they were cranked by hand, for electric starters had to be either entirely dismounted or put out of commission. An observer connected with a rival firm was placed aboard each car and kept count of distance covered. As the course was marked off by posts at 100 yd. intervals, it was an easy matter to calculate the distance.

High compressions were common, and in some cases oil consumption was high. The Voisin sedan, with sleeve valve engine headed the list in this respect with a consumption of 1½ gal. of lubricating oil to cover 79 miles, while the gas consumption for the same distance was only 2.75 gal. The companion open Voisin consumed slightly more than half a gallon. One-fifth of a gallon was used by the Bignan-Sport sedan to cover 67 miles. All the others used extremely small quantities of lubricating oil.

Cars and Drivers	Bore and Stroke	Distance Covered, Miles	Fuel Allowed U.S. Gal.	Miles per Gal.	Carbureter
1100 cc. (67.2 cu. in.)					
1 Mathis, Kuntz	2.29x3.94	93.57	1.53 B.	61.15	Solex
2 Mathis, Sommier	2.29x3.94	92.39	1.61 B.	57.38	Solex
3 Majola, Doutre	2.32x3.54	76.79	1.55 B.	49.54	Claudel
4 Gregoire, Porporato	2.44x3.58	72.39	1.12 B.	64.62	Lacharnay
1400 cc. (85.4 cu. in.)					
1 Citroën, Milcent	2.56x3.94	94.91	1.53 B.	62.03	Solex
2 Citroën, Poulain	2.56x3.94	92.48	1.56 B.	59.28	Solex
3 Mathis, Lahms	2.36x3.94	90.08	1.53 B.	58.86	Solex
4 Mathis, Battaglia	2.36x3.94	87.96	1.55 B.	56.74	Solex
5 Citroën, Barbier	2.56x3.94	86.47	1.56 B.	55.43	Solex
6 Citroën, Delva	2.56x3.94	76.64	1.37 B.	55.94	Solex
7 Citroën, Tallard	2.56x3.94	67.25	1.55 B.	43.38	Eureka
8 Citroën, Collière	2.56x3.94	59.87	1.49 B.	40.11	Solex
9 Citroën, J. Monseny	2.56x3.94	51.68	1.48 G.	34.91	Solex
2000 cc. (122 cu. in.)					
1 De Dion Bouton, Bocchi	2.76x4.73	78.55	1.60 B.	49.09	Solex
2 Chenard & Walcker, Léonard	2.72x5.12	76.98	1.79 B.	43.00	Solex
3 Chenard & Walcker, L. Chenard	2.72x5.12	67.56	1.78 B.	37.95	Solex
4 Corre La Licorne, Collomb	2.56x4.73	65.07	1.51 B.	43.08	Solex
5 De Dion Bouton, Labaume	2.76x4.73	63.09	1.58 B.	39.93	Solex
6 Suère, Lamberton	2.76x4.73	53.08	1.64 G.	32.36	Solex
7 Alva, Compertz	2.56x4.73	52.46	1.53 B.	34.28	Mob.

Cars and Drivers	Bore and Stroke	Distance Covered, Miles	Fuel Allowed U.S. Gal.	Miles per Gal.	Carbureter
3000 cc. (183 cu. in.)					
1 Delahaye, Barateau	3.35x5.12	71.75	1.96 B.	36.60	Solex
2 Talbot-Darracq, Mauriceau	3.35x5.12	69.79	2.23 B.	31.29	Cozette
3 Delahaye, Brun	3.35x5.12	65.51	1.87 G.	35.03	Solex
4 La Buire, Lacharnay	2.95x5.90	64.23	1.96 B.	32.77	Lacharnay
5 Grégoire, Penard	2.95x5.12	64.17	1.82 B.	35.25	Lacharnay
6 Delahaye, Antelme	3.35x5.12	63.91	1.96 B.	32.60	Cozette
7 Ford, Korner	3.75x4	58.74	1.51 G.	38.81	Solex
8 Ford, Bocquet	3.75x4	55.67	1.51 B.	36.86	Solex
9 Colombe, Pestour	3.75x4	53.75	1.67 B.	32.18	
10 Ford, Devarenne	3.75x4	45.49	......	.....	
11 Ford, Torres	3.75x4	35.95	1.45 G.	24.78	
12 Ford, Kemf	3.75x4	34.96	1.55 G.	22.55	
13 Ford, Torchet	3.75x4	34.89	1.61 G.	21.67	
14 Ford, Monseny	3.75x4	27.70	1.56 B.	17.30	
15 Ford, Chaumel	3.75x4	15.92	1.57 B.	10.14	
4500 cc. (275 cu. in.)					
1 Voisin, Caballlot	3.75x5.52	79.39	2.75 B.	28.86	Zenith
2 Voisin, Artault	3.75x5.52	76.84	2.10 B.	36.59	Zenith
3 Delahaye, Convert	3.35x5.12	67.79	2.39 B.	28.36	Cozette
4 Bignan, De Marne	3.62x5.12	67.40	2.46 B.	27.39	Claudel
5 Mors, Maudiquet	3.54x5.52	59.80	2.05 B.	29.19	Solex

B = benzol. G = gasoline.

New Coolant Circulating Pump

THERE has recently been installed at the Cleveland plant of The Steel Products Co. a number of Ross "two way" centrifugal pumps for delivering oil or water to drill presses, lathes, tapping machines, centering machines, screw machines, etc. One pump provides a ⅜-in. stream for six high-speed drill presses. Another handles the supply for twenty-one high-speed drill presses, a third handles six tapping machines, a fourth six centering machines, etc.

Where a battery of machines is cared for by a single pump, a reservoir with an overflow is placed in the main distributing line, thus providing gravity feed for normal use. When pressure is required the overflow may be plugged.

One advantage claimed for the Ross pump is that it needs to be primed only when installed. The pump is designed to deliver a flow of liquid from the same outlet regardless of direction of rotation of the impeller blade. This is required for machines which run in both directions, such as screw machines.

The pump has oilless bearings and graphite asbestos packing, and no bearings or gears come in contact with the cooling fluid. This feature is very important, as steel chips are carried along by the compound. The impeller consists of four light pieces of vanadium spring steel and is designed so that there is no end thrust. The gear ratio is four to one, giving a high impeller speed when belted to a slow pulley.

A New Transmission Designed to Facilitate Gear Shifting

Secondary clutch completely disconnects the transmission from propeller shaft during interval of gear shifting. Shifting is accomplished by imparting a rotary motion to a slotted camshaft in gear box which actuates the shifting yokes. Shifting lever mounted on steering column.

A TRANSMISSION gearset which has been under development for the past several years is now being put into production and is being offered automobile and truck manufacturers. A number of advantages, including a great increase in the ease of gear shifting, and absence of clash, are claimed. In place of the ordinary type of gear shift lever, an accessible steering column control is provided. Increased engine flexibility and increased fuel economy are also claimed to result from the use of this gearset, the former from the particular construction of the gearbox and the latter from the possibility of operating under more advantageous gear conditions.

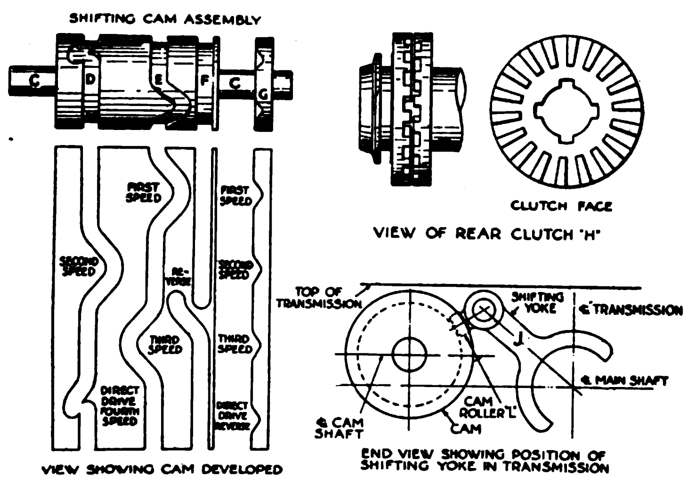
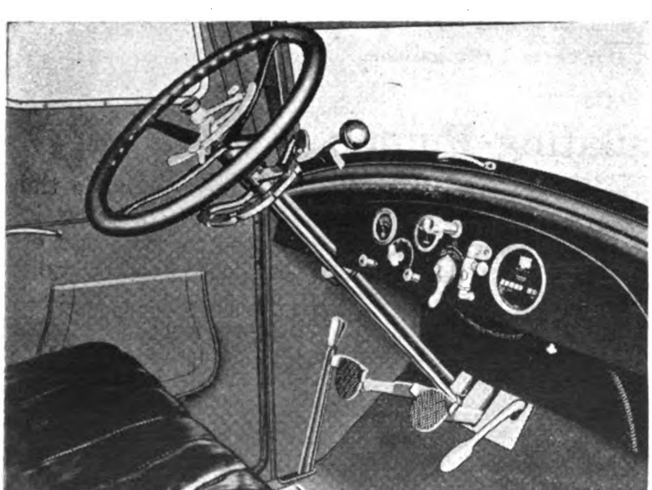


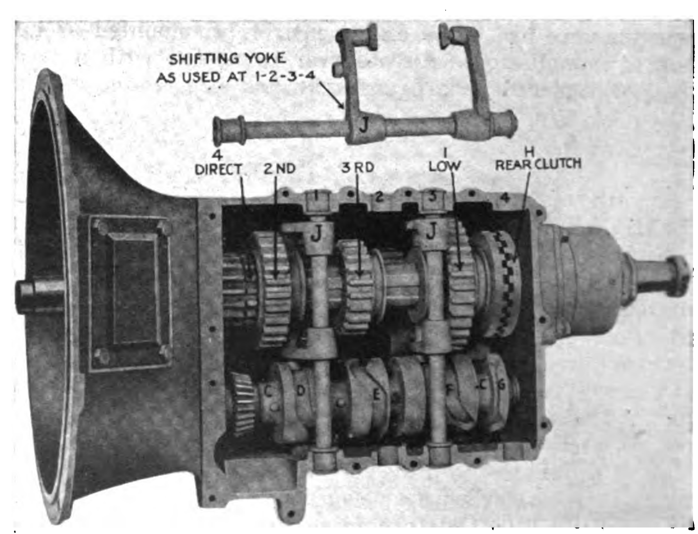
Fig. 1—Details of Flexo transmission gearset, whose operation is described in text.

Elimination of the gear-shift lever is made possible by the use of a secondary clutch of the jaw type within the gearbox itself by which the gearset is completely disconnected from the propeller shaft. The driver makes all gear changes by giving a slight motion to a wheel or lever on the steering post, as a result of which the rear or secondary clutch is automatically operated and the gears are shifted while relieved from load and positive drive. Because the gearset is thus unloaded at both ends by the usual power transmitting clutch and by the secondary clutch in the gearbox, it is possible to shift from any gear to any other gear desired, either forward or back, without the use of brake or accelerator. It is claimed that any desired shift can be made instantly, irrespective of roads, loads, grade and brake conditions, speed of engine, car speed and direction.

The gearshifting means also operates the secondary clutch. The device consists of a rotary camshaft, which is so timed that the gears do not begin to shift until the rear or secondary clutch is entirely disengaged. After the gears are completely meshed, the rear clutch automatically re-engages. The device, therefore, is positive in operation.

One of the important advantages claimed for the Flexo transmission gearset is better control of the gear or truck on steep grades or on slippery roads, because of the possibility of using the engine for a brake through the lower gears. With the usual sliding, selective transmission it is difficult to shift down from the higher to the lower gears. With the Flexo gearset, because of the unloading feature, it is possible to make this down shift just as readily as an upshift, and by


Peerless car equipped with Flexo transmission showing lever on steering column for gear shifting.



Assembly of the Flexo transmission showing details of parts.

using the engine as a brake, the tendency to skid on slippery roads is overcome. It is also claimed that the use of the device makes it possible to shift gear more quickly and hence with less loss of car momentum.

In making a shift to a lower gear when climbing a hill, it is ordinarily necessary to first allow the speed of the car to decrease very noticeably. Expert drivers are able to make this down shift at high speeds by speeding up the engine before disengaging the clutch while the gearset is in neutral. However, this requires a degree of skill beyond that of the average driver. With the Flexo transmission, by the use of the secondary clutch, the change down is made while the gears are stationary and unloaded, and consequently no clash is experienced.

This transmission is provided in a three-speed type, and also in types with from four to seven speeds. It is claimed that with the greater number of speed changes a smaller engine can be used and operated within a small speed range. The seven-speed transmission is particularly recommended for trucks.

Referring to Fig. 1, the operation of the transmission is apparent. By means of the hand wheel or lever on the steering post, a rotary motion is given to the camshaft C. On this shaft there are three slots, D, E, and F, which actuate the gear-shifting yokes J, J, J, and a face cam G. As shaft C is rotated, the yoke operated by cam G disengages the rear clutch H, thus completely disconnecting the transmission shaft from the rear drive shaft. As the camshaft C continues to rotate the particular set of gears corresponding to the speed desired is moved into mesh.

Cam G is so timed in relation to slots D, E and F that the rear clutch H re-engages after the gears are completely meshed.

The transmission is known as the Flexo and is manufactured by the Flexo-Motive Corporation.

Some New Automobile Accessories

An Eccentric Type Bonnet Lock

A NEW engine bonnet lock of the eccentric type, herewith illustrated, is claimed to permit of the use of a much stronger spring than is used on the present type of lock and still be readily operated with one finger. The eccentric locking element is associated with the bonnet catch in such a way that a two-point bearing of the same is secured, the intention being to prevent rattling and side motion of the bonnet.

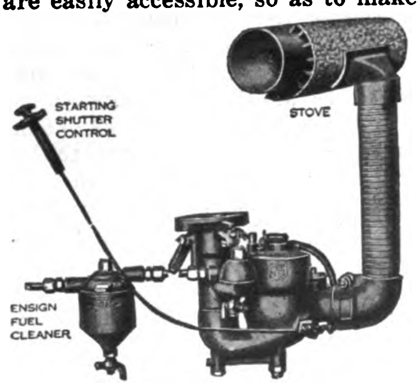
The bonnet lock is adjusted by rotating the body on the anchor bolt. This lengthens or shortens the lock, as desired. Each time the lock is released the anchor bolt is automatically forced into engagement with an absorbent oil saturated pad, contained within the lock body. This lubricates all moving parts.

All exposed parts of this lock are made of brass and nickel-plated. This lock is made in two styles, one with coiled spring and the other without. The anchor bolt is threaded down into the body, giving an adjustment of 1 in., to permit of holding the bonnet down with any desired tension. The lock is manufactured by the Ideal Brass Works.

New Carburetor Model

A NEW carburetor, known as Model E, having manual starting control and new idling adjustment, is announced by The Ensign Carburetor Co. The metering and mixing principles peculiar to the Ensign design are retained, but the adjustments are placed on the top of the carburetor where they are easily accessible, so as to make installation and adjustment as convenient and simple as possible.

The closing of the starting shutter (pulling out the choke, as it is known to most motorists) creates a greater whirling action in the mixing chamber, in proportion to the amount the shutter is closed, even at slow engine speeds. This imparts a higher velocity to the charge and thus more thoroughly breaks up and atomizes the mixture even at starting speeds.



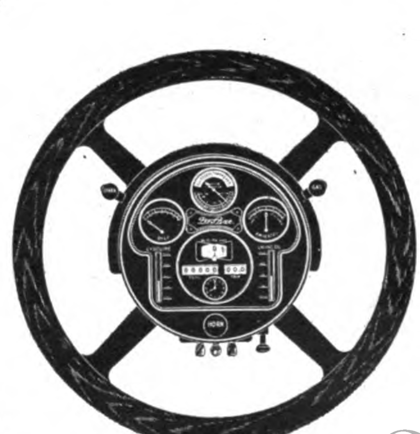
New Model of Ensign Carburetor

Eccentric type bonnet lock

Clearing the Instrument Board

AN instrument board for installation on top of the steering wheel has been developed and is being manufactured by the Whyte-Duffield Mfg. Co. The speedometer, oil gage, ammeter, ignition and lamp switches and any other indicating mechanism normally used in car operation may be mounted upon it, leaving the space ordinarily used for the instrument board and its connections free for storage compartments for gauntlets, lamp bulbs, spark plugs, curtains or any of the numerous other things that motorists like to carry on the car in a handy place. The control board is flush with the steering wheel, and all of the indicating devices are directly in the line of vision of the driver, which is certainly a convenience.

The Whyte-Duffield Mfg. Co. plans to furnish anufacturers with the wheel and post as a complete unit, fully wired, ready for installation. The design is said to possess advantages from the standpoints of both the manufacturer and the repairman.



A Steering Wheel Instrument Board

Tractor Tests Under New Rules Insure Comprehensive Results

The rules of the Fargo tractor demonstration, to be held next week, require that each tractor and horse outfit plow a 10-acre plot. Results will record the average performance of all the tractors. Factors considered will include fuel, lubricating oil and water consumed, stops, repairs, etc.

RULES for the series of three farm tractor demonstrations to be held during the present season have been issued by the National Implement & Vehicle Association's demonstration and show committee. The first is to be held at Fargo, N. D., June 28, 29 and 30. Tractors and horses are to meet in the demonstrations, which are intended primarily to arrive at some accurate figures of farm cultivation with either horse or tractor in order to counteract the mass of misleading information on this subject that has been in circulation for so long a time.

The rules are immeasurably superior to any previously used by the N. I. V. A. in its demonstrations. First, each tractor or horse outfit has a 10-acre lot that has to be plowed, disked and otherwise prepared for seeding. This is the first time that each tractor has been given so comprehensive a test. It will take a three-plow tractor approximately 10 or 12 hours to plow such a tract, which means a full day's work, which is much more of a test than the hour or so that each tractor has had to spend in plowing in the past.

Second, while at its work of plowing, preparing the seed bed and sowing the seed there will be two observers watching each tractor. One is to keep record of the tractor, including such matters as time, fuel, oil, feed, water, labor and other expenses, and the other observer will watch the work done, checking depth of plowing, contour of furrow, width of plowing and any irregularities in the work.

The observers will be appointed by the tractor makers competing and will follow the traditional contest rule of not observing on the make of tractor that they are employed with. These observers will have report cards on which all observations will be noted. It is the first time that observers have been used in connection with tractor tests conducted by the N. I. V. A., although they have been used in tests conducted by different state authorities.

The demonstrations are to be open to tractors of all sizes and to plow outfits consisting of any number of plows and each tractor has to cultivate completely a 10-acre tract irrespective of the number of plows it pulls. A tractor pulling eight plows has no more land to cultivate than one pulling two plows or one plow. This seems to be the unfair character of the test as naturally a two-plow tractor will be working nearly four times as many hours as a tractor pulling eight plows. The small tractor has four times the possibility of mechanical troubles and in reality gets four times as long a test.

This is the first N. I. V. A. demonstration in which a complete record is to be made not only of the fuel consumed by each tractor but also the lubricating oil consumed and also the water consumed in the radiator, in the air washer and in being fed direct to the cylinders through the fuel. A record will be kept of all tractor stops, and in making necessary repairs on the tractor no one will be permitted to perform the work except the driver under penalty of disqualification, and he is only permitted 30 minutes at any one stop for a repair. A stop in excess of this brings disqualification. Tractors are to be limited in speed to that at which they do good work, disqualification being the penalty for traveling too fast for satisfactory work.

The tractors will be required to begin plowing at 8 a. m. opening day and with an hour out for lunch will work continuously until 7 p. m. and on the second and third days will start at 7 a. m. and with an hour for lunch continue until 7 p. m. This will give the tractors a real test and give spectators a real opportunity to observe the different machines. It is just such a demonstration as this that has been needed for many years.

The findings and results of the demonstration are to be of a collective or group character rather than with regard to individual tractors. No tractor will be a winner in the two-plow, three-plow or any other class, but the results of all tractors qualifying are to be averaged and will show what it costs to plow, cultivate and seed a 10-acre tract by tractor and what it costs to do the same work by horses.

In arriving at these results what is known as a supervisor's committee has been appointed which will take the cards made out by the observers and make the necessary calculations from these. These calculations will be made for all of the tractors, and they will be totalled and averaged so that if 60 different models of tractors competed the cost of the work will represent the average of these sixty and not the cost of any one tractor, or any class of tractors, the object aimed at in the test being to give figures on costs that should be reliable. The average costs for the horse outfits will be similarly arrived at.

These results as obtained by the supervisor's committee will have to be referred to the demonstration and show committee of the N. I. V. A., which is the final authority and which approves of all results before they are given out and which also rules finally on all questions regarding the rules and questions arising out of them.

The individual tractor manufacturers are not to be permitted to publish the performance of their tractors until after Oct. 1, 1921. The time required by any tractor to plow, cultivate and seed its 10-acre plot will remain a secret until that time, the apparent reason being that two other demonstrations are to be made and no individual results can be published until the series of three tests is complete.

In publishing the results of each tractor test three figures will be given out: First, one cost figure that will give the average cost for the work of all the tractors.

Second, in order to get figures that will be fairer to these tractors that are better than the average, there will be averaged all those tractors that have performed better than the average of the first or total group. In short this means an average of the best half of all tractors competing.

Third: In order to get figures showing the best that tractors can do the performance of the best six will be taken and averaged and this figure given out.

In all three of these cost figures no mention will be made of individual tractors performances and not until after Oct. 1 will the different tractor makers be permitted to make use of the actual records of their machines.

Tractors will be permitted to use any fuel, such as gasoline, kerosene or distillate, but there shall only be one grade of each and this shall be used by all competitors using such fuel. This eliminates the possibility of any tractor using a superior grade of any particular fuel.

In view of the character of representation in this supervising observers committee it seems unfortunate that the N. I. V. A. demonstration and show committee does not let the findings of such an impartial committee be final. The world at large would acccept the findings of such a committee quicker than findings which are approved by a committee representing those tractor makers competing in the demonstrations. The results would carry greater weight and be of more value to the tractor industry if the findings of the supervisors committee were final. The results would then be free from all trade influence. As a great contest take the annual 500-mile Indianapolis speedway race in which the contestants have no say in the findings, but such rest entirely with a disinterested contest committee, made up of men in no wise associated with any of the manufacturers of competing cars, or even with concerns manufacturing parts entering into competing cars or accessories used on cars.

Entries for the Fargo demonstration closed June 21 for tractors competing in the demonstrations, but for those to be exhibited at belt work entries close June 27.

A large accessory exhibit tent is to be used for display purposes, the rent for space in such being $1.25 per sq. ft. An entry fee of $100 is made for tractors; $50 for garden tractors, and $50 for cultivators. Fees are charged for tractors for belt work as well as other for exhibit purposes only.

A New Canadian Truck

A NEWCOMER in the Canadian truck field is the G. & J. truck. This truck has been designed particularly to meet the conditions typical of Canadian transportation and has been under test for about 14 months.

Production of the 2-ton model began on a small scale in the fall of 1920. The designs of the 3½-ton model were put on exhibition at the Windsor, Ont., show in the latter part of February, and this model is now also in production.

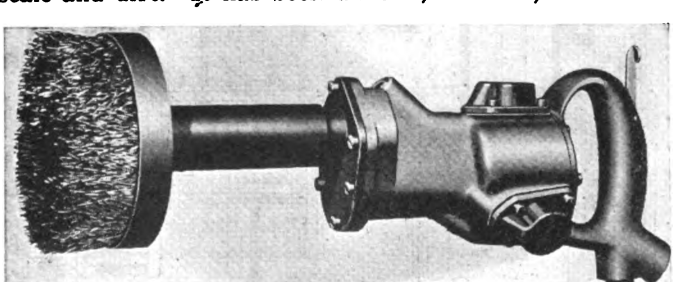
It is also purposed to bring out a light, 1-ton model, and eventually a 5-ton model. The specifications of the 3½-ton G. & J. truck, which is the latest model to be put in production, are typical of the entire line, except the 1-ton, which will be different in every respect, but on which information is not now available. The Hinkley Class B truck type engine in conjunction with the conventional, worm drive, Timken-Detroit axle, gives a foundation for the design of the truck. The engine is 4½ x 5½ in. and develops 50 hp. on the brake.

The other units in the truck include the Brown-Lipe transmission with four speeds mounted amidship on frame cross-members with provisions for a tire pump and power take-off. This transmission is mounted on Timken roller bearings and employs nickel steel gears throughout. Spicer propeller shafts with enclosed universal joints are employed, providing a straight line drive from the engine to the rear axle. The frame is rolled channel steel, hot riveted and reinforced with gussets. The depth of the channel is 7 in. and the width of the frame 38 in. The height from the ground to the top of the frame is 35 in. under average load. The road clearance under the front axle is 9½ in. and under the rear axle 9 in. The front wheel tread is 66½ in. and the rear wheel tread 65¾ in. The overall length is 245 in. and the width over the rear hubs is 86¼ in. Other specifications are as follows: Cooling by centrifugal pump and McCord finned tube radiator. Vacuum fuel feed to Stromberg carbureter. Bosch magneto with impulse starter. Dry plate clutch. Chrome vanadium springs. Gear reduction 10.3 to 1 on high, 55.2 to 1 on low. Ross steering gear. Chassis weight 7000 lb. Wheelbase 160 in.

The truck is made by the Gotfredson Joyce Corp, Ltd.

Wire Brush Cleaner

WIRE brush cleaning of metal surfaces offers an opportunity for considerable saving of time and labor over that required by hand in removing paint, rust, scale and dirt. It has been difficult, however, to obtain a wire brush of proper design and materials which would work effectively on an air motor and not wear out too rapidly.



Ingersoll-Rand air driven brush.

A wire brush of very rugged design has recently been placed on the market by the Ingersoll-Rand Company for use with its standard No. 6 "Little David" Drill. It is a brush with face diameter of 5 inches and is made up of wires of a special heat-treated steel.

It is manufactured particularly as an attachment for the No. 6 Drill (as illustrated), this type of machine being especially suited for work of this nature. The whole outfit weighs only 11½ pounds.

The wire brush outfit is adapted for removing paint, rust, scale and dirt from tanks, steel cars, structural steel and all sheet metal surfaces. It is very useful for cleaning iron, steel and aluminum castings.

Intake Manifold Practice in Europe

Poor economy results are frequently due to faulty manifold design. Fuel quality affects manifold performance greatly and renders difficult the designing of a manifold which will be satisfactory under all conditions. Past and present intake manifold practice is discussed in detail here.

By W. F. Bradley and S. Gerster

SPEAKING generally, insufficient attention has been given in the automobile industry to the design and construction of intake manifolds, and it is because of errors in this particular feature that many modern engines give poor economy results. Where mistakes have been made in the layout of the intake manifold, it is useless to attempt to discover a complete remedy by the use of a more modern or more efficient carbureter.

THIS article, by Automotive Industries' French correspondent and a well-known French consulting engineer, is based mainly on French practice. The gasoline sold in France to-day contains less of the heavy fractions of petroleum than does the motor fuel sold in this country. This may explain some of the recommendations made in the article, notably the insistence upon the importance of water-jacketing of the manifold and the slight reference to exhaust jacketing.—Editor.

It is not at all an easy matter to lay out a manifold which will give satisfactory results under all operating circumstances and with different qualities of fuel. If high grade gasoline could always be assured, the task of laying out a manifold which would operate satisfactorily under the wide range of temperature conditions of winter and summer, would not be very great.

With the heavy and poorly refined gases now commonly employed in America, the problem of designing an efficient manifold and a good carbureter is accentuated, and the inconveniences of these low grade fuels soon show themselves in carbonized combustion chambers, dirty valves and plugs, crankcase dilution, etc.

With light, well refined gas there is less necessity for preliminary heating of the mixture, and an increased volume of gas can be introduced into the cylinders. With heavier gasoline, with benzol, and with kerosene, the manifold should be a part of the carbureter, and the mixture should be well heated from the time it leaves the carbureter until it passes through the valves into the combustion chamber. It is even advisable, when using kerosene and benzol, to heat the fuel in the carbureter, and before it passes through the jet. In the case of napthaline the whole appliance must be heated in order first of all to liquify the fuel and then to vaporize it.

Experience has shown that gas velocity V_g

$$V_g = \frac{S' \times V_p}{f}$$

should be between 60 and 70 meters (196 and 230 feet) per second at the carbureter outlet. In the above formula S' represents the surface of the piston, V_p the piston velocity and f the section of the gas passage. Variations in the gas velocity occur according to the length and shape of the pipe, it generally being admitted that the velocity at the valve ports should be from 56 to 62 meters (183 to 203 feet) per second.

Intake Pipe

There is every advantage, in a single cylinder engine, to have the intake pipe as short as possible. In a four-cycle engine gas admission takes place once, and during

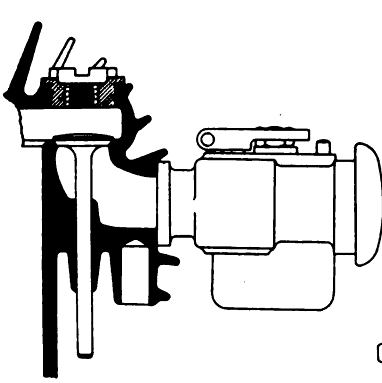


Fig. 1

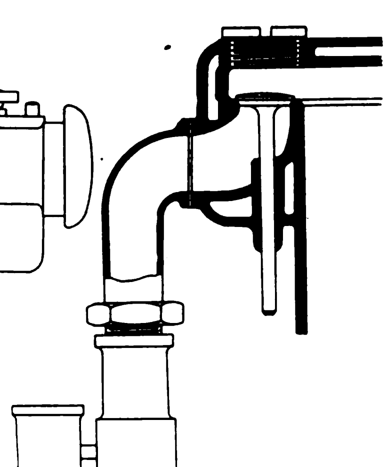


Fig. 2

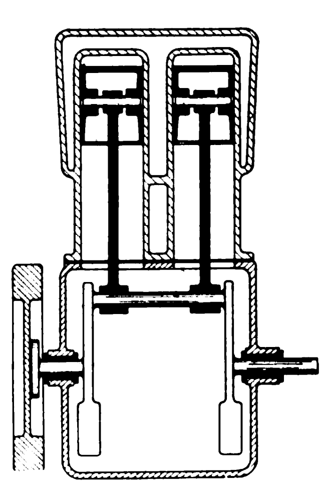


Fig. 3

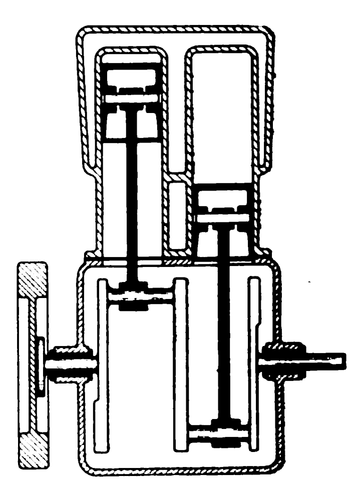


Fig. 4

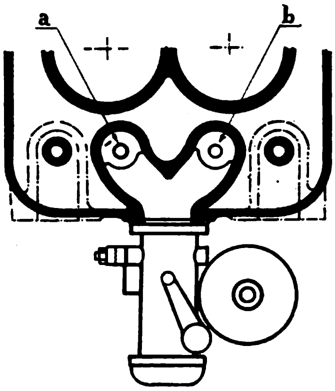


Fig. 5

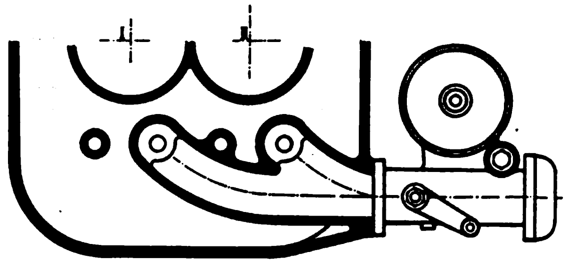


Fig. 6

a half revolution of the shaft, for two revolutions of the engine. In other words, during three-quarters of the time parts of the manifold are filled with gases which have been arrested by the closed valve. The greater the volume of gas, the greater the condensation, and this condensed gas is admitted into the cylinder without being mixed with air, and naturally burns badly. It is in order to avoid this that the intake pipe should be made as short as possible, or even better, the carbureter should be bolted up direct to the cylinder, as shown in Fig. 1.

When only vertical carbureters were in use the problem was rather different, for in order that the mixture be formed it was necessary to have a curved pipe from the carbureter to the intake port (Fig. 2) and it was advisable that the curve be made as easy as possible. A much higher efficiency is obtainable with the arrangement shown in Fig. 1 than with Fig. 2.

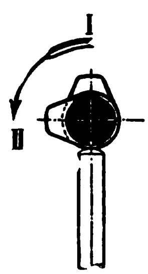


Fig. 7

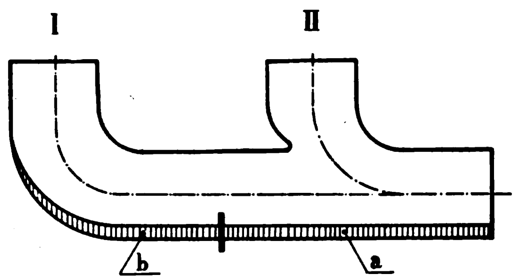


Fig. 8

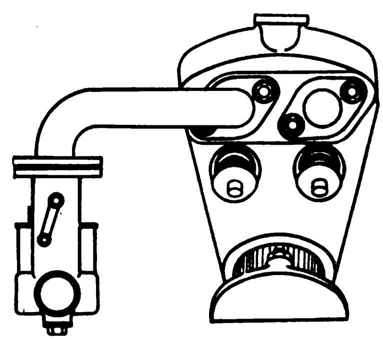


Fig. 10

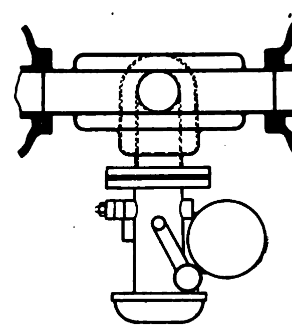


Fig. 11

Twin Cylinder Vertical Engine Practice

For twin cylinder vertical engines the type of manifold varies according to whether the throws are at 360 degrees (Fig. 3) or at 180 degrees (Fig. 4). With throws at 360 degrees the manifold should be laid out according to Fig. 5, (a) being the valve of the first cylinder, and (b) the valve of the second cylinder. It is advantageous to have an internal intake manifold, surrounded by the circulating water, the heat thus obtained being sufficient to maintain the gases at a sufficient temperature to prevent condensation. On some engines with thermo-syphon water circulation and inclined to run rather hot, this heating may be excessive in summer but in winter it gives every advantage.

The manifold of a two-cylinder engine with throws at 180 degrees, as shown in Fig. 4, should not be dealt with in the same way, for there are not the same intervals between the two aspirations as in an engine with cranks at 360 degrees. The length of time during which the gases remain still in the intake manifold is not the same for the two cylinders, and, in consequence, there is condensation for the cylinder which aspires after the interval, while the second cylinder, aspiring immediately after the first, is not affected by condensation. Fig. 6 shows a suitable type of manifold for an engine of this class, and Fig. 7 is the camshaft with the order of gas admission.

In this case cylinder 2 is the first to aspire, cylinder 1 coming immediately after it. During two revolutions of the engine the carbureter supplies a mixture to the succeeding cylinders at intervals of a half revolution, and during the rest of the cycle it is inactive.

During this revolution there is partial condensation of the mixture remaining in the intake manifold, and this condensed gasoline is drawn into the cylinder which is the first to aspire after the interval. If the manifold is laid out according to Fig. 5, the first cylinder to aspire after the interval will have a rich mixture. If the manifold is according to Figs. 6 and 8, either one cylinder will have a richer mixture than the other, or the two will have the same mixture, according to the order in which they aspire. If cylinder 1, Fig. 8, takes the first aspiration, it will receive the gasoline condensed at points *a* and *b*, while cylinder 2, aspiring immediately afterwards, will get no condensed gasoline, and consequently will have a weaker mixture. On the other hand, if cylinder 2, on Figs. 7 and 8, is the first to aspire, it will only take up the gasoline condensed at points *a*, while the liquid fuel at *b* will be drawn into cylinder 1.

This, therefore, should form the basis of the firing order for engines of this type, as well as for four, six and eight cylinders in line with one or several carbureters. This matter can readily be controlled on an engine with an external unheated manifold, when it will be found that the two cylinders will stand quite a different carbureter

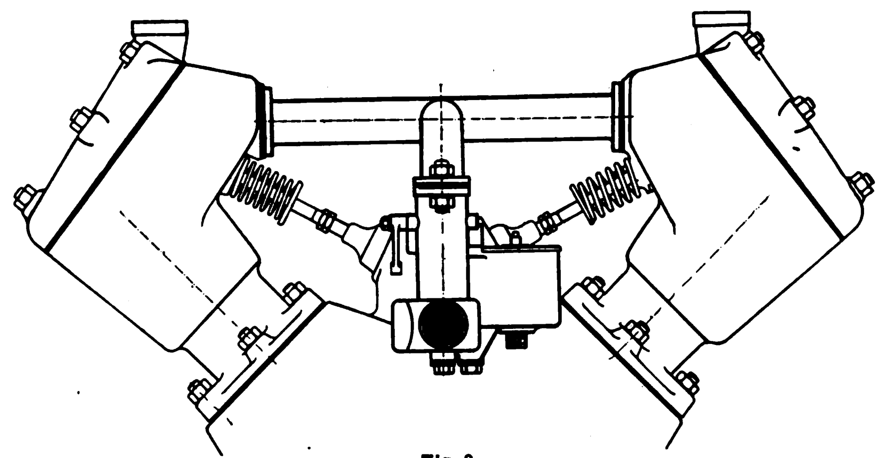


Fig 9

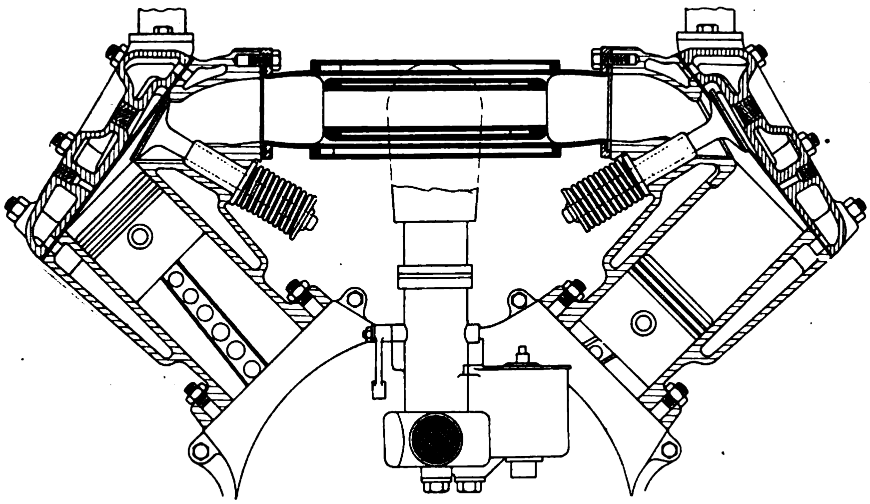


Fig. 12

very defective manifolds. An example of this is given in Fig. 13, where the long unheated pipe above the carbureter tends towards excessive condensation, and the pocket above the valves completely upsets the mixture. With an intake manifold of this type it is impossible to get slow running, and starting in winter is always difficult, for there is insufficient gas velocity to carry along the liquid fuel deposited in the pipe. Another old type, but still in use on some cars, is shown in Fig. 14. This has many defects, notable among them being the point (b) where fuel condenses, making starting and slow running difficult.

With a manifold of this type an improvement is obtained by the device shown in Fig. 15. The large diameter tube *a* carries air only, the rich mixture being taken through the small diameter tube *c* as far as the point where the branches are formed for the different valve ports. In addition to this, the part *d*, where there would normally be a tendency for fuel to condense, is heated by the water jacket.

Very few, if any, engines are now built with external carbureter on the opposite side to the valves, for better results can be obtained, by reason of the shorter pipes, with the carbureter on the valve side of the engine.

The manifold indicated in Fig. 16 has all the inconveniences of the unheated external manifold for twin cylinder engines shown in Fig. 5, for one of the cylinders in each group is always more richly supplied than the other. Fig. 17 gives a type of intake manifold suitable for an engine with separate cylinders.

Firing order should be 2-1-3-4, in accordance with the theory illustrated in Fig. 8. In this way cylinder (1) can receive gas of the same richness as cylinder (2), and the same applies to cylinders 4 and 3. With the lay out shown in Fig. 16 this is impossible.

The adoption of block cast cylinders has contributed considerably to the improvement of intake manifolds. For-

setting than would be required under other conditions.

When the whole of the intake manifold is inside the water jacket there is much less tendency for gasoline to condense and little trouble is experienced in this connection. Twin cylinder V-type engines, with carbureter and intake manifold mounted as in Figs. 9 and 10, are particularly susceptible to the defects mentioned above, and various devices are adopted to overcome these, without complete success, however.

With an intake manifold as shown in Fig. 11, the same defects are encountered as in twin cylinder vertical engines at 180 degrees, shown in Fig. 4, with the intake manifold of Fig. 5. Some improvement is obtained by water jacketing the manifold, as shown in Fig. 11, or by having a fairly long vertical branch, as indicated in Figs. 9 and 10. Another type of manifold is shown in Fig. 12, where an internal tube balances the two columns of gas and prevents condensation.

Old Types

Many old type four-cylinder engines still in use have

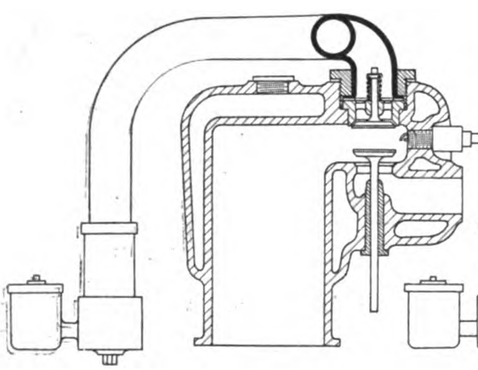


Fig. 13

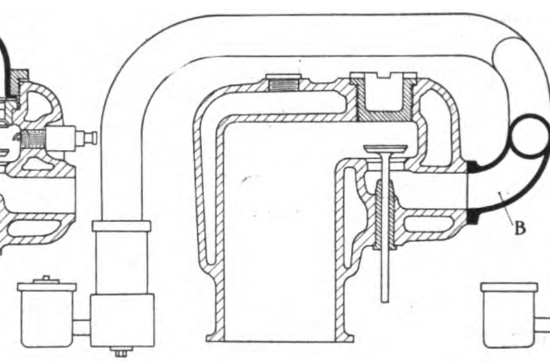


Fig. 14

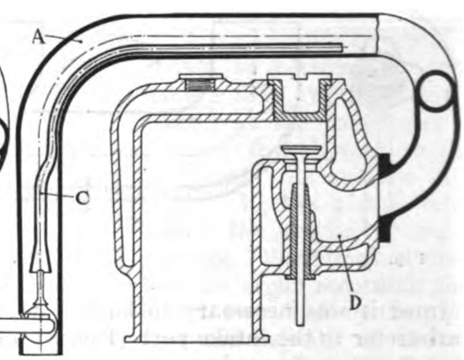


Fig. 15

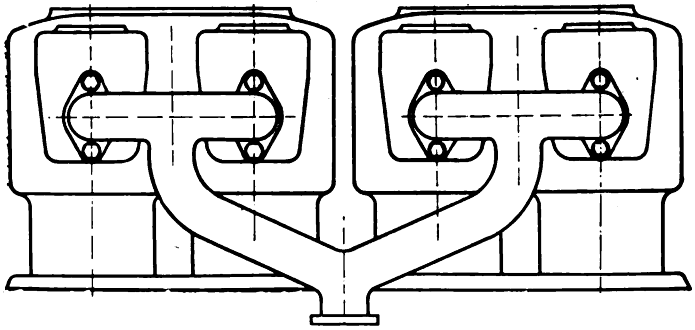


Fig. 16

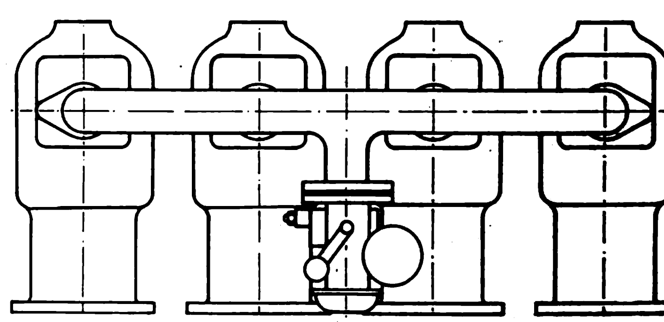


Fig. 17

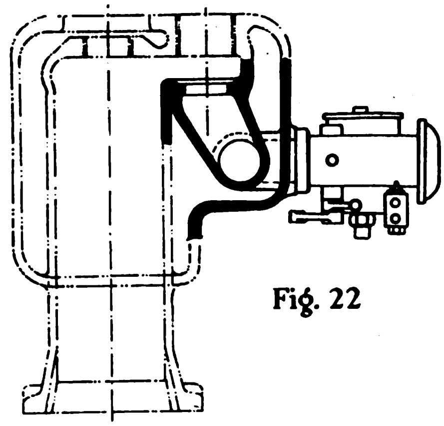


Fig. 22

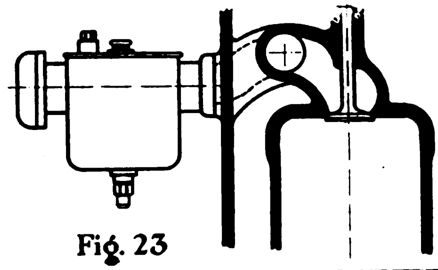


Fig. 23

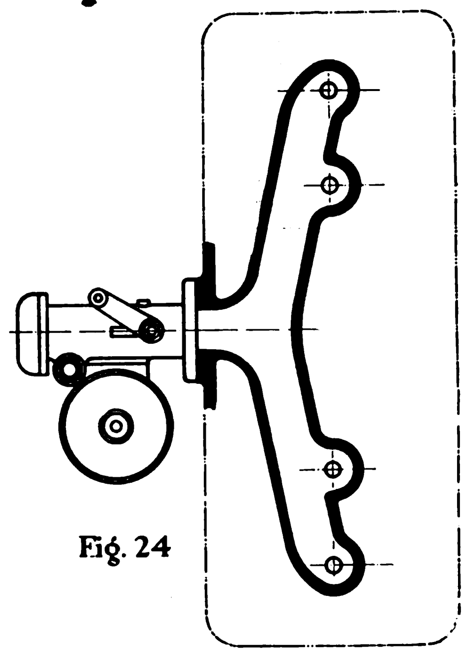


Fig. 24

merly the heating was secured by a by-pass from the circulating water, with pipes of small diameter which were liable to become choked, or with hot muffs from the exhaust, which gave too much heat and frequently failed to operate satisfactorily.

Since the introduction of internal manifolds surrounded by the circulating water the efficiency of automobile engines has been considerably improved. Figs. 18 and 19 show an internal water heated manifold placed externally to the valves. This should be compared with the more satisfactory layout illustrated in Figs. 20, 21, and 22. The manifold in Figs. 20 and 21 is designed for a gas velocity at the carbureter mouth of 230 feet per second, of 220 feet per second at the point *b*, and 210 feet in the valve ports. It will be noticed that the carbureter is placed at the lowest point and the gas takes an upward direction during the whole of its course, so that any particles which may be condensed will be carried along with regularity. Particularly for cold weather service this is a most satisfactory manifold, for the mixture is maintained at a reasonable temperature while in formation and until it passes into the cylinders. The manifold shown in Fig. 22 is certainly an improvement on the preceding one, for the length of the gas passages is reduced.

In order to secure successful and economical operation, the intake manifold should be of uniform diameter and have no sharp bends, and particularly no right angle bends at the valve ports such as are shown in Fig. 13. Sudden variations in the diameter of the gas passage cause expansion of the gases and provoke condensation. A manifold design which has proved satisfactory for overhead valve engines is shown in Figs. 23 and 24.

Six-Cylinder Motor Manifolds

Intake manifolds for six-cylinder motors differ in principle according to the layout of the crankshaft. The two arrangements shown in Figs. 25 and 26 are common practice. The firing order for a crankshaft of the type shown in Fig. 25 can be 1-3-5-6-4-2, or 1-4-2-6-3-5. For the crankshaft shown in Fig. 26 the firing orders are either 1-5-3-6-2-4 or 1-2-4-6-5-3. The order most commonly adopted by European manufacturers is 1-5-3-6-2-4, shown in Fig. 26 followed by the order 1-3-5-6-4-2 indicated in Fig. 25.

In deciding the firing order of the cylinders it is necessary not only to take into consideration the question of the intake manifold, but also the working conditions of the crankshaft. In laying out the order

Fig. 18

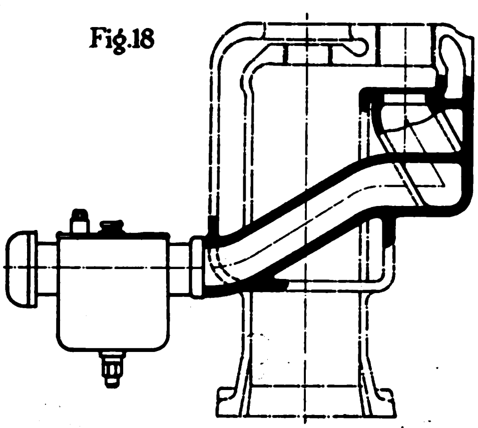


Fig. 20

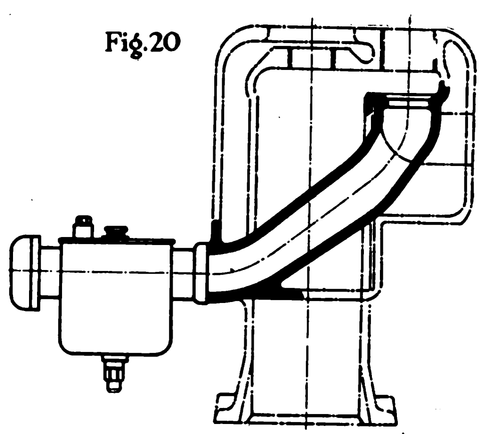


Fig. 19

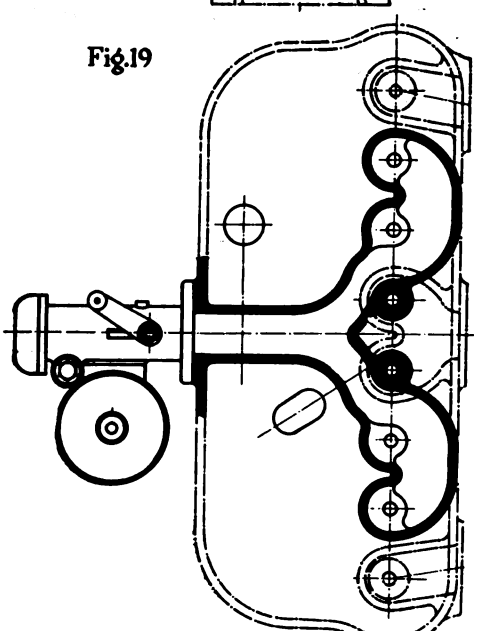
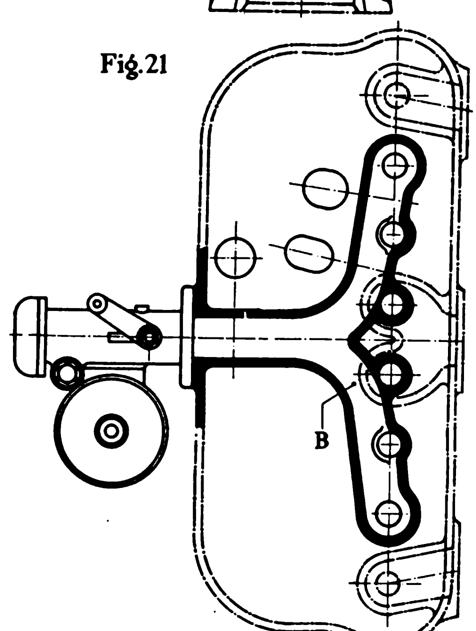


Fig. 21



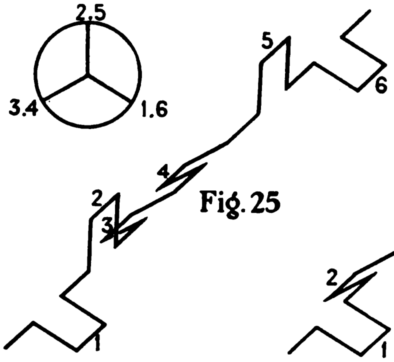


Fig. 25

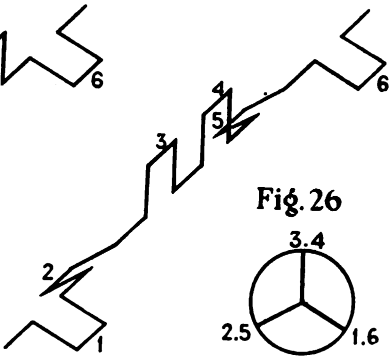


Fig. 26

in which the aspirations shall take place, the principles of condensation of fuel which have been explained in connection with twin cylinder engines at 180 degrees should be kept in mind.

The use is fairly common among European manufacturers of six-cylinder engines of two carbureters, one for each group of three cylinders, these two carbureters either being entirely distinct or having a common float chamber.

Experience has shown that with an external manifold having insufficient heating it is very difficult to avoid slight variations in the composition of the mixture from cylinder to cylinder. The manifolds shown in Figs. 27 and 28, for instance, cannot give good results, for these long pipes cause condensation, and the liquid fuel is always aspired by the same cylinder, which becomes choked with gasoline. Fig. 29 is another defective arrangement, by reason of its two long, unheated branches.

Satisfactory results can be obtained from the manifold shown in Fig. 30, if the firing order is 1-5-3-6-2-4; the flow of gas changes in its direction at each aspiration, the cylinders 3 and 4 then 2 and 5 being fed with the greater facility. This arrangement has been adopted by Delage for his overhead valve sporting type car with external manifold.

Another Firing Arrangement

When the firing order is 1-3-5-6-4-2, the arrangements of intake manifold most commonly adopted are those shown in Figs. 31 and 32, both of which are satisfactory, for they give practically equal lengths of pipe for cylinders 2, 3, 4 and 5. There is a greater length for cylinders 1 and 6, but this does not appreciably affect their operation, for as they are followed by their neighboring cylinders 2 and 5, there is no change of direction of the gas in the manifold. This general arrangement is almost essential when a single carbureter is used. Fig. 33, although found on certain cars, has little to recommend it.

If two carbureters are employed it would be difficult to get a better arrangement than that shown on Fig. 34, which is the general layout adopted on the six-cylinder Hispano-Suiza, the only difference being that instead of two independent carbureters, a double type with a common float chamber is employed.

With six-cylinder engines having internal manifolds it is rather difficult to ascertain what variations are taking place in the supply of gas to the different cylinders, and only a certain notion can be obtained when starting up with the engine cold. For this type of engine two manifold arrangements are common, namely the one shown in Fig. 35 when the firing order is 1-4-2-6-3-5, and the one shown in Fig. 36 with the firing order 1-5-3-6-4-2. For small engines with comparatively small intake pipes, the operation is practically perfect with these two layouts, and it is impossible to detect any substantial varia-

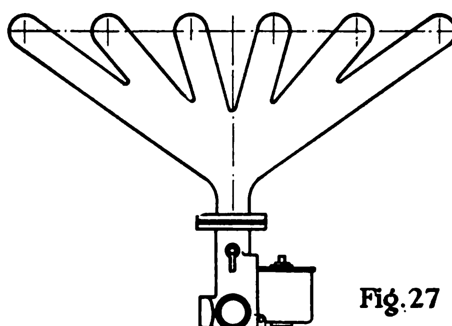


Fig. 27

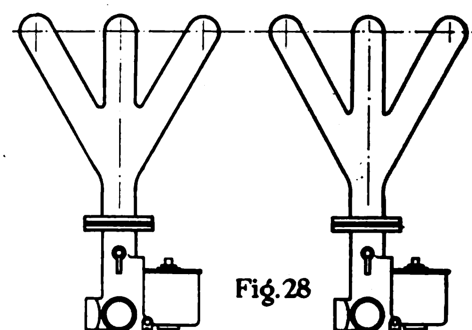


Fig. 28

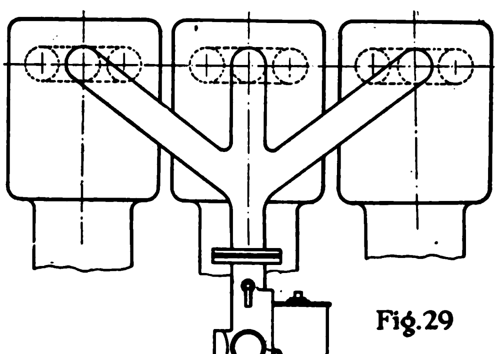


Fig. 29

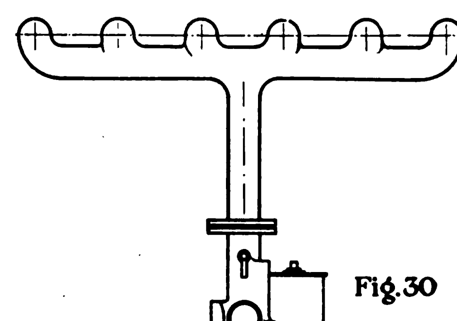


Fig. 30

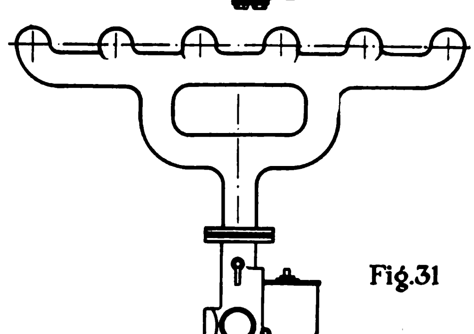


Fig. 31

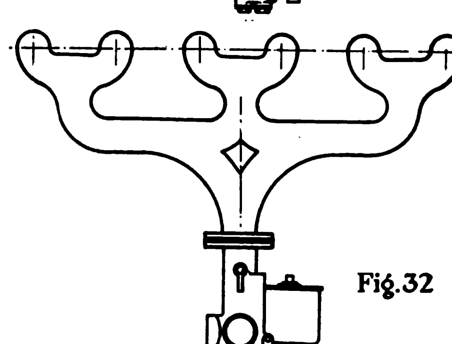


Fig. 32

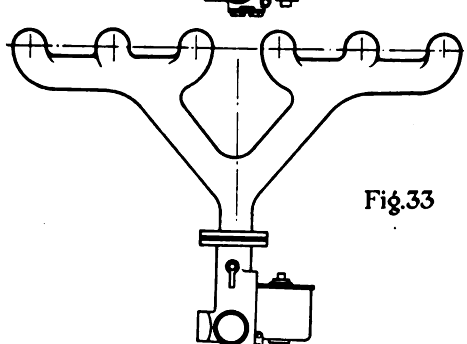


Fig. 33

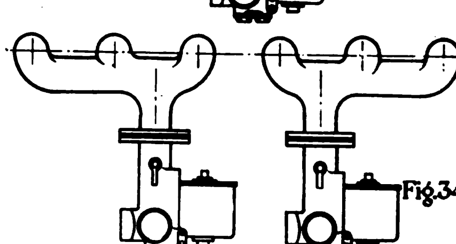


Fig. 34

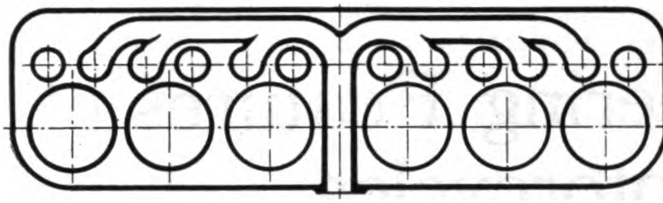


Fig. 35

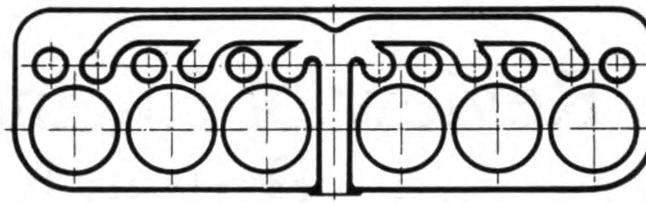


Fig. 36

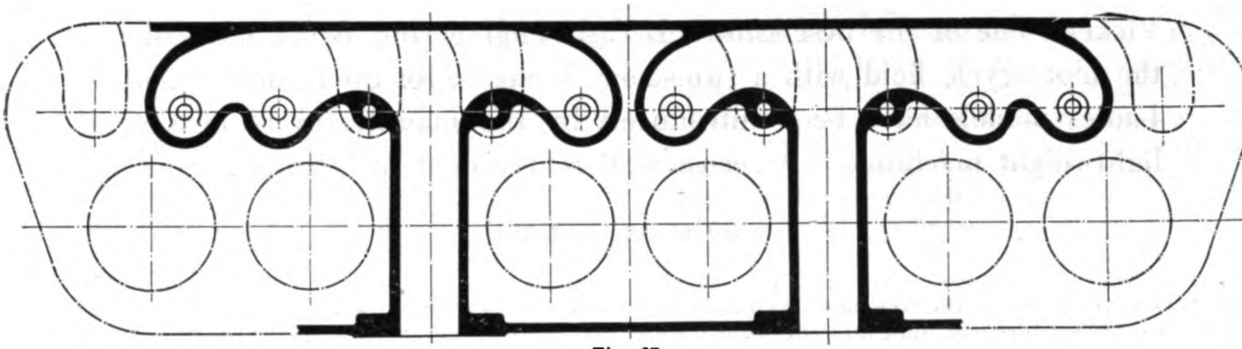


Fig. 37

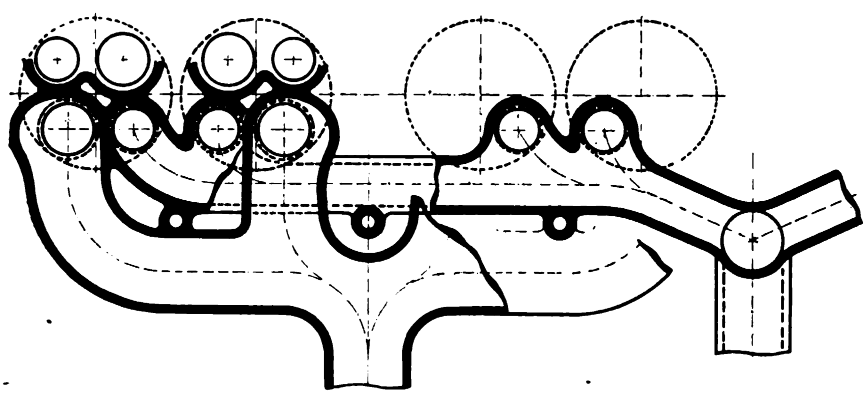


Fig. 38

tion in the mixture as between the different cylinders.

Six-cylinder engines with internal manifold and two carbureters can be laid out according to Fig. 37, when the firing order is 1-5-3-6-2-4. This particular layout is adopted by Delage for his stock six-cylinder model with internal manifold. Undoubtedly this arrangement is more satisfactory from an operating and efficiency standpoint than those shown in Figs. 35 and 36, but it is a more costly production job, by reason of the two carbureters and their combined throttle control. Theoretically a single carbureter is preferable, but practice has shown that better results are obtained with a carbureter for groups of three or four cylinders used on a multi-cylinder engine.

Eight-cylinder-in-line engines operate like two four-cylinder engines in line with the crankshafts at 90 degrees and with two carbureters. Generally the manifold of each group is laid out as for a four-cylinder engine. On certain high speed motors use has been made of three carbureters, a small one supplying the mixture for slow running, and two large ones coming into operation together with the small one, at high engine speeds. Fig. 38 shows this arrangement on a European eight-cylinder-in-line engine of 85 by 140 mm. In this engine each group of four cylinders is fitted with a 42 mm. carbureter which feeds through the big intake valves of each cylinder, while the small intake valves of the eight cylinders are fed from a single 36 mm. carbureter through a manifold uniting these eight valves.

It has not been possible to get really satisfactory results on eight-cylinder V engines with a single carbureter. Although it is reasonable to suppose that a single carbureter, as shown in Fig. 39, giving the quantity of gas required for the engine, should enable the same power to be obtained as with two single or one dual carbureter, tests have shown that the dual carbureter arrangement, as shown in Fig. 22, gives the better results.

It is not only necessary to consider gas velocities and the possibility of condensation in the gas passages, which upset the mixture, but account must be taken of changes of direction at the main fork above the carbureter. When the direction of gas flow is changed condensation takes place. As a consequence the mixture distributed to the different cylinders ceases to be uniform, and there are no reliable means of determining which cylinder or cylinders are being ill supplied. These defects can best be overcome by the use of one carbureter for each group of four cylinders, or by a dual carbureter. The preferable firing order is that shown in Fig. 41. The manifold should be water heated.

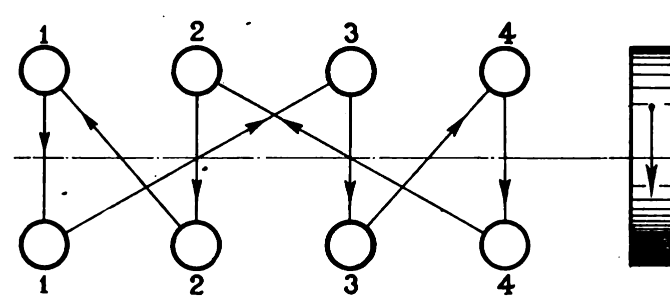


Fig. 41

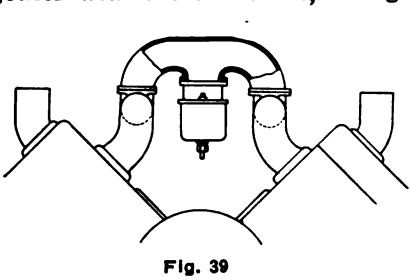


Fig. 39

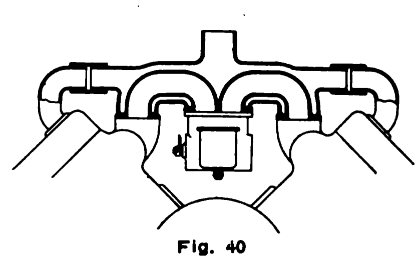


Fig. 40

Review of Engineering Features of British Motorcycles

Vickers, one of the best known British engineering firms, has entered the motorcycle field with a two-stroke V engine for the Enfield machine. Ladies models have been introduced by the manufacturers of several lightweight machines. America well represented in Olympia show.

By M. W. Bourdon

THE entrance of Vickers, the well-known engineering firm, into the motorcycle field and the appearance of several ladies' models comprise two important features of the recent British motorcycle show. Interesting engineering features appeared on a number of models, while changes in the method of lubricating two-stroke engines are common.

The Vickers entry thus far consists only of a twin-cylinder V engine for Enfield machines. Several other prominent British car manufacturers have also become interested in the motorcycle industry. Chief among these are Sunbeam, Humber and Rover, though these are all firms which graduated into the automobile industry from the manufacture of pedal cycles. The designers of their motorcycles are chiefly the men who were responsible also for their present pedal bicycles.

Several makers of lightweight machines have introduced a lady's model. The frame is not looped as in ladies' pedal cycles, but merely has the top tube inclined considerably so that it runs into the saddle tube about midway in the length of the latter. Motorcycling, not only on lightweights, but also on some of the heavier side-car machines, is becoming increasingly popular among women of all classes and of ages well into and often beyond the forties. A woman riding a man's machine occasions no remark, but while some makers, therefore, decline to standardize a special model, others believe that a wider field will be exploited by doing so.

Business in the British motorcycle industry was extremely slack during the two months preceding the November show at Olympia, but it has never for a moment been suggested that this has been due to the market having reached a state of saturation; it has been felt that orders were being held in abeyance for two reasons (1) an anticipation, or rather a hope, that a general reduction in prices would occur on the opening of the show, and (2) a doubt as to whether or not any radical changes in design would be in evidence in 1921 models. There has been no ground for either; prices have barely fluctuated, decreases and increases having occurred only in isolated cases, and even then have been small, while in the case of established makes variations in design have not been pronounced.

With certain exceptions, to be referred to later, the results of the past 12 months are, therefore, very disappointing from an engineering point of view. Improvements in detail were to be seen on almost every stand, but development in general has hardly occurred; in fact, there are not a few individuals, whose opinions are worthy of some respect, who maintain that development in certain directions has gone too far in the present-day motorcycle. The latter has been increased in power and speed and improved in suspension and equipment until, with a side-car attached, it has become as weighty and cumbersome as a light, two-seated, four-wheeled car, without the cleanliness of outline, ease of cleaning and protection of the occupants and power plant afforded by the latter. Further, in economy of running it provides little or no advantage over the miniature four-wheeler, which frequently covers 50 miles on an Imperial gallon of fuel, a consumption no more than equalled by some of the big side-car outfits. In speed and hill-climbing abilities only do the latter excel.

There were, however, at Olympia two machines which contain the germ of an idea for a new type of motorcycle for general purposes, a solo machine primarily, but one capable of carrying two passengers tandem fashion. At present the two machines in question are little better than glorified scooters, but though they differ very widely in constructional details, both contain the fundamentals of a practical type, with a screened engine. completely sprung frame of simple design, concealed controls and, generally, a motorcycle with many of the characteristics of a car. Further and detailed references to these machines and their possibilities of development occur later in this report. Meanwhile, dealing with the motorcycles as one found them at Olympia, a very pronounced tendency brought out by the show as a whole is the increasing popularity of lightweight machines, thus continuing a tendency which commenced about 1913. While there is no generally recognized definition of a lightweight motorcycle in Great Britain, it is usually assumed to be one having an engine of less than 15 cubic inches engine capacity, but, strictly speaking, this classification is misleading, for many machines of less than that capacity are outside the pale in weight.

Lightweights and Taxation

The popular type of lightweight is one weighing less than 200 lb., and there have been marked endeavors recently to lower the weight here and there so as to bring machines previously weighing over 200 lb. within that figure. These endeavors have been encouraged by the fact that on January 1 the new scale of automobile taxation comes into force, and in respect of motorcycles this will render machines under 200 lb. liable to an annual tax of $7.50, whereas machines over 200 lb. will be taxed $15. But the true lightweight machine is well within the maximum, and in its simplest form—namely, with a two-cycle engine of about 2½ hp., single speed belt drive and 24 x 2½-in. wheels—is less than 150 lb.

But while an increasing number of manufacturers are standardizing a lightweight model, none has discarded heavier and more powerful single- and twin-cylinder types. In fact, some have increased their range by adding a 6- to 8-h.p. model with twin-cylinder, 50-deg. Vee or horizontally opposed engine. For instance, Rudge has come out with a new Vee-engined model with all-chain drive.

There is a tendency to strengthen up some of the larger lightweights originally intended for solo work to make them suitable for light side-car attachments. It has been found that users of lightweights persist in fitting side-cars, so several makers have thought it advisable to recognize this fact and strengthen the frames to render them more suitable for passenger work.

Scooters and Motorized Bicycles

Although the motor scooter has not appealed to the public to an extent justifying the ambitious output plans of the number of firms who introduced them in 1919, it has had a certain vogue and was represented on five stands at Olympia. A seat is now general, but as a type no development has occurred, except in the cases already mentioned.

Motorized bicycles and pedal cycle motor outfits are in evidence. Of the former the J. E. S. has a stiffened frame, spring forks and a 1½-h.p. engine, both two-stroke and four-stroke types being used, the latter with superimposed valves. They have a direct belt drive to the back wheel with a jockey pulley for belt adjustment. In motor outfits, the Simplex unit has a 1-h.p., horizontal, two-stroke engine and a combined fuel and oil tank mounted as a unit on two pairs of tubular stays over the rear wheel, with a chain drive to a large sprocket secured either to the wheel spokes or rim. A single speed only is provided, with a hand-operated friction clutch within the driving sprocket.

Standardization Lacking

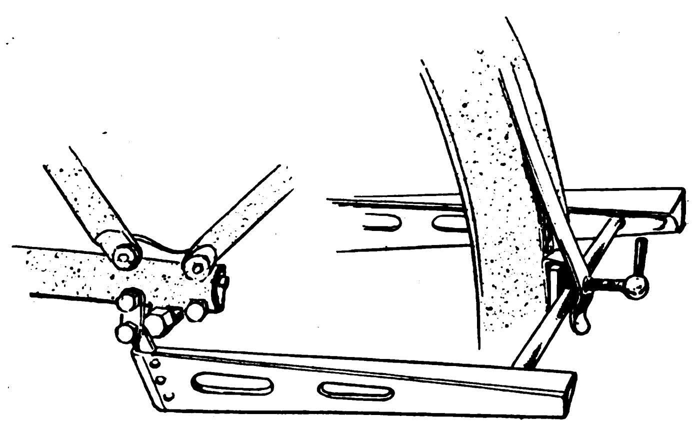
There is no evidence of real endeavor to reduce the production costs of any of the big range of types made by British firms, and there is no indication of any co-operation to standardize either frames or wheels, and no increased use of stock engines or gear-sets. The majority of firms make their own engines, only 38 per cent of the latter being stock jobs. Percentages are reversed in the case of gear-sets, and 55 per cent are of stock type. In four-stroke engines the most popular stock make is the J. A. P., which is supplied in many sizes; in two strokes the Villiers is favored. Of gear-sets, Sturmey Archer supplies 80 per cent of those that are not made by the motorcycle manufacturer. Spring front forks are frequently stock designs, but no other main detail is standardized. Frame design is still very involved and costly; no development in pressed steel frames has occurred since the introduction of the Pullin, described in AUTOMOTIVE INDUSTRIES last summer. There are three or four firms who specialize in the production of frames; but the latter are not stock jobs; they are made by these specialists to the design of small assemblers, each of whom has his own ideas concerning shape, size and general lay-out.

Rear springing for frames is developing very slowly, and designs are usually distinctly complicated and costly to produce. There is no observable endeavor to cope with heavier fuels, and a large proportion of standard machines, even new models, have no provision for heating either the air or the carbureter, except the proximity of the latter to the cylinders. Brakes are improving slowly, but there is still plenty of scope for further development; the same applies to the mudguarding of the smaller solo machines, though in the larger types and in side-car outfits guards run up to 8 in. in width.

Flexible Side-car Attachments

In side-car design there is very little development to report as compared with twelve months ago. There is, however, a tendency to provide a flexible coupling between the cycle frame and side-car chassis in order to prevent broken frame tubes owing to the stresses imposed through the side-car chassis from its wheel. This aim is attained by Beardmore by connecting the side-car axle to the frame through the medium of a short, laterally arranged laminated spring which displaces a section of the usual steel tube; upon the axle the body is mounted with Cee springs, intervening in the usual way, the front part of the body being spring mounted on the rigidly supported chassis. Two-seated side-cars (tandem or side-by-side seats) are now rarities.

Side-car taxicabs are now running in three British towns, Birmingham, Nottingham and Glasgow; the standard side-car machine is used usually with an 8-h.p. Vee twin engine, but a special two-seated body is fitted with a sedan or folding top.



Pressed steel rear stand of Beardmore machine

No maker has yet standardized electric lighting, but practically all of those producing machines over 3 h.p. and several of those making smaller types are prepared to fit a dynamo lighting equipment at an extra charge. When electric lighting is used a combined magneto and dynamo is becoming popular, two of the most widely used outfits being the Lucas Magdymo, which has two armatures, and the M-L Maglita, which has one armature generating the lighting current and a stationary ignition coil in the magnetic circuit.

An addition has been made to the names of important engineering firms associating themselves with motorcycle production. B. S. A. has for many years made complete machines; the show of 1919 saw the introduction of the Beardmore 3½-h.p., two-stroke machine with a number of novel and commendable features, such as the use of pressed steel for a fuel tank forming the top member of the frame, unit power plant and laminated springs, back and front.

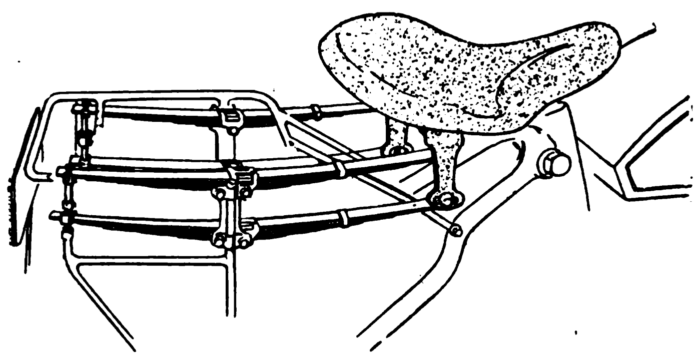
Individual and Aggregate Outputs

The great majority of British makers of motorcycles are quite small firms who consider they have done well if they reach an output of 300-400 per annum. There are only two whose output is believed to approach five figures; namely, Triumph and Douglas, both having probably turned out a similar number since last show, approximately 8000 machines each. But as with cars, so with motorcycles, British makers are very secretive concerning outputs. It is estimated, however, that the

aggregate number produced during 1920 will be approximately 50,000 from all plants, which averages, roughly, 500 each.

Engines

Dealing specifically with the engineering features of British motorcycles in general, it may be said that, while for lightweights having engines up to 2¾ h.p., two-cycle engines with crankcase compression are used in 45 per cent of cases; this form of motor is not made above 3 h.p. except in isolated cases. Nevertheless, the two-stroke motorcycle engine up to 4½ h.p. has shown itself to be quite satisfactory under normal conditions of use. A machine with an engine of this type and power, having a bore and stroke of 85 x 88 m.m., was introduced at last year's show. This is the 4½-h.p. Dunelt, which has a two-stroke crankcase compression engine, three-speed gear-set and chain and belt transmission. It weighs, complete, 260 lb., and put up some excellent performances in last year's big trials.



Four semi-elliptic springs supporting A. J. S. saddle independently of frame. Springs are anchored to rear luggage carrier

The Scott is another example of a comparatively high horsepower two-cycle engine, but this has two water-cooled cylinders, 73 x 63.5 m.m. This also stood out very prominently in the big trials of 1920. But, generally speaking, the four-cycle engine is still by far the more popular system, some 80 per cent of all machines having this type of engine.

There are only isolated examples of engines with more than two cylinders. A new machine appeared at Olympia with a four-cylinder motor. This is the first British motorcycle to have a four-cylinder engine, and it is believed to be the first of any nationality of such an advanced design as to embody overhead valves and camshaft, aluminum cylinders with steel liners and certain other features hitherto only associated with car engines. The transmission of this new machine is also distinctly unusual, for from the three-speed gear-set skew gearing conveys the drive to a countershaft and thence by roller chain to the rear wheel. There is one example of a British motorcycle with a three-cylinder, radial, air-cooled motor. This also is an experimental production and did not appear at Olympia.

Number and Arrangement of Cylinders

Apart from these isolated examples, 62 per cent of British motorcycle engines have only one cylinder. Of the remaining 38 per cent with two cylinders, 25 per cent are of the horizontally opposed type. This represents a small increase in the latter from 12 months ago, and for the first time an engine maker, Coventry Victor, has a stock engine with opposed cylinders; at present it is being used only by three or four small firms with a total output of under a dozen per week. The one example of a two-cylinder opposed engine having the crankshaft longitudinally arranged has dropped out since last year, for the A. B. C. machine, which had an engine thus arranged, is not now being made, its manufacturers having closed down owing to financial difficulties. Bradshaw, the designer of the A. B. C. motorcycle and the A. B. C. (e. g., Dragon Fly) aero engines, has come out with a new horizontally opposed, two-cylinder, overhead-valve engine on novel lines. This is described separately in this report and its peculiar features are worthy of careful consideration.

Only 24 per cent of British motorcycle engines have detachable heads, and side valves are well in the majority, 68 per cent being of this type, while only 6 per cent have overhead valves and 6 per cent inlet over exhaust, the remaining 20 per cent being of the valveless, two-cycle pattern.

One well-known maker, Quadrant, has a side-valve engine with the valves set at 90 deg. from one another in the circumference of the cylinder bore. The exhaust valve is in front of the cylinder and the inlet at the side; thus the pocket of the former is equally cooled on each side, tending to prevent distortion of the seat. The inlet cam is integral with one of the timing gears which drive a lateral camshaft arranged to operate the exhaust valve.

Distribution gearing on nearly all makes is of the straight-toothed pinion type, a long train of wheels often occurring. In one case, a single-cylinder James, there are six pinions in all, but in isolated cases a roller chain is utilized.

Engine Bearings

The plain bush for crankshaft and big-end bearings is slowly being displaced by ball and roller types. The majority of recently introduced models have ball bearings for the crankshaft and roller bearings for the big ends, and, while J. A. P. engines in the larger sizes have normally plain journals, they are also supplied with a ball bearing on the pulley or chain sprocket side and a plain bearing at the other end of the shaft. The fact that this maker also favors plain bearings for the big end accounts for the fact that 61 per cent of engines are fitted with this type of connecting rod bearing. If J. A. P. were ruled out, the majority of big ends would have rollers. However, J. A. P. cannot be ignored, for, as already stated, he supplies the greatest number of stock engines. The following percentages, therefore, apply to British motorcycle engines of all sizes: Of crankshaft bearings 45 per cent are plain bushes, 36 per cent ball, 13 per cent roller, while 6 per cent of engines have ball and plain. Of big ends 61 per cent have plain bearings, 36 per cent rollers and 3 per cent balls.

Cylinder and Crankcase Construction

With the exception specified, cylinders are invariably of cast iron with circumferential radiating fins. Usually they are secured by four studs and nuts to the top of the aluminum crankcase, which is vertically divided at right angles to the crankpin axis. In one instance, the Corona, a new job with a planned output of but 500 per annum, the cast-iron cylinder and crankcase are cast as a unit, with the exception of an end plate of aluminum for the crankcase. While in four-stroke engines a pair of internal flywheels are normal with a coupling forming the crankpin, the Corona has a single outside flywheel, in which respect it resembles the two-stroke motors. One maker of a two-stroke lightweight engine machines the top of the head off flat and fits an aluminum cap with horizontal fins, securing it by a central hexagon-headed screw.

Pistons

Aluminum pistons have not secured much favor with motorcycle makers, and at the present time only 2 per cent of engines are so equipped; cast iron is, therefore, almost universal with three rings in 65 per cent and two in 35 per cent. There are several cases of the total number of rings being divided between crown and skirt. Sunbeam and Rudge engines, for example, have only one ring in the crown, the second being near the bottom of the skirt, where it serves as a scraper.

In four-cycle engines the flat-top piston with internal webbing is general, while in two-cycle motors the piston has cast with it a deflector to separate the induction and exhaust gases when both valve ports are open.

Unlike British car engines, the majority of those in motorcycles still have the wrist pin fixed in the piston bosses. There are only 19 per cent otherwise arranged, one-quarter the number of these floating in both piston and rod and the remainder being fixed in the rod.

In some cases where the wrist pin is fixed in the piston no endeavor is made to locate it except its own good fit in the piston bosses. Occasionally one end is slightly tapered, but not infrequently a parallel sided pin is used. In B. S. A. engines the wrist pin is tapered at one end to fit a taper hole in the boss; the latter has an internal groove which prevents lateral movement through the agency of a spring wire ring located in a corresponding groove around the pin.

The floating pin of Rudge engines is located by a spring wire ring in a groove at each end of the piston boss; in other cases a copper plug is driven into the bosses at each end.

Ignition.

The magneto is universal for ignition, but in the case of the Villiers stock engine, a two-stroke model with the largest output of this type and fitted to over a dozen different makes of lightweight machines, a flywheel magneto is used. This has stationary coils of large dimensions and a stationary contact breaker, all mounted on a side plate around which rotate the pole pieces within the dished flywheel; all parts including flywheel are thoroughly enclosed by a dished coverplate. An advantage of this magneto is that it has double the range of advance and retard of the ordinary type, a feature of great importance in two-stroke engines, even ignoring their comparatively high speeds of rotation.

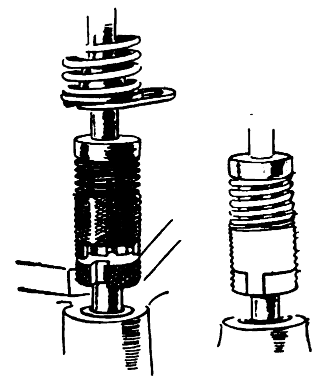
Engine Lubrication

Of engine lubrication systems there is almost endless variety, the modifications being so diversified as to prohibit any reasonable classification being made; but the purely splash system occurs in the majority of cases, the oil being delivered to the crankcase through a sight feed on the top tube, the oil being brought to this point from the tank by a semi-automatic pump. The plunger of the latter is intended to be raised or depressed by hand, a spring returning it to its normal position and delivering the oil under slight pressure to the adjustable drip feed and thence by gravity to the crankcase.

There is, however, a slight tendency toward the elimination of the separate oil tank and the carrying of the oil supply in the crankcase sump. In one or two instances, as for example, the 4½ hp. two-cylinder horizontally opposed Humber and the single cylinder Corona, the oil in the sump is delivered by a mechanically driven pump to troughs under the big-ends. But next to the simple splash the most popular arrangement is a mechanically driven pump in the crankcase, which is rotated by reduction gearing at 1/30th to 1/40th engine speed; it draws oil slowly from the bottom of the crankcase (the latter fed by drips from a top tube tank) and delivers it to the drilled crankshaft for main and big-end bearings, and thence by splash to the cylinder walls. A hand pump can be used to send charges direct to the crankcase to supplement the drip feed.

Appreciable difference is apparent in the majority of cases in the method of lubricating two-stroke engines. Until 12 months ago the prevailing method was to mix fuel and oil together in certain proportions and to rely upon the oil thus fed through the carbureter into the crankcase with the fuel on the suction stroke. But while Triumph and one or two other makers retain this system the majority now separate the oil and fuel supplies. The usual arrangement is a drip-feed delivery to the cylinder wall, the outlet having a non-return valve, and being uncovered by the piston during the upper two-thirds of its stroke and therefore delivering directly to the crankcase, the oil being drawn from the pipe by the partial vacuum occurring below the piston on its upward movement.

Finger tappet adjustment of Ariel engine. Finger plate forming valve spring anchorage is also illustrated



Levis, who may be looked upon as the originator of the two-stroke lightweight machine, has a drip feed supply to a branched pipe, one lead being taken to the cylinder wall and the other to one of the journal bearings of the crankshaft. Excess of oil from the cylinder wall drains into a gallery at the top of the crankcase and thence through an internal duct to the other crankshaft journal at the belt pulley end. The crankshaft is drilled and some of the surplus in the journals is carried by centrifugal force to the big-end.

In one case, the Precision stock engine, the main oil supply is carried in an aluminum chamber forming a side extension to the crankcase, but separate from the latter. The crankshaft projects through its journal bearing into this oil compartment and carries a chain sprocket for the magneto driving chain. The latter is enclosed and acts as a conveyor for the oil, lifting the latter into troughs whence some of it runs by gravity through an adjustable drip valve into the cylinder and so by suction to the crankcase on the up-stroke of the piston. This arrangement has the advantage of keeping all the oil in the neighborhood of the engine and introduces no extra parts, while enabling the magneto chain to be run in a bath of lubricant.

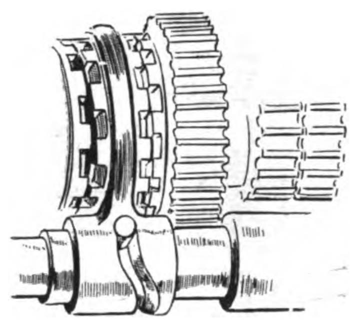
Engine Starting

The foot-operated lever ("kick starter") is almost universal where any means of engine starting other than pushing the machine is provided; Enfield is one of isolated examples having a handle, while Rudge is unique in having pedalling gear for starting the motor—not for moving the machine. Kick starters have toothed quadrants, which mesh when operated with a pinion; the latter is mounted on a quick thread and has a face ratchet drawn into engagement with a ratchet on a gear set wheel when rotation occurs.

Clutches

Ninety-five per cent of the clutches are of the plate or disk type. In those used for engines of small power, in lightweight machines, for instance, the single-driven plate pattern prevails with cork inserts, this being the type embodied in Sturmey-Archer two-speed gearsets, but with engines over 3 hp. the vast majority of clutches are of the multi-plate type, 90 per cent of these running dry with fabric friction surfaces against metal disks, the remainder being metal to metal and running in oil.

Clutch control by hand occurs in the vast majority of machines, approximately 85 per cent being so equipped, but in quite a number of instances where two-speed gearsets are used no friction clutch is provided, the gear changes from low to high being effected whilst the throttle is closed or the exhaust valve is momentarily held off of its seating by the usual lifting device. This absence of a clutch of course prevents an engine being started in neutral with the machine stationary and a gear engaged to move off; the neutral position is only utilized to wheel the machine, the engine being started by engaging the low gear and pushing or "paddling."



Forks operating dog clutches of B. S. A. gearset are moved by pins on rotary shaft working in slot of fork bosses

There is good reason for the hand control of the clutch, for with foot control the rider is at a disadvantage in not being able to move off from rest, with a solo machine, by straddling with both feet on the ground. In traffic riding especially this is an important point.

Gearsets

As already mentioned, the use of stock components is most pronounced in gearsets, 55 per cent of machines being so fitted. The majority have the gear wheels constantly in mesh, gear changing being effected by sliding dogs. The straight through change of gear shift is almost universal, there being only one example (a four-speed set) of the selector system as used on cars. Adjustable belt pulleys are used in place of gearsets by two or three prominent makers, Rudge and Zenith being the most noteworthy of these. Of the remaining machines 54 per cent have three-speeds. A great many of the lightweights can be obtained and are preferred without gearset at a reduced price. Obviously when so equipped they are suitable only for use in flat or merely undulating districts, for their hill-climbing powers are then, it need hardly be said, distinctly limited.

The unit construction of engine and gearset is not making any appreciable headway, for in 90 per cent of machines these components are separately mounted, with a primary chain drive from one to the other. An interesting combination of a unit and separate systems occurs in one instance, a lightweight termed the Metro-Tyler, which has the crankcase and gearcasing bolted up within side plates and a cradle with a top cover, which incloses the magneto midway between the engine and gearset. These three items, therefore, constitute a unit, which is mounted as such in the frame. The Wooler unit has the three-speed gearset below the crankcase of the horizontally opposed engine, the crankshaft drive to the gears being by straight cut pinions which eliminate this primary chain of the transmission; the final drive is by exposed chain.

Transmission

The most popular type of transmission for British motor cycles of all sizes is the combination of chain and belt. As already stated, the engine is in the vast majority of cases mounted separately from the gearset, and a roller chain is used to transmit the power from the crankshaft to the primary shaft of the gearset. From the latter to the rear wheel a belt is used in 48 per cent of machines, an all-chain drive occurring in 40 per cent, the remainder being all-belt. It is by no means universal practice to inclose the driving chains, in fact, while in the majority of cases the primary chain is inclosed, and lubricated by oil vapor from the crankcase breather pipe, the final chain rarely has more protection than a top shield. When chains are inclosed the casing usually consists of sheet metal, but in a few instances, B. S. A. is a good example, a cast aluminum chain case is fitted and obviously makes a much more workmanlike and permanent job. Chains are always adjustable, the primary one, as a rule, by sliding the gearbox backward or forward on its mounting; whether or not the rear chain requires adjustment, shifting the gearbox obviously necessitates some movement of the back wheel center to correspond. Douglas, in a new model with all-chain drive, rests the horizontally opposed twin engine on two longitudinal tubes and adjusts the front chain by sliding the engine backward or forward by means of a long draw bolt.

As previously inferred, the all-belt transmission is only used on 12 per cent of British machines. Usually only a single gear ratio is then provided, with a direct drive by belt from crankshaft pulley to the rear wheel; but as already mentioned Rudge and Zenith among others use as variable pulley to provide alteration of gear ratio in conjunction with an all-belt drive.

Only one British maker has adopted shaft drive, and that on a scooter, the Unibus, which has worm gearing on the back axle.

Frames

The tubular frame is practically universal. Pullin, however, as already mentioned, has a pressed steel frame, but did not show at Olympia, while in the Beardmore Precision the pressed steel fuel tank forms the top member of the frame and the steering head.

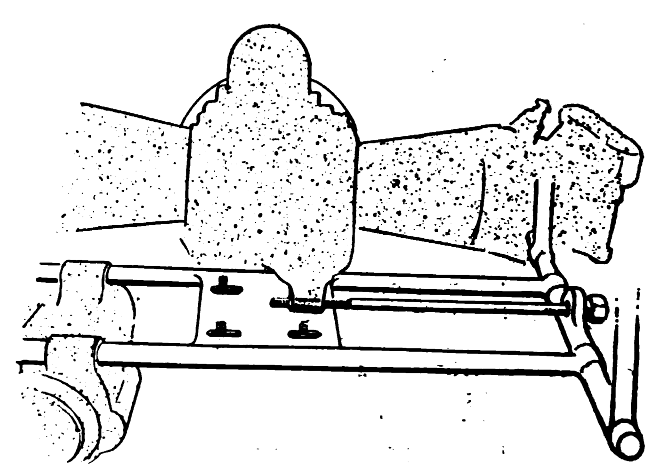


Diagram indicating mounting of Douglas horizontal twin engine in frame with draw belt adjustment for primary chain

Rear sprung frames are not increasing to any pronounced extent, 90 per cent of machines being rigid. Where the rear portion is sprung, the laminated spring is becoming increasingly popular, and there are additional examples this year of laminated sprung front forks. Most of the rear sprung frame designs are distinctly involved and costly to produce and probably the desire to keep down prices has discouraged the flexible rear suspension as more general practice.

The simplest system is the Wooler, which has its front and back axle ends mounted between pairs of coil springs and guided by slide blocks in slots in the spring cylinders.

There is no uniformity whatever in frame design, sprung or rigid. No attempt has been made to standardize this part of the machine, though one accessory maker, Brampton, has recently put forward a spring frame for assemblers, but this has been utilized by only one well-known maker up to the present.

Wheels and Tires

The use of interchangeable wheels is increasing slowly in the case of the expensive side-car machines with all-chain drive, any of the three wheels being interchangeable and carried when in position on "knock out" spindles, with a distance piece which is detachable when the spindle has been withdrawn, so that the wheel hub driving dogs or splines may be disengaged from the chain sprocket, the latter invariably remaining undisturbed when the wheel is withdrawn. A variation of this is seen on the only British four-cylinder machine, the Superb Four, which has journal ball bearings secured in the stay ends, the inner races and also the hub and chain sprocket having hexagon holes to receive the hexagon knock-out spindle.

But even where the wheels are not actually interchangeable, provision is frequently made to allow the rear wheel to be readily withdrawn, the knock-out rear spindle system being utilized for this purpose.

There is an increasing tendency to use tires of larger cross section in the heavier classes. At present the largest standard wheel and tire size is 28 x 3 in., but in the heavier tires it is probable that 3½-in tires will not be unusual in the near future. The 26-in. diameter wheel is, however, the usual size with a 2½-in. tire for medium-weight machines; for the lightweights a good many makers use 24-in. x 2¼-in. wheels and tires, though quite as many fit wheels of 26-in. diameter.

Disk wheels are not standardized, but detachable disks for wire-spoked wheels are supplied by some makers as an extra and by accessory firms. But the effect of side winds on the steering of solo machines with wheel disks does not encourage the use of the latter.

Mudguards

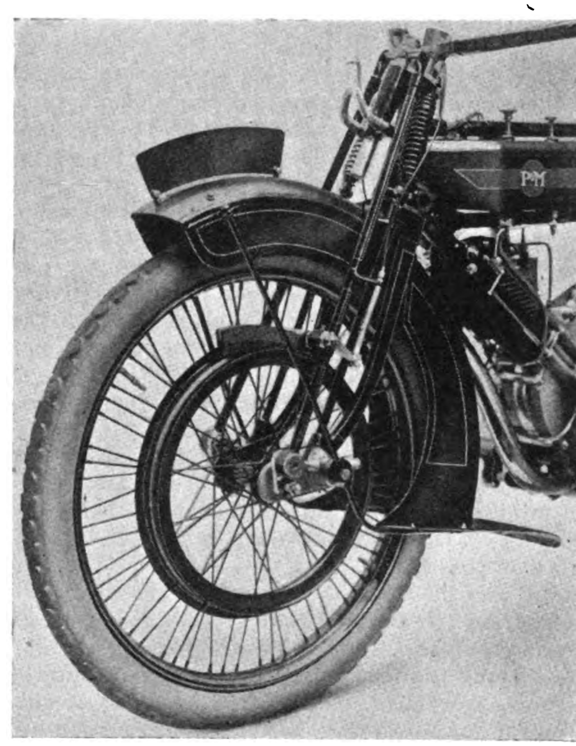
Mudguards are becoming wider, 5 to 7 in. being by no means unusual, in fact Ruby and Rover have 8-in. dome-shaped guards on the side-car model. The fitting of valances to the front is normal practice on medium-weight and heavy machines, though for rear mudguards a valance is somewhat exceptional. In place of a valance at either back or front some makers prefer flat side extensions of the curved guard.

To facilitate wheel removal and tire repair the back half of the rear mudguard is occasionally made easily detachable or, as in the case of the Rover, is hinged upon or with the rear carrier. The back end of the rear mudguard is usually supported by the stand, and in approximately 20 per cent of cases the front mudguard is similarly located, for front stands are increasing in number. Only in isolated cases is the stand pivoted round-about the center of the machine, Douglas, one of the firms with the largest output (8000 per annum) arranging a single stand in this position.

Brakes

Although it appeared probable at the 1919 show that a horseshoe brake with pads apply to the front tire rim was being rapidly discarded, it has not lost ground during the past twelve months, and 76 per cent of machines have this type of brake despite its universal condemnation by users; 18 per cent have a special V rim secured to the spokes, to which a segmental pad is applied; 4 per cent have expanding shoes and 2 per cent contracting bands, both the latter applying to drums of from 5 to 8in. diameter secured to the hub.

The prevalence of the belt transmission, with or without a primary chain, accounts for the fact that the rear belt rim is made use of for back brakes in 56 per cent of machines. Only 4 per cent of makers fail to make



P & M front wheel V rim brake, typical of many others to supersede tire rim brakes

use of this rim when a belt drive occurs. Of the remainder, 25 per cent have expanding shoes in 6 to 8-in. diameter drums, 14 per cent fit a special V rim, as in the case of the V rim front brake already referred to, and 5 per cent have contracting bands.

Only two makers concentrate the brake gear on the rear wheel, the Bat having expanding shoes within a drum attached to the hub and a contracting band on the outside of the same drum, while on the Coulson two contracting bands applying to hub drums are used.

A CABINET Conference held in Tokyo has passed the draft of the revised Japanese patent laws. The new laws, which will be immediately presented to the Imperial Diet for approval, provide for the collection of public views as to patents applied for before the applications are officially considered, the fixing of the period of cancellation of patents within five years after their being granted, the granting of patents to the actual inventors or employees inventing for their masters, and the giving of the preferential right of patent to the earlier application in case two applications are submitted for the same invention.

Poppet Valve Manufacture Requires Special Equipment

Automotive engineers will be interested in this description of poppet valve manufacture. The article discusses in detail the various operations and methods. Many special machines are used because the manufacturing problems differ from those of the ordinary machine shop.

By J. Edward Schipper

MANUFACTURE of gasoline engine poppet valves calls for some unusual equipment both because of the shape of the valve and the difficult functions which it has to perform in the engine. It has been generally found that different materials are required for the stem and head, and a great many of the valves in use are employing cast iron heads with carbon steel stems. Such a valve is manufactured by the Schlieder Mfg. Co., which specializes in this product. The capacity of the plant is 25,000 valves per day, operating on a 9-hr. per day basis.

Manufacturing this number of valves calls for the use of a great many special machines, the largest part of which have been designed in the Schlieder factory, as the problems encountered are widely different from those met in the ordinary machine shop. The factory building is a three-floor, 50 by 180-ft. structure, with a three-floor, 50 by 110-ft. wing. The main part of this building was erected in 1916, and the addition put on in 1918 to double the capacity of the plant, allowing it to reach the 25,000 per day now possible.

The valve is made up of two parts, the stem and the head. The stem stock is carbon steel, which very closely approximates the No. 1010 S. A. E. specification, the only difference being that the sulphur limit is kept lower. The heads are of very fine quality gray iron, no steel being permitted as extraordinary hardness is very undesirable.

The first operation in manufacturing the valve is to cut off the stems to a length 3/8 in. longer than is required by the finished valve. The stem stock is rolled .010 in. oversize, so that the raw stems as they leave the turret lathe shown in Fig. 1 are this much larger in diameter and 3/8 in. longer in length than the finished product to allow for future machining. The unusual feature of the turret valve used for cutting off these stems is the automatic feeder which is a special type of feeder which brings the bar up to the stop on the turret for the cut-off. The cut-off operation is simply a cross-cut.

The heads, which come as cast iron disks, are first drilled on a special six-spindle machine arranged so that the spindles are placed in a vertical line as shown in Fig. 2. This machine has a capacity of 1000 heads per hour. It is a cam-feed arrangement and the holes drilled are .010 in. smaller than the diameter of the valve stems. The purpose of this is in the welding operation, which is later described when the heads are shrunk onto the stems before they are welded.

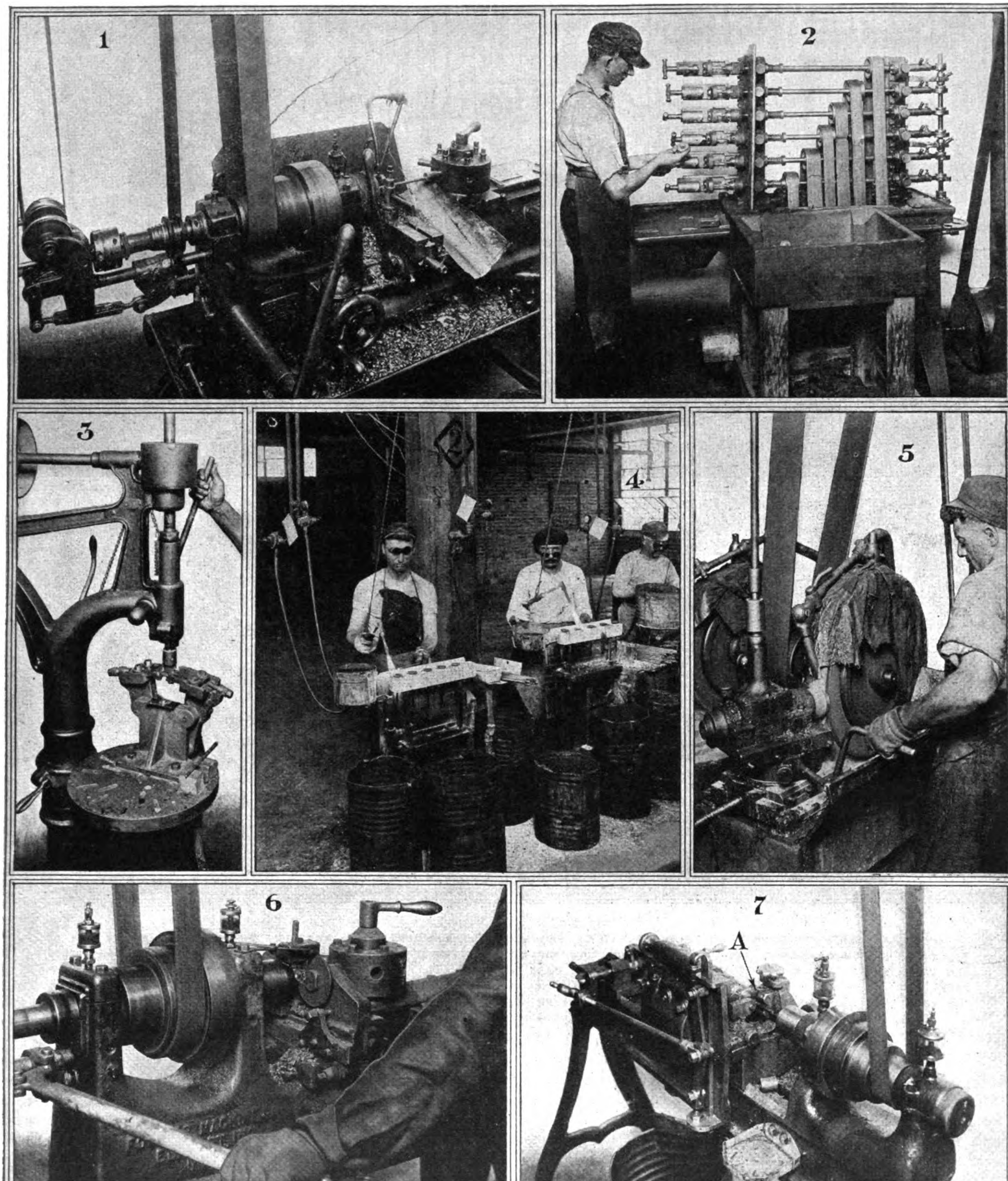
Following the drilling operation on the head, a countersink tool cleans out the countersink which is cast into the head. This operation is on a hand-fed machine with a special chuck to hold the head, and is illustrated in Fig. 3. The valves are now in position for the welding operation, which is by the oxy-acetylene process. The torch is first directed on the valve head, expanding it, and the stem is then pressed in. The stem is then welded over inside the countersunk portion of the head with a special flux which fills up the entire countersink and forms an intimate juncture between the cast-iron head and the carbon steel stem. When the carbon steel stem is forced into the head a small portion of the stem projects through, and in the welding process this is turned over and joins with the flux in filling the countersunk portion above the cup-shaped depression in the head. This not only gives a welded connection, but a sort of rivet effect, which gives a very firm juncture between the head and stem, and, in fact, makes it practically a unit part.

When the valves have been through their welding process, they are thrown into pans adjacent to the welding stand and there allowed to slowly cool. Inasmuch as these pans retain the heat from the welded valve, a sort of annealing action is provided which promotes the homogenity of the metal. The cooling in these pans is so slow that the valves cannot be handled for 24 hr.

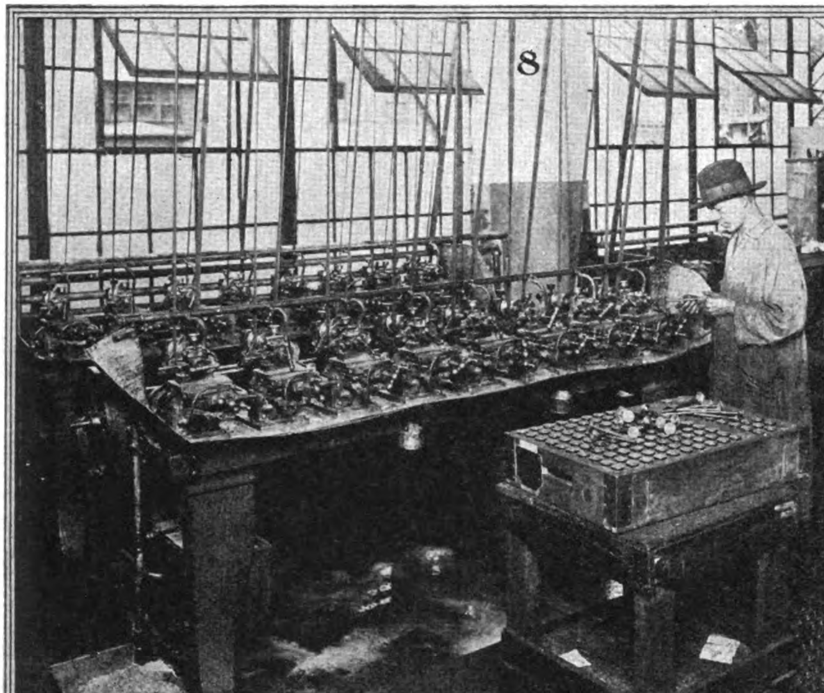
After the valves are removed from the cooling pans they are given a rough grind on the top of the valve head and the scale is ground from the bevel or seating edge of the valve. This scale is extraordinarily hard and would be very destructive to the tool if it were not removed before the machining operation. The rough grind is shown in Fig. 5.

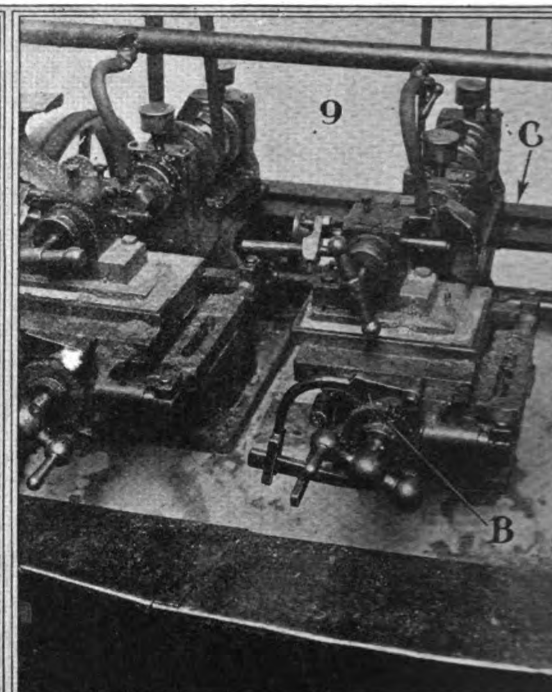
All of the work which has been done up to this point is preparatory to the machining operations. The valves are now slipped into special counting racks holding 100, 150 and 200 valves and are then passed along for the preliminary inspection. This inspector notes the weld and sees that the scale has been removed from the heads and bevel seats so that there is no danger of tool damage from this source.

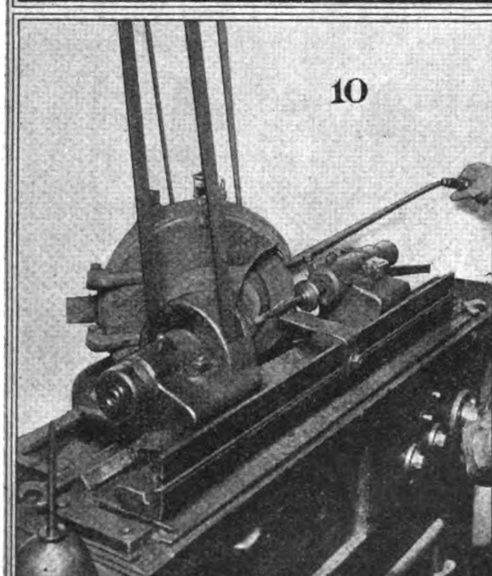
The first machine manufacturing operation on the valve is that of forming the head. This is done on a turret lathe with a compound tool. The operation is shown in Fig. 6. The machine is an ordinary Fuller turret lathe, the interesting feature being the cutter, which works on a cross-feed. This tool cuts the outside diameter of the valve, forms the seats and forms the underside of the valve to proper radii. The operation is located from the valve stem diameter, which is held in an ordinary chuck. After the head is formed in this rough forming operation, the heads are given center marks for locating the finish grinding and machining work on the stems. The centering operation, which is shown in Fig. 7, is done on a special machine, the stem being clamped in a V-block which serves as a locating means. When so clamped the

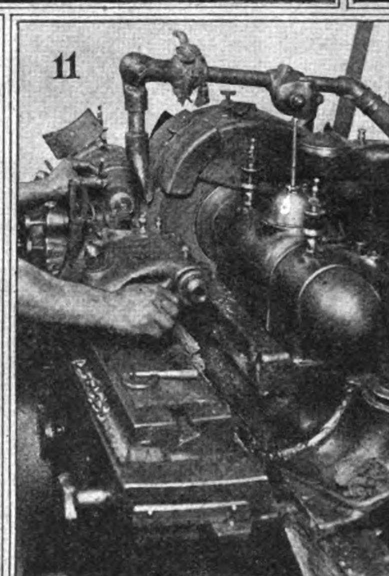


1—Cutting off stock to length ⅜ in. longer than finished valve stem. Stock is .010 in. diameter larger than finished stem. 2—Drilling the cast iron valve heads on a special machine which drills six at a time. 3—Cleaning out countersinks in the valve head casting. 4—Welding valve stems to valve head. The stem projects within the countersunk portion of the head and after welding, the projecting piece of stem and the flux when fused fill the entire countersunk portion. 5—Rough grinding the valve head to take off the hard scale after welding. 6—First machine operation which forms the head and seats of valve. 7—Operation for establishing center of valve head, locating from diameter of valve stem by means of V-block at A.









8—Eight-headed machine for slotting the stems of valves for overhead valve engines. 9—Enlarged view of one of the heads on stem slotting machine. B—Connecting rod bars for establishing reciprocating motion of heads. C—Ratchet and pawl feed for table. 10—Grinding the valve seat on a Star wheel. This grinds a 45 deg. seat on the valves, only a very light cut being taken. 11—Finish grinding the valve stem. Note the locating center point on machine. 12—Gaging the valve on final inspection. The racks contain counted valves and the inspection operation consists of a go and no-go gage on the valve stem and an amplifying gage for testing concentricity of head and stem.

center spot is accurately placed in the head of the valve.

On the overhead valves which are used in the Buick, Chevrolet and other motors, it is necessary to slot the stems of the valve, and this is done on a very ingenious machine which is capable of handling 8 stems per min. In other words, the special machine can handle as many stems per minute as it has heads. The machine illustrated in Fig. 8 is an eight-headed machine, and is, consequently, capable of slotting 8 stems per min. A close-up on one of the heads is given in Fig. 9. It will be seen that this machine, which is a product of the Schlieder company, is very highly ingenious in its operation. A crank arrangement allows the head to swing back and forth. This is the portion which carries the belt pulley. The operating bars, to give the reciprocating motion to the head, which is really a side-to-side swing, are shown behind the machine at *B*. This head carries the cutter, and the table which carries the valves is fed up to it by a ratchet and pawl arrangement, *C* which connects with a worm feed. This advances the work toward the cutter at the desired rate.

All of the valves are given either a screw-driver slot in the head or two small holes to hold the valve grinding tool, are placed in the valve on either side of the center mark. The slotting operation is done on an ordinary saw and the two pilot holes are put in by a short drill, and the valve is then ready, practically, for its finish grind.

Special valves for certain makes of cars require some additional work on the stems such as, for instance, putting a groove at the bottom of the stem, chamfering the bottom,

etc. All of the valves, before going to the grinding, are cut off at the correct length from the seat, but some of them require these special slots or key holes which take the particular type of valve spring retainers needed. In order to provide the wearing surface necessary at the bottoms of the stems, these are cyanided to give them the hard skin necessary as a wear resister.

The heads are rough ground on a Landis grinder, the same operator taking care of both the rough grind and finish grind. This is done as it is then possible to hold the operator responsible for the finished valve. It has been found where one operator took care of the rough grinding and another the finish grinding that it was impossible to locate inaccuracies. Each grinder, of course, being positively certain that it was the other one who caused the trouble. The way it is worked out now, the .010 in. oversize is ground off all by one grinder. He takes off .008 in. on the rough grind and .002 in. on the finish grind, and on a 9-hr. basis, he will be 6 hr. rough grinding and 3 hr. finish grinding.

Probably the most interesting operation in the entire manufacture of the valve is that of grinding the seat. This is done on a Star grinding wheel which takes a very light cut, the depth being just sufficient to give the desired seating surface. This wheel is illustrated in Fig. 10, and it has been selected after a long search for the proper equipment for this work. The stems are then finish ground, the excess metal which was left at the beginning on the stems being taken off on this cut. This operation, which is shown in Fig. 11, is a straight grinding operation without any exceptional problems. The valves are then checked and gaged for diameter and concentricity. The final inspecting operation is done by girls, the operation being shown in Fig. 12. On this operation the operator has two gages, an over and under go and no-go gage for the stems, and then a concentricity test which is shown in operation in the illustration. The valve is placed in a V-groove, turned about with an indicator pointer of an amplifying gage resting against it. A variation of over .002 in. is sufficient to cause rejection of the valves. Following this final inspection, the valves are flushed in oil, wrapped and packed for shipment.

German Organization of the Factory Inspection Department

THE organization of the inspection department in a machine shop engaged in the production of interchangeable parts was covered (from the German point of view) in a paper recently presented to the Dresden Section of the Verein Deutscher Ingenieure by Prof. Toussaint. In the first place there is to be created a department to which may be referred all questions relating to measurements and fits. This department should be accorded a large degree of independence, as it represents in a sense the conscience of the works and is responsible for the interchangeability of the products of the plant. The superintendent of this department should represent the firm on all standards committees that are working on the standardization of systems of measurement and fits, that concern themselves with questions relating to standard measuring or gaging temperatures and with the standardization of tools. He must conduct correspondence with the government department of weights and measures, obtain the reference gages for use in disputes concerning shop gages and see to it that these reference gages are periodically checked by the government department.

The inspection department should also work up instructions for checking measuring instruments and tools and machines. It must determine when gages are to be regarded as worn out and should therefore be withdrawn. It should furnish drawings and specifications according to which the inspectors pass tools and machines. It is charged with the proper storage and issuing of the gages, preferably in such a way that the gages for any particular job are let into a board. When the gages are turned in at the end of the week, the inspection department should be able to immediately observe any injuries they may have received and subject them to a checking process before they are handed out again.

It devolves upon the inspection department, moreover, to study the checking systems in use in the works as to their suitability and to improve upon them, to work out new inspection methods and to introduce them into service after a suitable try-out. To this end the inspection department should be furnished by the works library all publications relating to the subject of inspection and gaging.

Aside from instructions for checking the shop gages, there should be worked out general instructions regarding the use of gages in the shop. It is advisable to instruct the engineers, foremen, inspectors, assemblers and better machinists in regular courses, which results in better co-operation between drafting room, shop and inspection department. In the lectures such terms as nominal dimension, fit, tolerance, maximum dimension, minimum dimension and tolerance unit should be made plain. The location of the zero line, the influence of the gaging temperature, and the different kinds of fit should be discussed. The markings and inscriptions of the gages should be explained and shown by samples, and this should be followed by a general discussion on the system of inspection in use in the plant.

Oilless Bearings

TWO forms of oilless bushings or oilless bearings are manufactured by the Massachusetts Oilless Bearings Company. One is a bearing made of certain grades of wood impregnated with lubricant. Six different densities of lubricant are used, suiting the bearings to different conditions of load and speed. These bearings are known as phosphor lignum bearings and are used for shafts running at from 25 to 25,000 r.p.m., we are informed. These bearings are not a stock product but are made to order for any particular application. The phosphor lignum bearing is said to have a crushing strength equal to that of a babbitt bearing, to be moisture and oil-proof and not to swell or shrink under climatic conditions.

The other type of oilless bearing referred to is known as the Cole graphite matrix bearing. This is a cast metal bearing, the graphite being incorporated with the metal. The bushing comes ready to be pressed into the housing and must not be reamed or machined. In case the bearing has to be fitted to a shaft it is recommended to dress the shaft not to ream the bearing. The minimum thickness of wall is 1/8 in. and the following tolerances are worked to are medium sized bearings: Length, $\pm$ 0.010; inside diameter, $\pm$ 0.001; outside diameter, $\pm$ 0.001. These bearings too are made special for different applications, the proportion of graphite being varied.

Detailed Analysis of Holland as Market for American Automotive Products

Lack of domestic automotive manufacture renders Holland an excellent market for foreign products. The facts presented here will be of definite value to the manufacturer seeking Dutch trade. Motorcycle delivery cars are popular. There are about 10,000 automobiles in use in Holland.

By Coldwell S. Johnston*

ALTHOUGH always difficult to properly estimate the value of any foreign territory as a market, one will find the problem simplified if able to visualize the size of the country with known home districts and to know the population, its wealth and area, as well as its buying capacity and other characteristics.

Holland, or to be more correct, the Netherlands, is the smallest, with one exception, of the important countries of Europe. Its area, 12,000 square miles of land or gross total of 15,700 square miles with inland waters, is less than that of either Denmark or Switzerland, although its population of seven millions exceeds the combined population of these other two countries by several hundred thousand.

There is only one real manufacturer of automobiles in Holland, and a rich and thrifty population has to buy practically all of their motor cars from abroad.

The nearest tabulation of the number of automobiles in licensed circulation in Holland is obtained from the Royal Automobile Club, The Hague. The secretary states that the number of pleasure cars in use does not exceed 8000 or 9000; this seems too conservative, in view of the fact that 3000 cars alone from the United States were imported last year out of the gross total of 6000 from all parts of the world.

If we base our estimate on 10,000 automobiles as being in use in Holland, which is about correct, this would show only one automobile to every 700 inhabitants, as compared with one to every twelve persons in America.

At the beginning of the year 1921 there were only 20,000 motorcycles in use in this country and a steady demand for more.

The year just ended far surpassed all others as to records in number of passenger automobiles exported from U. S. A. The total is over 125,000; the first ten months of 1920 show 112,376, or double the figures of 1919, which were 67,145.

After the United Kingdom and British possessions, the Netherlands tops the list of foreign buyers with 2565 cars taken in ten months from the United States, and the Dutch East Indies with 3439, all in the ten months for which we have official figures, making a total of 6000.

Therefore, with the safe estimation of 3000 cars having been sold in Holland in 1920, of a total value of Fl. 12,612,000, or an average declared value on importation of about Fl. 4,200 per car, the important question is what are American manufacturers and exporters of automobiles going to do to increase, protect and maintain the Dutch market? (See my report published in Commerce Reports No. 306, dated December 30, 1920.)

*American Commercial Attache, American Legation, The Hague, Netherlands.

Foreign Representatives

There are in Holland the following number of automobile agents from the various foreign countries:

American	27
French	26
English	24
German	19
Italian	7
Belgian	3
Swiss	1

A questionnaire was sent recently by the Bureau to all of these agents concerning various topics of interest to the American automotive manufacturer. A digest of the replies is presented here.

Vehicles in General

But for a temporary overstock the demand for cars is good, and revival of selling in the spring will no doubt move all cars now on the dealers' floors. The attached statistics show the imports of automobiles into Holland during the year 1920 in comparison with the year 1919.

The percentage of cars in use of domestic make in Holland is negligible, there being only three manufacturers or assemblers of motor cars in Holland, so that practically all automotive vehicles in Holland are imported.

The total production in Holland of cars would not exceed, if it equals, a couple of hundred cars a year, excepting Spijker.

The Spijker plant, the most important concern producing automobiles in Holland, estimates a yearly output for 1921 of 100 cars per month, but as this car is to be a superior six-cylinder vehicle, selling for approximately Fl. 20,000, it is very doubtful now, under the financial conditions ruling, if a thousand such cars can be produced, or even half that number manufactured in Holland and sold here or abroad. The bulk of the production last year, which sold for half the price of their new model, went to England, amounting to some 350 cars of the four-cylinder model, selling to 12,000 guilders.

Passenger Cars

Holland is less affected by the depressed conditions in the European market for the sale of motor cars than any other country on the Continent, with the possible exception of Spain. Money is here and available, and

the American producers control the market to a greater extent than any other nation, although heretofore the reputation of the French car has been one of superior quality and durability.

Trucks

The ample facilities afforded by cheap waterways prevent the development of a large truck business. It is hardly worth while to attempt to force the market with anything larger than a 1½-ton truck, although some 2-ton trucks are noted in daily use.

Trucks of all types and kinds are to be seen in Holland, but the most successful and best adapted are the four-cylinder type motors from ¾- to 2-ton trucks. Exceedingly heavy trucks are rare, and, due to the narrow streets and roadways, are often impractical.

Great popularity is noted in the light delivery car and the adaption for light delivery made to attach to motorcycles for city delivery purposes.

American Advantages

The simplicity of American design and the interchangeability of parts with the quick supplying of spare parts are items that the European makers do not afford their customers. Right here the matter of service is very important and should be developed the same as at home; up to date the subject is badly neglected.

The particular type of car that might prove the best seller is naturally the one combining the lowest first cost and demonstrating its economical maintenance and operation. Europe has long been acquainted with the small-bore, high-speed motor, which has demonstrated to the satisfaction of the European that it is not an extravagant fuel user and the most economical to own.

Statistics

IMPORT OF MOTOR CAR TIRES INTO JAVA

Origin from Where Imported	August 1919	August 1920	8 Months 1919	8 Months 1920
	(Number of Tires)			
Great Britain	140	916	4,270	7,246
France	1 382	3,665	33,216	16,560
Italy	....	440	1,991	8 077
United States	5,251	7,212	35,952	47,710
Singapore	1,358	474	4,378	5,867
Japan	8.967	4,835	64,307	38,594
Elsewhere	1,179	1,749	5,065	9,799
	18,277	19,291	149,569	133,853

IMPORT OF BICYCLE TIRES INTO JAVA

Origin from Where Imported	August 1919	August 1920	8 Months 1919	8 Months 1920
	(Number of Tires)			
Holland	....	4 182	948	15,966
Great Britain	....	590	441	2,287
United States	....	1,002	3,276	4,074
Singapore	350	410	1,625	11,726
Japan	20 521	33,946	85,877	340,108
Elsewhere	....	3,000	14,210	9,824
Total	20,871	43,130	106,377	383,985

IMPORT OF MOTOR CAR TIRES INTO THE NETHERLANDS

Origin from Where Imported	1920	1919
Casings:		
Belgium	6,380	3,062
Great Britain	14,388	31,060
France	7,251	8,015
United States	50,650	27,501
Total including all others	81,332	69,760
Tubes:		
Germany	1,559	145
Belgium	5 106	1,819
Great Britain	11,287	23,888
France	5,840	8,772
United States	40,530	18,408
Total including all others	64,780	53,037

IMPORT OF MOTORCYCLE TIRES INTO THE NETHERLANDS

Origin from Where Imported	1920	1919
Casings:		
Belgium	5,738	1,051
Great Britain	10,163	14,963
France	1,642	2,843
United States	2,156	4,758
Total including all others	20,239	23,701
Tubes:		
Germany	761	211
Belgium	1,854	306
Great Britain	8,050	14,683
United States	2,503	4,237
Total including all others	14,758	21,404

NOTE.—*Regarding Market for Bicycle Tires:* It is remarkable to note here from the above large total of bicycle tires imported from various countries enumerated above no imports of bicycle tires were reported from the United States. The market for this article seems to have been ignored by American manufacturers and as practically everybody in Holland rides a bicycle, American makers should make an effort to obtain some of this business which can easily be had. The same applies to American bicycles, as there are none on the market here in Holland.

IMPORT OF BICYCLE TIRES INTO THE NETHERLANDS

Origin from Where Imported	1920	1919
Casings:		
Germany	58,086	7,184
Belgium	108,746	31,886
Great Britain	333 084	681,693
France	201,504	207,792
Total including all others	755,001	972,610
Tubes:		
Germany	130,345	11,081
Belgium	122,416	49,687
Great Britain	205,568	535,424
France	134,772	150,133
United States	19 653	36,546
Total including all others	632,968	796,271

IMPORT OF SOLID RUBBER TIRES INTO THE NETHERLANDS

Origin from Where Imported	1920	1919
Great Britain	4,678	2,936
United States	1,110	240
Total including all others	6,330	3,202

IMPORT OF AUTOMOBILES INTO THE NETHERLANDS

	1920	1919
Motor Cars Complete with Body:		
Pleasure Cars:		
From Germany	2,144	3,478
Belgium	402	115
Great Britain	207	101
United States	2,968	1,040
Total including all others	6,089	3,478
Trucks:		
From Germany	1,398	937
Total including all others	1,646	1,064
Motor Car Chassis:		
Pleasure Cars:		
From Germany	310	236
Belgium	79	31
Great Britain	48	28
United States	57	133
Switzerland	43	8
France	144	45
Italy	71	2
Total including all others	767	500
Trucks:		
From Germany	159	94
United States	539	66
Italy	32	27
Switzerland	28	51
Great Britain	13	41
	789	295

IMPORT OF MOTOR CARS AND TRUCKS INTO JAVA

Origin from Where Imported	August 1919	August 1920	8 Months 1919	8 Months 1920
	(Number of cars and trucks)			
Holland	..	19	5	67
Other European countries	1	33	10	90
United States	416	286	2,053	2,359
Elsewhere	9	58	60	526
Total	426	396	2,128	3,042

NOTE.—*Regarding Motor Car Tires:* It is always advisable to have cars for export to Holland equipped with millimeter rims to take millimeter sized tires instead of American inch sized tires. This caution is recommended, being advisable here as well as in all other European countries.

The more closely producers aim at a car of the above type the more excellent are the chances of big business developing; to-day the ability to make prompt delivery, supply spare parts quickly and to furnish complete cars fully equipped for the road with ample road equipment are the important items in our favor.

National Preferences

No national preference is evidenced, although, as above mentioned, the French makes are favorably referred to, while a good reputation has been established by the English cars on account of their sturdy construction. The Belgian-block or stone-paved streets and roadways in Holland tend to make many American cars become noisy and develop weaknesses due to the vibration developed on stone-paved ways, where light construction results in rattles and rapid depreciation.

The reputation of German cars has suffered greatly because of the poor material and inferior finish on the post-war German cars being delivered now.

Gasoline Supply

The gasoline supply is mostly drawn from American sources, although an effort is being made to deliver from the Dutch East Indies and from the Royal Dutch Company's source of supply. Few gasoline substitutes are in the market, the most prominent being benzol. The price of gasoline, known as petrol, is 40 to 50 cents (Dutch) per liter, or approximately 60 cents (American) for a gallon.

Credit

Practically all business in Holland is done on a cash basis to the consumer, but if a practical and workable system of partial payments on motor cars were established, similar to that in effect in America, no doubt an additional amount of business would be developed and quicker sales would result.

If this was in force at the present time, it is the writer's opinion that there would be fewer cars on the agents' floors than is the condition to-day.

This system of time purchase as developed in America is not known in Holland, and there is a wide field awaiting any acceptance corporation putting it into effect.

The question of barter so often applied in Europe where the value is greatly depressed is not required in Holland.

Taxes

The Government taxation system depends almost entirely upon the income tax as a Government source of revenue. The duty on motor cars is normal and only 5 per cent ad valorem. There is a general tendency to increase the taxation, although the luxury tax has at this writing been practically abandoned or delayed for the present, so that it will probably not become a handicap in the immediate future for the importation of motor cars.

No special taxation on foreign companies is levied, and foreign companies have the same rights as native. If located in Holland they are obliged to pay the income tax estimated on the business done in the country. (See my special report on this subject: Incorporation, Branches and Taxation on Companies, Foreign and Domestic, in Holland, dated November 3, 1920.)

Tax on Motor Vehicles

There is no tax on the following vehicles: Automobiles held by public authorities; equipped as ambulances; trucks; those used by manufacturers and dealers in carrying out their business.

All other motor vehicles (excepting motorcycles) are taxed according to value as follows (the selling price of the car is considered as the value):

Less than Fl. 2,000; Fl. 2 for each Fl. 100.

Fl. 2,000 or more, but less than Fl. 4,000; Fl. 40, plus Fl. 2.25, for every Fl. 100 over Fl. 2,000.

Fl. 4,000 or more, but less than Fl. 7,000; Fl. 85, plus Fl. 2.50, for every Fl. 100 over Fl. 4,000.

Fl. 7,000 or more, but less than Fl. 10,000; Fl. 160, plus Fl. 2.75, for every Fl. 100 over Fl. 7,000.

Fl. 10,000 or more; Fl. 242.50, plus Fl. 3, for every Fl. 100 over Fl. 10,000.

Three-wheeled motor vehicles, each, Fl. 15.

When used exclusively for business purposes, the tax is decreased one-half of the above amounts; when used principally for hiring by taxi company or by dealers or manufacturers of motor cars, the tax is decreased to one-quarter of the above amount.

The import duty into Holland on motor vehicles is 5 per cent ad valorem.

The taxation system on motor cars seems to be in a chaotic condition at the present time, 1918 taxes having not been collected as yet.

Agriculture

Holland is primarily an agricultural and dairy farming country; the average farm is about ten acres. There is approximately 1,210,000 hectares (2½ acres 1 hectare) of permanent pasture land and 867,274 hectares under farm crops. Every square foot of available land capable of cultivation has long been carefully utilized by the industrious Dutch farmer.

Live stock is showing a large increase since the armistice and has now approximately reached its pre-war figure, or about 2,400,000 cattle.

Farm labor seems adequate, although there is a tendency on the part of the Dutch farmer to emigrate to America. The farmer is better off than in 1914, having never received such high prices before, and is still maintaining a good price for his products.

There is no rapid increase in the use of farm machinery except where the falling off in labor supply has introduced the installation of some few motor implements. Tractors have not been used to any extent. Because of the low lands in Holland only light tractors can be used, nothing heavier than a Fordson or Samson being practicable.

Transportation

Shipping is adequate; the best ports are Rotterdam and Amsterdam. The first named has direct steamer connection with America, and there are ample facilities for storage for all kinds of goods; free port facilities for goods stored entreport for shipment to other countries can be had at Rotterdam without paying customs duty on goods to be re-exported.

Railroads are equipped to handle shipments direct from warehouses to any European country where reasonably normal conditions exist. The canals, however, play the greatest part in the transportation of freight in the Netherlands.

IN Munich, Germany, hearse service has been "communalized" and will be carried out by means of gasoline automobiles exclusively in the future. Heretofore the service has been partly in the hands of livery men, who furnished horse-drawn hearses, and partly of the city, which owned a number of electric hearses. The change from electric to gasoline hearses was due to the fact that the electrics were about worn out.

Exports of Automobiles and Tires for April, 1921.

COUNTRIES	COMMERCIAL Complete Cars		COMMERCIAL Chassis		PASSENGER Complete Cars		PASSENGER Chassis		Parts	TIRES Casings	TIRES Inner	TIRES Solid	All Other Tires
Europe													
Azores and Madeira Is.					1	$ 1,200							
Belgium			30	$ 13,488	33	26,940			$ 13,792				
Czechoslovakia					1	600					$ 125		
Denmark					14	25,141			18,947	$ 10,794	46		
Finland			6	6,000	3	8,375			1,514	1,250		$ 650	
France	1	$ 5,564			18	45,505	1	$ 360	56,001	203	63		
Germany					7	20,800			1,745				358
Gibraltar					2	2,463			37	141	17		
Greece	1	1,002			7	7,654			11,504	1,640	695		
Iceland and Faroe Island													
Italy					4	3,949			5,640		20		100
Malta, Gozo, and Cyprus Is.					1	875			1,449	2,133	4		
Netherlands	7	3,980	4	3,449	24	25,758			14,819	2,673	639		
Norway					2	2,650			6,834	38,887	1,082	400	
Poland and Danzig					5	8,500	2	600	7,389	530	235		
Portugal									2,218				
Roumania					3	12,000							
Spain					42	102,027	3	5,560	81,498	46,787	153	350	58
Sweden					62	71,045			5,514	47,773	1,961	2,569	4,913
Switzerland					3	8,527			2,904	1,548	256		
Turkey in Europe					1	605			2,843	27	7		
England	9	25,088	1	2,940	15	41,322			491,656	79,885	8,949	829	
Scotland									1,047				
Ireland									8,967				
Yugoslavia, Albania, et	1	980							2,399				
North and South America													
Bermuda									36				146
British Honduras			1	459	2	883	1	375	231	365	146		
Canada	87	145,818	140	174,680	807	1,290,067	5	3,765	1,688,126	40,863	3,353	2,163	9,300
Costa Rica					2	2,227			1,774	505	41		115
Guatemala									1,260	1,340	223		
Honduras			1	450	2	1,421			1,467	1,581	428		218
Nicaragua					1	1,250			484	1,437	311		
Panama	1	1,550	3	1,514	14	17,562			12,965	7,669	1,120	2,408	2,050
Salvador									563		15		
Mexico	127	142,936	12	23,361	675	539,484	20	8,000	149,445	135,777	19,808	4,894	2,617
Newfoundland and Labrador					2	1,372			2,098	2,447	358		56
Barbados									1,484	2,012	62	150	
Jamaica					2	2,250			2,540	4,636	196	992	
Trinidad and Tobago			6	4,775	2	2,476			5,833	6,796	1,396	1,445	81
Other British West Indies	2	986			7	3,398			1,016	545	104		
Cuba	4	3,987	8	9,899	184	106,542			106,690	140,652	9,838	9,402	1,239
Virgin Islands of U. S	2	925			3	1,458			1,068	512	228	7,582	105
Dutch West Indies			1	519	2	1,959			1,577	1,077	68		48
French West Indies									2,359				
Haiti					4	1,723			1,613		64		
Dominican Republic					17	15,952			13,761	12,326	979		57
Argentina					3	8,250			46,903	19,921	4,125	309	3,683
Bolivia									2,079	430	101		
Brazil					5	7,162			12,162	5,853	540	776	87
Chile	3	1,559			3	5,650			17,094	5,918	529		
Columbia									4,241	3,869	286	1,546	91
Ecuador	3	11,249			3	6,358			3,231	1,872	188		
British Guiana	2	2,702							2,130	1,519	[illegible]		
Dutch Guiana									999	407	83		
Paraguay									764				
Peru	1	1,853			12	30,855	4	1,636	28,276	8,871	2,248	1,195	
Uruguay					2	3,946			28,559	5,401		229	
Venezuela					19	17,784			20,086	11,648	2,198	97	103
Asia and Far East													
Aden									1,095				
China					2	3,800	17	9,747	5,086	8,601	762	167	
Kwantung, leased territory			1	1,795	3	9,000			142				
Chosen													
British India	5	14,513	6	17,614	51	78,996			21,965	27,198	108		
Straits Settlements					3	3,870			12,835	543	150	1,300	607
Other British East Indies					3	4,239			2,567	1,347	30		
Dutch East Indies	10	20,231	20	52,569	8	13,980			54,543	4,454	2,143	15,442	
French Indo China									9,943	287	58		
Hongkong					1	3,500			1,124	10,303	523	190	
Japan	1	2,249	65	53,694	100	93,124	65	45,189	14,694	8,871			2
Persia													
Siam									1,431	2,300	290		
Turkey in Asia	1	850	2	7,500	44	26,805			11,350	353	118		
Australia	2	9,463	12	20,326	16	24,280	34	45,588	63,614	7,250	3,772	821	
New Zealand			3	6,930	30	40,723			32,869	29,357	1,475	6,524	2,112
Other British Oceania									427	1,280	363		
French Oceania									523	568	130	138	
Other Oceania					1	650			1,041	698	115		
Philippine Islands					3	4,520			16,418	14,896	820	3,604	1,163
Africa													
Belgian Kongo									154				
British West Africa									14,620	8,691	2,431		
British South Africa			2	5,093	2	3,600			8,910	260	40	1,312	186
British East Africa					4	3,360			316	659			
Canary Islands			3	1,349	8	3,766			1,357	988			
Egypt			9	4,543	7	2,688	6	1,781	12,363	2,193	149		
French Africa					2	726			3,177		84		
Kamerun, etc.									458				
Liberia													
Madagascar									1,040				
Morocco			3	1,349	2	1,040			667				
Portuguese Africa									374				
Total	270	$397,545	339	$414,296	2,311	$2,808,632	158	$122,601	$3,196,734	$791,617	$77,020	$67,484	$29,585

The FORUM

Steam Cooling

Editor, AUTOMOTIVE INDUSTRIES:

Referring to the interesting article on Mr. Rushmore's cooling system described in AUTOMOTIVE INDUSTRIES of May 26, the writer wishes to mention that early in 1918 he designed a cooling system based on the same principle, which, however, showed a somewhat different mechanical arrangement, as will be seen from the following brief description.

A conventional radiator is modified in such manner that the steam entering from the motor has to follow a certain predetermined path through the entire cooling portion, the water being collected in the bottom tank, from where it is returned by a positive pump in such manner that syphoning back owing to leakage of the pump is impossible.

A water supply tank is provided for the purpose of keeping the water in the motor at a predetermined height in case of loss through leakage or failure of the radiator to condense all steam under extremely unfavorable working conditions.

An adjustable blow-off valve may be provided permitting variation of the temperature, and if located at the outlet of the motor, relieves radiator and hose connections of the pressure against which, however, the pump has to lift the water in this case.

The advantages of this cooling system in comparison with the one developed by Mr. Rushmore are the following ones:

(1) Quicker heating and more uniform temperature of the motor owing to the absence of water circulation at any time.

(2) Assurance that at all times, especially when starting, the jacket is filled with water, which according to the sketch showing the application of Mr. Rushmore's system to a Cadillac car does not seem to be assured.

(3) A still smaller pump can be installed because its capacity has to be sufficient only for returning the maximum quantity of water evaporated by the motor plus a factor of safety, while in Mr. Rushmore's system the pump has to be large enough to fill in short time the jacket which will be empty if the water level in the tank stands below the outlet pipe from the motor.

There is no doubt that cooling by evaporation is one of the most important steps toward increasing the economy of motor vehicles, but in many cases the design of the motor will have to be adapted to the working conditions at a higher average temperature.

Anent the subject of economy, it might be mentioned that previous to working on the cooling system the writer designed a device described below for assuring a dry charge of, as far as possible, uniform temperature, which in connection with the evaporation principle of cooling should materially increase the fuel economy of the conventional motor vehicle engine besides reducing crank case dilution.

To the exhaust manifold of the motor is attached a stove of extra large heating capacity from which hot air is conveyed to the main and auxiliary air inlet of the carbureter; the charge leaving the carbureter passes a thermostat which expands as soon as the temperature of the charge exceeds a predetermined maximum insuring the absence of liquid fuel particles; this expansion opens a valve provided in the hot air line to the carbureter which admits cold air, thereby causing the temperature of the charge to drop.

Preliminary experiments with this latter device gave promising results, but war conditions prevented further development, while the cooling system, for the same reason, did not reach the experimental stage; later on the writer did not have any opportunity for further experiments.

VICTOR JAKOB.

How Trucks Can Be Improved

Editor, AUTOMOTIVE INDUSTRIES:

In reply to your letter of April 27, containing the question, "What do you regard as the next step in truck design to render them more economical and more satisfactory in the hands of the user?"

I am pleased to submit a short discussion on some of the phases of truck development yet to be achieved.

Barring certain engine modifications which may or may not come about as the result of research activity in fuels, it is not stating too much to say that the engine design of trucks has reached a point where the fundamentals are shaken down to a basis of general understanding. We understand the power requirements and the methods of application. We understand the speed requirements and limitations. We are manufacturing trucks of a very high degree of interchangeability of parts, and we are constructing vehicles of great reliability and economy of operation.

To my way of thinking, the next step in truck design is to make them more suited to the requirements of operation and maintenance, and we must improve the design to a point where the parts are easily accessible for repairs, and we must provide cheaper replacement parts in the way of bushings, sleeves and pins at all wearing places, in order to facilitate saving in time and expense in making repairs. This will do away with the replacement of large parts of the vehicle, which are often scrapped, due to the fact that while 95 per cent of the part performs a non-wearing service, the other 5 per cent is subject to wear, and replacement of the entire piece is necessary.

More study is required in reducing the points of lubrication, and facilitating the none too pleasant operation of oiling and greasing of the vehicle.

It is generally recognized that the driver must have reasonable comfort and protection, in order to accomplish the best results. This point is worthy of still further study, as it pays a handsome return on the investment.

In increasing the power and road ability of trucks, it is necessary also to increase the braking ability or stopping ability of motor trucks. It is not only necessary to have enough braking ability to slip the wheels under any conditions, but it is necessary to so arrange the system as to dissipate the enormous amount of energy liberated in the operation of braking. This is particularly true in hilly sections of the country. It calls for a separation of the

braking systems, and the front wheel brakes loom up as a possibility.

The only remaining point has nothing to do with truck design. However, it has everything to do with truck operation in certain lines of work, viz., the development of auxiliary power devices to be used in conjunction with motor trucks. This is an ever widening field, and there is bound to be great development in the years to come.

THE PIERCE-ARROW MOTOR CAR COMPANY,
Francis W. Davis, Consulting Engineer,
Truck Department.

Thermostats in Extremely Cold Weather

Editor, AUTOMOTIVE INDUSTRIES:

In reading Mr. Heldt's article on the cooling system advised by Mr. Rushmore, the writer was somewhat surprised at a statement made to the effect that it is the practice of manufacturers of cars using thermostats to suggest that they be thrown out of operation during very cold weather.

So far as the writer knows, the Cadillac Company was the first company to adopt thermostatic control of the cooling. This company has never recommended that the thermostats be thrown out of operation during cold weather or at any other time, for that matter, except when the cooling system is being filled or drained.

Since the thermostats open the control valves when a predetermined temperature is reached, regardless of the temperature of the atmosphere, there is no reason, in the Cadillac construction at least, why the thermostats should be thrown out of operation.

The writer believes that Mr. Heldt was in error and that this statement should not stand uncorrected.

CADILLAC MOTOR CAR COMPANY,
E. C. Garland, Technical Department.

We were given to understand by our informant that the reason for cutting out the thermostat in extremely cold weather was as follows: If a driver is in a hurry and starts out with his car in zero weather before the thermostatic valve has opened, with the water stationary in the radiator core and the very cold air being forced through it by the motion of the car and drawn through by the fan, it takes but a very short time till the radiator core is frozen solid. This would prevent all circulation when the thermostatic valve opened and might result in serious damage. The fault, of course, would be with the driver, who should know that under such conditions it is not safe to start out before the engine has become warmed up and the thermostat has opened.—ED.

The Next Step in Tractor Design

Editor, AUTOMOTIVE INDUSTRIES:

We believe that there is a real need for a two-plow tractor of such a design as to be a satisfactory unit for drawbar work and belt power, as well as for cultivating. We believe that it is possible to design a machine of this size which will accomplish these three classes of work in a satisfactory manner. In our opinion, it should be a three-speed tractor, with possibly two belt speeds for the different classes of belt work which must be done.

In order to enable this tractor to successfully cultivate or harvest certain row crops, such as potatoes, sugar beets, etc., it would seem necessary that the wheels be adjustable laterally. It should also be possible to couple readily and properly to binders, mowers and similar harvesting machinery, and to belt conveniently to all forms of belt-driven farm machinery. It should be, as nearly as possible, a universal power unit for the small farm, designed to use existing types of farm machinery wherever possible and to eliminate animal power as much as possible.

In our opinion, the design of three- or four-plow tractors should be dictated mainly by the drawbar and belt work which they must perform. More attention should be given to refined design, better materials and more careful workmanship. These same remarks apply to the large tractors used on large grain farms, particularly, and for road-building work.

The track-laying type of tractor must be considered from a different viewpoint, as it is a machine intended to operate under different conditions than a wheel machine is expected to do.

Yours truly,
MINNEAPOLIS STEEL & MACHINERY CO.,
A. W. Scarratt, Automotive Engineer.

Non-Ferrous and Organic Materials

IN connection with aircraft development during the war a great deal of experimental and research work on materials of construction was conducted, and most of the results obtained found their way into the publications of the national advisory committees on aeronautics of Great Britain, the United States and other countries. Aircraft construction makes use of a great variety of materials which while extensively used in other lines previously, had never had to meet such rigid requirements of strength and lightness. These different materials with the exception of steel are dealt with in a book by Arthur W. Judge published by Sir Isaac Pitman & Sons, Ltd. It bears the title of Non-Ferrous and Organic Materials and is the second volume of a set on Aircraft and Automobile Materials of Construction, the first volume of which relates to steels.

The second volume, here under review, covers a great variety of subjects, as follows: Aluminum and its alloys; Copper and its alloys; Bearing metals; Nickel and its alloys; Structure and properties of timber; Testing of timber; Airplane fabrics and coverings; Dopes and varnishes; Glues and gluing; Rubber and its compounds; Paints and painting; Miscellaneous metals and materials; Veneers and plywoods; X-ray method of examining materials. Owing to the great variety of subjects covered they are dealt with in a rather superficial way and the book is generally of an elementary character. It is obvious from the above outline of the subjects covered that aircraft materials are given first consideration, but as most of the metals dealt with are used also in automobile construction their applications in that field are referred to. For instance, in the chapter on Aluminum and its Alloys there are illustrations of cylinder castings, aluminum pistons, a dashboard, etc. Numerous references to sources where more complete information can be found are given throughout the volume.

ACCORDING to a report recently issued by the Dutch Department of Commerce there was a heavy increase in the imports of automobiles and tires into Java and Maduras in 1920 over 1919. There were imported in 1920 1372 motor trucks (621 in 1919), 4448 passenger cars (2470) and 247,663 tires (200,936).

Strength of Labor Lies in Definite Objective of Organization

Employees never forget their text and seldom do they wander far from it, but the employers usually organize for a merely defensive purpose and their objective wanders from meeting to meeting, consequently they never reach a goal. What is written here has many applications.

By Harry Tipper

I HAD a visit from a gentleman the other day who is getting up a new organization of an industrial character. His purpose in visiting me was to find out if I could attend the organizing meeting to suggest to these gentlemen how they can organize. The comment which he made in the course of conversation was very interesting. After visiting one or two associations, he said, "Most of these organizations do not seem to know where they are going. They have no definite object."

May and June are convention months in the business world, and I have had ample opportunity to find out the correctness of this statement.

I have just returned from a convention of approximately two thousand people representing an organization of nearly twenty-four thousand. Among the men who are interested in the development of this organization I heard very little which would indicate that they were moving in a definite direction or had a definite object in front of them.

We have in this country a very large number of business associations and we seem to be confused by the volume of activity in these associations. The volume of activity is not important. The tendency of the movement is important because the movement grows in intensity, not by virtue of the volume of its activity, but by virtue of the definition of its objects.

The power of the trade union to discipline its members, to preserve its characteristics and to influence outsiders is due primarily to the careful definition of its objects. For years the trade union has been moving in a definite direction with a very definite object in front of it.

Even in countries where the trade union itself represents only a small proportion of the working population, the influence of its movement is to be observed in all the discussions upon labor, industrial conditions and the general industrial economics. Even those reactionaries who have refused to see any value in the collective organization of workers have been obliged to take new positions every few years from the pressure of public influence and their own readjustment to outside conditions. Similarly, the definition of the Socialist creed has exerted an influence upon the modern political thinking far beyond the confines of the organization itself and far beyond the liberal elements in the population.

In comparison with these movements the organizations of manufacturers and other employers have developed a great amount of activity with little or no definition of their objects. They have exerted little influence outside of their own membership, and their actions have not affected the political or social thinking to any considerable degree.

Most of these organizations have been started without any definite object other than the protection of the members against the aggression of outsiders. This is the negative and defensive attitude, and these organizations have been obliged to modify their policies, rearrange their objects to meet the new attacks coming from different sources. Taken all in all, the business and professional associations in the United States comprise a membership much larger than the membership of the American Federation of Labor, but as far as their influence is concerned they have no definite common object of any kind, they are moving in no particular direction and their movement does not intensify particularly even after a number of years of action.

The same situation is developing in the discussion of industrial relations. All groups of labor, where they are affiliated with the American Federation of Labor or grouped within the establishment, have two or three definite objects in common. As a rule they do not know how these objects can be obtained most effectively, and they are not in any position to offer a suggested solution of the present problem.

They have indicated the objects, however, and they have suggested the solution they believe to be correct. Because of this definition they have convinced a large part of the working population that the objects are more or less reasonable and the solution more or less valuable.

Professional and industrial associations dealing with the human side are new. They should offer opportunities for the better definition of the human problems of industry and the suggestion of better methods looking to solution.

At present, however, they are floundering around after the manner of so many other associations endeavoring to secure a great volume of activity, discussing and considering matters covering a wide range, and with neither a definite object in front nor a continuing policy of development.

It is interesting to note that it was comparatively easy to secure a unity for the negative object of protection against the aggressions of Germany. That situation produced a larger measure of unity in action and in thought than any other situation since the beginning of the mechanical civilization.

For the positive purpose of peace, however, and reconstruction, we have been unable to preserve even

a decent measure of unity in respect of the most important objects.

An enormous amount of time has been expended in dickering over this or that detail of the matter without success. It is not at all sure that we have elements of peace in the agreements that have been made so far. The same thing is true of the small nations created by the war. They have been a unit in demanding recognition and protection of their racial traditions and associations. That accomplished, they have fallen into the usual political disturbances in attempting a reconstruction program.

It is the same way in business. Men will get together for protection against legislation, for protection against labor troubles, for protection against poor creditors, but in the attempt to throw up a positive program of improvement they fall apart, either becoming negative or split into other associations. It is to be expected that the labor unions of Great Britain, now that they are approaching the responsibility of constructive necessities on account of their great power, will find it impossible to secure the adherence of the millions of workers to any program of construction. The reason for this impossibility of agreement upon constructive measures is obvious. Only a very small percentage of the leaders have definitely examined the situation sufficiently far to build up a program of improvement, and the rest of the population has not even thought beyond the deficiencies.

The improvement can be made, then, only because of the activity and the intensity of the movement of the small minority of any association. **This minority must be prepared to lay down a program within the range of practical possibility to compromise on some of their objects in order to secure a movement in the right direction and to continually force upon the majority the necessity for this development.** They are not liked by associations and they are frequently discredited by the majority who do not understand them. Many of the great English leaders who brought the labor party to its present power died discredited by their own party.

Manufacturers who have been bold enough to experiment in the endeavor to provide a better basis for the co-operation of labor and management are looked upon as fools or denounced as Bolsheviks.

Not much can be expected from the organized associations dealing with the human side of industry; improvements must come from the patience and experimentation undertaken by men who have studied the situation sufficiently to know that they are right, and who are not very careful to receive the plaudits of the general body.

Reinforced Concrete Roads in France

THE use of reinforced concrete as a road material has made its appearance in France and has been experimented with in the city of Lyons with good results.

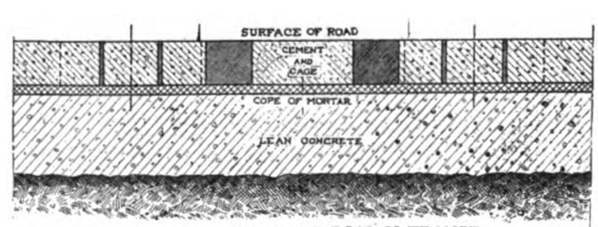
This invention is the property of the Pont-a-Mousson Steel Works, one of the biggest firms in France specializing in iron pipes. A concrete foundation, varying in depth from 4 to 8 inches, according to the amount of traffic to be carried, is first laid and given a surface dressing of fine cement about half an inch in thickness. Before this is quite dry it receives the cast iron reinforcement, the elements of which are roughly square frames 1¾ in. in height with a spur from each corner, and are laid staggered, from 16 to 25 to the square yard, according to the amount of traffic intended to be carried. The base of each cast iron member is slightly reinforced in order to give it a better seating in the cement. Finally a layer of concrete composed of fine Portland cement and quartz chips is laid over the metal reinforcement and carefully tamped down so as not to disturb the elements. When finished the metal is hidden, the road having the appearance of an ordinary concrete highway.

According to the report issued by the road engineer of the city of Lyons, after the road had been in service for six months, during which time it had carried exceptionally heavy traffic, the results are satisfactory. It is stated that the metal reinforcement now slightly projects, but not sufficiently to cause any inconvenience to traffic, and so slightly that for all practical purposes the surface can be considered as perfectly smooth. Water flows off easily and the street is less dusty than others paved with granite blocks.

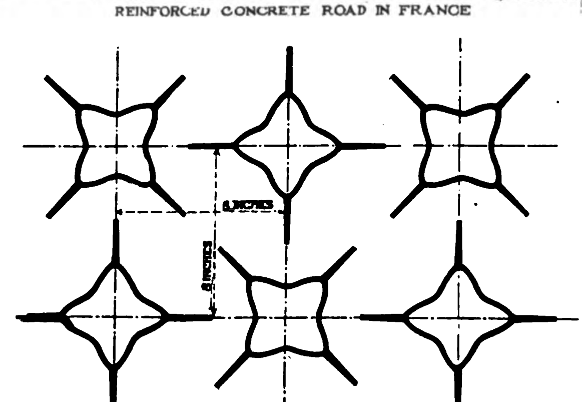
The cost of construction of this experimental road was $5.30 per square metre (nominal exchange), but this was higher than normal, owing to the total inexperience of the workers in this class of road construction. It is estimated that with a little experience cost would be reduced to $5 per square metre, or even less.

Other experiments have been carried out in towns in the east of France, where reinforced concrete roads have been in use for nine years. It is found that with the correct mixture of surface dressing there is only a very slight tendency, and after a long period, for the cast iron members to project above the surrounding surface, and even when considerable wear has taken place there is no inconvenience to vehicular traffic.

The cost of construction on a pre-war basis is given by the Pont-a-Mousson Steel Works as $3.80 per square metre for their reinforced concrete road, compared with $4.45 for asphalt, $4.46 for wood blocks, $4.77 for granite blocks on sand, and $5.32 for granite blocks on concrete. One of the main advantages claimed for the reinforced concrete road is that maintainance costs are practically nil, whereas wood paving blocks cost as high as 42 cents per square metre per annum.



REINFORCED CONCRETE ROAD IN FRANCE



SPACING OF CAST IRON REINFORCEMENTS FOR HEAVY TRAFFIC ROAD

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE
Reg. U. S. Pat. Off.

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Management's Responsibility to the Salesman

A NUMBER of sales managers were asked this question recently by St. Elmo Lewis: "What one thing can the salesman do to overcome the present sales resistance?" Many of the answers were interesting, but that given by F. M. Manning, director of sales, Diamond Match Company, bears an especially pertinent message to the manufacturer at this time. He said:

"I would like to throw this thought into your question: 'What is the house doing to make it possible for good individual sales effort to accomplish results?'

"Too many of us unconsciously regard the salesman as the creator, gatherer and finder of our business. . . . And when we need more business we usually start to 'stimulate' the salesman.

"We owe the salesman a product, a price and a proposition which will be successful if the salesman presents it properly to the prospect. I think there is a tendency to under-estimate the responsibility of the management and to over-estimate the responsibility of the salesman.

"Therefore, we should ask ourselves the question, 'What are we doing to make it possible for the salesman to overcome the present sales resistance?'"

This attitude on the part of the management will produce results. The problem is not to find reasons for lack of sales, but to find ways of making sales. "Passing the buck" may excuse the individual, but it will not sell cars and trucks.

The recent trend of prices and production methods indicate that the automobile manufacturer has realized his share of the responsibility and that he is facing the issue squarely.

We Have the Power

THE recent reports of the Bureau of Census have established the automotive industry clearly as ranking second in value of a finished product.

This classification is interesting, especially so in that it supplies a key as to the position the industry should take in the business world. The industry is new and it has been the victim of many and varied opinions within its own ranks. But there is nothing like a touch of adversity to bring people together. A man and wife may fight each other, but in nine cases out of ten when the outsider attempts to take part in the fight, both will turn on him.

During the last winter many differences of opinion were buried under snow drifts. The industry is reaching a common viewpoint as to what is good for it. Just now there are several points of general interest before the public, especially the political public and each member of the industry should use his own political power to promote the best interests of his own industry. Each member of the industry has political power, and so has his wife. Among the ideas that need promotion are:

The Townsend bill that has been reported favorably by the Senate.

A reasonable tax law by Congress.

A drastic curtailment of Federal expenses.

A just recognition of business by Government.

Legislators and other government officials are merely human, after all. They frequently will move in the line of least resistance. Many industries are better organized for promotion of self interest that the automotive industry and, consequently, get more recognition. We believe the position taken by the automotive industry on these public questions has been the position for the greatest good to the greatest number, and each member of the industry should do all in his power to promote the common platform.

An Inventory As a Liability

IN a recent speech before a gathering of business paper editors George M. Graham asked permission to tell a short story, illustrating a point about inventories, before he began his real talk of the evening. His story was, in effect, as follows:

"This morning I arrived in New York at 9 o'clock

wearing a straw hat and found that it was raining. The rain continued to fall all day and as I moved about the city making calls, I employed taxicabs, primarily to protect that straw hat. When I had finished the day, I found that if I had started the day by throwing that straw hat under a truck and had bought a cap I would have been several dollars ahead. I am suggesting this, merely to present the view that sometimes an inventory can be a liability instead of an asset."

It would be interesting to know how many automotive concerns have made the inventory of a year ago a liability by protecting it with high sales prices.

Motorcycle Activities Abroad

ALL of the European countries which participated in the war are more or less impoverished, and, to judge by current exchange rates, the European neutrals are in a not much better position. This condition is being reflected by the demand for motor vehicles in the different countries. There is great need for motor transportation by reason of the inadequate railway services, due to different causes. The war, with its intensive industrial activity, brought home the advantages of quick travel, and the only thing that stands in the way of heavy motor car sales in Europe is the economic situation.

Speaking in general terms, Europe wants the quick transportation which the motor vehicle makes possible, but cannot afford the expense which generally goes with the touring type of car, the sport runabout or speedster. It is, therefore, natural that it should turn to the most economical type of motor vehicle known, the motorcycle. There has been a greatly stimulated interest in motorcycles in all the large European countries since the war, most of all, perhaps, in Germany. Motor vehicles are increasingly used for business purposes, and in practical work it is seldom that more than one or two persons need to be carried at a time. The motorcycle with side car provides transportation for up to three persons, and therefore meets the practical requirements of a great many people. Its economy is the result of its low weight and relatively simple construction.

In Germany the development has run to a certain extent in the direction of fitting ordinary pedal cycles with gasoline engines and driving means. It is hardly necessary to point out that this line gives very little promise of success, because a framework and wheels designed for the restricted weight and power of the rider quickly goes to pieces when subjected to the additional weight and power of a mechanical engine. The conversion plan, of course, appeals to the man who owns a bicycle, since the outlay required is very much less than that for a new motorcycle. But it is not very likely that the popularity of converted pedal bicycles will outlive the reconstruction period.

There is evidence of much thoughtful development work being done on motorcycles throughout Europe. The pressed steel frame, for instance, has made its appearance in a number of rather attractive and promising designs. By the use of pressed steel the designers may succeed in solving the problem of protecting the rider from mud and dust. Spring suspension is also receiving much attention, and this may result in a material increase in riding comfort. A large market for motorcycles in Europe is practically assured for the next several years, and technical developments will undoubtedly be commensurate with commercial activity.

A Notable Victory for the Straight Side Tire.

OWING to the fact that there is a large international trade in automobile tires and that tire renewals must be provided for cars extending through a number of countries, it is hardly conceivable that the present double standard of tire design will be maintained; that is, that both the straight side and the clincher tire will continue to be made in all sizes. The recent agitation against the straight side tire in France has brought the matter to a head, and it seems that there will be from now on persistent rivalry for supremacy. In contrast to the leading French tire manufacturer, a number of the smaller French makers have taken a favorable attitude toward the straight side tire, and one or two have even decided to manufacture it.

The greatest accession of strength to the ranks of the straight side protagonists, however, has been that of the Dunlop Rubber Co. of Great Britain, which has reached the conclusion that the straight side tire has a balance of advantages over the clincher type, especially in the larger sizes, and its chief product hereafter will be straight side, cord passenger car tires. The conversion of the Dunlop company to the straight side principle for automobile tires is particularly significant, because the design of the straight side tire is based on that of the Dunlop type of bicycle tire.

Little Manifold Heating in Europe

EUROPEAN engineers have not gone nearly so far as we have in the matter of applying heat to the incoming charge, as is evident from the article on manifolds by Messrs. Bradley and Gerster in this issue and from descriptions of European cars that have recently reached us. This may be in part accounted for by the fact that none of the large European industrial countries has the low winter temperatures that we have to contend with, but the chief reason undoubtedly is that the gasoline sold in Europe at the present time does not have the low end point that ours has. As compared with the United States, the number of automobiles in use in the different European states is comparatively small, and the demand for gasoline there does not bear the same proportion to the demand for other petroleum products that it does here, hence there is not the same temptation to convert as much as possible of the crude into gasoline. As a result, European engineers are now using about the same vaporizing and distributing devices that we used about two years ago.

June Sales Prove Gloom Untimely

New York Business Far Ahead of May

Price Reductions Start Rally Which Is Continuing Strong —Registrations Swamped

NEW YORK, June 18—Spurred by price reductions which seem to have convinced at least part of the public that automobile prices have at last been stabilized and by ideal June weather, passenger car sales in the Metropolitan territory since June 1 have run far ahead of May business, which in turn was 727 cars ahead of April.

Actual figures on June sales will not be available until the end of the month, owing to lack of daily compilation of figures in the Motor Vehicle Department, but reports from Albany show that there has been a veritable avalanche of registrations.

May registrations for ten counties in and around New York, just compiled, show a gain of 727 over April. This in itself is an illuminating commentary on the effect of substantial reductions. April had been a big month, for April, sales having been stimulated by the early spring. May started off poorly and indications at the end of two weeks were that the April total would not be reached. However, following the lead of Marmon and Jordan, price reductions followed each other rapidly throughout the month and by the fifteenth sales were running far ahead of the daily record of April and the final report showed that the last half of May had splendidly offset the slump of the first two weeks when two or three price reductions not immediately followed by manufacturers generally left the public in a state of confusion wherein purchasing was scant.

All Classes Find Buyers

An interesting study of passenger car registrations, which are equivalent to deliveries, is made possible through information contained in the Automobile Sales Analysis published monthly by Sherlock & Arnold and patronized by most of the metropolitan dealers. According to this report, registrations in ten counties in and around New York for the first five months of the year were as follows:

	$3000 and Up	Under $3000	Total
January	101	470	571
February	185	1383	1568
March	385	2919	3304
April	561	4749	5310
May	579	5458	6037

ALL COMPANIES SHARE IN HARVEST OF SALES

NEW YORK, June 21—Retail sales of automobiles in all sections of the country promise to surpass this month the record set for April and the volume of business will be materially greater than in May. The greatest sales harvest is being enjoyed by the companies which have made substantial price cuts, but it is reflected all along the line, and companies which have not made reductions are sharing.

Reports on sales conditions, gathered by correspondents of AUTOMOTIVE INDUSTRIES in distribution centers, all show that almost without exception June business is running ahead of the last two months. This seems to be true particularly in the New York and Chicago territories.

Manufacturers who were deeply pessimistic at the end of May now admit that the outlook is brighter and a considerable number declare that the orders on hand will carry their plants through the middle of July on the present production schedule.

The Goodyear Tire & Rubber Co., which announced a short time ago that the automotive industry was due for another slump and prepared many of its employees for a lay-off, has been compelled to recast its plans. There will be no curtailment of production, and there will be no extended vacation for "inventory."

The outlook, as forecast in AUTOMOTIVE INDUSTRIES of last week, is distinctly encouraging. Sales probably will slow up in July and August, but there is every reason to believe there will be a renewal of interest and a resumption of buying with the coming of September.

Detroit Sales Jump

DETROIT, June 18—Dealers handling cars on which prices have been cut, report increases in business in the last 10 days ranging from 100 per cent to 1500 per cent. On the other hand, dealers handling cars on which no cuts have been announced are not having this increase. G. O. Simons, Overland and Knight distributor, reports an increase of 200 per cent. T. J. Doyle, Dodge, reports an increase of 1500 per cent.

Best Month of Year in Chicago Opinion

Price Cut Lines Lead in Demand But All Dealers Get Share— General Outlook Good

CHICAGO, June 18—Automobile dealers in this city are almost a unit in declaring that business for June is better than for April or May. Naturally the largest business is being done by those lines which have made substantial price cuts but conditions are by no means discouraging even for dealers whose companies are standing pat on prices. Collections are good and most dealers are satisfied with the outlook for the future although they expect that there will be the usual slump in sales the last half of July and August.

Oakland sales in May were the largest in seven years, showing an increase of 175 per cent over April and the indications are that June will be as good as May. Prospects are numerous and the outlook is bright.

June sales of Oldsmobile are not as good as in April or May but the volume of business thus far in 1921 has been better than in 1920 up to June.

Overland reports a 500 per cent sales increase over April and May and already has delivered as many cars this month as in any previous month. Cash is being paid for many of the cars.

June business for Franklin will show an increase over May. Sales for 1921 have been away ahead of the first 5½ months of 1920. Collections are good.

Dodge sold as many cars the week following the price cut as ordinarily would be disposed of in two months.

Briscoe Reports Gains

Although there has been no cut in price by Briscoe, sales have increased in the last two weeks and are much better than in May or April.

June is running better than April or May for Buick than all three months last year. The Chicago company has received a consignment of 500 cars and expects to clean them out in the near future.

Other companies which report that June business is better than April or May include Mitchell, Gardner, Lexington, Hudson and Essex.

Those which say that June is equal to that of either April or May include National, Packard, Haynes, Allen, Sayers, Handley-Knight, Stevens-Duryea, Pierce-Arrow and Peerless.

Reports on Business Conditions Continued on Page 1401

Buick Re-enters Automobile Field

Pioneer Named Head of Lorraine Motors

Will Make New Car at Grand Rapids Plant—Amassed Fortune With First Product

DETROIT, June 20—David Buick of Detroit, founder of the Buick Motor Co. of Flint, has re-entered the automobile business as head of the Lorraine Motors Corp. of Grand Rapids, and has designed a new car which will be put on the market shortly. The car will be marketed as the Lorraine, although it will be an entirely different product from that which the Grand Rapids organization has been manufacturing.

Buick and his associates have secured a controlling interest in the Lorraine Motors Corp. and a strong organization already has been perfected. A. H. Wyatt, well known in automotive and financial circles in Michigan, will be associated with Buick, in addition to John J. Larkin, former sales manager of the Haynes Automobile Co. of Kokomo, Ind., who will be general sales manager, and William Hulin of Grand Rapids.

The new car, which, it is promised, will rank with the higher priced cars in body design, will sell for less than $1,200, according to an official of the company. It will be equipped with a valve-in-head engine. Buick being credited with having brought out the first engine of that type.

Since leaving the Buick organization, although interested chiefly in carbureter production, Buick has continued to experiment with engines, and the one installed in the new Lorraine is declared to include several new features. The new car will have a 115-in. wheel base and will be equipped with a carburetion system thoroughly tried and tested under Buick's direction. The first car is being assembled and will be shown at Grand Rapids within a few weeks.

Buick left the company which bears his name in 1909, after six years spent in developing it, during which time he and his associates amassed fortunes. The Buick Co. was started with a capital of $37,000, and stockholders were made wealthy when the General Motors organization was formed with Buick as a central company.

R. A. A. BACKS TOWNSEND BILL

NEW YORK, June 20—Joining forces with the National Automobile Chamber of Commerce and the Rubber Association of America, the Motor and Accessory Manufacturers Association, has sent to its members a bulletin in which it declares that the United States highway policy has reached the cross-roads and that Congress must decide whether it will adopt President Harding's recommendation for a Federal highway commission as proposed in the Townsend bill, or let things drift. The bulletin states that to eliminate the plan for a Federal highway commission, as suggested in other legislation introduced in opposition to the Townsend bill would be to rob America's new road policy of its essential strength and efficiency.

Makers and Dealers Meet Again June 30

NEW YORK, June 20—The second of the series of conferences between committees representing the National Automobile Chamber of Commerce and the National Automobile Dealers' Association will be held June 30 at the Detroit Athletic Club. William E. Metzger has been appointed chairman of the N.A.C.C. committee which was headed by W. C. Sills of the General Motors Corp., until he retired from the Chevrolet company to become distributor for the New England territory. While Metzger is a vice-president and a large stockholder of the Columbia Motors Co. he looks upon the problems of the dealer from a sympathetic viewpoint for the reason that he is a member of the company which distributes the Willys-St. Claire car in Detroit.

Employment in May Shows 4.4 Per Cent Gain

WASHINGTON, June 20—Employment figures for the month of May compiled by the Bureau of Labor Statistics showed that there was an increase of 4.4 per cent in the number of men employed in the 46 automobile plants from which reports were received. The number of employees in April was 83,566 and last month it was 87,266. The number of employees in May, 1920, was 128,982.

In its discussion of the automotive industry, the report says:

"In this industry market conditions have improved since April and the per capita earnings show an increase of 4.9 per cent when comparing April and May figures."

The only other industries which showed an increase in employment for May over April were cotton manufacturing, cotton finishing, hosiery and underwear, woolen leather and boots and shoes.

WHITE WINS TAX DECISION

CLEVELAND, June 20—In a decision handed down in Common Pleas Court this week by Judge Manuel Levine, the White Motor Co. was adjudged within the Ohio personal property tax law in deducting its Federal tax due from its total credits.

Goodyear Cuts Price On All Truck Tires

Reductions Range from 10 Per Cent on Cushion Tires to 23½ on Pneumatics

AKRON, June 20.—The Goodyear Tire & Rubber Co. has made sweeping price cuts on all motor truck tires, including both solids and pneumatics and also cushion truck tires, effective to-day. The Goodyear price cuts will average 23½ per cent on all six, seven and eight inch cord pneumatic truck tires, including the sizes most generally used on trucks and buses. Reductions on all Goodyear S V solid tires will average 12 per cent and on cushion tires the cut will average 10 per cent. Prices on pneumatic tires for trucks over eight inches and on the new all weather solid tires for trucks will also be reduced to some extent.

Goodyear is the first major tire company in the United States to announce price reductions on truck tires. Practically all companies have reduced automobile tire prices, but none outside of Goodyear so far as revised prices on pneumatic and solid motor truck tires.

"These reductions will complete the stabilization of tire prices through the entire Goodyear line, following the reduction in prices on all kinds of automobile casings and tubes announced last month," says a Goodyear statement on the subject.

Goodyear to-day recalled 1200 of the tire builders who were laid off several weeks ago. Goodyear has completely revised its announced plans for closing down the factories from June 24 to July 5 for semi-annual inventory and will keep most departments running through that period, closing them only long enough for a hurried invoice. The steady increase in dealers' orders makes necessary the rehiring of several hundred men, officials state.

Dealers' Orders Increase

Three weeks ago Goodyear announced the tire industry apparently had entered a new slump. This, it was said, had been brought about by automobile manufacturers reducing their original equipment specifications. Dealers' orders have continued to increase, however, and Goodyear reports its dealer business now will compare favorably with normal dealer business for any time in the company's history.

Goodyear declares the increase in dealers' business does not assume the phase of a spurt, but justifies the belief that business will hold up in a stabilized way and will warrant putting on more men and increasing production.

Body Makers Discuss Needs of Industry

Credits, Contracts and Inventories Considered at Detroit Convention

DETROIT, June 18—Unethical practices of customers, labor problems and wage adjustments, liquidation of inventories, raw material prices and problems of financing occupied the time of the members of the Automobile Body Builders' Association at the convention which closed yesterday.

In opening the convention, following the meeting of the executive committee Thursday morning, President E. J. Thompson, of the E. J. Thompson Co. of Philadelphia, announced that no set program had been fixed, the conditions existing in the industry at this time calling for intimate discussions and the viewpoints of all present rather than the usual addresses dealing with generalities. On account of the vital problems confronting the association and the intimate questions to be taken up, he asked for an expression regarding the advisability of a closed session, and upon motion of A. R. Guider of Detroit, the 30 members present voted to exclude all but members and a few manufacturers "invited" to participate in the sessions.

A great portion of the discussion, officials said after the meeting, centered on problems of finance. Experiences of the members in satisfying their banking connections were heard and suggestions offered for closer relation with the financiers and a spirit of more hearty co-operation in furnishing them every bit of information on which to base credit. Methods of emergency fianancing—where to get money and how to make the most of a firm's capital, also were dwelt upon at length. Chief interest, however, centered in the matter of frankness with the banker as certain to assure extension of credit where deserved.

Find Practices Unfair

The cancellation of contracts by customers and the question of past due accounts came in for serious consideration, and practices that were declared to be most unfair were shown by members in detailing their various experiences. Questions of how best to overcome the evil and the formulation of a definite policy were discussed, but no formal action taken.

The matter of uniform sales contracts also was brought up and much time was consumed on the question of establishment of repair agencies throughout the country. Bad paint jobs, due to various causes other than poor material or inefficient workmanship, brought forth much discussion and suggestions for remedies.

The liquidation of inventories was urged as the all-important question before the association, and this brought to the front the problem of prices of raw materials now as compared with last fall, and the effect of those prices on production and sales costs. Standardization of materials and the extent to which raw material manufacturers will go in financing body builders, also were discussed.

Cost of production and the influence of present labor and wage conditions were gone into, and while it was the consensus that labor efficiency has increased more than 50 per cent, further wage recessions to meet demand for reduced prices were held imperative. Problems of administration as affecting the production end also were taken up.

Members of the association following the meeting said the time was spent almost wholly in discussions, and no action of definite nature taken on any of the many problems brought out.

Legislative Activity Important, Says Graham

NEW YORK, June 17—George M. Graham, vice-president and sales manager of the Pierce-Arrow Motor Car Co., was the principal speaker of the evening at a dinner of the New York Conference of Business Paper Editors. Speaking on business, its obligations and opportunities, Graham cited some illuminating facts about the tremendous wealth of the United States, as compared with its indebtedness. He showed that indebtedness is $24,000,000,000, from which $10,000,000,000 may be subtracted as representing our loans to the Allies, while the national wealth is at least $225,000,000.000 and, in the opinion of some authorities, $350,000,000,000. Graham observed that the United States decidedly was a "going concern."

Graham declared that business must be constantly alert to present its case correctly before government authorities, citing the recent effort of the automotive industry to bring about reduction or at least prevent increase of "stigma" taxes and pointing out the surprise of Senators and Representatives when they were shown for the first time, the essential nature of the industry. Business would suffer less from discriminatory legislation, the speaker said, if it would take the pains at all times to make sure that the public and officials understood its motives and accomplishments.

OHIO STARTS IMPORTANT ROAD

YOUNGSTOWN, OHIO, June 21—Work has been started on one of the most difficult and important highway jobs in the State in Wayne, Ashland and Knox counties. It will bring this city into closer touch with Columbus and Cincinnati, and the road will be an important link in the Lincoln highway. The estimated cost is $2,250,000. It is expected that all the 48 tractors owned by the State will be used as well as 75 more trucks and a dozen large steam shovels. State Highway Commissioner Herrick will have personal charge of the work and Major Adolf Stellhorn, highway department engineer, will be second in command.

Reserve Board Bans Import Parts Loans

Holds Goods Not Readily Marketable Within Meaning of Federal Act

WASHINGTON, June 18.—According to an opinion expresed by the Federal Reserve Board here to-day, renewal acceptances to finance the subsequent storage and resale of automobile parts imported from France are ineligible for acceptance by national banks. The Board was advised that "a national bank makes acceptances covering the importation of automobile parts from France, with a maturity of 90 days, which is supposed to be sufficient to cover payment for the merchandise in France, its transit to New York, its warehousing, and subsequent sale from warehouse. It is found, however, that before the transaction has been completed by the sale of the merchandise, that the 90-day period has expired."

In reviewing the case, the Board said that it appeared from the letter that the importer was drawer of the original drafts and was to be the drawer of the renewal drafts and that at the maturity of the original acceptances the parts had already arrived in the United States and were stored in warehouses pending resale by the importer.

It was said that section 13 of the Federal Reserve Act does not confer authority upon national banks to accept drafts growing out of the storage of goods other than "readily marketable staples," and automobile parts cannot be regarded as readily marketable staples within the meaning of this section. Consequently, if the drafts are to be secured by warehouse receipts covering the automobile parts, that fact would not of itself make the drafts eligible for acceptance by national banks. The drafts are eligible for acceptance only if and upon the ground that they can be said to grow out of the importation of the automobile parts within the intent of section 13.

McSHERRY IN RECEIVERSHIP

SPRINGFIELD, Ill., June 17—Alleging that the McSherry Mfg. Co. has liabilities exceeding $175,000, L. N. Rosenbaum, of New York City, filed a petition for receivership to protect his credits of $27,000. Judge E. S. Smith has named Joseph F. Bunn and E. H. Holbrook receivers. The petition sets forth that under the receivership, the firm with $400,000 assets will be able to meet its creditors. Capital stock is $1,400,000.

JOIN MOTOR TRUCK MAKERS

CHICAGO, June 18—The Atterbury Motor Car Co., Buffalo; the Federal Motor Truck Co., Detroit; the Selden Truck Corp., Rochester, and the Stewart Motor Truck Corp., Buffalo, recently have become members of the Motor Truck Manufacturers' Association.

Endurance, Economy; Most Sought in Car

N. A. C. C. Poll Shows Price Consideration Ranking Fourth—Speed Little Sought

ATLANTA, June 18—"Endurance is the most popular, and economy the second favored feature of the motor car, according to a nation-wide poll of motorists," said J. C. Long of the National Automobile Chamber of Commerce, speaking before the Associated Advertising Clubs of the World in session here.

"Comfort is the third consideration, followed by price. Speed and distinctive refinements have little interest for the average purchaser.

"These conclusions are the compiled returns from question cards sent to car owners in all sections of the United States by the National Automobile Chamber of Commerce, asking motorists to express their relative preference concerning the following features of a car: Appearance (general), appointments, comfort, economy, indorsement of other owners, endurance, flexibility, hill climbing, price, service (good local repair shops), specifications, speed."

"Buying points," said Long, "rather than selling points, are the important considerations to-day; and this poll of the customer should prove a helpful guide to both engineer and advertiser.

"Returns from 20 States, covering more than 30 makes of cars, on the index basis of 100 give the following emphasis to the different buying points:

Endurance 15; economy 14; comfort 9½; price 9½; appearance 8; service 7½; hill climbing 7; flexibility 6½; endorsement of others 6½; specifications 6; speed 5½; appointments 5.

"Fifty-one per cent of the voters said they were not interested in slogans. Forty per cent did not comment on this point, and of the remaining 9 per cent many specified that they were interested in lines which referred to motor transport in general, such as 'Drive Carefully.'

"Twenty-three per cent of this poll expressed an interest in specially featured parts, such as motors and springs, but 48 per cent were not interested, and 29 per cent were non-committal."

REES BUYS ATTICA PLANT

COLUMBUS, June 21—The Rees Motor Co. has purchased the plant of the Halladay Motors Corp. at Attica, Halladay having moved to Newark, Ohio, and it is the intention of the Rees organization to build a four-cylinder passenger car to sell for $1,450. The bore will be 2¾ in. and stroke 5⅛ in. Ignition will be by Atwater Kent system and the starting and lighting, Dyneto.

PAIGE ADDS DAYTONA ROADSTER

DETROIT, June 18—Following the record made at Daytona by the Paige 6-66, the Paige-Detroit Motor Car Co., has added a new body to the line on that chassis, this to be called the Daytona Roadster. It is primarily a sportsman's job but the skeleton equipment ordinarily found on racy-type models is replaced with comfortable seats and equipment. There is an auxiliary seat on the side of the body with foot rest on the aluminum step. Wheels are wire with 33x4½ cord tires. The finish is deep red for the body, wheels enameled in blue and other running gear black. Other equipment includes bullet side lamps, cowl ventilator, safety latches on doors, electric clock and muffler cutout.

Lexington Cuts Prices $200 to $600 on Line

CONNERSVILLE, IND., June 20—Reductions in the prices of its cars were made to-day by the Lexington Motor Co. The reductions, ranging from $200 to $600, will be effective immediately. They cover all Series "S" and Series "T" models, the former being equipped with Continental motors and the latter with the Ansted engine which was used in the Lexington specials that won both first and second honors in the two major events at the Pikes Peak hill climb last Labor Day.

Comparative table of new and old prices follows:

Models	New	Old
"S" Touring Car	$1885	$2285
"S" Thorobred	1985	2285
"S" Lex-Sedan	2185	2785
"S" Coupe	2750	3250
"S" Sedan	3150	3350
"T" Touring Car	2785	2985
"T" Sedanette	3750	4150

Martin-Parry Reduces Prices on Ford Bodies

NEW YORK, June 20—The Martin-Parry Corp., manufacturers of light commercial bodies with plants at York, Pa. and Indianapolis, has made another reduction in the prices of commercial and farm bodies for Fords. This reduction amounts to 10 per cent on certain models and became effective to-day. The Martin - Parry factories are operating on a good volume of production and officers of the corporation are confident that the business of their dealers and branches will be stimulated by this price revision.

STANLEY MAKES BIG CUT

BOSTON, June 16—The Stanley Motor Carriage Co. of Newton announces a cut in prices of all models of the Stanley car, the reduction averaging 33⅓ per cent. The reduction on the open models announced to-day is $1350 and follows a cut of $925 which was made last October.

PAN AMERICAN PRICE CUT

DECATUR, ILL., June 20—Prices on Pan-American cars have been reduced $250, the new prices to become effective at once. Both the roadster and touring car are now priced at $2,000.

Many New Models to Make Fall Bow

Era of Keen Competition Seen in Efforts to Induce Sales—G. M. C. Lines Active

NEW YORK, June 20—Much interest is being manifested in the industry in the unusually large number of new models which will be brought out in the late summer or early fall. They presage a new era of keen competition which close observers believe will give a new stimulus to the automotive trade. These new models are evidence that the manufacturers do not propose to depend entirely upon price inducements to get business.

The General Motors Corp. will be particularly active in the presentation of new models this year, and they will take in practically all the General Motors lines, including Cadillac, Oldsmoble, Scripps-Booth and Buick.

There is much speculation concerning the Durant line, which will be put on the market in the fall. The Durant four cylinder car has been promised for Aug. 1. Preliminary work on it has been completed and persons who have seen the car declare it a very high class job for the price at which it will sell.

The Sheridan, which recently was purchased from the General Motors Corp., will be converted into a six cylinder instead of a four. Experimental work on it is now under way at Long Island City. Except for the engine, the car will be practically the same as at present.

Experimental work on the Collins car now is being carried on in Detroit by R. H. Collins. The car will be developed along lines of his own and he will be given a free hand by Durant.

Reports from Detroit are to the effect that orders for the Lincoln car are coming in faster than they can be filled. The Lelands had considerable difficulty in really getting under way, but now that business actually has been given a substantial start, the car is creating something of a sensation.

The new Chrysler six which will be turned out at the big new plant of the Willys Corp. at Elizabeth probably will be put on the market in the late fall. It is understood that experimental work on it has been virtually completed and that it is entirely satisfactory to the Willys organization.

SARLES DUESENBERG WINS

GERMANTOWN, Pa., June 18—Roscoe Sarles, driving a Duesenberg car, won the 225 mile trophy race at the Uniontown speedway to-day. He averaged 97.75 miles an hour. Eddie Hearne, in a Revere Special, was second. His average was 97.25 miles an hour. Eddie Miller in a Duesenberg was third; Tom Alley in a Frontenac fourth; Alton Soules in a Frontenac Special fifth; Jimmie Murphy in a Duesenberg sixth; Frank Elliott in a Leach Special seventh, and Tommy Milton in a Frontenac eighth.

Buick Extends Work to Meet Heavy Sale

Production Now Over 250 Daily —Expect Steady Operation Through Winter

DETROIT, June 18—Orders are coming in from all sections of the country in good volume according to Buick Motor Co. officials. As a result production has been increased slightly and General Sales Manager E. D. Strong said to-day the plant now was hitting better than 250 daily. This is slightly in excess of the output for the past two months which ranged between 200 and 250. A driveaway of 500 cars destined to the Chicago dealers left the Buick factory Wednesday.

More than 11,000 employees now are at work in the Buick factory, according to President Bassett, and the factory is operating practically on a normal time schedule. Demand for cars has taken a decided leap, President Bassett said, and in increasing production it will be the policy to increase the working hours rather than add men to the force.

Despite the sharp jump in the sales demand, Buick officials are not to be stampeded and Sales Manager Strong said production at all times would be strictly in conformity with demand. "We are going to continue operation under this plan of building and we expect to be working next winter as steadily as we are to-day," said Strong.

Cars for all adjacent cities are being driven away from the factory, but the more distant points are being served by the railways. On Wednesday, the same day the 500 cars left overland for Chicago, a shipment of 300 was sent out by train to eastern dealers.

While all of the factories which have announced price cuts have reported increases in orders, the few which did not join in the price slash also declare they are experiencing good business right now.

Ford Sales on Coast Run Far Ahead of 1920

PORTLAND, ORE., June 18—Nearly 50 per cent more new Ford cars were sold in the city of Portland during the period from Jan. 1 to May 20 this year than during the same period of last year. In that time a total of 1212 new Fords were delivered by the Ford factory branch to the six authorized retail Ford dealers of this city. The Ford branch is now 355 cars behind.

Last year, for the same period, 851 Ford cars were delivered, this spring's business showing an increase over last of 361 cars, or an increase of about 40 per cent. Sales throughout the entire state of Oregon show a distinct increase for the Ford this year. Taking the state as a whole each month from January to June has shown an increase of from 40 to 62 per cent.

WAGON MAKING DROPS TO HALF 1914 TOTAL

WASHINGTON, June 18—A preliminary statement of the 1920 census of manufactures with reference to the manufacture of carriages and wagons, together with the materials used in the production of the completed vehicles, shows that the number of establishments engaged in this industry is rapidly decreasing. Reports were received from only 2666 in 1919, as compared with 5286 in 1914. The number of vehicles manufactured in 1919 was 695,200, valued at $66,083,000, as compared with 1,177,400 valued at $72,284,000 in 1914. The decline in the industry is due almost exclusively to the increasing use of passenger automobiles and motor trucks.

Vim Truck Operating on 14 a Day Basis

PHILADELPHIA, June 18—Formal announcement is now made by the Vim Motor Truck Co. that it has been taken over by the Standard Steel Car Co. of Pittsburgh and is now being operated as a subsidiary of that concern.

Harold B. Larzelere, vice-president and general manager of the Vim Motor Truck Co., will continue in that office. He says that the plant is now working at about 20 per cent of capacity and producing 14 trucks a day.

The Standard Steel Car Co. manufactures steel cars and automobiles and, in addition to its interests in the Vim company, controls the Middletown Car Co. and the Baltimore Car & Foundry Co. John M. Hansen, the president, is also a director and a member of the executive committee of the Baldwin Locomotive Works.

ONEIDA INCREASES OUTPUT

GREEN BAY, WIS., June 18—The Oneida Motor Truck Co. resumed operations on June 6 on a production schedule of 30 to 50 trucks per month, with a working force of about 60 per cent of the normal prior to the shutdown several months ago. Shortly after Jan. 1 it was found necessary because of business conditions to reduce the force 75 per cent or more. New business booked during the last six to eight weeks and orders for future delivery have enabled a resumption.

DUPLEX EXTENDS OUTPUT

LANSING, MICH., June 20—Renewed activity is shown in the plant of the Duplex Truck Co., which now is running three full days each week. Developments at the plant lead officials to believe the next two or three months will show rapidly increasing business. A recent order for three passenger motor buses from the South Bend-Elkhart Motor Bus Co. is reported as an encouraging sign.

Thousands to Attend Fargo Tractor Test

Leading Companies Enter Machines for Demonstrations of Power Efficiency

CHICAGO, June 20—Reports from Fargo, N. D., indicate that the demonstration of tractor and horse farming, scheduled for that city June 28, 29 and 30, is attracting wide interest in the Northwest and that a big crowd of farmers and dealers will attend the demonstration. The fact that an effort will be made to show the efficiency of the average tractor and that horse teams will be put at the same work as tractor outfits, not in competition, but in such manner as to leave the onlooker free to draw his own conclusions, has aroused wide interest.

The expectation of large crowds is borne out by the demand made upon the housing facilities of Fargo. There is reason to believe that the capacity of the city will be taxed and hundreds of farmers are planning to drive to the demonstration with their families and camp out along the Red or Cheyenne rivers for the three days of the demonstration. Excellent camping facilities have been provided.

Among the companies that will be represented are the following: International Harvester Co., Avery Co., Emerson-Brantingham Co., Aultman & Taylor Machine Co., Advance-Rumely Co., Rock Island Plow Co., J. I. Case Plow Works Co., J. I. Case Threshing Machine Co., Hart-Parr Co., Eagle Mfg. Co., Liberty Tractor Co., Meadows Mfg. Co., Oliver Chilled Plow Works, Ford Motor Co., American Industrial Development Corp., Paris, France; Hyatt Roller Bearing Co., Timken Roller Bearings Co., Cole Mfg. Co., Minneapolis Steel & Machinery Co., Townsend Mfg. Co.

MOTOR PARTS PLANT STARTS

BRISTOL, CONN., June 18—Motor Parts Corp. has bought the Garrigus plant on Riverside Avenue from the Bristol Machine Tool Co. and will manufacture parts for automobiles. The Bryce plant in Forestville has been taken over by the new concern, which was recently capitalized at $1,100,000 and, commencing to-day, will begin operations with a full complement of employees. Residents interested in the corporation are Frederick N. Manross, John F. Wade, John W. Bryce, Charles H. Curtiss and Roger S. Newell.

REPORT TRADE IMPROVEMENT

SPRINGFIELD, OHIO, June 18—At a conference held recently with E. H. Gilcrest, general sales manager for the Westcott Motor Car Co., the members of the sales force in attendance reported general improvement in business conditions is noticed and that there is a steady increase in sales. The Westcott company is increasing its force.

ALL SECTIONS REPORT SALES GAINS IN JUNE

Milwaukee

MILWAUKEE, June 18—The Ford Motor Co. branch here showed sales of 4000 cars in April, but this was limited by capacity and output. May sales were 5100 cars and June is certain to reach the same figure. Sales for July are expected to reach 4000. This branch covers 51 counties, or the largest part of Wisconsin. The Milwaukee Retailers' Association is just completing a survey of the local field. President Tom C. McMillen, who heads Overland sales here, said to-day:

"General business conditions in Wisconsin apparently are better than in adjoining States. This is reflected in the automobile market and affects all priced cars favorably except those that have not revised price schedule. Distributors are finding the market good immediately following price reduction announcements. The increased sales in Milwaukee clearly demonstrate that the public was waiting for reductions."

Minneapolis

MINNEAPOLIS, June 17—No doubt exists that the automobile business has improved the first half of June over the two preceding months. A difference of opinion exists as to the percentage of gain. One of the biggest distributors of moderate priced cars put the gain at 30 per cent. At the branches and agencies where prices have been cut and where some models have been out of alignment, especially in the smaller popular sizes, the new prices have stimulated buying. Business still is better in the larger towns than in the country districts for the money situation has not loosened up enough yet to make large buying possible to small dealers.

Des Moines

DES MOINES, June 17—June retail sales show material improvement over April and May. Conservative dealers attribute this to stimulation of business by price cuts. Those cars which made cuts during the past 30 days have had a brisk business. Dealers are perplexed as to whether or not stimulation is permanent or temporary but are inclined to believe that the next 30 days will see more or less activity followed by a letting down, although the stagnation of spring is not expected. Two distributors whose companies made material price cuts report their stocks completely cleaned out.

Kansas City

KANSAS CITY, June 20—Dealers whose prices have been reduced are selling cars in volume—one such dealer being reported to have accumulated orders for delivery as late as August 1.

On the other hand, some dealers who have guaranteed prices for the year are said to be in an embarrassing position, with sales temporarily almost suspended, and danger to them whether the price is cut or not.

Weather has been good for country driving, with renewed interest in motoring, and consequent increase of attention to cars by prospective purchasers, the chief benefit accruing to country dealers.

Columbus

COLUMBUS, June 20—Under the stimulation of price reductions and better industrial conditions, business in passenger cars in Columbus and central Ohio territory has shown remarkable increases in the past few weeks. Practically all dealers are sharing in the better business.

The public apparently had been waiting for the reductions and immediately stepped into the market and purchased freely. Dealers report a larger number of prospects, many of which are considered high class and likely to be new owners.

In the rural sections there is still some slowness reported although some increase in sales is reported from the dealers in the larger towns. Farmers are now busy with their crops and have little time to look around. With their crops in, it is believed there will be better business in the rural sections.

The truck business is still quiet and the public is apparently waiting for price reductions.

Indianapolis

INDIANAPOLIS, June 17 — Retail sales here show a slight improvement thus far in June over April and May of this year. The average increase is about 10 per cent. The increase actually is more marked on those cars in which price reductions were made. Dealers in handling cars on which price reductions have been made say that for a month or six weeks following cuts a decided increase in sales can be seen but the rate soon decreases. Larger increases are shown by the medium and low priced cars. Dealers in high priced cars report only a slight increase over the two preceding months and in some cases no increase at all.

Boston

BOSTON, June 17—Retail automobile sales during the past few weeks have improved compared to April and May. The dealers whose makers had cut prices found that people who had been holding off came in and closed up orders. There were a number of new orders booked from others who were not on the lists of prospects. All dealers have not been selling as largely as a year ago, of course, but when an average is made of the entire motor district, balancing up the sales of high and low priced cars, and those which have cut with those which have not, the conditions in the trade are much better than a month ago, when there was a lull after the show orders and prospects had been cleaned up.

Portland, Oregon

PORTLAND, ORE., June 18—Sales of new automobiles in Portland during May totaled approximately one and one-half times as many as during April, according to the record of new licenses secured during the two months. Whether June will show further increase or will run behind May in volume is matter of speculation and too early of determine. The record of new licenses, while not showing absolutely in volume of sales for new cars, forms an excellent basis of comparison. According to the record April sales of new cars totaled 444 while May sales totaled 681. In each case slightly over half were Fords.

Recent price reductions have increased activity in some lines, particularly Dodge, but daily license reports indicate that so far all makes concerned reductions have had no marked effect yet in total sales.

Los Angeles

LOS ANGELES, June 17—Stimulated by price reductions, retail automobile sales now are more numerous than in the corresponding period of May or April but indications are that this condition will not continue long. Immediately following price changes, salesmen bore down on every prospect who could be swayed and obtained signed orders. This number now is about exhausted and already a slackening is evident. Business right now is very good and June will be an excellent sales month but southern California has led the entire United States throughout the year and the present cannot be taken as a criterion for the future when the existing impetus will have passed.

Denver

Denver, June 18—Automobile sales in the Rocky Mountain territory have been upset by abnormal conditions due to price unrest and disastrous floods. Some distributors who had a big April and May, report June sales about 40 per cent as good. Some are better and many worse. Few lines are gaining through the new price drop while others are losing in same price class without a drop. Intensive selling is helping two particular makes with price stabilized since a reduction in January. Dealers take the view that the unrest and readjustment are inevitable and hope for an early improvement.

Spokane

SPOKANE, WASH., June 20—The motor trade has improved substantially in Spokane and begins to approximate conditions before the slump. A point in case is the Marsh-Strickle company which placed 19 cars and trucks during the week ending June 4. Improved general conditions and the advent of exceptionally fine weather have combined to stimulate trading.

Durant Plans Ready for Plant on Coast

Will Have Capacity of 20,000 Cars Yearly—Will Not Buy Truck Company

NEW YORK, June 20—R. C. Durant, president of Durant Motors of California, started back to the coast to-day after a brief visit to this city for a discussion of plans for the Oakland plant. He was accompanied by C. M. Stevens, who will be sales manager of the California company.

A site has been purchased in Oakland for the assembly plant, which will have a capacity of 20,000 cars a year. Plans for the building have been practically completed. The factory will be similar in design to the main assembling plant on which work has been begun at Lansing. It will be about half the size of the Lansing plant, which will cost $3,000,000, and have a capacity of 40,000 cars a year. The Oakland building will be 600 feet long and will have three wings besides a large storehouse and an administration building, which will be located in front of the main plant.

The Durant plants at Lansing, Oakland and Long Island City all will be used for assembling. Practically all the parts of the car will be purchased from other manufacturers for the present, but Durant proposes ultimately to build many of them in a factory of his own. The location of this plant has not been decided upon, but it is quite possible it will go to Flint, which has been promised one of the Durant factories.

Reports that Durant contemplates the purchase of some widely known truck company are without foundation. He has not lost his faith in the future of commercial motor vehicles, but his interest will be centered for the present upon passenger cars. A line of trucks ultimately will be added to the Durant products, but it will not be until the outlook for sales in this field is brighter than it is now. He has definitely decided not to undertake the manufacture of tractors or other farm machinery.

Assertions made recently in Wall Street that Durant was buying stock of the Studebaker corporation for speculative purposes were incorrect. Most of the stock he bought was as an investment, and it is now held by Durant Motors, Inc., which is authorized as a holding company to buy the stocks and securities of other companies. It also has in its treasury a considerable quantity of General Motors stock.

Four Durant Companies to Issue Securities

LANSING, MICH., June 18—On account of the fact that Durant Motors, Inc., is to have four distinct branches, Durant Motors, Inc., a Delaware corporation; Durant Motors, Inc., of New York; Durant Motors, Inc., of Michigan, and Durant Motors, Inc., of California, the Michigan Securities Commission has issued an order that all brokers and salesmen for Durant Motors stock must designate to the purchaser in which of the four corporations the stock offered is included. At present two of the corporations are organized and approved, the Delaware and New York concerns. The proposed Michigan company has not yet been incorporated and the same is true of the California company. In each of these cases, however, the only difference is in the designation of the State in which the company is incorporated.

According to information given the Securities Commission, the Delaware company is the holding corporation of the Durant chain. The New York company will manufacture automobiles for the territory east of the Alleghenys. The California company will supply the Pacific Coast and Mexico, and all of the central part of the country between the mountain chains will be served from the Lansing plant where parts will be manufactured and cars assembled.

At present only Durant Motors stock of the Delaware corporation is being offered in Michigan.

Reo Opens Coast Branch, Sales Officials Change

DETROIT, June 20—Several changes are announced in the Reo organization, including the establishment of a branch house in San Francisco to handle business in California and along the Coast, and to serve as an export basis for the Pacific islands and the Orient. Carl Parker, manager of the Lansing-Reo branch, has been transferred to the sales organization at the factory and is succeeded by George Hopkins.

The California branch will be managed by P. L. Emerson, who has been an assistant to Sales Manager R. C. Rueschaw and an auxiliary to the branch in California, a large wholesale and retail establishment in Los Angeles will be under the management of Byron C. Foy, now assistant manager of the Detroit-Reo branch. C. P. Green of the engineering department will be in charge of service at the San Francisco branch. Establishment of the Western branch completes a chain in Reo branch houses extending across the continent, the others being at New York, Detroit and Chicago.

MACK BRANCH FOR HOUSTON

HOUSTON, TEX., June 20—The International Motor Truck Corp. is planning to establish a factory branch here. This was announced this week when J. George Truelson, formerly of Dallas, was made district Southwestern manager for the company. The branch here will take care of business in Mexico and the Southwest generally, it was said. Company officials declare there is a fine business prospect in Mexico and the rail and water shipping facilities here cause the factory branch decision. The company has factory branches at Dallas and Fort Worth.

New Driggs Car Near Manufacturing Stage

New Haven Product Is Designed for Fuel Economy—Weight 1600 Pounds

NEW HAVEN, CONN., June 21—The production of a new four-cylinder car will shortly be started at the New Haven plant of the Driggs Ordnance & Mfg. Corp., of which L. L. Driggs is president. The car is called the Driggs and sells for $1,175 in the touring model and $100 more for the special roadster. The Driggs Ordnance Mfg. Corp., while a newcomer in the automobile manufacturing field, has behind it extensive experience in the manufacture of ordnance and automobile parts.

The new car has been designed for minimum gasoline consumption. While rated at about 11 S.A.E., the engine actually delivers 18 hp. The bore is 2⅝ and the stroke 4½ inches. Several tests made with the experimental cars convince the manufacturers that the machine under tolerably good conditions will run at least 30 miles to a gallon of gasoline. When fully equipped, the car weighs only a trifle over 1600 lb.

The engine is three points suspended. Ignition is by battery, with the option of a magneto for use abroad. Lighting and starting are by the Gray & Davis system. The clutch is a Borg & Beck dry disk, while the transmission is of the selective type, with three speeds forward and one reverse. Service brakes are of the contracting type, emergency brakes expanding.

The front springs are semi-elliptic, but the rear springs are of the cantilever type, extending from the rear end of the frame forward to the axle. The company will manufacture its own rear axles, which are of the three-quarter floating type, with taper roller bearings. The front axle is the drop forged I-beam type, also with roller bearings.

The pump and splash system of oiling is used, and cooling is by the thermosyphon method. The gasoline tank, of 10 gal. capacity, is located in the rear, with vacuum feed to the carburetor. Steering is to be standard left hand, although the right hand drive may be had at an additional charge. All bodies (including a sedan) are mounted on the 104 in. wheel base chassis.

SEVERIN PETITION FILED

KANSAS CITY, June 20—An involuntary petition in bankruptcy has been filed in the Federal Court against the Mokaw Motor Co., makers of the Severin car, by the Equipment Co., the Mutual Motors Stores Co., the Ever Ready Tire & Service Co., the Thomas Cusack Co. and Price Cary, whose claims total about $1,500.

The Mokaw company succeeded the Severin Motor Co. several months ago. A hearing on the petition will be given next week.

Banks Arrange Plan to Finance Willys

Proposal Calls for Underwriting $20,000,000 in Mortgage Bonds at 8 Per Cent

NEW YORK, June 22—After a series of conferences extending over several months, the bank creditors of the Willys-Overland Co. have agreed upon a plan for refinancing the company in such a way that its overdue bank loans, amounting to $21,000,000, can be paid. The proposal calls for the underwriting by a strong banking group of approximately $20,000,000 in first mortgage, 8 per cent bonds. This will provide funds to pay the bank loans, and with the cash now on hand, which approximates $10,000,000, the company would be in a strong financial position.

It is assumed a similar plan will be adopted for the Willys Corp. and the Moline Plow Co., both of which are being directed by creditors' committees.

Announcement that this plan has been decided upon by the bankers' committee makes it evident that more than three-fourths of the preferred stock outstanding has given its consent. The preferred stock of all the Willys companies contains the provision that without the consent of 75 per cent of the amount outstanding no mortgage can be placed on its property and that neither the parent company nor any subsidiary company can place any mortgage on its property or create any stock having priority over or on a parity with the present preferred stock or dispose of any material part of its property. Preferred stock has preference as to assets as well as to dividends, and in case of voluntary liquidation is entitled to 110 per cent and accrued dividends.

The Willys-Overland preferred stockholders must consent to any similar plan for the refinancing of the Moline Plow Co., which is to all intents and purposes a subsidiary. Willys-Overland does not control the Willys Corp. Three distinct banking groups are involved in the transactions.

Chrysler Division Separate

Under the new financing plan, it is understood, the huge new plant at Elizabeth, N. J., where the "Chrysler six" is to be built will be made a separate division. It is now a part of the Willys Corp. but there is reason to believe it ultimately may be taken over by Walter P. Chrysler, executive vice-president of the Willys enterprises.

Another plan under serious consideration is the merger of the Auto-Lite Corp. and the New Process Gear Corp., which also are parts of the Willys Corp.

The Elizabeth plant was nearing completion when the depression began and at the behest of the bankers production in it was deferred until the market outlook became more favorable. This project is one close to the heart of Chrysler but it is now about the only unprofitable Willys unit, for Auto-Lite and New Process Gear are reported to be doing an excellent business. If these two companies are merged and the Elizabeth plant sold to Chrysler, all the Willys enterprises may be brought together into one company under the original plan of the bankers, announced in AUTOMOTIVE INDUSTRIES several months ago.

Townsend Presses Senate for Passage of Bill

WASHINGTON, June 21—Senator Townsend is pressing the Senate for the immediate consideration of his bill to provide for the establishment, construction and maintenance of a post road and interstate highway system under the direction of a Federal Highway Commission. The reports of the majority and minority members of the Senate Committee on Postoffices and Post-roads were submitted to the Senate and were ordered printed on Monday. It is expected that the measure will be enacted within a few weeks. For the majority, Senator Townsend submitted the report favoring the continuation of Federal aid in the construction of highways for two years.

In discussing the need of highways and the importance of the motor vehicle, the committee stated:

"A new era in transportation confronts the United States. An evolution of far reaching social, political and industrial importance has been effected through the constantly growing use of highway transport. The modern vehicle has rendered obsolete old methods of highway construction. The question is no longer local alone in application; it is national. Obviously, our highway policies must be broadened and strengthened to meet this changed condition if public expenditures are to be conserved and the best interests of the nation cared for. Living costs can be reduced, our defense strengthened, and a new spirit of nationalism created, if we use intelligently this new means of communication between communities and states."

The report of the minority dissenting from the report of the majority was regarded as an appeal to prejudice in the interest of the farmers, and a defense of the present law which President Harding and others have condemned.

FORM NEW REYNOLDS COMPANY

DETROIT, June 17—The Reynolds Truck Co., Mt. Clemens, Mich., an outgrowth of the Reynolds Motor Truck Co., which went into receivership last spring, has been incorporated with a capital of $75,000 and approved by the Secretary of State. Albert Schott is president, Fred B. Schott, vice-president, and L. F. Wolf, secretary-treasurer. These officers were stockholders in the old concern. Charles Kennan of the Service Garage at Mt. Clemens, who purchased the property of the former company, is sales manager. Kennan said yesterday there is sufficient material on hand to permit the manufacturing of 150 trucks.

Big Plants Speeding to Meet Sales Push

Notable Increases Are Made at Dodge and Chevrolet in Recent Weeks

DETROIT, June 21—The influence of recent price reductions is reflected in increased production in Michigan factories, notably Dodge and Chevrolet. The big Dodge plant is turning out an average of 425 daily as compared with an average of 288 in May. Chevrolet is maintaining its schedule of 176 daily against an average of 118 in May. Buick, which ran around 250 daily in May, now is hitting near 300.

Ford is running to capacity, maintaining an average of 4100, and Ford officials said the present schedule would be maintained indefinitely. Paige, according to W. K. Towers, advertising manager, is keeping to its schedule of about 35 daily which was also the May average. Packard is building on a schedule of 1000 single sixes in June as compared with 800 in May, and Cadillac is running about the same as last month, which is around 55 daily.

Studebaker is producing about 335 daily in Detroit and South Bend against 292 in May. A slight increase is reported at the Oakland factory and by Hupp. Olds Motor Works are producing at about the same ratio as in May, though the month's total will be greatly increased because the plant was down several days in May. Reo also is continuing on its May schedule.

The Maxwell and Chalmers plants, which built 50 and 20 daily in May are now producing in conformity with the increased demand though officials will not give out actual figures. Brisk demand for Hudson and Essex compelled a speeding up in production and officials say reports from all sections indicate an improved market. One train of 40 cars left the factory for Chicago last week carrying Essex touring cars.

Tire Makers to Promote Straight Side Use Abroad

NEW YORK, June 22—Subjects of interest to the entire industry were discussed at a meeting of the executive committee of the tire manufacturers' division of the Rubber Association of America at Atlantic City last week. One of the most important was the request of Secretary of Commerce Hoover that the association co-operate in the gathering of statistics covering inventory, production, sales and production capacity. Members of the committee expressed a willingness to work with the Department of Commerce so far as possible. Much interest was displayed in foreign trade and a program was adopted for the promotion of straight side tire sales in other countries. Discussion was continued on various phases of standardization.

Decrease in Exports Due to Short Credit

Automotive Shipments Abroad Far Below May, 1920, Figure —All Lines Hit

WASHINGTON, June 20—Further decline in the volume of foreign sales in automotive products is revealed in the report of the Department of Commerce on export conditions during May. The falling off of export business affected all branches of the trade because the sales of cars, parts and engines were at very low ebb. Foreign trade experts attribute the decline in all commodities to inadequate credit facilities and problems of international finance.

Despite the fact that promotors of foreign trade are optimistic, the economic story revealed by the statistical studies show other tendencies. For instance, shipments of commercial cars during May of this year numbered 462, with a value of $794,699, as compared with 3194 cars and a value of $4,858,026 for May of 1920. These figures show a slump of more than $4,000,000 in one item. Total shipments of trucks for the eleven months ending May, 1921, amounted to 17,180, with a value of $28,980,721, and for the same period last year there were 21,659 commercial cars exported with a declared value of $37,361,182.

Shipments of passenger cars fell off at a more alarming rate. The export records show that 2479 passenger cars with a declared value of $2,973,334, were exported during May, 1921, while in May, 1920, the exports of passenger cars amounted to 14,990, with a value of $16,434,244.

Exports of automotive parts, not including engines and tires, during May of this year, were valued at $3,204,723, as against $8,382,749 in May, 1920. Despite this reduction, the total value for the eleven months ending May, 1921, was greater than the corresponding period of 1920. The same condition exists in respect to airplane shipments.

The most significant decline in volume of engine reports was that of tractor engines, as exports for May, 1921, amounted to 18 engines, with a value of $34,108, as compared with 2286 engines and a value of $2,475,346. The eleven months total of 13,366 tractor engines stacked up fairly well with the corresponding period of last year, when 18,522 engines were sold abroad.

Exports of Automobiles, Airplanes, Trucks, Farm Tractors, Motorcycles and Parts for May and 10 Previous Months

	May				11 Months Ending May			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	17	$214,000	7	$29,500	59	$430,694	63	$446,455
Airplane parts	..	198,633	..	37,673	..	633,827	..	186,603
Commercial cars	3,194	4,858,026	462	794,699	21,659	37,361,182	17,180	28,980,721
Motorcycles	4,324	1,144,467	564	178,686	32,484	8,860,537	24,157	7,631,945
Passenger cars	14,990	16,434,244	2,479	2,973,334	102,786	110,897,663	82,466	101,720,480
Parts, not including engines and tires	..	8,382,749	..	3,204,723	..	58,863,464	..	65,198,078

Engines

	May				11 Months Ending May			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	3,965	$615,771	1,202	$248,637	35,305	$5,389,282	13,631	$2,536,811
Marine, gas	1,368	390,850	357	113,038	9,147	3,154,036	6,588	2,470,303
Stationary, gas	3,260	578,180	688	136,184	25,752	3,948,332	22,664	4,374,253
Tractor, gas	2,286	2,475,346	18	34,108	18,522	17,731,655	13,366	13,445,300
Total	10,879	$4,060,147	2,265	$531,963	88,726	$30,223,305	56,249	$22,826,667

JUGO-SLAVIA HAS 2000 CARS

WASHINGTON, June 18—Official figures for the year ended April 24, 1920, showed the number of motor vehicles in Jugo-Slavia to consist of the following: Passenger cars, 1592; trucks, 274, and motorcycles, 290, according to a report received from Vice-Consul Don S. Haven, Belgrade. The figures do not include about 2000 cars of all classes under the control of the Ministry of War. A German concern has recently put 100 trucks on the local market, but a close estimate of the increase in motor vehicles for the past year does not exceed 400 passenger cars and 200 trucks.

New Interests Propose Angus Sanderson Deal

LONDON, June 10 (By Mail)—The British licensee for the Dutch Spyker car has come to the rescue of the Angus Sanderson Co. with a financial proposition which probably will be accepted. He proposes to build the Spyker car together with the Angus Sanderson in the new plant of J. Tylor & Son, Ltd., engine builders, at New Southgate. He agrees to buy the Tylor assets for $625,000, provide $450,000 to finance the project and guarantees unsecured creditors 25 per cent of their claims in cash and 15 per cent of the profits until they are liquidated.

BETHLEHEM TO MAKE WHEEL

BETHLEHEM, PA., June 22—The Bethlehem Steel Corp. is entering the automotive field with the development of a steel wheel for light and heavy motor trucks. This wheel is being made by a special process and has not developed to a point where it can be placed on a commercial basis, but experiments with the wheels are being made on trucks in various parts of the country and the results thus far have been so successful that the corporation expects to have the wheel on the market in a short time.

TO DRAFT OIL STANDARDS

WASHINGTON, June 21—Conferences will be held here July 2 by the Technical Committee on Standardization of Petroleum Specifications, for the consideration of specifications under which the Government purchases gasoline, fuel and lubricating oils.

British Trade Shows Heavy Falling Off

LONDON, June 10 (By Mail)—In May Great Britain imported 425 cars, 137 trucks and 305 chassis for cars and trucks, and 27 motorcycles. The respective figures for May, 1920, was (in the above order) 2593, 1254, 1146 and 193. The value of imported car and truck parts was $1,333,725, as against $2,212,565 in May, 1920, and of motorcycle parts $38,345, as against $45,100 in May, 1920. The value of the month's tire import was $70,290, against $1,575,205 in May, 1920.

The month's export of British automobiles and tires was ninety cars, of which 10 went to British India, 3 to New Zealand and 77 to unspecified countries; 73 trucks of all categories, of which 47 went to British India and 26 to countries not specified, and 94 chassis, of which 1 went to British South Africa and 93 to not specified countries. The corresponding export figures for May, 1920, were 248 cars, 71 and 226. The value of the month's parts' export was $635,715, against $841,225 in May, 1920.

The month's export of British motorcycles was 864, as against 1599 in May, 1920. The month's value of British motorcycle parts exported was $105,475, as against $238,660 in May, 1920. The value of British tires exported was $687,170, as against $2,415,880 in May, 1920.

DORT MAKES SECOND CUT

DETROIT, June 24—The Dort Motor Car Co. announces the second price cut in a month, effective immediately. The touring car and roadster are reduced from $1,115 to $985; the coupe from $1,685 to $1,535, and the sedan from $1,835 to $1,685.

It is understood that a reduction of $200 on all models of the Briscoe car will be announced July 2.

Business in Nation Close to 1920 Total

Volume of Sales in April Exceeds 1919—Some States Equal 1920 Figure

NEW YORK, June 22—Statistics of the volume in dollars of monthly purchases of all classes of commodities by individuals and business concerns in all the states of the Union, show that in a majority of the districts the volume for April, 1921, exceeded April, 1919, and that in some states it was almost equal to 1920.

The districts in which April sales for 1921 exceeded those for the same month in 1919 were New England, Pennsylvania, Ohio, Virginia, Georgia, Illinois, Texas and the Pacific Coast. They were virtually the same in the New York and Northwest districts. They were slightly less in the Missouri district.

Accepting the average of sales for April for a 10-year period as normal, April sales this year ran far ahead of normal except in the State of Delaware. The volume of April sales this year ran behind April, 1920, however, except in Arkansas and Wyoming. There was a very slight decline in California, Idaho, Nevada and Utah, and other states in which the falling off did not exceed 10 per cent were Connecticut, Delaware, Indiana, Maine, Maryland, New Jersey, Pennsylvania and West Virginia. The heaviest shrinkages were in Georgia, Kentucky, Louisiana, North Carolina, North Dakota, South Dakota, Tennessee, Mississippi, Nebraska and Washington.

Census Statistics Show Tire Growth Tremendous

WASHINGTON, June 18—Development of the automobile industry is reflected in the report of the Bureau of the Census on the manufacture of rubber goods in 1919 and 1914. The comparative summary shows that the total value of rubber products manufactured in 1919, in 475 establishments, was $1,138,216,000, as compared with 342 establishments and products valued at $300,994,000 in 1914. Of the 1919 total, pneumatic tires casings were valued at $485,904,000.

There were 39,700,000 inner tubes valued at $199,305,000 produced in 1919, as compared with 7.908,000 tubes, valued at $20,101,000, in 1914. Casings for motorcycles and bicycles produced in 1919 aggregated 3,422,000, with a value of $11,892,000. Inner tubes for motorcycles and bicycles in 1919 numbered 1,393,000, with a value of $2,904,000. Statistics show that solid truck tires amounted to 1,620,000, valued at $43,917,000, in 1919. All other solid tires total 6,635,000 and $9,005,000. The total production of solid tires of all kinds in 1914 was valued at $13,736,000. Rubberized fabrics for automobiles and carriages produced in 1919 amounted to 14,429,000 yd. valued at $10,697,000.

Ford Record Now 4322 Cars a Day

DETROIT, June 22—The Ford Motor Co. broke its 1921 record and all other motor vehicle records yesterday with a production of 4322 cars and trucks. The rate for the first half of June assures completion of the schedule of more than 100,000 for the month. Officials say the present output will be continued through July and as long as the demand keeps up.

Ferris Receivers Named, Will Continue Schedule

CLEVELAND, June 21—Federal Judge D. C. Westenhaver to-day appointed William E. Ferris and Norton McGiffin receivers for the Ohio Motor Vehicle Co. They gave $25,000 bonds each. The receivers were appointed upon the application of the Continental Motors Co. of Detroit which alleged in its petition that the Ohio corporation was indebteded to it in the sum of $32,880 for motors delivered and unpaid for.

Charles Riegler, president of the Ohio Motor Vehicle Co., stated that his company had insufficient cash on hand to pay its obligations as they mature. The obligations are placed at $175,000 by Riegler. He says the company is solvent and will pay all creditors in full if the assets are properly protected and are not dissipated. The physical assets of the corporation, exclusive of patents and good will, amount to $600,000.

The embarrassment of the company arises from the fact that it is no longer able readily to dispose of its products which consist of the Ferris automobile tractors and trailers. Most of the company's indebtedness now is for parts that have gone into the production of cars and tractors worth $250,000.

Riegler said that market conditions had hampered the company and that it had been sued by 20 different creditors, some of whom have obtained judgments. He asked that the receivers be given authority to conduct the business. Judge Westenhaver gave the receivers full authority to operate the plant and to sell its products. Word has been passed out to the trade that the corporation will promptly fill all orders, carry out all contracts and proceed as before.

EXPECT ORDER TO SELL COTTA

ROCKFORD, ILL., June 18—Trustees of the Cotta Transmission Co. expect within a week to receive a court order to discontinue operation of the plant and sell the property. Since the declaration of the company as a bankrupt, trustees were permitted to operate the plant under an order expiring June 1. Many creditors have signed a petition asking that the plant continue until Oct. 1 but no new orders are on hand.

G.M.C. Awards Stock Under Bonus Plan

Shares Totaling 123,884 Distributed to 6577 Employees for Work in 1920

NEW YORK, June 22—General Motors Corp. this week is awarding 6577 of its employees 6332 shares of the 7 per cent debenture stock and 117,552 shares of the common stock of the corporation as bonus for the calendar year ended Dec. 31, 1920.

The bonus plan was adopted in 1918 as a solution of the problem of how employees of exceptional merit might be induced to remain with the corporation for a period of at least five years. This profit sharing plan is also substantial recognition of the fact that in a marked degree the success of the corporation may be attributed to the inventions, ability, industry, service and loyalty of its employees.

Employees, by the operation of the plan, are made partners and part owners in the business and thereby encouraged to further effort and initiative. It is the intention to continue the plan year after year, the right being reserved, of course, to modify or repeal the plan at any time; however, a bonus once granted an employee cannot be recalled or modified.

The annual awards under the bonus plan are held in trust for the employee for a period of five years, but during that time dividends are paid direct to the employee. The awards for the three years during which the plan has been in operation follow:

Years Ended Dec. 31	Number Shares Common Awarded	Number Employees Receiving Common	Number Shares 7% Deb. Awarded	Number Employees Receiving 7% Deb.
1920...	117.552	3,210	6,332	3,367
1919...	214,659	1,721	14,088	4,709
1918...	261,460	2,277	....	....
G'd total	593,671	7,208	20,420	8,076

The corporation each year, after deducting from net earnings 6 per cent of the capital employed in the business, sets aside 10 per cent of the remaining net earnings and this amount of money is placed in the bonus fund, which is invested in the common and 7 per cent debenture stock of the General Motors Corp. The total amount of money set aside out of earnings in the three years, 1918, 1919 and 1920, with which to carry out the bonus plan work is in excess of $13,000,000, and this does not include the expenditures of administration.

ILLINOIS TRACTOR IN SUIT

BLOOMINGTON, Ill., June 18—Charging misrepresentation in sale of stock, S. W. Cramm, of Kansas City, has filed suit for $25,000 damage against the Illinois Tractor Co. and its Board of Directors. The bill alleges that Cramm subscribed to stock to the amount of $9,180. He said it was represented that the stock was worth $150.

U. S. Car Sales to Cuba Total $8,618,270 in 1920

HAVANA, CUBA (By Mail), June 20—A compilation of automobile imports from the United States shows that in 1920 they were valued at more than twice as much as in 1917. The following table shows the number and value for four years:

	1917	1918	1919	1920
Number	3446	2400	3935	5715
Value	$3,364,551	$3,394,830	$4,921,648	$8,618 270

Imports from other countries were insignificant except last year when 112 cars valued at $256,559 were imported from Germany; 71 cars valued at $132,701 from France and nine cars valued at $12,451 from Italy. The total value of automotive imports in 1920 was $9,031,589.

Nash Cuts Prices on Complete Line

Reductions Ranging from $150 to $250 Will Become Effective on July 2

KENOSHA, WIS., June 23—The Nash Motors Co. announces a reduction in prices of Nash passenger cars, both six and four cylinder models, ranging from $150 to $250. These prices, effective July 2, are as follows:

6 cylinder	old price	new price
5 passenger touring	$1695	$1545
7 passenger touring	1875	1695
7 passenger sedan	2895	2695
4 passenger coupe	2650	2395
2 passenger roadster	1695	1525
4 cylinder	**old price**	**new price**
5 passenger touring	$1395	$1195
2 passenger roadster	1395	1175
3 passenger coupe	1985	1735
4 passenger sedan	2185	1935

In a statement announcing the price cut, C. W. Nash said the reductions represented lower production costs in the plants at Kenosha and Milwaukee. He added that during the four years prior to last October Nash prices had risen only 31 per cent. Plant economies have been effected by the installation of the latest labor and time saving devices.

HANDLEY CUTS TOURING CAR

KALAMAZOO, MICH., June 22—The Handley-Knight Co. has reduced the price of its seven-passenger touring car from $2,985 to $2,850, making a total reduction of $500 since last November. Prices of the sedan and deluxe models remain unchanged. The company notified its distributors on June 1 that prices which prevailed then would be guaranteed up to Jan. 1.

CADILLAC NOT TO CUT PRICE

DETROIT, June 22—President H. H. Rice of the Cadillac Motor Car Co. denied to-day reports current here that the price of the Cadillac would be cut July 1. "We have said right along there would be no reduction in Cadillac cars this year and that statement stands," said Rice.

MORELAND TRUCK REDUCED

LOS ANGELES, June 22 — Moreland Motor Truck Co. has reduced prices on all models effective to-day. The 1½-ton model is priced at $2,800; 2½-ton, $3,500; 3½-ton, $4,600, and 5-ton, $5,000. The former prices on these models were $3,125, $3,900, $4,975 and $5,350, respectively.

VICTOR INCREASES OUTPUT

SPRINGFIELD, OHIO, June 20 — Starting to-day the Victor Rubber Co. will increase its production from 500 to 700 cord tires per day. "The outlook for business is much better," said H. H. Durr, secretary-treasurer of the company. "Dealers' trade is reported good in practically all sections, but there is a slight slump among the big factories on new cars. Our company sells to dealers and as a result business is good." Durr said that the rubber mat department is rushed with work.

Wilson Assumes Place as Maxwell President

DETROIT, June 21—In assuming his duties as president of the Maxwell Motor Corp., W. R. Wilson declared he welcomed the opportunity presented by his new position for getting a further insight into the automobile business.

"During the period I have been out of direct contact with the automobile industry," he said, "I have watched its development very carefully. I have had a vantage for observation that is in a measure denied those who have been active in it as I have had the benefit of distance in looking at its present problems and its promising future. I feel that the Maxwell offers a wonderful opportunity."

Louisiana Protests High Gasoline Prices

SHREVEPORT, LA., June 20—Automobile dealers and users here are incensed because of the continued high prices of gasoline, when small Texas towns less than 40 miles away are favored with a rate 5c per gallon less. Voicing the sentiments of local automobile dealers and users, George D. Wray, an official of the Shreveport organization, has sent the following telegram to former Lieutenant Governor T. C. Barrett, member of the Constitutional Convention at Baton Rouge:

"Automobile dealers of Shreveport, seriously protest against continued high prices of gasoline in Louisiana. Texas points having no refineries are quoting 18c or lower at filling stations. Price at Shreveport is 23c. Perhaps this is not the business of the Constitutional Convention, but it is a matter which should engage the attention of every citizen of Louisiana who has the best interests of his state at heart. Forty thousand users of gasoline in Louisiana would like to see some action taken before adjournment."

Pierce-Arrow Assets Far Exceed Liabilities

NEW YORK, June 23—The balance sheet as of April 30 of the Pierce-Arrow Motor Car Co. shows quick assets of $20,878,000 and current liabilities of $8,379,000, a ratio of approximately two and one-half of assets to one of liabilities. Directors of the corporation said that the information is made public at this time to refute rumors in Wall Street. Both the common and preferred stock of the corporation were under pressure yesterday, the preferred dropping 5⅝ points to 34 and the common 3½ points to 15⅝.

"The Pierce-Arrow Motor Car Co. is in a sound condition," said the statement. "Of course our business has slumped and the truck business is very poor. We sold 2200 passenger cars last year. Our schedule this year was 1000 passenger cars to June 1. We have sold and shipped 850 of these and we now have orders for 350 cars on our books.

"Our cash on hand, as of this morning, amounts to $1,137,000. Our bank loans are $6,650,000 and our borrowing limit has by no means been reached. Among our quick assets we have listed $17,027,000 as inventory, and cash on hand, and current assets and accounts receivable of $3,851,000. On the other hand, our liabilities are $1,604,000 in bills for raw materials, $125,000 due customers for deposits and $6,650,000 in bank loans."

Rear Bumpers to Make Lower Collision Rate

MILWAUKEE, June 20—Milwaukee automotive dealers have just received advices of additional reductions in collision insurance that will become effective July 1. The Automotive Underwriters' Conference, which for some time has given a 10 per cent reduction in the collision insurance rate for the use of front bumpers, so far as such accessories are approved by the Underwriters' Laboratories of Chicago, will offer an additional 2½ per cent reduction for the use of approved rear bumpers, when the list of such bumpers is ready. The casualty department of the laboratories is now making tests and will issue new list July 1.

Front bumpers have been found unsuitable.

Austin Light "Four" to Appear in Fall

Design Will Follow Specifications of "Twenty"—Coal Shortage Hits Rover

LONDON, June 10 (By Mail)—Design of the new light car which the Austin company will standardize for 1922 is not definitely settled, but it will be of 10 hp. and practically a replica of the Austin "twenty." It will have a 4-cylinder detachable head engine with side valves, three point suspension as unit with four-speed gear set, the latter with central control. Bore and stroke are to be 2 7/8 x 4.

Other details include silent chain for distribution, pump water circulation, fabric disk, universal joints, helical bevels, straight sided frame, tapering front to rear, and semi-elliptic springs Two types of body will be standardized—four-passenger and coupe. The new model will be shown for the first time at the Olympia show in November.

The hearing of the petition of creditors for action on their claims has been adjourned for several months to give the company opportunity to complete its working plans. Operations are continuing under the receivership.

Judgment was entered this week in default of defence against the Austin Motor Co., in the suit of the Eagle Star & British Dominions Insurance Co., holders of all the first mortgage notes of the Austin Co., the value of which is £150,000 and carrying 10 per cent interest. The judge, besides deciding for the Eagle company, directed an account to be taken of what is due to a London bank as holders of the second mortgage debentures.

Limited coal supply, owing to the miners' strike, has compelled the Rover company to reduce its output of the new 8-hp., air-cooled, 2-cylinder runabout. Orders had been received warranting a production of 200 weekly, but this is now cut to one-third of that schedule.

Owing to the national financial tightness the Air Ministry will dispose of the six airships now under its control. These are ready to operate under commercial conditions from a mooring mast. The capital of any company acquiring the ships must be controlled by British shareholders and the Air Ministry must be represented on the board of directors.

Entry of implements for the farm tractor and implement tests to be run in the autumn at Shrewsbury by the Society of Motor Manufacturers and Traders, Inc., has been so large that it has been necessary to obtain special land for their trials. To further encourage a bigger entry list, the closing date was extended to June 30.

PHILIPPINES DOUBLE ROAD WORK

NEW YORK, June 18—Nearly 200 kilometers of new road were completed in 1920 in the Philippine Islands, according to reports received by the Bureau of Foreign and Domestic Commerce showing that the total expenditure of $1,905,645 for public works that year was about $1,100,000 greater than during 1919. Many roads were reconstructed and numerous bridges built. Waterworks and irrigation systems also were gotten under way which are designed to benefit about 300,000 hectares of agricultural land when the projects are completed.

British Dunlop to Make Straight Side Tires

NEW YORK, June 18—News has just reached this country that the Dunlop Rubber Co., the largest tire manufacturing concern in Great Britain, has decided to manufacture straight side tires for passenger cars hereafter. In a recent talk to members of the press the production organizer of the Dunlop company summarized the advantages of the straight side tire as follows:

"The straight side type carries within itself the inextensible edges which resist the outward radial pressure due to inflation of the air tube. The beaded edge type, on the contrary, depends on the proper engagement of the thickened edges with the inturned lip of the rim. The stresses and movement of the cover at this point produce a serious risk of failure by rim cutting.

"The straight side rim provides a wider base for the tire than is possible with the beaded edge type and holds the tire more steadily, prevents roll reducing the tendency to side slip, provides greater air space, and consequently increased cushioning capacity within the tire, and entirely eliminates accidental bursts due to careless fitting.

"The attachment is sound and simple; it is effected without any strenuous levering and stretching of stiff edges into or out of position as is necessary with the beaded edge type. The larger and heavier the tire the more marked the advantage of the straight side type. It is only the lighter weight and greater pliability of the smaller sizes which still permit small beaded edge tires to compete with the straight side type.

"When in position on the rim, no sudden deflation from a cut can cause the straight side tire to leave the rim, and there is no possibility of the tire edges blowing over the flanges. The straight side type of tire has proved the most secure tire for racing work."

TO CLEAR WAREHOUSED STOCKS

NEW YORK, June 18—Preliminary organization of the liquidating corporation to handle and dispose of any unclaimed merchandise in South American customs houses will be undertaken by a committee of eight, among whose members are C. I. McReynolds of the General Motors Acceptance Corp. and S. A. Breese, of the International Harvester Co. The committee was announced by the Argentine-American Chamber of Commerce here and will proceed with the organization plans at once.

METAL MARKETS

MARKET opinion has now been unanimous for several weeks that steel prices must and will be reduced. There has not been and is not now such concord of view as to the time when this generally looked for downward revision of prices will materialize. Still greater disparity of opinion prevails as to the extent which the expected cut in prices will assume. In fact the minds of those who as a rule are qualified by experience and intuition to pass worth while judgment on the impending course of the market are so far apart on this subject that its discussion is eschewed—seemingly by common consent. In seeking to arrive at an estimate of what would constitute a logical reduction in steel prices the consumer is naturally tempted to have recourse to the pig iron market as a plumb line. Eliminating from consideration the period of 1916, when the pig iron market in its upward climb was for a brief spell on the same basis as it is to-day, prevailing levels put the market back to where it was in September, 1907. In the latter month billets sold at around $29, compared with the present quotation of $37. The average price for black sheets, No. 28 gage, in 1907 was 2.50c., compared with the present nominal quotation of 4c. If the forthcoming cut in steel prices is to re-establish the conditions that prevailed in 1907, i. e., the ratio which then prevailed between pig iron and steel prices, it would have to range approximately from 25 to 37½ per cent. Even if the fervently prayed for revival in demand should exceed the fondest expectations, the steel market of 1921 and 1922 is bound to be in more precarious a condition than was that of 1907, for the simple reason that capacity is so much greater. So that taking for granted as preliminaries to any reduction in steel prices a satisfactory pruning of freight rates and further paring of wages, a 25 per cent cut in prices when the cut does materialize, would be consonant with conditions in general and with those in the pig iron market in particular. It is, however, not at all improbable that by the time revision in steel prices materializes, the pig iron market will have rebounded from its present low levels. At best it is never an efficient instrument for measuring the future trend of steel prices. The probabilities are that the powers that be will permit the steel market to find its own low levels in the present depression, resorting to more and more shut-downs to meet the situation, thus facilitating the downward readjustment of wage schedules. Constructive action with reference to prices will be deferred until sufficient demand has accumulated to make revision of prices yield immediate results in the form of orders.

Pig Iron.—Inquiry by the Ford Motor Co. for 60,000 tons of ore is not looked upon as presaging contracts for that tonnage. Experience throughout 1921 has convinced the iron ore and pig iron trade that there is a wide gulf separating inquiries from actual orders and sales. Buyers, for the time being, can make their own prices for foundry and malleable pig.

Steel.—Virtually no new business is forthcoming from the automotive industries. Cold-rolled strip steel and steel bars are moving in less than carload lots, if at all. It is stated that the Sharon plant of the Savage Arms Corporation, which has closed for repairs, will resume as soon as these are completed, to continue production of frames for the Dort Automobile Co. Spasmodical sales of sheets in retail tonnages are the order of the day.

FINANCIAL NOTES

Studebaker Corp. earnings for the second quarter of 1921 which ends June 30, are $8 a share. The quarter is the best in the history of the company. Earnings for the first quarter were slightly better than $3, which means that the $7 dividend for the year has been earned with a margin of $4.

Hendee Mfg. Co. has reduced the total of its bank loans to $240,000, a reduction of $610,000 since 1920. Accounts payable have also been reduced to $262,000, a reduction of about $600,000 this year.

Elgin Motor Car Corp. will offer $500,000 serial debenture 8 per cent notes to stockholders at par. They will mature in one year $100,000; in two years $150,000, and in three years $250,000.

Sayers & Scoville Co., Cincinnati, has declared the regular quarterly dividends of 1½ per cent on both preferred and common stock, payable July 1.

American Bosch Magneto Corp. has passed the quarterly dividend due at this time. The company had been paying at the rate of $1.25 a share.

Reo Motor Car Co. has declared the regular quarterly dividend of 2 1-5 per cent on the common stock, payable July 1.

Stutz Motor Car Co. directors were all re-elected at the annual meeting of the company.

INDUSTRIAL NOTES

Neskov-Mumperow Motor Car Co., St. Louis, has entered the storage battery manufacturing field, producing the Hy-Volt battery. Harold Dickelman, who has been associated with several local battery concerns, has been appointed manager of the new branch of the business. The new battery is sold under a two-year guarantee.

International India Rubber Corp., South Bend, Ind., is now the Odell Rubber Co., the change being now officially announced by the directors of the company. The business of the company will not be changed in any detail. New offices and warerooms at the plant will be completed by July 1.

Ward-Boucher Specialty Mfg. Co., Minneapolis, has been incorporated to manufacture an auto signal which operates from a button on the steering post an arrow at either side of the windshield to give a traffic warning.

Cutler Auto Radiator Co., Inc., Camden, N. J., has been incorporated with $125,000 capital stock, to manufacture a new type of automobile radiator having a removable and floating cooling unit.

Soss Mfg. Co., Brooklyn, N. Y., manufacturers of Soss automobile hardware, has completed an addition to its factory, extending the company's efficient manufacturing facilities.

A. H. Petersen Mfg. Co., Milwaukee, has discontinued its tool and die department to concentrate on the manufacture of portable elecric drills and other automotive devices.

Ford Motor Co. may acquire three plants of the government nitrate works at Sheffield, Ala. An inspection tour of the plants has been made by Henry Ford with a view to discovering their practicability for automotive manufacturing.

Lafayette Motors Corp., Indianapolis, has turned over its entire building and housing project to the real estate department of one of the Indianapolis banks.

Automatic Oil Indicator Co., Newark, has been organized to manufacture oil indicating apparatus and other automotive equipment.

Gill Mfg. Co., Chicago, manufacturer of piston rings, reports a sales increase of 45 per cent for the first four months of 1921.

Philadelphia Rubber Works at Buffalo have been sold to the Du Pont Fibersilk Co.

Trustee Is Nominated for Seiberling Property

AKRON, June 20—An arrangement has been entered into by F. A. Seiberling, former Goodyear president, and various of his creditors, whereby it is agreed that a corporation to be known as the Prudential Securities & Realty Co. will assume trusteeship over Seiberling's personal assets and liabilities and will manage his property at least temporarily.

Seiberling's assets, not including his $5,000,000 mansion Stan Hywet Hall, which is said to be in his wife's name, are listed at $10,136,570 and his total liabilities are $6,700,000.

Under the agreement creditors consent to extension of maturity of debts and claims against Seiberling.

Seiberling's largest holdings include Goodyear common and preferred stock, $2,535,430; raw rubber $500,000; Ladysmith Smelting Corp., $1,681,750; Ohio Savings & Trust Co., $144,500; Whitman & Barnes Co., $203,500; Hotel Cleveland Co., $45,000; Blackstone & Fairlawn Heights property, $2,286,475; Morris Plan Bank of Akron, $18,000; old Seiberling home on East Market Street, $82,048; one-half interest in the Delaware building, and appraised value of realty and other assets, $943,686; equity in Central office building of Akron, $160,000; Summit County farm land, $378,202.

TO SELL IMMEL JULY 9.

COLUMBUS, June 18—R. H. Schryver, president of the Citizen's Bank & Trust Co., and receiver for the Immel Co., manufacturers of closed bodies, has been authorized to sell the physical property at public auction July 9. The court issued the court order upon application of the receiver, who believes it is a good time to sell. The preferred stockholders of the company have organized and will be a bidder for the property, which consists of three separate plants and some separate land. The entire property is appraised at $253,200. All materials on hand will be offered for sale and are separate from the plants. No appraisement of the materials has been announced.

RAILROAD DISCONTINUES

WASHINGTON, June 20—Motor vehicle competition is given as the cause for the abandonment by the Ocean Shore Railroad of its lines in California, extending from San Francisco to Tunitas Glen, and from Santa Cruz to Swanton. Authority for abandoning the road was granted to-day by the Interstate Commerce Commission. A lumbering and agricultural territory was served by the carrier.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, June 23—The local money market was little affected last week by the announcement of the New York Federal Reserve Bank that it had cut its discount rate on commercial paper from 6½ per cent to 6 per cent, making the discount rate now 6 per cent for all classes of bills. The whole financial community as a matter of fact was concerned more with the continued precipitate decline in the stock market, the irregularity and dullness of the bond market, and the unsteadiness of the foreign exchanges. In addition to these unfavorable factors, cotton prices reached the lowest level for several years, and the grain markets were under pressure.

In spite of marked improvement in the great majority of items in the Federal Reserve System's midweek statement, the reserve ratio declined last week from 58.3 per cent to 56.8 per cent. Gold reserves increased $14,896,000, and total reserves $23,078,000. Total bills on hand declined $204,981,000, largely as a result of a $188,680,000 reduction in bills discounted. In spite of the reduction in bills on hand, total earning assets increased $93,261,000 as a result of large government borrowings shown on the statement by a $295,861,000 increase in certificates of indebtedness. Federal Reserve note circulation declined $36,288,000, while deposits increased $194,170,000, which accounted for the lower reserve ratio.

Commercial failures for the month of May show a substantial decline in the number of failures, but a marked increase in the total liabilities involved. The number of failures at 1356, was 131 less than in the previous month, but compares with 547 in May, 1920. Liabilities involved amounted to $57,066,471—the high record for the month of May. In May of the preceding year, liabilities involved for the 547 failures amounted to only $10,826,277. For the first five months of the current year, the total number of failures amounted to 7713, which was exceeded as recently as 1916, but the total liabilities for the five months at $276,032,229 are by far the high record for all time for the five months. The liabilities involved in commercial failures for the first five months of 1920 amounted to only $53,752,911.

U. S. BUYS RUBBER FOR YEAR

NEW YORK, June 18—The United States Rubber Co. is taking advantage of the current price of 16 cents to 17 cents for crude rubber and is laying in a year's supply. Rubber producers assert that the actual cost of producing crude rubber is about 32 cents and that growers are losing money at the current level. The United States Rubber Co. will leave the trees on its own plantations untapped for a year or so, or as long as rubber can be purchased in the open market cheaper than it can be produced.

MEN OF THE INDUSTRY

C. M. Alexander has been appointed manager of the Houston plant of the Ford Motor Co., succeeding W. M. MacDonald, who has resigned. Alexander has been with the Ford Motor Co. in Houston for the last five years and has been assistant manager most of that time. MacDonald will be tendered a Ford agency at some point it is understood. With the early occupancy of the newly-built addition to the plant of the Ford Motor Co., Houston will have the largest Ford assembling plant in any of the southern states, officials state. At the present time the plant is turning out seventy cars per day, which will be increased to more than one hundred as soon as the installation in the new addition is complete.

George J. Fix has resigned as manager of the New Orleans branch of the Bearings Service Co. and will establish in Dallas, Texas on July 1 a sales agency representing the Baldwin Chain & Manufacturing Co. and the Joyce Auto Products Co., covering the State of Texas. Fix was formerly connected with the Maxwell Motor Co., in charge of service for the southwest.

John N. Willys has accepted the appointment on a committee which will organize throughout the country branches of the "Sell Now League." The purpose of the organization is to stabilize economic conditions by selling "now" in selected markets. Willys believes such a campaign is absolutely necessary to hasten the return of normal conditions.

L. O. Haskins, vice-president and general manager of the Powrlok Co. of Cleveland, has become associated with the Seelye & Brown Advertising Agency, Detroit. He was formerly with the O. & S. Bearing Co., Detroit, and later with the Willys interests. He is a member of the Society of Automotive Engineers.

Nelson B. Nelson, formerly superintendent and chief engineer for the Kardell Tractor & Truck Co., St. Louis, and for the past twelve years connected with tractor engineering, has become associated with the New Departure Mfg. Co., and will have charge of engineering at its Chicago office.

A. E. Fauts, who for the past two years has been in Europe in the interests of the Garford Motor Truck Co., has returned to New York, where he will confer with officials of the company on European truck markets and the future policies of the company in that field.

C. E. Wagner, export manager of the Miller Rubber Co., is attending the International Trade Conference in Mexico City. In addition to his representation of the company, he is also representing the Cleveland Chamber of Commerce and the Akron Chamber of Commerce.

Harry W. Anderson has been appointed general sales manager of the Duesenberg Automobile & Motors Co., Inc., Indianapolis. Until recently Anderson was sales manager of the Templar Motors Corp., Cleveland. He will assume his duties with Duesenberg at once.

Ernest M. Orr, plant manager of the Jacox Steering Gear plant of the Saginaw Products Co., has been made assistant to George H. Hannum, president and general manager of the Oakland Motor Car Co. Orr has been associated with Hannum since 1906.

J. Parker B. Fiske has resigned as president and general manager of the Frigidaire Corp., a General Motors Corp. subsidiary. The Frigidaire interests are being merged into the Delco Light Co. and will be under the direction of R. H. Grant, general manager.

M. E. Lyle has been elected a vice-president of the Terminal Engineering Co., Inc., New York. M. E. Peck has been elected secretary and assistant treasurer. J. F. McGonigal and J. H. Potter have joined the engineering staff of the company.

Harry Gardner has retired as manager of passenger car sales for the Packard Motor Car Co. He has not decided upon his plans for the future. Gardner formerly was secretary of the New York Automobile Dealers' Association.

John J. Plath has been made director of sales of the Maxwell Motor Sales Corp., and E. W. Clark, director of sales of the Chalmers Motor Car Corp., according to announcement by A. W. Barker, general sales manager.

George H. Daugherty has been elected a vice-president of Johnson, Read & Co., advertising agents of Chicago. Daugherty has specialized with this company on car, truck and tractor advertising.

J. A. Callahan, vice-president, in charge of production of the Martin-Parry Corp., has been elected vice-president and general manager of the corporation at the annual meeting of the board of directors.

L. J. Ollier, vice-president of the Studebaker Corp. of America, has returned from a trip to Europe, where he has made an investigation of trade conditions.

J. H. Appleby has been appointed a motorcycle tire representative by the Firestone Tire & Rubber Co.

Revere Reorganization Opposed by Stockowner

INDIANAPOLIS, June 20—An order was issued by Judge Geiger in Federal Court yesterday in the suit filed by John B. Porter, of Buffalo, N. Y., a stockholder of the Revere Motor Car Corp., who is seeking to prevent reorgnization.

The order directed officers of the Revere company and the Citizens Loan & Trust Co. of Logansport, Ind., receivers of the corporation, to appear in Federal Court June 22 and show cause why a temporary restraining order should not be issued against them preventing the reorganization or sale of the corporation. The bill also asks for an accounting, alleging that the corporation should have more than $1,500,000 in visible assets, instead of being insolvent.

CHINA DEVELOPS CAR LINES

WASHINGTON, June 17—Progress is being made in China in the way of establishing motor car highways, declares Consul John K. Davis, Nanking, China, in a report which has been received by the Bureau of Foreign and Domestic Commerce. Previous reference has been made by Consul Davis to the establishment of a motor car service between Pochow, Anhwei, in the Nanking consular district, and Techow, Honan, and he reports four other similar services are either in the process of being established or are definitely planned. It is stated that American exporters desirous of cultivating the automobile market in the Nanking consular district, said to be rapidly growing, can do so to the best advantage by establishing branches or agreements in Shanghai.

Receivers Are Named for Ideal Tire Company

CLEVELAND, June 20—On the application of Edward Maurer of New York, who furnished the company with much of its supply of fabric, Federal Judge D. C. Westenhaver has appointed Newton D. Baker, former secretary of war, and Edward L. Griffith, well known business man and financier, receivers for the Ideal Tire and Rubber Co.

The assets of the company are placed at $1,660,000 and the bills payable amount to $700,000, most of which is due on materials bought at prices far above the level of to-day. A short time ago, it was announced that the company owed but $114,000 exclusive of the money due for materials and that approximately $500,000 was owing on rubber fabric that was purchased at $3.10 a pound. The price now is about 80 cents a pound.

The factory is employing approximately 200 men and women now and the receivers will continue to produce tires, for which there has been a good demand. The corporation was organized in 1917 with a capital of $5,000,000. A factory was built and production started early after the organization.

Seek $10,000,000 for New Mexican Highway

SAN ANTONIO, TEXAS, June 20—The Highway Propaganda Committee of the Meridian Highway Association, has left Laredo, Tex., for an automobile tour to Mexico City to further the proposed Mexican highway through the States of Tamaulipas, Neuve Leon, Coahuila, San Luis Potosi, Guanajuato, Queretaro, Hidalgo and Mexico. The road, which will be over 1000 miles in length, will cost in excess of $10,000,000 Mexican currency.

The road party will endeavor to finance the road. It is proposed that the Mexican government furnish 40 per cent of the cost of construction and assess an automobile tax which will bring in about $2,500,000. The remainder, about $3,500,000, is to be raised by subscriptions along the run.

MINNEAPOLIS TO HAVE SHOW

CHICAGO, June 20—A tractor show will be held during the coming winter in Minneapolis by the National Implement & Vehicle Association under the Show and Demonstration Committee, headed by Chairman J. G. Bartholomew. This committee has also agreed to have a tractor show during the winter at some point in the Southwest, either at Kansas City or another place where suitable arrangements can be made. Last winter the tractor show was held at Columbus, Ohio.

Calendar

SHOWS

Sept. 5-10—Indianapolis, Automobile and Accessory Show in conjunction with Indiana State Fair, conducted by Indianapolis Automobile Trade Association, John B. Orman, Mgr.

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Sept. 23-Oct. 2—Berlin, German National Automobile Show, Auspices of German Automobile Mfg. Ass'n and German Automobile Club.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

July 4-9 — Mackinac Island, Mich., Summer Meeting Automotive Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

Dec. 27-29—Chicago, American Society of Agricultural Engineers, Auditorium Hotel.

RACES

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

Commission to Clarify Aeronautical Situation

WASHINGTON, June 21—As a step toward clarifying the aeronautical situation, Herbert Hoover, Secretary of Commerce, has agreed to appoint an Aviation Consulting Commission which will present for the consideration of President Harding a policy for the advancement of aeronautics in this country. This action followed a petition to the President by 50 executives representing civilian aviation organizations throughout the country.

The petitioners included Glenn H. Curtiss, Glenn L. Martin and C. F. Redden, and such organizations as the Aero Club of America, the Manufacturers' Aircraft Association, the National Aircraft Underwriters' Association, the Society of Automotive Engineers and the National Advisory Committee for Aeronautics. They asked for a commission to study and outline a report dealing with America's future in the air, a general policy for the Government to follow in developing civilian aviation, suggestions for air routes and termini and recommendations for aerial laws.

Borah Offers Measure to Abolish Air Board

WASHINGTON, June 18 — Senator Borah of Idaho, has introduced a joint resolution which would abolish the organization known as the National Advisory Committee for Aeronautics, and transfer its property and duties to existing governmental agencies. It is expected that a fight will develop when this measure is reported from the Committee on Military Affairs, for the Advisory Committee for Aeronautics has functioned as an independent agency.

The joint resolution provides that in the abolition of the committee, the technical duties that have heretofore been carried on by the body, or that have heretofore by law been charged to the body, be transferred to the Department of Commerce, to be carried out by the Bureau of Standards. It is also provided that the technical equipment now in the possession of the National Advisory Committee for Aeronautics be transferred to the Department of Commerce, Bureau of Standards. The duties of this committee as relate to its advisory capacity on the subject of aeronautics would be transferred to the War Council, as created by the national defense act approved June 3, 1916, as amended by acts subsequent to June 3, 1916, to and including the act of June 4, 1920.

Kerosene Carburetor Is Demonstrated Here

NEW YORK, June 17—Mr. Mandahl, a Swedish inventor, has arrived in this country with samples of the Kjellberg kerosene carburetor, a device adaptable to use on trucks, tractors and other automotive vehicles. He has fitted the carburetor to a Republic truck and is giving demonstrations with same.

The general principle of the device is that a mixture of kerosene spray and air is formed in the mixing chamber and the kerosene mist is then vaporized while passing through a copper pipe surrounded by an exhaust heating chamber. This stream of over-rich mixture is later diluted with additional air entering through a supplementary air valve, passes through a throttle valve and through a change-over valve to the engine. By means of the change-over valve the engine can be connected to a gasoline carburetor for starting and for heating up. A full description and a diagrammatic illustration of the carburetor appeared in the Sept 16, 1920, issue of AUTOMOTIVE INDUSTRIES.

FIX BRITISH SHOW DETAILS

LONDON, June 10 (By Mail)—The big British automobile show will be held simultaneously at Olympia and White City from Nov. 3 to 12. The truck show will be held Oct. 13 to 22. Arrangements have been made whereby accessory exhibitors who have space in the gallery at Olympia for the truck show may retain the same space for the passenger car exhibit. No changes in prices will be permitted while the shows are in progress. Tractors will be admitted to the truck show if they are provided with means for traveling the roads and are licensed for that purpose.

Transportation Situation Shows Gains for Trucks

WASHINGTON, June 17—One of the outstanding developments of the present transportation situation has been the growth of the automobile truck in short hauls, making it a formidable competitor of the steel rail, according to Archer Wall Douglas, chairman of the committee on statistics of the Chamber of Commerce of the United States, in his semi-annual report on business conditions. He also stressed the fact that there has been some increase in the output of automobiles, notably in certain localities. He finds that purchasing power is still high, despite many untoward conditions and that there is still money to be spent where bargain prices are in evidence. The committee advises American business that there is no immediate return to prosperity in sight, at least until the termination of the harvest season.

Gasoline Railway Cars Keeps Operation Low

LOUISVILLE, June 18—The Carrollton & Worthville Railroad Co., operating a strip of road ten miles long, is the only company operating in Kentucky which has not raised passenger fares since the depression period began.

This company solved the problem by shelving its steam locomotives and substituting gasoline motor vehicles. The cars, have attracted the attention of short line railroad companies as far south as Louisiana and as far west as New Mexico. Automobile manufacturers have studied them with a view to their practicability for adaptation to street car service.

Operation of one of these cars for one round trip costs $2, counting repairs, labor, gas, oils and depreciation. The trip with a steam locomotive costs from $15 to $18.

PERFECTION SUIT DROPPED

WILMINGTON, Del., June 20.—The receivership proceedings brought in the United States Court here against the Perfection Tire & Rubber Co. of Detroit, by the Southwark Foundry & Machine Co. of Philadelphia, have been dropped.

AUTOMOTIVE INDUSTRIES
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Industry's Present Opportunity for Public Service

We recently have had lessons in what government can cost. Now the demand is for a more economical and a more efficient government. This can come about only as economy and efficiency are put into government by those who know how.

By Clyde Jennings

DURING the war the automotive industry sent many men to Washington and into similar public service because they were needed.

It was this public service on the part of the men of the industry that has gained for the industry, since the war, an instant hearing when it has asked opportunity to present its side of any controversy.

Now comes an opportunity for a similar service. The present crisis is not, perhaps, as acute as the former opportunity. Then men were needed to avert the calamity of violence that threatened from the other side of the world. Public service then was self-preservation for our institutions and our country.

At this time the opportunity for public service is chiefly to hasten the period when American business will come back to its own; to dislodge the bureaucracy that has become more strongly enthroned in our Government during the war; to put our Government on a modern business basis, compatible with the change that has been brought about in business during the last decade; to assist Congress in resisting those who have little respect for the greatest benefit of the public; to end the period of public extravagance; to carry out the tax program suggested by the National Automobile Chamber of Commerce and practically adopted by the administration.

The meat of the N. A. C. C. tax suggestion was contained in this one sentence that stood at the head of its program:

"Reduce ordinary expenses from war standards to sane, normal standard at once."

The Chamber of Commerce of the United States had for a slogan at its annual meeting:

More Business in Government.
Less Government (management) in Business.

To which Herbert Hoover added this line:

Better Government assistance in business.

A proper response of the chamber would have been:

Better Business Assistance to Government.

The present administration is working to this end, and this offers the present opportunity for public service. Very prominent in the program are two points, and both of these must have co-operation from business if benefit is to be gained. Here are the two most prominent:

The Budget Commission.
The new Department of Commerce.

The appointment of Maj. Gen. Charles G. Dawes, the Chicago banker and once Comptroller of Currency, as Director of the Budget is evidence that the

administration is in earnest in this economy move. General Dawes has performed two admirable feats of public service for the Harding administration, hence the appointment. He it was who went to Washington and was outspoken in defense of the earnest men who made some mistakes but did the best they knew to win the war. His outspokenness in this cause brought cheer to every dollar-a-year man who was threatened with a technical inquiry into his acts.

Hardly had the air been cleared from his lurid testimony on this subject when he was called back to conduct an inquiry into the mistreatment of invalid soldiers. This was supposed to be a six months' job. But Dawes surprised the country by granting that mistakes had been made, and in two days he had drawn a report of a reasonable system of management of this work and going home, putting the entire situation up to those whose responsibility it is to carry out this work.

Now this same Dawes is called back to inquire into the methods and systems of the Government and see if they are economical and efficient. He says this is a big task and that he must have much more assistance than can be employed with the money Congress has placed at his disposal. He proposes to work fast and to bring about such changes as may be wise or necessary within six months. He says that government is a big business, and the only men competent to adjust a big business enterprise are men who have had experience in big business. So he proposes to call to Washington many big business men who will be placed in the departments there to see if these departments, bureaus or whatnot are efficient from a business standpoint.

To answer such a call will doubtless disturb many a business man's plans. But government is much like a trade association: In the main you get out of it only in proportion as you put into it. Business men with one accord are saying that our Government is not efficient. They have demanded changes. Dawes is going to say to them:

You have been uttering destructive criticism, now we ask you for constructive assistance.

If business does not answer the Dawes call, it will never again be able to ask with reason for an adjustment of government to a new basis.

The response of the automotive industry and other industries that are crying out against high taxes will be the measure of the answer to that call.

The need for public service is very great in this crisis. The administration has neatly put industry on the defensive. We have faith that industry will not fail.

The New Department of Commerce

It has long been an axiom that a trade association benefited the member only in relation to what he puts into it.

The same is true of government. Secretary Hoover is offering to industry a very great opportunity to put much into government and in return draw much out of it. Hoover's connection with the engineering service, world adjustment of supplies and similar big enterprises are too well known to need comment here. His last public service before entering the Department of Commerce was at the head of the Survey for the Elimination of Waste. This movement is doubtless familiar to most industrial leaders, although the results have not as yet been made public in a definite form.

It is evident that in assuming his duties as Secretary of Commerce, Hoover carried with him many of his ideas on industrial waste. His present effort is to make this country a more efficient industrial unit, and to this end he is lending his assistance toward making government more efficient and to making industry more efficient.

It is Hoover's idea that business needs some sign-posts and traffic regulations, so that the movement of business can be more uniform and some of the sudden bursts of speed that serve only to exhaust the particular industry can be eliminated.

Business, as Hoover views it, is an interdependent structure. It has the common purpose of serving the population of the world well, or it cannot be at its best. Waste, be it in materials, idleness of plant or employee, is a handicap on everything in the world. Waste in any part of the world is important to all business.

The automotive industry cannot flourish without assistance from other industries, according to the Hoover view, and in turn the automotive industry greatly aids all other industries. This is true not only in actual turnover of business, but in the information that the industry may have gathered from its own peculiar field.

Industry needs to become better acquainted, so that it may better appreciate its interdependence and better help itself as a whole. It needs to better balance its production with sales prospects, and sales prospects depend entirely upon buying power. Buying power is at its best only when all industry is going with a considerable degree of efficiency. Each industry is too inclined to "go it alone."

This condition can be greatly remedied by acquaintance and a mutual program. Hoover sees in the ideal Government Bureau of Commerce just such an agency, and he is working toward this end with the material that he can avail himself of. His present efforts are chiefly toward a gathering of the material that will serve as sign-posts and, when properly appreciated, as traffic regulations. The over- or under-production is at present probably the greatest waste in industry. That probably is why the first step has been taken toward a gathering of industrial activities to present a complete picture of index of business.

This accomplished, the other points of the program will become workable. Too few of us appreciate standardization in the big way. The first idea always is that all automobiles or stockings are to be made by the same pattern and of the same material. Secretary Hoover in his vision of possibilities sees a much larger meaning for standardization. It has not been harmful to the hosiery business that stockings have been standardized as to size, so that one firm's size 9 was the same as another firm's size 9. It has been helpful. The standardization that has been accomplished within the automotive industry has been helpful and it may be possible that this standardization can be carried on between industries in many particulars for better production.

A very great waste exists to-day because of idleness of plant equipment. It is entirely possible that, with better equipment, those industries that are seasonal can be brought to the aid of other seasonal industries, and a steadier use of equipment and employment brought about.

It is entirely obvious, of course, that a government survey of buying power in a foreign country can be made available to all industries much cheaper than a similar survey by each unit in each industry. Such a survey would indicate whether there was necessity for a survey of a particular unit for its own needs.

Secretary Hoover is going to ask much of industry. It will be a public service to join his efforts, and to assist him in making his plan efficient and equitable.

If we can join these efforts to make our Government efficient and helpful, we will get that much more out of it. If industry puts more into government, it will matter much less what government costs.

Analysis of the Recent Horse-Tractor Work Cost Report

It appears to be extremely difficult to get down to actual facts on what it costs to do work on the farm with a tractor. A recent comparison of horse and tractor cost comes nearer the point than many previous reports.

By David Beecroft

MANY misleading bits of information on what a tractor can do on the farm and how it compares in capacity for work and cost of work are partly corrected in a preliminary report on an investigation of tractor and horse work on 286 farms in Ohio, Indiana and Illinois, conducted by the Bureau of Farm Management and Economics of the Department of Agriculture, the investigations being made by a series of investigators who visited these 286 farms in the latter part of 1920. The Department of Agriculture was assisted in the work by a horse association known as the Bureau of Animal Industry and as such was sponsored by a horse organization rather than by tractor manufacturers. Having originated under what might be designated as horse auspices it can scarcely be considered favorably to tractor farming, but yet the result is generally highly complimentary to the tractor.

During the year covered by the investigation on the 286 farms on which horses and tractors were used, the report shows that the cost of farming by tractor was no greater than the cost by horses. This really means a cheaper cost for tractors, for as the preliminary report of the Department of Agriculture says, "any saving in man labor costs, any gain due to getting a larger amount of work done in a given time, and any other advantage connected with the use of tractors, which cannot be measured directly in dollars and cents, might be considered clear profit."

It has always been considered that a good way for a farmer to get advantages of the tractor on farming is the conservation of man power due to the short time in which a tractor will accomplish a given unit of work, as compared with the time needed by horses. Still another tractor advantage of importance, has been the ability to do the farm work when it best can be done and the greater crop yield due to this, as compared with the longer time needed by the horse. Big tractor farmers have always advanced this as the strongest reason for the tractor. This has appealed to them more than the cost per acre to do the work by tractors as compared with horses.

The government report shows that on the 286 farms using tractors, the tractor does the work of 2.1 horses on an average throughout the year. On these farms the tractors averaged only 30.8 full days' work per year; but the old tradition that the horse works 300 days in the year on the farm was exploded. The horses on these 286 farms averaged 68.6 full days' work per year. The horse is far from working 300 days per year. There is not work for him all the time and if there were he could not stand it the year round.

The report shows that in 1920 the cost of plowing by horse was higher per acre than by tractor. Here are the figures:

Plowing cost per acre, 2-plow tractor	$2.20
Plowing cost per acre, 3-plow tractor	2.20
Plowing cost per acre, horses	2.90

Here the report adds that in 1921 with reduced cost of horse feed the cost per acre of plowing by horses would be $1.90, adding that to the cost of farming by horses has reduced much more in the past year than the cost of farming by tractor. The report makes an effort to show what reduction in cost has been made by tractors due to reduced tractor prices and lower fuel prices.

In such other farm operations as disking and grain cutting the costs by tractor and horse are remarkably close. Here they are:

Disking, tractor, cost per acre	$0.67
Disking, horse, cost per acre	0.64
Grain cutting, tractor, cost per acre	0.67
Grain cutting, horse, cost per acre	0.59

Some light on the cost of keeping horses per year is shed by the report which states that on the 286 farms the average cost of keeping a horse per year is $159. This cost includes charge for feed, shoeing, veterinary, housing, interest at 6 per cent on investment and depreciation. It also gives the horse a credit of $15 per year for manure. The feed for the horse averaged $134 per year alone. Again the report apparently endeavoring to favor the horse estimates that based on March, 1921, prices the cost of feed per horse for 1 year would be about $80, but no deduction as to reduced tractor cost has been made. The average farm cost for horse labor per year on the 286 farms was $1,076. The cost of a horse per day is $2.43 for each day it works based on 68.6 days' work per year.

Some side lights on the long mooted question as to whether a farmer can sell some of his horses when he purchases a tractor are given in the report from the 286 farms. On 172 of the farms there was a reduction of 2.2 horses per farm. A still further analysis of these 172 farms reveals the following:

Farmers who did not reduce horses	44
Farmers who reduced by 1 or 2 horses	62
Farmers who reduced by 3 or 4 horses	43
Farmers who reduced over 4 horses	23

This is a definite answer to the question and the fact that a horse averages only 68.6 days' work per year on the 286 farms leads to the conviction that quite a few more horses could be disposed of if the farmer analyzed the situation as carefully as he might. Before these 286 farmers purchased tractors they had 1 horse to every 27.6 acres and after they had tractors they averaged 1

horse to every 37.9 acres. That there is a very great surplus of work horses on the average farm is plain by the fact that on 143 of the 286 farms all of the horses were not used for any one operation on the farm, there was always a reserve of horses.

Some useful cost figures on tractor operation are covered in the report. The 286 farmers estimated the life of the tractor at 6.7 years. To operate a two-plow tractor per day costs $12.65, and a three-plow tractor $17.75.

In fuel consumption while the kind of fuel used is not given in the report quantities are, and for different farm work the fuel consumption per day is:

Plowing 2-plow tractors	18 gallons
Plowing 3-plow tractors	23 gallons
Hay-loading, 2-plow tractors	11 gallons
Hay-loading, 3-plow tractors	15 gallons
Fuel per acre for plowing 2-plow tractor	2.8 gallons
Fuel per acre for plowing 3-plow tractor	2.7 gallons

The capacity of these tractors per day for different works are as follows:

Plowing 2-plow tractor	6.6 acres
Plowing 3-plow tractor	8.6 acres

The measure of work done by the tractors on the 286 farms covered in the report varied according to the kind of work, naturally the hardest job plowing being largely done by the tractor. Average percentages for all farms:

Plowing (by tractor)	85 per cent
Disking (by tractor)	73 per cent
Harrowing, etc.	43 per cent
Grain cutting	41 per cent
Haying	15 per cent

The volume of tractor sales in a given territory is highly dependent on the acreage of farms in the territory, and the type of tractor is also influenced by this fact. Here are the figures:

2-plow tractors	174 farms
3-plow tractors	104 farms
1-plow tractors	1 farm
4-plow tractors	6 farms
5-plow tractors	1 farm
Total	286 farms

The 286 farms averaged 258 acres, which is larger than the average of farms in these three States and the two-plow tractor was used on 75 per cent of farms under 160 acres and on 53 per cent of farms 160 acres or over.

The tractors were not all new, several having been used over three years and others as follows:

One year or over	106 tractors
One and one-half or two years	100 tractors
Two and one-half or three years	49 tractors
Over three years	31 tractors
Total	286 tractors

With these figures in mind the repair cost per year may be considered. The repair cost per year on the two-plow tractor was $39 and was the same on the three-plow tractor. The two-plow and three-plow tractors were out of commission only two days per year on the average when they were needed. Annual depreciation of the two-plow tractor is put at $164 and on the three-plow tractor $217.

It is questionable if tractors on these farms are used as much as they might be. There is always considerable belt work for tractors, but the report shows them used very little for such. The big job is what is called drawbar work, that is, pulling some implement, such as plow, disk, self-binder, hay-loader, etc. Here is an analysis showing averages on the 286 farms:

Drawbar work	23.5 days
Belt work	2.7 days
Custom work	4.6 days
Total	30.8 days

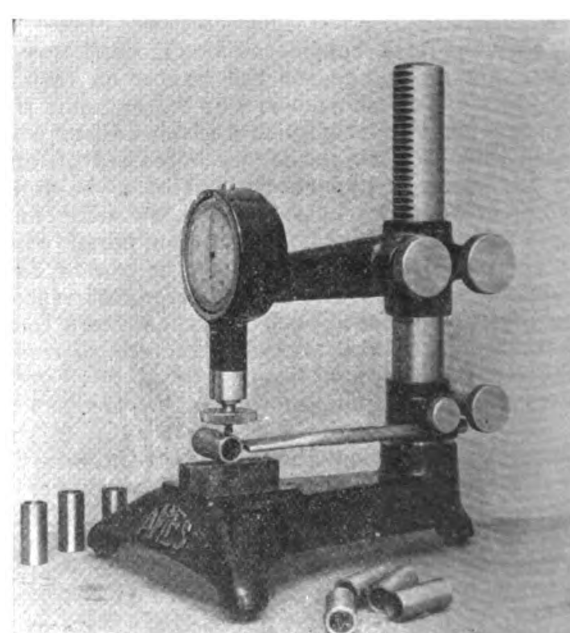
The report contains a few very useful observations on the possibility of farmers reducing cost of doing work by horses and also by tractors. It says: "Repair costs and fuel consumption of the tractors could in many cases have been reduced. The fact that on 20 of the 286 farms the work horses did less than 40 days' work per head per year indicates that on some farms there are still more work stock than needed."

A New Dial Comparator

THE Ames dial comparator, a new instrument herewith illustrated, is intended for use in the shop on production as well as in the inspection department. All parts of the instrument are protected from dust and all bearing surfaces are hardened and ground. The gage is designed for use on bushings, pins, shafts, plates and similar parts. Its advantage over the micrometer is that the personal element is eliminated, the operation of gaging being controlled by a spring. The dial is 1⅞ in. in diameter, giving 0.00005-in. readings direct as 1/16-in. on the dial, thereby enabling readings of .00025 in. to be made with ease.

In using the gage the clamp is loosened and the arm supporting the dial is raised or lowered by the knurled nut until the contact point touches the work or standard. The clamp is then tightened and the hand of the gage brought to 0 by turning the adjusting screw above it right or left. The gage has a travel of ¼ in., so that when set to a 0.500 in. standard it will measure from 0.500 in. to 0.750 in., making it handy on shafts, bushings, etc., of more than one diameter.

A stop is furnished for revolving work against, for out of roundness, etc. The gage is furnished with two hardened and ground anvils, ½ x 2 in. and 2 x 2-in. scored. It stands 10½ in. high and weighs 10 lbs.



The Ames Dial Comparator

An American Built Light Car

Designed along European lines for production in this country. Chassis has 100 in. wheel base, 50 in. tread, and weighs only 850 lbs. Adjustable steering gear and propeller shaft brake among the novel features.

By Herbert Chase

ADMIRERS of British and other European light cars have often expressed the hope that a car of similar design and proportions would be built in this country. Some efforts in that direction have indeed been made but have either failed or the design has been modified to meet the demands of the American public or other domestic factors, notably the competition of cars produced in quantity at a lower price. The Moller Motor Co. is attacking the problem from another angle by the production by American methods of a light car intended not primarily for domestic, but for European consumption. Cars will be marketed in this country, but the present intention is to export the bulk of the cars produced, and not to produce large quantities, probably about 300 chassis the first year.

The chassis, illustrated herewith, has a 100 in. wheelbase, 50 in. tread and weighs only 850 lb. The total weight with two seater body is said to be approximately 1100 lb. The engine has four cylinders of 2¾ in. bore cast in block with detachable L-head. The stroke is 4 in. The crankshaft has three white metal bearings. The front bearing is 2 in., center bearing 1¼ in. and rear bearing 2¾ in. long. The camshaft is also carried in three bearings. It is driven by Whitney chain and an idler is provided to take up the slack in the chain, this adjustment being made by turning a locknut and set screw projecting through the crankcase. The valves have cast iron heads 1⅜ in. o.d. welded to carbon steel stems. Connecting rods are drop-forged from .40 carbon steel. Lynite pistons with two hammered piston rings are employed. Both halves of the crankcase are of aluminum.

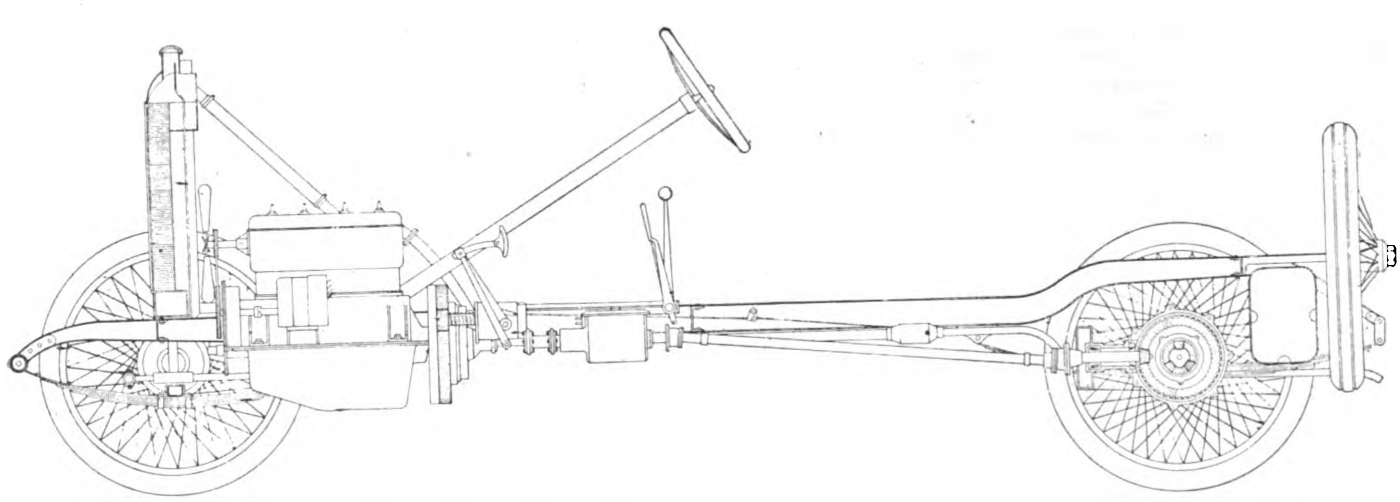
The engine is designed for high speed operation and is carefully balanced. It is said to be capable of speeds as high as 4000 r.p.m. It develops 20 hp. at 3000 r.p.m., at which speed it will, according to the manufacturers, drive the car at 60 m.p.h. with 4 to 1 gear ratio and 27 in. wheels.

Lubrication is by splash, the pump being bolted to the front plate of the distribution case, where it is readily accessible. Thermosyphon cooling is employed and the fan is belt driven. An attractive and distinctive honeycomb radiator with aluminum shell is fitted. Ignition is by Eisemann magneto. Bosch starting and lighting units are employed. These are carried on the subframe in which the engine and transmission are mounted and are located just forward of the gearbox. The generator is driven by a spring belt, and the starting motor is fitted with Bendix drive.

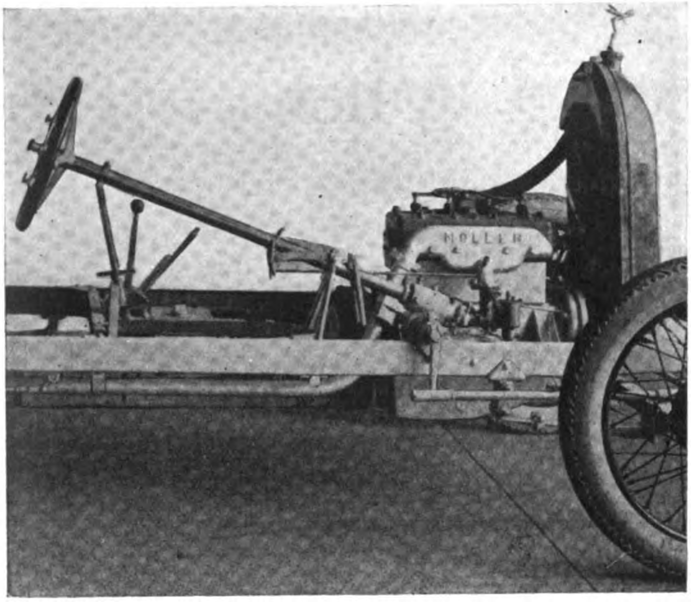
The clutch is of the multiple disk type. It has two driven plates and is enclosed by an aluminum case bolted to the flywheel. The gearbox is located amidship, following European practice, and is connected to the clutch by a shaft with two fabric disk joints. Gearbox and cover are of aluminum. The controls with *H* gate are located centrally above and just to the rear of the box. Three speeds are provided, the total reduction on low being 12 to 1 and on intermediate 8.68 to 1. The drive shaft is equipped with the smallest size of Spicer universal joints at each end. Hotchkiss drive is employed.

The final drive is by straight bevel gear to the semi-floating type of rear axle. The housing of the latter is of malleable iron. An interesting feature is the propeller shaft brake located on the axle just aft of the rear universal. This mounting gives the advantages of the transmission brake without transmitting the breaking stresses through the universals and propeller shaft. This brake is of the internal expanding type and is foot operated. The hand brake is also of the expanding type and is located on the rear wheels according to conventional practice.

The front axle is built up of square section seamless steel tube. The spindle yokes are welded into the ends of the tube, care being taken to secure an air tight joint so that water is excluded and corrosion prevented.



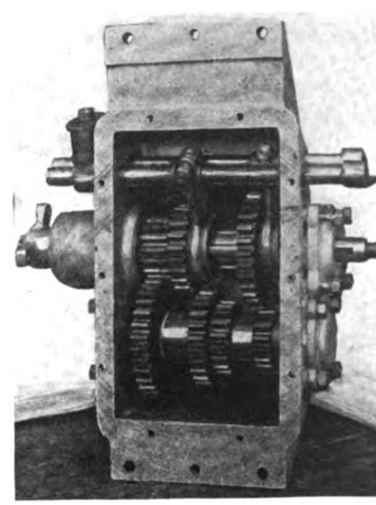
Side and part sectional view of the Moller light car chassis. Note location of foot brake on axle just aft of rear universal



Forward end of Moller chassis, showing adjustable steering gear and combined inlet and exhaust manifold.

Great care has been exercised in designing the spring suspension since the designers are convinced that the failure of many light cars has been brought about by failure to realize the importance, not only of easy riding, but of protecting the chassis parts from road shock and excessive stresses resulting from failure to provide proper springing. The entire chassis can be lifted by two men and the spring action is so soft that considerable deflections of the springs result from a rocking motion easily imparted to the chassis frame by one hand. The car is also easy running. It can be readily moved by grasping the propeller shaft in the hand and imparting to it a turning effort. All the springs are semi-elliptic. Those in front are 31 in. long and the rear pair 40 in. long. The leaves are tapered, being thinner at their outer ends, and made of silico-vanadium steel. Lubrication of chassis parts is provided by 21 Alemite connections where necessary.

The frame is of 1/8 in. pressed steel and has a 4 in. kick-up at the rear end. Three hot riveted cross members, one under the radiator, one just aft of the gearbox and the third just aft of the rear axle, are provided. The two forward cross members carry the subframe used to support engine and gearbox. Five Stewart wire wheels, with four 27 x 3½ in. clincher tires, are furnished as standard equipment. The road clearance is 8 in.



Amidship transmission used in Moller chassis.

The 5 gal. gasoline tank and the spare wheel are carried at the rear of the chassis. Fuel feed is by the Giorgio Georgy vacuum system to a 1 in. Zenith carbureter. Inlet and exhaust manifolds are cast in one piece, to provide heat to vaporize the charge. The car is claimed to make 35 miles per gallon of gasoline.

One of the novel features of the car is the adjustable steering gear. This is of the worm and wheel type and is mounted on top of the chassis frame, with the steering arm outside. It can be furnished for either right or left hand drive, as desired. The steering column can be raised and lowered from the driver's seat to suit the driver's convenience. It is locked in the desired position by an adjustable link, the forward end of which is connected to the dash.

It will be noted that nearly all the units in the car are designed especially for use in the Moller chassis. The small size and light weight of the car made it impossible to use many standard parts, hence the car is not an assembled product in the ordinary sense of the term, though many of the units are, for the present at least, being built outside the Moller factory—some of them by makers of standard parts. The aim of the Moller brothers, who are Danish engineers, has been to produce by American methods a high grade light car incorporating many European features of design and equipment, and primarily for sale in Europe.

Cars sold in the domestic market are expected to retail for about $2,000.

Motor Vehicles in Denmark

A CENSUS of motor vehicles has been taken in Denmark each year since 1909 except during the years 1918 and 1919. The latest census was held on Sept. 1, 1920, and showed that on that date there were in the country 11,594 private passenger cars, 2276 motor cabs and omnibuses, 3787 motor trucks and 12,182 motorcycles. The following table gives a general survey of the growth of motor transportation in Denmark:

Date of Census	Passenger Cars	Trucks	Motorcycles
Sept. 1, 1920	13,870	3,787	12,182
May 29, 1917	6,360	930	8,633
Sept. 1, 1916	4,995	723	7,766
Sept. 1, 1915	3,773	558	6,347
Sept. 1, 1914	3,079	351	5,248
Sept. 1, 1912	1,025	162	4,507
Sept. 1, 1910	920	77	3,478
Sept. 1, 1909	699		3,167

In connection with the above table it should be mentioned that in the figures for 1920 are included the cars, trucks and motorcycles in South Jutland, or that portion of Northern Schleswig which fell to Denmark as a result of the plebiscite last year. The census showed that district to possess 463 passenger cars, 41 motor trucks and 160 motorcycles. The rapid increase in the number of cars and trucks in Denmark during the past three years is noteworthy. The increase was especially great in the country districts.

ALL tests on recent aluminum solders have been completed by the Bureau of Standards, and Circular 78, "Solders for Aluminum," will now be revised to include these tests. In spite of claims made by those interested, no solder for aluminum has yet been found which will withstand the corrosion test, although the fused zinc chloride solders withstand corrosion for the greatest length of time.

Renault Now Producing Wheel Type Tractor

Has abandoned track-laying type and other tank features in new wheel type model which is much lighter than earlier machines. Built-up frame and axle with bevel and planetary reduction are employed.

By W. F. Bradley

FIRST of all French automobile manufacturers, Renault got into the agricultural tractor business a few weeks after the armistice with a track-laying type of machine based on his war tank design. Naturally the machine was lightened for the special work it had to perform, but in order to gain time some of the purely war tank features were retained. A later edition of the same tractor made its appearance a year ago with modifications suggested by a year's practical experience on the land.

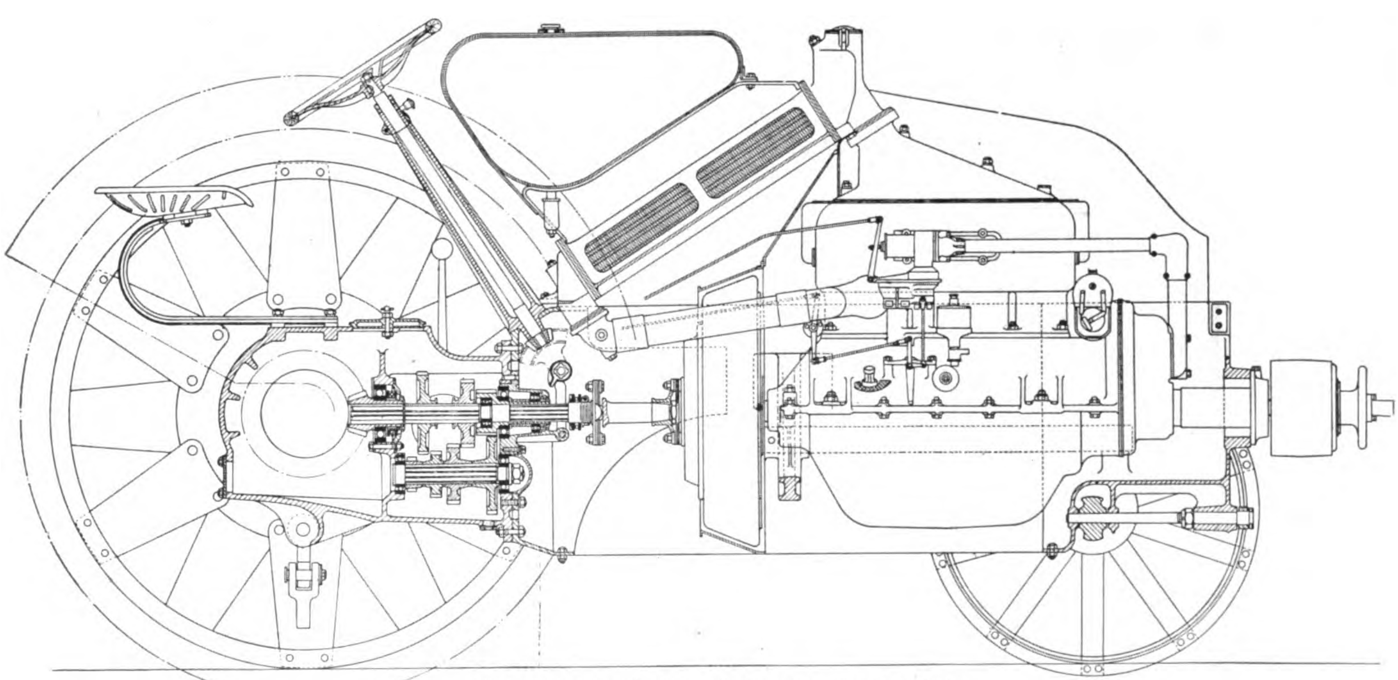
A third model of the tractor has now come forth, and although this is the direct successor of the war tank machines, all the military features have disappeared. Renault has abandoned creeper bands in favor of wheels, and although the two types are being produced, their capacities are so nearly alike that it is reasonable to suppose the endless track machine will ultimately disappear.

The engine is a block-cast, 95 x 160-mm. (3.74 x 6.3-in.), four-cylinder type, with fixed L-head, high-tension ignition, thermo-syphon water circulation, and a pump-circulated oiling system. This type of engine has long been standardized by Renault, for in addition to being used on his tanks, with a special lubricating system, it is employed on his 3-ton trucks. The radiator is placed back of the engine and inclined at about 45 degrees; a strong draft of air is assured through the tubes by the flywheel fan, and there is a lesser tendency for dust to enter under the hood than with the radiator mounted in front. An air washer is not used.

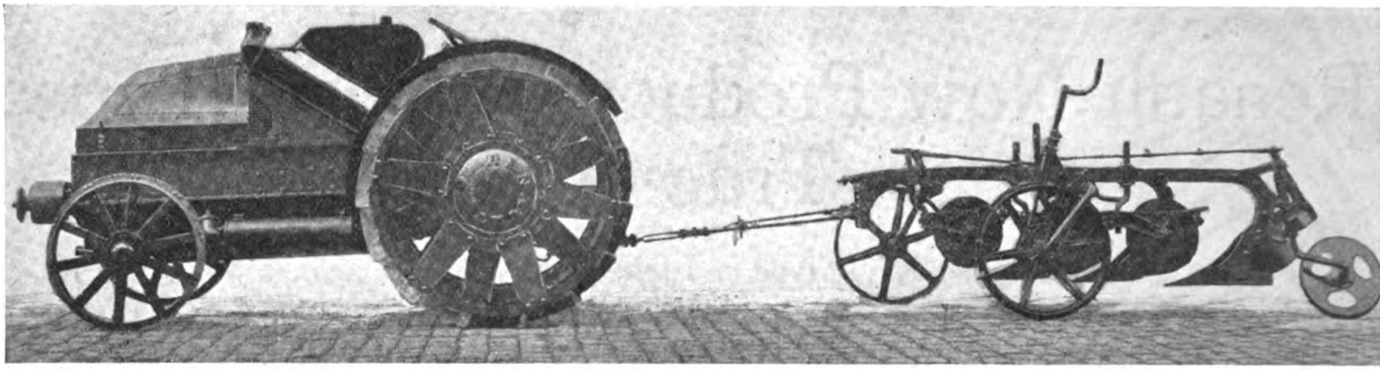
The new Renault tractor occupies a midway position between the frameless type of machine as represented by the Fordson and the automobile type with full frame. There are two channel section main frame members united at the front by a cast-steel cradle in which the front axle is pivoted, and at the rear by another cast-steel member which forms a face plate to which the united gearbox and differential housing is bolted. A channel section subframe carries the engine, and this latter is connected to the gearbox by a short shaft with two flexible steel disks. This design permits the use of the stock truck engine and at the same time reduces total weight of the machine compared with a frameless tractor. The total weight of the Renault wheel tractor is given as 2 tons, whereas the track-laying type machine, with the same engine, weighs more than 3½ tons.

The rear axle housing is built up with a cast-steel center and steel tubes, and forms a unit with the gearbox, the housing of which is also a steel casting. This unit is bolted to the face plate of the rear cross member of the main frame, in which is mounted the engine and radiator.

An inverted leather-lined cone clutch is used, and



Sectional view of the new Renault wheel tractor.



The Renault wheel tractor with plows attached. Note muffler carried below tractor frame

the gearbox gives three speeds and reverse, the ratios corresponding approximately to 1¾, 2½ and 7 miles an hour. Bevel gears give the first reduction from the drive shaft to the axle shafts, but there is a final reduction by planetary gears and internal spur pinion within the rear axle hubs. This type of final reduction has been in use for a considerable time on Renault 7-ton trucks and has given very satisfactory results.

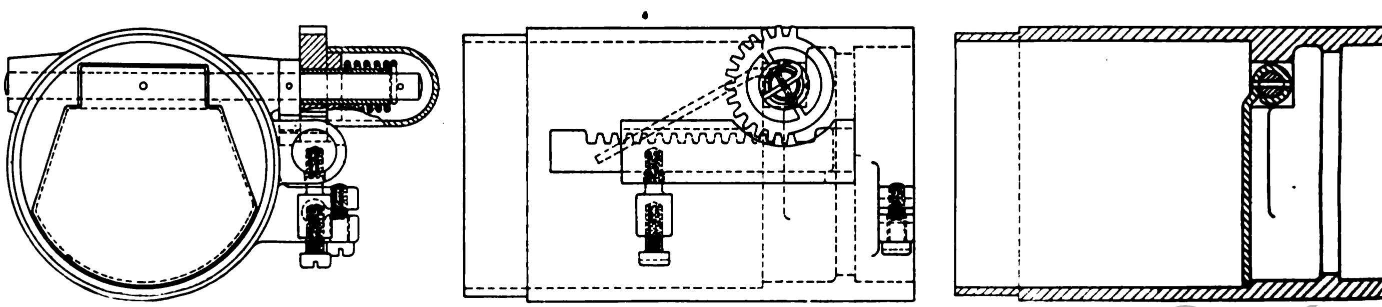
The rear wheels are built up of sheet-steel rims with flanged edges and sheet-steel spokes riveted to the hub carrying the final reduction gears. Diameter of the wheels is 45½ in. and width 11 4/5 in. The front wheels are of the same design, and have a diameter of 27½ in. They are mounted on a straight axle, which is pivoted to the forward cast-steel cross member of the main frame. There are no springs, and, as the rear is rigid, the entire chassis pivots around the point of attachment to the front axle. A clutch-controlled pulley for belt drive is mounted on a forward extension of the crankshaft.

A Flexible Choke Valve

THE carbureters of practically all American cars are now fitted with a choke valve in the air inlet by means of which the vacuum around the spray nozzle can be increased while starting the engine and while warming it up, with the result that a richer mixture is fed to the engine than would otherwise be the case. This richer mixture is required because the fuel contains some constituents of very high boiling point which are not vaporized when the engine is cold and therefore really do not count in the combustible mixture. The ordinary choke valve is a butterfly valve which is controlled by hand from the driver's seat. One disadvantage of this type of valve is that with it the vacuum in the carbureter increases exceedingly fast with an increase in engine speed, and that then excessive amounts of fuel are drawn in.

A type of choke valve intended to obviate excessive enriching of the charge at the higher engine speeds is being marketed by the Gasoline Economy Co. under the name of the Winters flexible choke valve. It is in the form of a flap valve which is held to its seat by a coiled spring. The spring comprises quite a number of complete convolutions of wire, so that its torsional force is not very much different whether the valve is open or closed. As the speed of the engine increases, the increased suction opens the valve farther, but this increase in the opening of the valve in turn tends to keep down the suction. According to a test made for the manufacturers, the suction in the carbureter with the Winters flexible choke varied from 0.15 in. of mercury at 300 r.p.m. to 0.65 in. of mercury at 1500 r.p.m. and was then only imperceptibly higher than when no choke at all was used. With the regular choke, 30 deg. open the vacuum rose to 6.4 in. of mercury at 1,350 r.p.m. A rack and pinion mechanism is provided for easy adjustment of the spring force.

THE competition between road and rail transport may lead to a wasteful use of both these agencies unless steps are taken to effect the necessary degree of coordination. Arthur Watson, general manager of the London and North-Western and Lancashire and Yorkshire railways, dealt with this aspect of the question in a recent address to the Manchester Statistical Society. Although the committee which inquired into the subject was in the main hostile to the granting to railways of extended powers to engage in road transport, Mr. Watson believes that the telegraph and telephone communication systems established by railway companies could be utilized with advantage to organize transport by road as well as rail. Any fear of a universal transport trust being brought into existence by the intrusion of railways into the arena of road transport could, it was intimated, be dismissed as groundless.



Sectional views of the Winters flexible choke valve and its operating mechanism.

Examples of European Practice in Three and Four-Point Suspension

Tendency is toward three-point type though majority of cars still employ the four-point arrangement. One maker employs a self-aligning ball bearing as support for extended front end of crankcase.

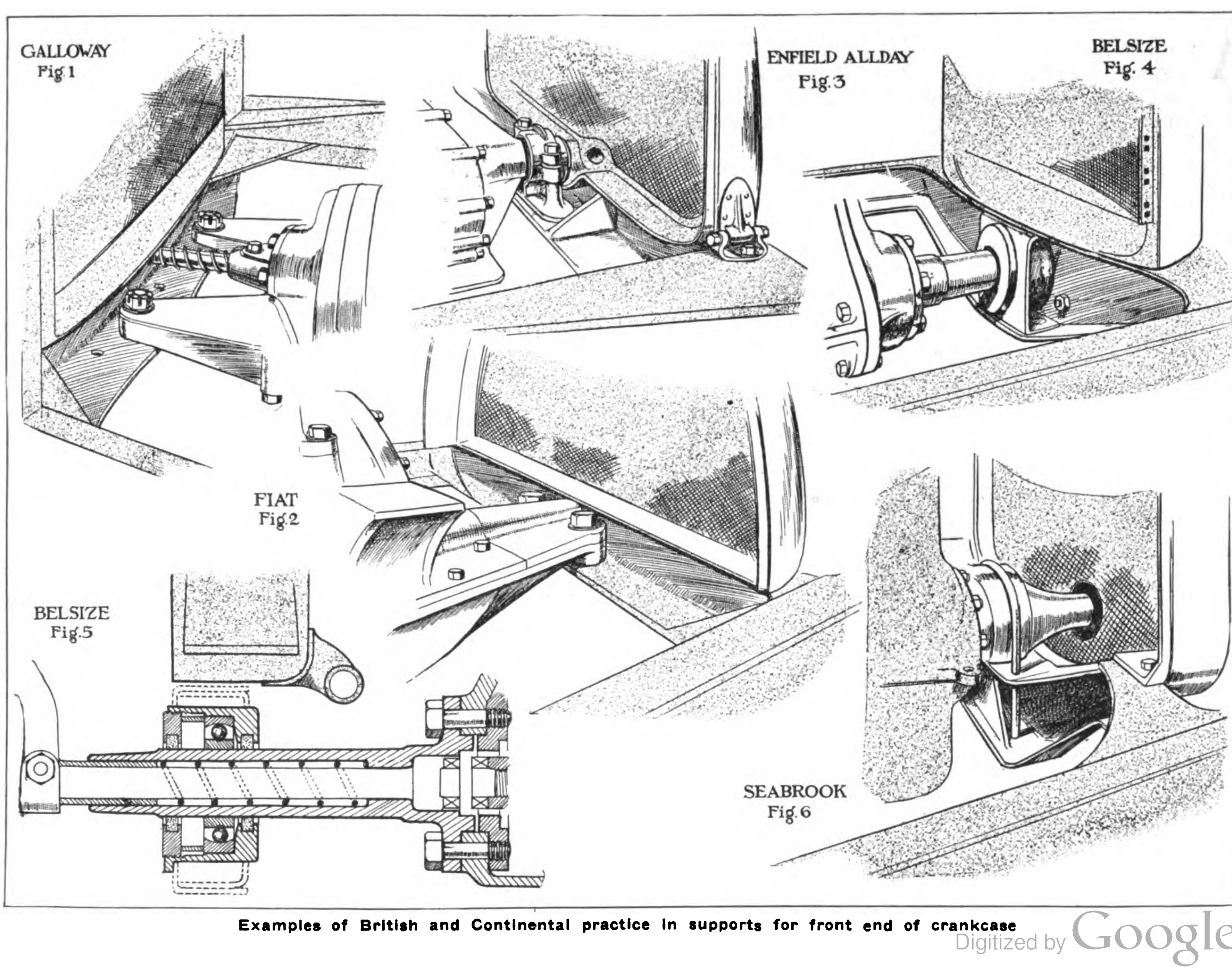
By M. W. Bourdon

THERE is a gradually increasing movement among European, and particularly British, designers to drop the four-arm crankcase in favor of a three-point support for engine or power unit, though admittedly the majority of European cars still have the former or some equivalent—for example, a four-point supported sub-frame or side extension webs of the crankcase.

But when the three-point arrangement is aimed at there is a great divergence in the manner in which the object in view is approached. Some designers apparently fear to go all the way, and, while discarding the two front arms extending from the side of the crankcase, still retain a two-point front end support. Examples of this compromise are seen in Figs. 1 and 2 herewith, the first being a sketch of the Galloway (one of the productions of the Beardmore interests), the second illustrating the Fiat front end.

Obviously the latter approaches nearer to the three-point ideal, and, compared with some single front end suspensions, is clearly a cheaper arrangement to produce. But, like the Galloway arrangement, it is a four-point suspension, nevertheless, and something has to yield when there is frame distortion; probably the frame webs accommodate themselves to the conditions of the moment.

The hemispherical trunnion bearing for the nose of the crankcase, somewhat on the lines of that shown in Fig. 3, is most usually favored by engine designers with



Examples of British and Continental practice in supports for front end of crankcase

three-point suspension in view. In the case illustrated the cross member is an angle casting with stiffening webs each side of the center, as shown; but as a rule a pressing of the usual channel section is favored, which necessitates a modification of the trunnion bracket—unless there is a pronounced dip in the cross member or a relatively high crankshaft center. This modification generally consists of securing the bracket to the vertical web of the pressing by horizontal bolts. But whether the bracket be supported as shown or otherwise, a split bronze bushing with a parallel bore and hemispherical exterior surface is almost invariably an accompaniment, with a grease cup in the bracket cap.

What is probably unique in front end engine mountings is the arrangement shown in Figs. 4 and 5, which is used on the Belsize, a medium-priced British car. To secure the effect of a spherical attachment to the frame the front extension of the crankcase is encircled by a self-aligning ball bearing mounted within a cage or cylindrical housing, itself supported by a piece of reversed channel steel riveted to the front cross member. Two felt gland washers are used, the front one located in a groove of a ring nut screwed into the bearing house from the front. A point about this mounting is that it allows for end movement between the parts, besides providing a spherical mounting, for the crankcase extension is not secured axially to the inner ball race or to any other detail. Apart, however, from direct considerations of cost, this Belsize mounting is open to criticism owing to the difficulty of insuring perfect alignment of the holes in the riveted channels for the bearing housing.

The last example, shown in Fig. 6, has greater possibilities as a production job, though the illustration represents the front end engine support on a British car (the Seabrook) with a very small output. The front end extension of the crankcase is, seemingly, larger than need be, though this is a fault on the right side in view of the fact that in this case it is of aluminum. The need for welding a triangulated web stiffener within the channel of the cross member will probably constitute no objection to the production expert, in view of the elimination of that *bête noir* of the machinist—*i.e.*, a spherical surface.

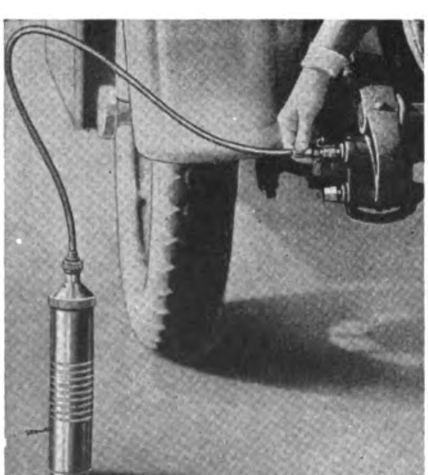
This last scheme is obviously capable of improvement. In the first place, the aluminum surface in contact with the cross member will clearly soon be indented and become a source of noise and hammering. But it should not be difficult to overcome this in a simple and cheap manner—if merely by the provision of a cradle of brass or steel, located by the U bolt, to form an immediate support of quite considerable area. Admittedly, this arrangement, lacking a spherical bearing, would not provide the ideal front end support for a three-point suspension, but it would go a very long way and take up the effects of frame distortion.

An Oil Pressure Reservoir

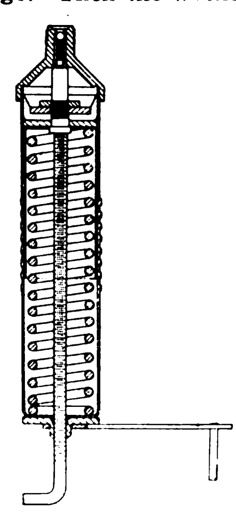
AN oil gun designed for use in a chassis lubricating system consists of a nickel plated metal bottle in which are located a piston and a heavy coil spring. The oil is contained in the upper part of the bottle and is put under pressure by the piston and coil spring. A length of flexible tubing is attached to the top of the bottle and the end of the tubing is equipped with a check valve which is released by the special fittings which replace the grease cups and oil cups on the car.

In fitting the gun, the cap at the top should not be removed until the full tension has been taken off the piston by contracting the spring to the fullest possible extent. This is done by inserting through a hole in the bottom of the bottle, the long, threaded rod which is supplied with the outfit. This rod contracts with a socket in the bottom of the piston. The rod is screwed into place and then the nut run up this rod as far as it will go. Then the wrench is used to bring the piston back to as near the bottom of the bottle as possible. This comprises the spring and releases all pressure from the top of the bottle. The cover is then removed and the bottle is filled, the cap replaced, the tension taken off the spring by turning back on the nut at the bottom, the threaded rod removed, the bottom cap replaced, and the oil gun is ready for service.

The device described is known as the Romon oil gun and is manufactured by Roberts & Monroe.



Romon oil gun in use



Sectional view of Romon oil gun

An Optical Pyrometer

A SIMPLE and cheap optical pyrometer known as the Pyromike has been developed in England by the Rudge-Whitworth Laboratories. It weighs only 5½ ounces and can be carried in the vest pocket. It is suitable for measuring all temperatures from a red heat upward. Its appearance resembles one-half of a pair of binoculars, or a little telescope 1¼ in. diameter by 2¼ in. long. Within the body of the instrument is a cell, composed of two circular glass disks joined by a piece of rubber tube, the latter being surrounded by a spiral spring. This cell is filled with colored liquid, and can be collapsed lengthwise by the rotation of the end of the instrument relatively to the eyepiece and body. The amount by which the cell is shortened is read off a graduated scale on the barrel, somewhat similar to that of a micrometer. To determine the temperature of any article, the latter is looked at through the instrument, and the cell slowly lengthened by rotating the end ring until the article ceases to be visible on account of the increased length of the light-absorbing liquid which has to be traversed by the light. The temperature can then be directly read from the scale engraved on the body. Each instrument has a total range varying from 250 deg. to 600 deg. C., depending on the kind of temperature which it is specially arranged to measure.

An Analysis of Elements Which Govern Automobile Fuel Economy

Part II.

The influence of air-fuel proportions, metering characteristics of carbureters, mechanical efficiency at part load, ignition timing and the size and speed of engines, is considered. A summary of theories and facts relating to fuel knock is also given, with pertinent comment thereon.

By H. C. Dickinson, S. W. Sparrow and R. L. Wales*

Influence of Air and Fuel Proportions Upon Engine Efficiency and Power

THE carbureter exists to proportion air and fuel so that the engine can deliver its maximum power or attain its maximum efficiency. Experiments to determine what these proportions should be have been made usually upon multi-cylinder engines. Faulty distribution influences the results thus obtained, since it necessitates an excess of fuel being supplied to some cylinders in order that the other cylinders can receive sufficient fuel for satisfactory operation. These results are, however, of immediate value, as they show what proportions the carbureter must furnish to cope with the faults of existing induction systems and yet give satisfactory engine operation.

The chemical combining proportion of air and a given fuel is a fixed quantity. In practice, a lower air-fuel ratio usually gives greater power and a higher air-fuel ratio greater economy. One reason for this is the lack of an intimate mixing of the air and the fuel. Supplying excess air tends to make certain that all the fuel is intimately associated with sufficient air to insure its combustion and thus to attain the maximum economy.

Investigators are in fairly close agreement as to the air-fuel proportions for maximum power, finding ratios of from 11 to 1 to 13 to 1 best in this regard for ordinary gasoline. A recent series of tests at the Bureau of Standards has shown that with an aviation engine having compression ratios of 5: 3, 6: 3, 7: 3 and 8: 3, the maximum power was obtained with air-fuel ratios of from 13 to 1 and 14 to 1, with air densities of from 0.025 to 0.075 lb. per cu. ft. This was, however, with aviation gasoline, a more volatile product than the commercial fuel.

Work done at the Bureau of Standards and elsewhere shows that the efficiency with any proportions with which the engine will operate is independent of the power developed. The same conclusion seems to have been reached by Ricardo. Failure of the engine to operate properly at very low loads with mixtures as lean as those giving maximum efficiency at greater loads seems to be due to dilution by the residual products of combustion. In present types of automobile engine the maximum power is obtained with air-fuel ratios of from 11 to 1 to 13 to 1 and the maximum efficiency at ratios in the neighborhood of 16 to 1, if the engine will operate regularly with such mixtures. Where dilution by the products of combustion necessitates richer mixtures, the maximum efficiency is attained with the leanest mixture at which the engine will operate regularly.

Metering Characteristics of Carbureters

As any wide departure of the mixture ratio from that corresponding to the maximum economy with a changing load on the engine may mean a serious waste of fuel, the load-mixture characteristics of several widely used carbureters are of interest. It might be assumed that since the pressure reduction causing fuel flow depends on the velocity, at a constant density, through the venturi in the normal type of carbureter, the gasoline discharge, and consequently the mixture ratio, would be determined solely by the weight of air used per second, or by the engine load. It is to be remembered, however, that a given weight of air may be used under very many different combinations of throttle position and manifold depression, corresponding with different relations of torque and speed of the engine. Experiment shows that with the usual location of the throttle, throat suction and, consequently, mixture ratios are affected not only by quantity of air passing but by the degree of opening of the throttle itself. Tests at the Bureau made with six widely used carbureters for various rates of flow, each at several relations of throttle position and manifold depression, show that the mixture ratio varies in one case from about 10 to 1 to nearly 17 to 1, and between still wider limits when comparing the different makes of instrument. The actual mixture proportions depend largely upon the particular adjustment used, but the change in proportions with change in load involve decreased economy under some conditions.

The Mechanical Efficiency of Engines, with Particular Reference to Part-Load Conditions

The mechanical efficiency of the engine is the ratio of the power delivered at the clutch to that developed in the cylinders. The difference between these two powers is used to overcome the internal friction of the engine, drive the auxiliaries and draw in and exhaust the charge. All of this power loss is included in the term "friction horsepower," although some of the elements are not due, strictly speaking, to friction. Thanks to the widespread use of the electric dynamometer, the determination of this friction horsepower is comparatively easy. It con-

*Members of the staff of the Bureau of Standards, Washington. Condensed from appendices to the paper by W. S. James presented at the Semi-Annual Meeting of the Society of Automotive Engineers.

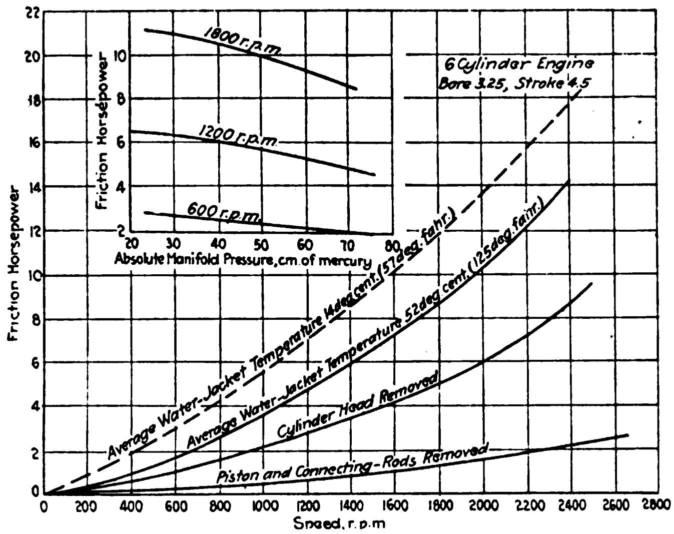


Fig 2—Relation between Friction Horsepower, Speed and Manifold Pressure Under Various Conditions.

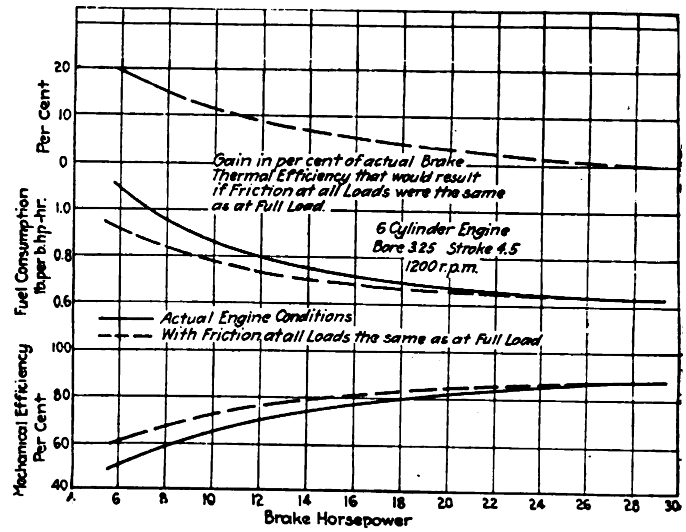


Fig. 3—Results of Tests on a Six-Cylinder Engine Showing the Relation Between Mechanical Efficiency, Fuel Consumption and Brake Horsepower.

sists in measuring the power required to drive the engine without fuel or ignition, while keeping all conditions as nearly as possible the same as when the engine is operating under its own power.

Fig. 2 makes clear the need for maintaining the jacket water temperature at its normal value during such determinations. At 1000 r.p.m. the friction with a jacket water temperature of 14 deg. C. (57 deg. Fahr.) is more than 50 per cent greater than when the temperature is 52 deg. C. (126 deg. Fahr.). This difference is a consequence of the higher viscosity of the oil at the lower temperature. One should not infer from these curves that the proper viscosity for an oil is that which gives the minimum friction. The viscosity must be high enough to prevent metal-to-metal contact, even when the oil is diluted with fuel. Nevertheless, the curves do illustrate the excessive friction loss that will ensue from use of oil of a viscosity unnecessarily high.

Comparison of Frictional Losses

A rough comparison of the magnitude of the several elements that comprise the friction loss is given by the lower three full-line curves. The results show piston friction to be responsible for a large proportion of the total loss. At 2400 r.p.m., with the cylinder head removed, the power required to drive the pistons and the connecting rods is three times as great as that to operate all the rest of the engine.

It is frequently assumed that the difference between the friction horsepower measured under normal conditions and that obtained with the valves or cylinder head removed represents the pumping loss. Values of the pumping loss obtained in this manner are considerably higher than those given by actual indicator card measurements. It appears, therefore, that the removal of the cylinder head not only eliminates the pumping loss but also reduces the piston friction through the change in pressures that results. This statement is made reluctantly because it has been found that the friction of the engine under power is not sensibly different from that when the engine is driven by the dynamometer, in spite of the lower pressures in the latter instance. At present the best that can be said is that measuring the pumping loss by this method of difference is open to question.

It is well known that the mechanical efficiency of the automobile engine decreases with a decrease in the load. One cause is the increase in the friction horsepower that results from closing the throttle. Fig. 2 shows this effect at three speeds, the absolute manifold pressures indicating the amount of throttle opening. That this is not the major cause of the low efficiency will be evident from Fig. 3. Here the mechanical efficiency and fuel consumption are plotted against the brake horsepower. The fuel-consumption calculations are based upon 0.55 lb. of fuel per i.hp.-hr., a value that is assumed to be constant over this load range. The dash line curves show results that might be obtained if the friction horsepower did not increase with the closing of the throttle. At 20 per cent load the upper curve shows a 20 per cent increase in the efficiency to be possible; that is to say, a car now going 15 miles on a gallon of fuel could then go 18. Even under these conditions, at 20 per cent load the specific fuel consumption would be 40 per cent greater than at full load. The low efficiency of the automobile engine is thus seen to be due primarily to the fact that it normally operates at a small percentage of its maximum power. This reserve power, however, if not actually a necessity, is at least a luxury that will not be willingly relinquished.

Emphasis may well be placed on the importance of keeping the friction as low as possible because its influence is multiplied at reduced throttle. For example, under the conditions of Fig. 3 an increase of 1 friction hp. would increase the fuel consumption at full load only 3 per cent, but at 20 per cent load, 9 per cent. Small gains in mechanical efficiency thus justify the expenditure of considerable effort toward their attainment.

Ignition Timing

The point in the cycle at which the ignition spark should occur in order that the engine efficiency may be a maximum is affected both by the speed of the engine and by its load. Many systems are constructed so that the timing of ignition changes with any change in the speed. There have been, in experimental use at least, devices which enabled the ignition timing to be controlled by the manifold pressure in an endeavor to meet the requirements of changing load.

There seems to be a dearth of experimental data on the amount by which the timing should be changed with changes in speed and load. Fig. 4 is typical of the data that are required. It shows the brake mean effective pressure obtained with various degrees of spark-advance for two speeds and three loads. The length of the blocks adjacent to the curves indicates the range of spark-

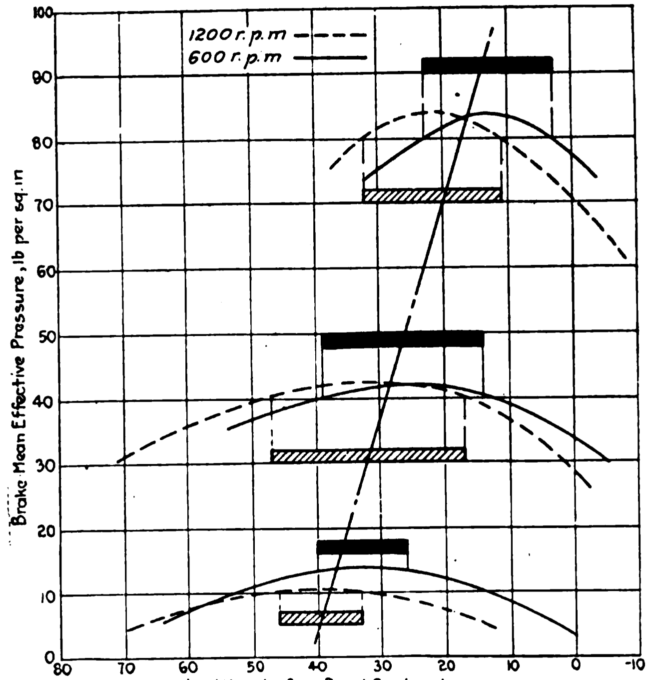


Fig. 4—Influence of Ignition Timing Upon Brake Mean Effective Pressure

timing within which the brake mean effective pressure will not be more than 5 per cent less than its maximum value. Inasmuch as the fuel consumption does not change appreciably so long as the speed and the throttle opening are kept constant, a change in the brake mean effective pressure means a corresponding change in the thermal efficiency. A compensation for load changes that would give the spark-advance brake-mean-effective-pressure relation shown by the dash line would be fairly satisfactory for the two speeds tested. Data of this sort should be obtained over the range of speeds and loads at which the engine will operate in service.

It is a common belief among automobile drivers that the maximum efficiency is obtained with the maximum advance at which the engine will operate without knocking. Under the conditions shown by the lower curves no knock was obtained even with the maximum advance, so that an adjustment in accord with the aforementioned belief would result in a decrease in efficiency of over 50 per cent. With manual control of spark-timing the possible advance should be limited to prevent this excessive loss of efficiency.

Fuel Knock

The phenomenon variously known as fuel knock, detonation and pinking has assumed so much importance because of the practical limitations it imposes on compression ratio and consequently on fuel economy that there has come to be much discussion and more speculation as to the exact nature of what takes place in an engine cylinder when this phenomenon occurs. However, neither the discussion nor the mass of information gained, directly and indirectly, from experiments has led to a definite understanding or even to a satisfactory theory of the nature of the phenomenon. The term detonation implies that something occurs in the cylinder which corresponds to the detonation of a high explosive. Such conditions are easily produced in explosive gas mixtures, but there is scant proof that the same thing occurs in an engine cylinder. In fact, some of the experimenters most familiar with these phenomena doubt the possibility of such occurrence.

To clear up some of the indefiniteness, an attempt has been made to enumerate the various facts and observations concerning fuel knock and to discuss the bearing of these facts on the several theories that have been advanced to explain the nature of the phenomenon. Fuel knock, as ordinarily understood, is characterized by the following phenomena:

(1) A very sharp metallic noise
(2) Bright yellow flame within the cylinder
(3) Decrease in power
(4) Increase in heat rejected to the jacket water
(5) High instantaneous cylinder pressure
(6) Destructive mechanical effects
(7) Occurrence of smoke in the exhaust
(8) Preignition, in most cases

Observations show that the occurrence and intensity of the knock are intimately related to the following factors:

(1) Chemical composition of the fuel
(2) Ignition timing
(3) Compression pressures
(4) Mixture ratio
(5) Position and number of spark-plugs
(6) Shape of cylinder and piston-head
(7) Temperature of the charge
(8) Cylinder temperatures

Aside from more or less random speculations, there are at least three rather definite theories or hypotheses presented as explanations of the character of this knock phenomenon. These are (*a*) what may be termed the mechanical-knock theory, which explains the sound by means of some mechanical knock or impact between parts of the engine mechanism—as, for instance, between cylinder wall and piston, or between shaft and bearings. This theory does not attempt to explain the cause of pressures which must exist to produce these mechanical impacts. On this theory it would be assumed that there is no necessary difference between the so-called fuel knock and any other purely mechanical knock, except that the former is primarily due to cylinder pressures, while the latter may be due to inertia effects, etc.

Ricardo's Fuel Knock Theory

Another theory (*b*) is that proposed by Ricardo, which explains the sound and other phenomena as due to a sudden very rapid increase in cylinder pressures. It is assumed that a portion of the charge, compressed to the ignition point by the expansion of the portion first ignited, burns simultaneously, causing a very sudden rise in pressure. This theory does not contradict the former, but assumes that the sound may be produced either by the sudden distortion of the cylinder walls by gas pressure or by mechanical impacts in the mechanism, due to the sudden pressure increase. It seems to require the assumption that a fuel will show a tendency to knock somewhat proportional to its spontaneous ignition temperature, but it makes no attempt to explain the nature of the explosion or detonation which occurs in the compressed charge.

A third theory (*c*), which may not necessarily contradict either of the foregoing, is the so-called detonation-wave theory. According to this the process of explosion is explained somewhat as follows: When ignited the wave of combustion spreads out from the ignition point at a relatively slow but increasing rate. Under certain conditions before the flame has filled the combustion space, its rate of motion increases to what is known as detonation velocity, a velocity so high as to constitute practically the simultaneous burning assumed by Ricardo. An interesting theory regarding the nature of the chemical reactions which account for the increase in flame

velocity has been proposed by Midgley. Such detonation waves in gas mixtures were first discovered in 1881, independently by Berthelot and by Mallard and Le Chatelier. These velocities and characteristics are reasonably well understood. The velocities are from 1 to 2 miles per sec., sufficient to account for the sound and pressure effects which are observed in engine cylinders. But in direct experiments it seems never to have been possible to attain these velocities within the short space in an engine cylinder.

Of the three theories, the first does not attempt an explanation of the phenomenon. Whatever causes the characteristic sound is certainly actuated by the sudden increases in cylinder pressure which have been measured repeatedly. The direct causes of these increases in pressure are of more interest than the source of sound, and the only attempt at explanation of sudden pressure increases is found in the theories (*b*) and (*c*); hence these appear of greater interest. In considering the bearing of known and observed facts on these theories, it is important to note that the one important difference between the two theories is that (*b*) assumes that the cylinder pressures are true pressures produced by a sudden increase of pressure throughout the cylinder, while (*c*) includes the assumption that the high pressure may be localized impacts of the detonation wave. This means that the maximum pressure may not be by any means the same at different points within the combustion space.

Phenomena Which Accompany Fuel Knock

The short metallic sound produced by fuel knock, particularly in light-weight cylinders, suggests the impact of a very light hammer on a heavy anvil. Observations of the velocities imparted to a light steel rod resting on the top of a Liberty engine cylinder during detonation show a number of interesting facts. For instance, it is found that under detonation conditions this cylinder head is distorted with a velocity which might correspond to that of a tuning-fork, corresponding to that of a sound having a pitch above the range of the piano keyboard, or of the order of 4000 vibrations per sec. The action of the cylinder pressure is, therefore, entirely sufficient to account for the characteristic sound produced.

The characteristic bright yellow flame within the cylinder, which is observed to accompany the fuel knock, has been shown by stroboscopic observations to be of very short duration, occupying not over 10 deg. rotation of the crankshaft or about 0.001 of a sec. in time. Evidently the flame phenomenon is worthy of more careful study as to its exact time of occurrence, its duration and the characteristics of the intermediate products of combustion. Such information might go far to explain the knock phenomena.

A decrease in the power output accompanies knock, but there seems to be no very close relationship between power and knock. Apparently fuel knock of itself does not reduce the power, but rather the conditions at which the knock occurs are not those for maximum power. Whether these conditions would produce the maximum power with a fuel that did not knock cannot be answered with certainty.

It has been observed that whenever fuel knock develops, due to a change in the timing or pressure, or a change in the fuel, there is an abrupt increase in the heat rejected to the jacket water. There are several possible explanations of this: (*a*) the increase in temperature and pressure may directly increase jacket losses by increasing radiation and convection to the cylinder walls; (*b*) the increase in pressure may increase leakage past the piston; (*c*) high-velocity detonation-waves, if they exist, may transmit energy to the walls by impact, and (*d*) the burning of oil directly on the cylinder walls, due to high temperature of the charge, may add to the heat loss.

Whatever the immediate cause of this increase of heat loss, the fact is significant. According to either of the two proposed theories, assuming localization and burning of a portion of the charge under increased pressure, it might be expected that the excess heating effect would be most pronounced at the particular location where this local combustion took place. Experiments to verify this by thermoelectric couples inserted in the cylinder in various positions with relation to the firing plug, show no significant difference in the temperature rise for different locations. These observations seem to show that the excess heating effect during knock is *not* localized as might be expected. The effects of increased radiation and of combustion of oil would be in accord with these observations.

Extremely high cylinder pressures have been found by different observers by various indicating devices. In one case, with a compression ratio of about 5 to 1, pressures of 1300 lb. per sq. in. were observed to occur consistently at each explosion; this pressure being the maximum measurable with the apparatus at hand. It is safe to assume that the maximum pressures were at least 1500 lb. and probably much higher. These pressures occurred with kerosene as fuel.

The amount and distribution of these pressures is of importance in relation to the two theories advanced. According to the Ricardo theory, the pressure may be uniformly distributed throughout the combustion chamber, although this is not a necessary assumption. If uniformly distributed, the pressure must not exceed that which could be produced by burning all the fuel at constant volume at intake pressure and then compressing adiabatically to the final volume. In fact, due to the nature of the process, the pressure can hardly exceed that which would be produced by compressing the charge adiabatically and burning it at constant volume under compression.

Possibility of Localized Pressure

On the other hand, the detonation theory presupposes that the maximum pressures are localized and places no limit on their magnitude below the calculated impact pressures of detonation waves in the compressed charge. This limit would be between 5000 and 7000 lb. per sq. in., but it is important to remember that these are not true sustained pressures, but resemble those produced by the blast from a high explosive; that is, they would last only a few millionths of a second. It is very doubtful if any indicator in use is capable of responding to such instantaneous pressures, other than to register a kick, so to speak.

As for experimental results, some indicator observations seem to show differences in the maximum pressures for different locations of the firing plug; other results worthy of equal confidence fail to show any such differences whatever. At the Bureau of Standards the maximum indicator pressure, the increase in combustion-chamber temperature and distortion of the cylinder head have all been carefully analyzed for different locations of the firing plug to detect any localization of pressures and none has been found. This appears to constitute strong evidence that no marked localization of pressure occurs which depends directly on spark plug location.

As noted above, the maximum pressures reached are occasionally as high as 1500 lb. per sq. in. at least. If they are normal uniform cylinder pressures, they cannot exceed the pressures that would be produced by com-

plete simultaneous combustion of the charge before compression, as stated. Moreover, from an examination of the pressure change it is evident that comparatively little of the charge is burned much before dead center; therefore, in practice, the knock pressures cannot exceed maximum computed pressures unless they are due to some effect other than normal combustion of the charge. Maximum pressure produced by the latter cause can be determined approximately. The maximum temperature reached on compression in the ratio 5 to 1 and combustion of a normal charge, taking account of dissociation, is given by Pye as from 2500 to 2700 deg. C. (4532 to 4862 deg. Fahr.). If dissociation is neglected, the temperatures are computed as about 3000 deg. C. (5432 deg. Fahr.). As the effect of dissociation is to lower the temperature, with a slight increase in volume relative to temperature, take the higher figure. This temperature corresponds to, roughly, 3250 deg. C. (5882 deg. Fahr.) absolute. If, therefore, the pressure were 1 atmosphere before compression and 5 atmospheres after compression, and the temperature 300 deg. C. (572 deg. Fahr.) absolute before compression, the pressure after compression and combustion has a maximum value of $5 \times 3250 \div 300$, or slightly over 50 atmospheres, which is about 750, or, say, 800 lb. According to Pye's results, the temperature would be only about 500 deg. C. (932 deg. Fahr.) higher and the pressure only about 1000 lb. per sq. in., if the combustion took place before compression. Pye gives 700 lb. per sq. in. as the maximum attainable cylinder pressure. This neglects the volume of water vapor which would increase the pressures somewhat.

Remembering that these are absolute maximum pressures if Pye's results are to be accepted, pressures of over 1000 lb. per sq. in. must be due to some cause other than normal gas combustion. In other words, such pressures cannot occur simultaneously at all parts of the cylinder.

Destructive Mechanical Effects of Knock

Destructive mechanical effects are somewhat difficult to interpret. Broken spark plug porcelains, cracked piston heads and burned-out bearings, as well as general evidence of excessive mechanical stresses, accompany continued detonation, particularly in aircraft engines. But none of these effects is subject to direct measurement. An index of the nature of the pressure rises which accompany knock is had, as referred to above, by observing the height to which a light weight is projected from its seat on the cylinder head. A measurement of this height and of the deflection of the cylinder head per unit pressure change leads to the following conclusions, which can be readily computed from the following data:

(1) The maximum height is 1½ in. The deflection of the cylinder head at this point is 0.0005 in. for each 100 lb. per sq. in. rise of pressure.

(2) The rate of pressure increase required to produce this effect is, roughly, 7,000,000 lb. per sq. in. per sec.

(3) The pressure was found to rise about 550 lb. per sq. in. above normal maximum when detonation took place, and to produce this rise at the above rate would require less than 0.0001 sec.

(4) For the Liberty engine cylinder, the combustion flame must traverse the explosive mixture at a rate of *at least* 4500 ft. per sec. to produce this observed rise of pressure. It is of interest to note that this figure is in fair agreement with the detonation velocities found by Dixon for explosions in tubes.

The observed occurrence of black smoke in the exhaust may have many explanations. One of the most obvious, that it indicates incomplete combustion, is apparently contradicted by the observed fact that the indicated power, therefore the amount of energy liberated in combustion is at least as great with as without fuel knock. I know of no definite conclusions which can be drawn from this occurrence.

The frequent occurrence of preignition following violent fuel knock is a natural sequence of the increased amount of heat rejected to the jackets, spark plugs, valves, etc. It hardly needs any other interpretation.

With reference to the several factors which affect fuel knock, the general consideration that the phenomenon is intimately connected with the process of combustion would indicate that any change in conditions would affect fuel knock.

The very marked effect of the chemical composition of the fuel, and particularly of the addition of certain anti-knock compounds as demonstrated by Mr. Midgley and others, shows the extreme sensitiveness of the phenomenon. In this connection, it should be noted that the comparison of different fuels by these observers has shown that some fuels which readily ignite spontaneously do not knock, and vice versa. This seems to be strong evidence contrary to the spontaneous-ignition theory of Ricardo.

Effect of Ignition Timing

The effect of ignition timing has been shown by observations at the Bureau of Standards to be of very much more significance than previously supposed. For instance, it is proved that knock can be made to appear on cutting out one of two spark plugs, or under other conditions to appear when the second plug is switched in; and these effects are apparently due solely to the changes in the effective timing of the combustion relative to piston position. The use of two plugs in effect advances the timing. It is shown, also, that knock can be prevented much more readily and with less loss of power by careful regulation of ignition timing than had been supposed. However, it is difficult to draw any conclusions from these facts as to the nature of the fuel knock.

The other factors enumerated, such as the compression pressure, mixture ratio, temperature of the charge, and temperature of the cylinder, seem to offer no direct evidence as to th probable validity of the two theories under consideration. They might, however, afford valuable data if the nature of knock were better understood.

The number of ignition points and their relation to the shape of the combustion space seem to be of significance. It appears to be a fact that the larger the number of ignition points, and the nearer these are to all portions of the charge, the less is the tendency to fuel knock. The much-discussed subject of turbulence appears to be probably of significance mainly as it affects the distribution of the burning mixture. Distribution of burning charge should be nearly equivalent to distribution of ignition points. Obviously the maximum rate of pressure increase which can be produced by normal burning occurs with the greatest amount of flame area, but the larger the number of spark plugs the greater the total area of flame, at least at the beginning of the combustion; yet this maximum area never produces sudden pressure rises of the order observed. Something beside normal rates of burning are, therefore, necessarily involved.

The conclusions to be drawn are as follows:

(1) The two theories of fuel knock, that of Ricardo and the detonation wave theory, do not appear to be essentially contradictory but make somewhat different assumptions as to the maximum pressure.

(2) The sound produced by fuel knock can be adequately accounted for by the distortion of parts of

the cylinder, without assuming any metallic impacts.

(3) The excess heating effect accompanying detonation does not appear to be localized in any particular portion of the cylinder, as might be expected from either theory.

(4) No differences in maximum pressure when measured in different positions relative to the point of ignition have been definitely demonstrated, although some observations indicate them.

(5) The maximum pressures measured seem to exceed those which could be produced by the normal explosion of the charge. This indicates that some phenomenon such as detonation must be assumed to account for the pressures observed.

(6) The rates of increase of pressure which have been observed are such as to require the existence of some such disturbance as detonation, as an adequate explanation.

(7) It has been shown that fuels which are particularly subject to auto-ignition by compression are not necessarily subject to fuel knock. This indicates that the spontaneous ignition theory of Ricardo, in its simplest form, is at least incomplete.

From the foregoing it may be concluded that whatever the phenomenon of fuel knock may involve, the observed facts are in reasonably close agreement with the theory that the high pressures and attendant phenomena are the result of an abnormal type of combustion which can be accounted for with a reasonable degree of completeness by the so-called detonation theory. The only serious discrepancy between this theory and the observed facts appears to be the failure to discover positions within the cylinder where maximum pressures and temperatures occur. If it can be assumed that the impact waves, which are taken as an explanation for the very high pressures, are capable of reflection within the combustion chamber, the hypothesis of localized maximum pressures is not essential to the theory.

Relative Merits of Large Slow-Speed and Small High-Speed Engines

For comparison one engine is assumed to have a piston displacement 50 per cent greater than that of the other. Rear-axle ratics are taken as 3 and 4.5 for the large and the small engine, respectively, in order that substantially the same torque can be delivered to the rear wheels in each case. Rather than inject a detailed analysis of the relation of friction losses to piston displacement, it is assumed that the increase in displacement is obtained by adding two cylinders to a four-cylinder engine and that the friction power is increased 50 per cent thereby.

A fuel consumption of 0.55 lb. per i.hp.-hr. has been used in the calculations for all conditions of engine speed and load. Tests made thus far at the Bureau of Standards indicate that the efficiency for a given load is independent of the speed over the range of speeds covered in this discussion. One further assumption, the relation of friction horsepower at part load to that at full load must precede the calculation of fuel consumption per brake horsepower-hour. An approximate relation, derived from tests on an automobile engine has been used for this purpose.

In calculating the fuel consumption in pounds per brake horsepower-hour, the first step is the determination of the brake horsepower developed at the speed selected. The brake horsepower developed at full load at that speed is also determined, and hence permits the percentage of full load at which the engine is operating to be deduced. Knowing this, the friction horsepower can be obtained by the relationship between the friction horsepower at full and part load, given in Fig. 5. Three steps remain: (*a*) the addition of the friction horse-

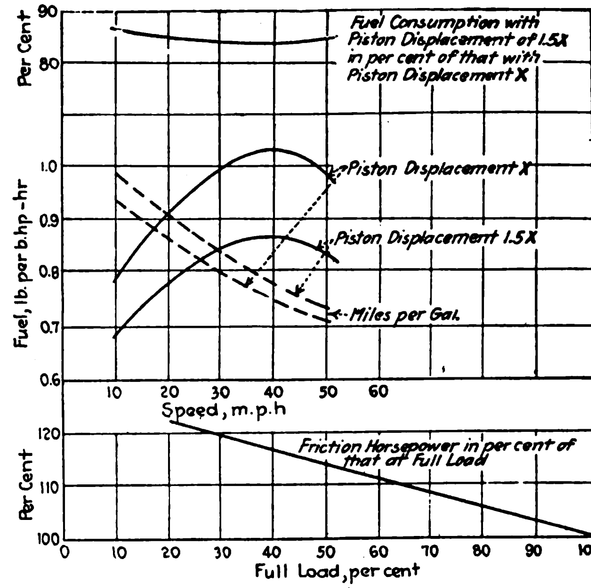


Fig. 5—The relation between fuel consumption and the friction horsepower at full and part loads

power to the brake horsepower to obtain the indicated horsepower; (*b*) the division of the brake horsepower by the indicated horsepower to obtain the mechanical efficiency; (*c*) the multiplication of the fuel-consumption expressed in pounds per indicated horsepower-hour (0.55) by the mechanical efficiency, to obtain values of fuel consumption in pounds per brake horsepower-hour. Results calculated by this method are given in Fig. 5.

Percentage values, given in Fig. 5, show the larger engine to have a 15 per cent lower fuel consumption than the smaller engine. This figure is unfair to the small engine, as the increased weight of the large engine means that the ability of the car is reduced. Published data show that usually in a series of engines built by any one company, the weight per brake horsepower is less the greater the horsepower. Let this effect be neglected to take care of any weight increase in the transmission and drive required by the larger engine and let the increase in the engine weight be 50 per cent. As the engine-weight is about 15 per cent of the car weight, the weight of the latter will be increased 7.5 per cent. It is concluded, therefore, that the car has lost 7.5 per cent in ability and gained 15 per cent in economy. Furthermore, it is evident that increasing the large engine until its ability equals that of the small engine will still leave it somewhat superior from the standpoint of economy.

The foregoing analysis does not prove the superiority of either type of engine for every case. Engine cost, durability, relative ability for slow speed operation and many other factors must influence such a decision. There is a widespread belief that the small high-speed engine is vastly more efficient than the larger slow speed type. The purpose of this discussion is to challenge that belief and to show the factors of major importance in the comparison of the two types.

A PHOTOGRAPH of a California motorcycle hill climb contest was published recently in the British journal *Motorcycle*. This picture showed a rider, his machine almost turned over backward, in an attempt to climb a gradient of 1 in 2. The caption was "American Conception of a Hill Climb," and this comment was appended: "Such stunts are purely spectacular, and while exciting for the onlookers and riders, in no way help to advance design as do events in this country (England)." Here is a criticism worth considering both as regards motorcycles and automobiles.

Running Balance and Uniformity of Crankshaft Effort in 8-Cylinder 60 Degree Vee Engines

The vibrating forces in an eight cylinder Vee engine are dealt with by the analytical method in this article. One conclusion reached is that the maximum vibrating force of the 60 degree eight cylinder engine is only 61.2 per cent of that of a 90 degree eight cylinder Vee engine.

By P. M. Heldt

EIGHT-CYLINDER engines have been built in at least four different types so far, namely with the cylinders all in line and as 90, 60 and 45 degree Vee engines. The original eight-cylinder engines for aircraft and automobiles were 90 deg. Vee engines, and this type has enjoyed the greatest popularity up-to-date. Eight-cylinder all-in-line engines were first used—at least as far as automotive practice is concerned — by Charron, Girardot & Voigt in France in 1902 and revived by Ballot in 1919. The first Liberty aircraft engine was a 45 deg. eight-cylinder Vee engine, and recently the 60 degree Vee eight-cylinder engine has come to the fore by its adoption for use on the Lincoln and Wills-Sainte Claire cars.

There are two main objects aimed at when going to the complication of an engine with as many as eight cylinders, namely, balance of the reciprocating parts and uniformity of crank effort or torque. If the explosions come at equal intervals the crank effort will be the same no matter whether the cylinders are arranged vertically or in Vee form. But with 45 degree and 60 degree Vee eight-cylinder engines it is impossible to get evenly spaced explosions if the ordinary four-throw crank is to be used, which is necessary for the sake of compactness. It is reported that the 45 degree Vee Liberty engine showed a great deal of vibration. Theoretically there are no greater vibrating forces in a 45 degree than in a 90 degree Vee eight-cylinder engine, but the direction of these forces is entirely different. Whereas the direction of the vibrating forces is nearly vertical in the 45 degree engine, with only slight horizontal components, in the 90 degree engine these forces are absolutely horizontal, and it is conceivable that an airplane is much more sensitive to vibrating forces in a vertical plane than in a horizontal plane, owing to its much smaller vertical rigidity.

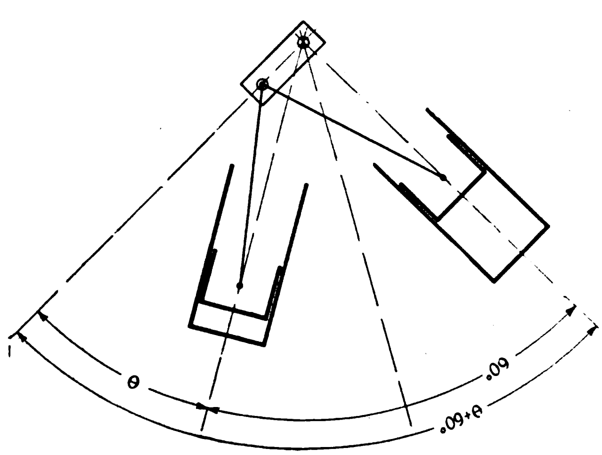


Fig. 1—Diagram of Vee engine

The writer first investigated the subject of vibrating forces in eight-cylinder Vee engines with different angles of Vee in an article printed in *The Horseless Age* of Feb. 1, 1916, and came to the conclusion that with a 60 degree angle of Vee the vibrating force is of constant value and uniformly rotating, the same as the vibrating force due to a rotating unbalanced weight. It rotates at twice the angular speed of the crankshaft and therefore cannot be balanced by weight rotating with the crankshaft. Its value is only about 61 per cent of the maximum value of the unbalanced force in a 90 degree eight-cylinder engine.

The method employed in the article referred to was partly analytical and partly graphical. It is, however, quite possible to deal with the problem by the analytical method alone. In doing this we can base our reasoning upon the fact that as far as balance of reciprocating parts is concerned the eight-cylinder Vee engine consists of two four-cylinder engines having a common crank axis and mounted at a certain angle relative to each other. We can obtain the instantaneous value of the vibrating force of the whole engine by combining corresponding vibrating forces of the two four-cylinder engines on the principle of the parallelogram of forces.

The vibrating force of a four-cylinder engine is

$$F_4 = \frac{2(0.0000142)\ W\,l\,N^2}{n}\cos 2\theta$$

where W is the weight of the reciprocating parts appertaining to one cylinder, in pounds; l, the length of stroke in inches; N, the number of revolutions per minute; n, the ratio of connecting rod length to length of stroke and θ the angle through which the crankshaft has turned from the top dead center position. We may write this in an abbreviated form as follows:

$$F_4 = \frac{2c}{n}\cos 2\theta$$

This is a harmonic force of twice the periodicity of the crankshaft revolutions, the so-called primary unbalanced force of the individual crank being entirely eliminated in the four-cylinder engine.

If we take the above expression as representing the un-

balanced force of the right hand set of cylinders in an eight-cylinder 60 degree Vee type engine rotating right-handedly, then the vibrating forces of the left hand set of cylinders can be expressed by

$$F_4 = \frac{2c}{n} \cos 2\,(\theta + 60 \text{ deg.})$$
$$= \frac{2c}{n} \cos\,(2\theta + 120 \text{ deg.})$$
$$= \frac{2c}{n} (\cos 2\theta \cos 120 \text{ deg.} - \sin 2\theta \sin 120 \text{ deg.})$$

We now have the instantaneous values of the vibrating forces for both sets of cylinders. These forces always act at an angle of 60 degrees to each other and the problem is to find their resultant.

In Fig. 2 the parallelogram of forces is shown, the diagonal c representing the resultant of the unbalanced forces due to the individual sets of four cylinders. We must now solve the problem of an oblique triangle of which two adjacent sides a and b and the included angle C are known, the value desired being that of c, the side opposite the known angle.

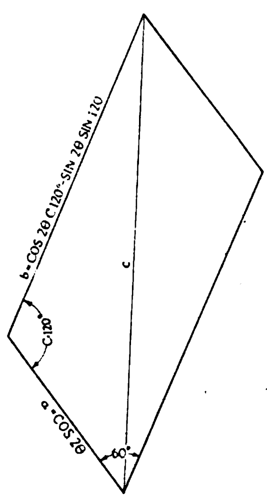


Fig. 2 — Parallelogram of vibrating forces in 60 deg. Vee engine

According to the rules of trigonometry, the value of c in terms of the other two sides and the included angle is:

$$c = \sqrt{a^2 + b^2 - 2\,a\,b \cos C}.$$

In our case

$$a = \frac{2c}{n} \cos 2\theta$$
$$b = \frac{2c}{n} (\cos 2\theta \cos 120 \text{ deg.} - \sin 2\theta \sin 120 \text{ deg.})$$
$$C = 180 \text{ deg.}$$

Since both a and b contain the factor $\frac{2c}{n}$, and there is a constant angle between them, c will also be proportional to $\frac{2c}{n}$, and we may therefore omit this factor in solving the triangle, thus making

$$a = \cos 2\theta$$
$$b = \cos 2\theta \cos 120 \text{ deg.} - \sin 2\theta \sin 120 \text{ deg.}$$

Substituting in the above equation for c—

$$c = \sqrt{\begin{aligned} &\cos^2 2\theta \\ &+ \cos^2 \theta \cos^2 120 \text{ deg.} \\ &+ \sin^2 2\theta \sin^2 120 \text{ deg.} \\ &- 2 \cos 2\theta \cos 120 \text{ deg.} \sin 2\theta \sin 120 \text{ deg.} \\ &- 2 \cos^2 2\theta \cos^2 120 \text{ deg.} \\ &+ 2 \cos 2\theta \sin 2\theta \cos 120 \text{ deg.} \sin 120 \text{ deg.} \end{aligned}}$$

The fourth and sixth term cancel out, leaving

$$c = \sqrt{\begin{aligned} &\cos^2 2\theta \\ &+ \cos^2 2\theta \cos^2 120 \text{ deg.} \\ &+ \sin^2 2\theta \sin^2 120 \text{ deg.} \\ &- 2 \cos^2 2\theta \cos^2 120 \text{ deg.} \end{aligned}}$$

Now, $\sin^2 120$ deg. = ¾ and $\cos^2 120$ deg. = ¼. Therefore,

$$c = \sqrt{\begin{aligned} &\cos^2 2\theta \\ &+ \tfrac{1}{4} \cos^2 2\theta \\ &+ \tfrac{3}{4} \sin^2 2\theta \\ &- \tfrac{1}{2} \cos^2 2\theta \end{aligned}}$$
$$= \sqrt{\tfrac{3}{4}\,(\cos^2 2\theta + \sin^2 2\theta)}$$
$$= \sqrt{\tfrac{3}{4}} = 0.866$$

Therefore, the vibrating force of an eight-cylinder 60 deg. Vee engine is

$$F_{8\text{-}60} = 0.866 \times \frac{2c}{n}$$
$$= \frac{0.866 \times 2 \times 0.0000142\, W\, l\, N^2}{n}$$
$$= \frac{0.0000246\, W\, l\, N^2}{n}$$

This shows that the vibrating force is independent of the crank angle and has a constant value. Graphically it can be represented by a circle.

The vibrating force of a 90 degree eight-cylinder engine is

$$F_{8\text{-}90} = \frac{0.0000402\, W\, l\, N^2}{n} \cos 2\theta$$

and its maximum value is

$$F_{8\text{-}90} = \frac{0.0000402\, W\, l\, N^2}{n}$$

The maximum vibrating force of a 60 deg. eight-cylinder engine therefore is only 61.2 per cent of the maximum vibrating force of an eight-cylinder 90 deg. Vee engine. On the other hand the vibrating force of the 90 deg. engine acts in a horizontal plane only, where vibration is damped by the lateral rigidity of the chassis springs, whereas the

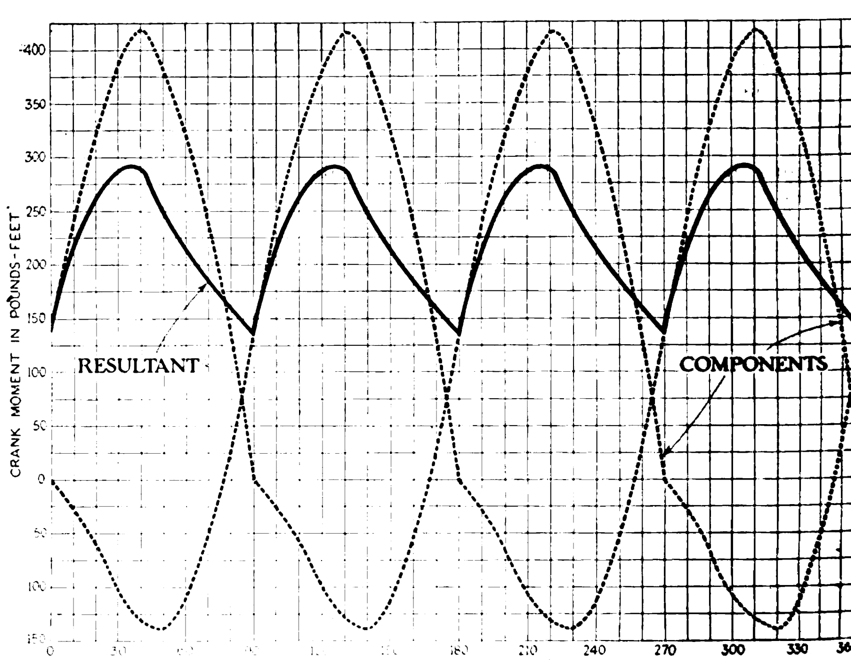


Fig. 3—Torque diagram of 90 deg. Vee engine

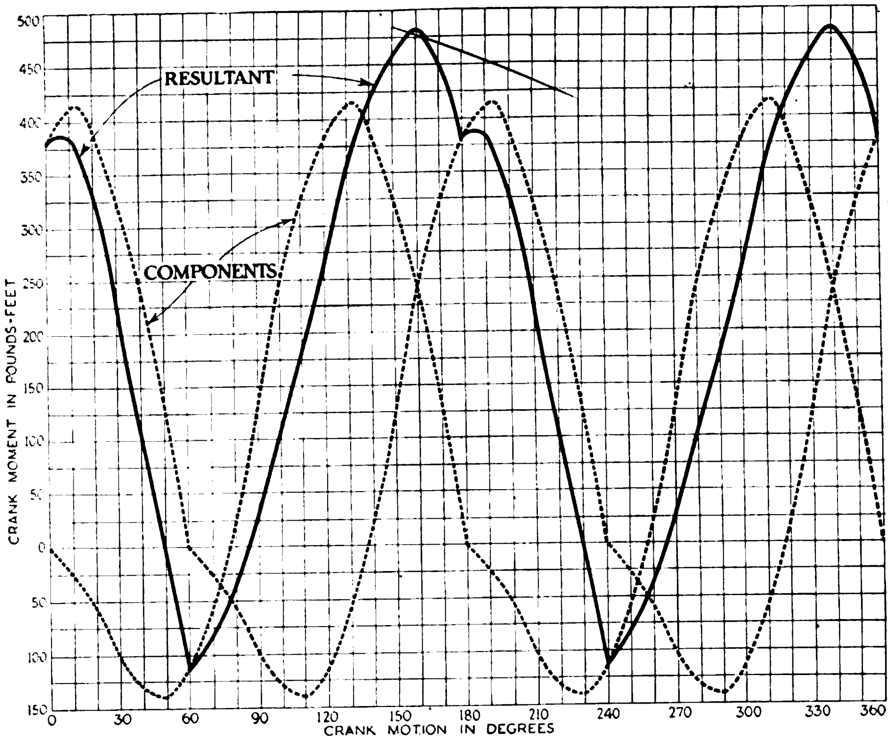


Fig. 4—Torque diagram of 60 deg. Vee engine

60 deg. engine tends to vibrate both vertically and horizontally.

In any eight-cylinder Vee engine using an ordinary four throw crankshaft there must be two explosions in every 180 degrees of crank motion, because that is the angular distance between successive explosions in cylinders of one block. In the 90 deg. Vee engine all explosions are evenly spaced and come at 90 deg. intervals. In the 60 deg. engine the explosions come at intervals of 60 deg. and 120 deg. respectively. In order to obtain a crank effort diagram we may take that of a four-cylinder engine and superpose upon it another one displaced 60 deg. with respect to the first for the 60 deg. engine, and 90 deg. for the 90 deg. engine; adding the two curves thus superposed in each case we get the crank effort diagrams of the 60 deg. and 90 deg. engines. These diagrams are shown in Figs. 3 and 4. It will be seen that the torque fluctuations are much greater in the case of the 60 deg. engine than in that of the 90 deg. engine. In the 60 deg. engine for the conditions assumed the torque varies between — 110 and plus 483 lbs.-ft. and in the 90 deg. engine for the same conditions between plus 140 and plus 290 lbs.-ft. The average torque is the same in both cases.

The maximum unbalanced force in an eight-cylinder 45 deg. Vee engine may be found in a way similar to that used above for the 60 deg. engine. In this case it is preferable to measure angles from the radial line midway between the axes of the two sets of cylinders. The unbalanced force of the right hand set of cylinders will then be

$$F_r = \frac{2c}{n}\cos 2\,(\theta + 22.5^\circ)$$

$$= \frac{2c}{n}\cos\,(2\theta + 45^\circ)$$

$$= \frac{2c}{n}\,(\cos 2\theta \cos 45^\circ - \sin 2\theta \sin 45^\circ)$$

$$= \frac{2c\,\sqrt{1/2}}{n}\,(\cos 2\theta - \sin 2\theta)$$

and that of the left hand set of cylinders

$$F_l = \frac{2c}{n} = \cos 2\,(\theta - 22.5^\circ)$$

$$= \frac{2c\,\sqrt{1/2}}{n}\,(\cos 2\theta + \sin 2\theta)$$

In combining these two forces by the parallelogram of forces we may neglect the factors outside the parentheses, as they are the same for both sides of the triangle, and will therefore also appear in the third. We then have an oblique triangle of which two sides and the included angle are known, and the problem is to find the value of the side opposite the known angle, which is the resultant of the two component forces.

$$a = \cos 2\theta - \sin 2\theta$$
$$b = \cos 2\theta + \sin 2\theta$$
$$c = 135^\circ$$
$$c = \sqrt{a^2 + b^2 - 2ab\cos C}$$
$$= \sqrt{2\cos^2 2\theta + 2\sin^2 2\theta - 2\,(\cos^2 2\theta - \sin^2 2\theta)\cos 135^\circ}$$
$$= \sqrt{2 + 2\sqrt{1/2}\cos^2 2\theta - 2\sqrt{1/2}\sin^2 2\theta}$$

In order to determine for what value of θ this expression is a maximum we should differentiate it, place the first differential coefficient equal to zero and solve. It is obvious, however, that the expression reaches its maximum value when $\cos 2\theta = 1$ and $\sin 2\theta = 0$, that is when $2\theta = 0$ deg. For this case we have

$$c = \sqrt{2 + 2\sqrt{1/2}} = 1.848$$

Multiplying this by the factors which we neglected when finding the resultant of the two forces we get

$$\frac{2c\,\sqrt{1/2}}{n} \times 1.848 = \frac{2.613\,c}{n}$$

Further, since

$$c = 0.0000142\,W\,l\,N^2,$$

we have, finally, for the maximum force of unbalance of an eight-cylinder 45 deg. Vee engine

$$F_{8-45} = \frac{0.0000371\,W\,l\,N^2}{n}$$

Therefore the maximum unbalanced forces in eight-cylinder Vee engines with angles of Vee of 45, 60 and 90 degrees, bear to each other the relation of

371 : 246 : 402

This, however, does not mean that the amplitudes of vibration of the car will bear the same proportion to each other when engines of the different types are fitted, because these maximum vibrating forces act in different directions and the resistance of the chassis to vibration is different in different directions.

AT the plant of the Baush Machine Tool Co. worms for automobile drives are hardened by quenching after being heated in a cyanide bath. The worms have previously been carbonized, and the object in heating in cyanide is not to form a thin surface layer of carbonized metal as might be surmised, but to prevent decarbonization of the surface layer while being heated and the formation of a layer of oxide while the worm is being transferred to the quenching bath. The cyanide is contained in a pressed steel pot and has a low-pressure oil fire under it. There are two furnaces side by side, with a common chimney to carry off the combustion products.

A New System of Gear Grinding and Gear Inspection

Great accuracy of tooth and more rolling with less sliding action are claimed. Grinding machine works on generating principle and means for compensating for wear of grinding wheel is provided.

By P. M. Heldt

THE Maag system of gearing, due to Max Maag of Zurich, Switzerland, has been before the engineers of this country for some years. These gears are characterized by teeth of true involute form. In order to avoid interference in pinions with a small number of teeth, such pinions are made with a relatively small dedendum and large addendum, and the mating gears with a large dedendum and small addendum. In fact, the proportional dimensions of addendum and dedendum depend upon the gear ratio. In a pair of gears giving a large ratio there is a large difference between the addenda of the pinion and gear, while in a pair of gears for a 1-to-1 ratio, the addenda are equal, as are also the dedenda. Thus a pinion made by this process will run properly only with a gear of a certain number of teeth made by the same process. There is no definite pressure angle in this system, the angle varying somewhat with the point of contact along the tooth flank. It is claimed for the Maag form of tooth that with it there is more rolling and less sliding action than with other forms of gear teeth. Another advantage claimed is great accuracy of tooth outline, due to the fact that the teeth are formed on the generating principle by means of a rack-shaped cutter, the sides of whose teeth are straight lines.

Mr. Maag has recently developed a gear grinding machine embodying some novel features. This permits of making the gears of low carbon or alloy steel, case hardening them, and then, after hardening, correcting any distortion that may have occurred in the grinding machine. One of the difficulties in gear grinding in the past has been that, owing to wear of the cutting surfaces of the grinding wheel, the tooth spaces will gradually become narrower. The Maag gear grinding machine works on the generating principle, the same as the gear cutting machine. The grinding is performed by means of two saucer-shaped wheels which are set apart and inclined toward each other in such a way that the planes of the saucer lips coincide with the flanks of one tooth of the rack cutter if superposed upon same. The gear wheel to be ground is mounted on a horizontal axis and is fed longitudinally beneath the revolving grinding wheels. As it passes beneath the grinding wheels the gear wheel is reciprocated transversely through a short distance and at the same time is rocked through a corresponding angle, the two movements being correlated so as to exactly reproduce the movement of the gear wheel if it were rolled without slipping, on its pitch circle. A true rack and pinion action is thus obtained, the same as in the cutting machine, but in this case, as the rack has only one tooth, the work has to be indexed relative to the grinding wheel once for every tooth space. The arrangement shown in Fig. 1 is used for gear wheels above a certain minimum pitch. The tooth spaces of gears of small pitch are of insufficient width to permit of both grinding wheels working within them at the same time, and in that case adjacent spaces are ground simultaneously.

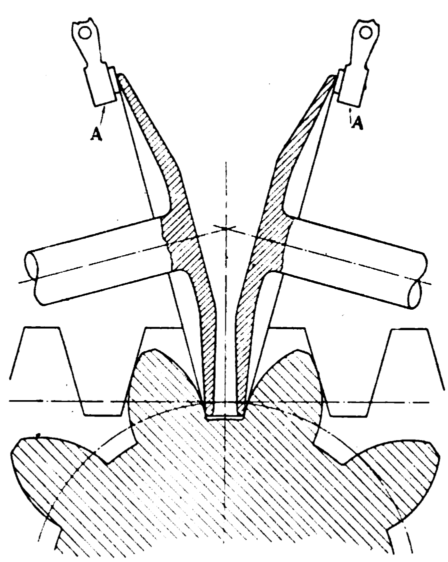
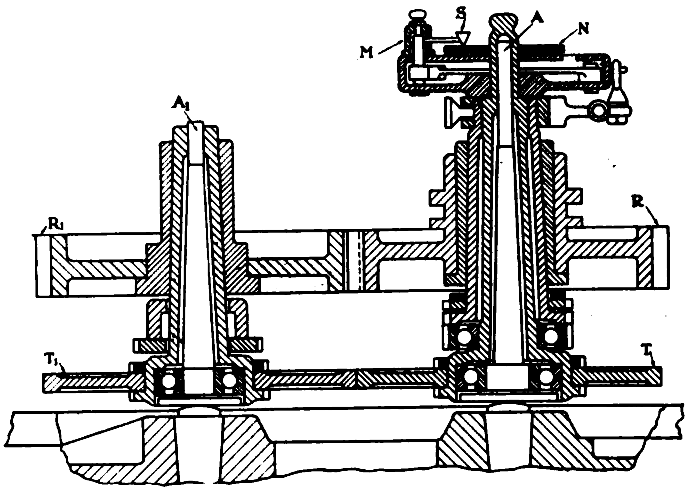
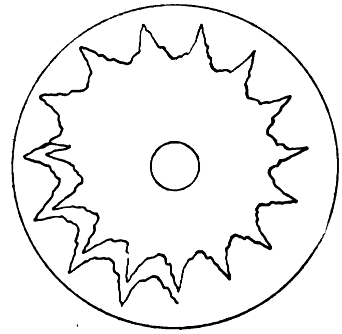


Fig. 1. Diagram showing the disked wheels used in Maag gear grinding machine.

The interesting feature of the Maag grinding system is the means adopted for correcting for wear of the grinding wheels. It is stated that whatever wear takes place is evenly distributed over the cutting face of the grinding wheel, so that this face always remains plane and parallel to its original plane. The effect of wear is to reduce the width of tooth of the imaginary rack cutter and therefore to increase the thickness of the teeth being ground. The wear can therefore be compensated for by moving the grinding wheels apart, each parallel with itself.

The compensating mechanism consists of an electrically controlled mechanical device. For each grinding wheel there is a camshaft driven continuously at about 10 r.p.m. by belt and gearing from the motor driving the grinding wheel spindle. At each revolution the camshaft causes the lever A, Fig. 1, to oscillate on its pivot and to advance a diamond carried on its lower end toward the grinding wheel edge. If the movement of the lever is stopped by the edge of the grinding wheel at the correct point, nothing happens. But if the grinding lever has worn a certain amount the lever will swing far enough to establish an electrical contact. In this way an electric circuit is closed and the current flowing in this circuit is relayed to operate a clutch on a continuously driven shaft, from which, when the clutch is in, motion is transmitted through a pawl and ratchet wheel to a differential thread and thence to an adjusting screw on the grinding spindle bracket. By this means the bracket is moved until the grinding wheel lip plane is restored to its correct position. It is





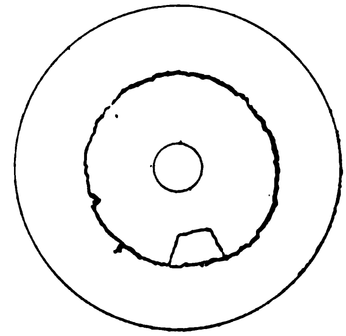


Fig. 3. Fig. 4.
Diagrams made by Saurer gear testing device.

Fig. 2. (Left) Saurer gear testing device used by Maag for gear inspection.

claimed that this adjusting mechanism is sufficiently sensitive to permit of an accuracy of the order of 0.001 mm. The mechanism, moreover, is said to be so trustworthy that it can be relied upon to keep the softest grinding wheel in adjustment. This allows of the use of relatively soft wheels, which, while wearing faster, cut more rapidly.

The adjusting mechanism is also used for setting new grinding wheels in the correct position. With the grinding spindle running, an electrical contact is made to bring the compensating mechanism into action. The adjusting screw then moves the spindle bracket until the wheel reaches its correct position, when the diamond carrying lever is forced back by the edge of the wheel sufficiently to break the contact and stop the motion. Electric current for the compensating mechanism is supplied by a two-cell storage battery.

Another interesting feature of the Maag gear grinding machine is the method by which the correct rolling motion of the gear during the grinding operation is obtained. The gear must, of course, be fed in an axial direction in order to grind the whole length of the teeth. Reliance is not placed upon a separate feed for the rolling motion, but, instead, rotary movement is imparted to the gear simultaneously with the axial movement by means of two steel ribbons, one end of which is fixed to the bed of the machine while the other is caused to unwind from or onto a segment secured to the work spindle and having a radius equal to that of the pitch circle of the gear being ground. Nine sizes of pitch blocks, covering the range of pitches in most common use, are supplied with the machine. Other pitches than those covered by these blocks can be cut by using the nearest size block and moving the stay carrying the fixed end of the ribbon by power at the requisite rate to give the difference of the motion.

For inspecting gears, Maag makes use of a very sensitive testing device developed by the firm of Adolph Saurer of Arbon, Switzerland (well known as truck manufacturers). A sectional view of this device is shown herewith. To determine possible inaccuracies of the gears the wheels R and R_1 are set on studs A and A_1 of the gear testing device and are slowly turned by hand. A friction wheel T_1, located upon stud A_1, is rigidly secured to wheel R_1, and carries along friction wheel T. The shaft of the latter is free to rotate in the wheel R, and is connected to the indicator disk N of a registering device M, the pencil S of which, through the intermediary of a system of levers, is connected to wheel R. If the teeth are cut perfectly, the pencil describes a smooth spiral line. But in case of defects the resulting tangential displacements between the absolutely uniformly rotating friction wheel T and the toothed wheel R are registered by the pencil on a scale enlarged about 200 times. By observing the wheel while turning, it is an easy matter to determine the location of defects and their nature.

The device can also be used in order to check the roundness and tooth clearance. By means of suitable bushings the wheels are placed upon the studs A and A_1, and with the hand wheel R and a scale they are set to the desired center distance. If now the two wheels are turned by hand, the feeler lever device, which is connected by means of links with A and A_1, shows how much the wheels deviate from cylindricity. Each division of the gage corresponds to a deviation of 0.01 mm.

If the hand deflections are repeated uniformly for each tooth, the fault lies with the tooth form. The clearance can be determined by multiplying the movement of the gage hand by twice the tangent of the pressure angle.

The two diagrams, Figs. 3 and 4, were made by means of this instrument. Fig. 3 is from a gear with inaccurate tooth form, which causes periodic fluctuations clearly shown by the diagram. Fig. 4 is from a gear with very accurate teeth. The sharp deflection of the indicator hand at one place is due to a human hair being placed between the teeth of the mating gears and the slight deflection at another point is due to a speck of dirt on one of the gears.

A Treatise on Gasoline and Other Motor Fuels

A VOLUME of some 700 pages entitled Gasoline and Other Motor Fuels by C. Ellis and J. V. Meigs, recently published contains much information of value to refiners and others interested in the chemistry, production, testing, mixing and use of liquid hydrocarbon fuels. More than twenty of the 27 chapters are devoted to description and comparison of cracking processes, but the remaining chapters deal at length with mixed fuels, fuel testing, refining methods and practice, benzol and alcohol as motor fuel, and shale as a source of motor fuel.

The authors of the book are chemists, and the volume naturally deals with the subject quite largely from the chemists' standpoint, though it contains much information bearing upon engineering and refinery practice and should prove of interest to automotive engineers who desire a knowledge of the characteristics of the various motor fuels, and the methods by which they are produced. The volume is well indexed and contains bibliographies of the subjects treated. The appendix contains much tabular information on the production and the physical and chemical characteristics of petroleum products. The book is published by the D. Van Nostrand Co.

A Production Manager's Solution of the Labor Problem

Production is largely dependent upon the men who operate the machines. A production manager recently outlined his practical ideas in an informal interview. His opinions show clearly how very closely related are low unit production cost and effective mental and physical workmanship.

By Norman G. Shidle

UNSTABILITY of employment is one of the biggest problems confronting American industry to-day, according to the general manager of an important automotive manufacturing plant. He believes, also, that the actions of employers at the present time in regard to their workmen will be of vast importance in determining the future trend and possibilities of industrial development. The plant operated by this executive employs several thousand men and is situated in a large urban district which was visited with the many labor troubles common to the war period.

The ideas on industrial relations held by this man are the result of many years of actual experience in production work. He holds his opinions regarding labor because, as he put it, "such methods pay a profit in better production and lowered costs." This indicates that he approaches the problem from a practical production standpoint and that he is not concerned with philanthropic motives. For this reason an outline of his methods and ideas should be of very practical value to other executives of the industry. This article summarizes an interesting conversation with this executive.

Unstability of employment is an extremely important problem, not only to the workman, but to the employer as well. Workmen are often blamed for holding back on production; for trying to avoid working themselves out of a job. It is easy to point out to the worker the bad economics of such procedure, but it is difficult to show him where his next week's wages are coming from.

The facts show that the workman has been urged to produce to his utmost one week and then been thrown out of work the next. It is not fair, and the best production cannot be expected from any man who is not certain as to whether or not his job will be good a week or two hence.

You ask me the question, "What is the solution to the problem of unstability of employment?" I don't know. I wish I did. The facts of the case are before us, however, and the vast importance of the problem must be recognized and all must aid in studying the matter.

The individual employer may mitigate conditions to some extent. We have tried to do that here. We have used every possible device to keep our old men at work. We have swung them from one kind of job to another. We have put them at work on a lathe one day and at pushing a truck the next. In this way we have kept as many at work as possible. A few of them didn't like being changed around at first. So I called them into my office here and talked to them. I told them why they were being shifted. I told them that I was striving in every way to keep them at work; to hold a job for them.

Then I pointed out the fact that when they got through being shifted around they were going to be bigger and better men. That in their particular case, the industrial depression was giving them a chance to learn more, to vary their experience, and to come through with a broader knowledge of the plant, its methods and organization. And what I told them is true. They will be better men—for themselves and for our organization. Even though a particular man on a particular day may not earn what we give him, he will earn it in the long run. Through this shifting around he will be worth more to us. We are making a virtue of necessity and will profit thereby in dollars and cents.

Better planning and more consideration for other organizations by our customers would help the situation a lot. And we are in the same position as many other plants. We make a large unit and are equipped to meet big production needs. Some of our customers do not think anything of sending us a telegram in the midst of a 500-a-week production telling us to stop production until further notice. Take a specific instance which has just occurred.

Two weeks ago one of our largest customers asked us to stop production for a week, and then to resume production last Monday. We laid off a number of men and told them to come back the beginning of this week. The men came back, but our customer changed his mind again and has delayed production indefinitely. We are running now simply on the hope that the customer will reinstate his order to go ahead within a few days.

We had promised those men work at that time. Had we not done so, they would have been free to look for other jobs. We had a real obligation to provide those men with work for at least a limited period after having made that promise. And we are making good. Had we failed to do so, we could not expect the workmen to believe us the next time we told them anything. The man that sends the telegram canceling orders usually considers the matter only from the financial standpoint. But he is having a direct permanent, as well as temporary, effect on the problem of human relationships in industry.

Better planning, better sales analysis and better scheduling of merchandising possibilities and probabilities will have a definite effect upon this big problem of unstability of employment.

Present Attitude to Labor

Right now is a very important time in the development of industrial relations. Labor was undoubtedly arrogant during the war; its newly acquired power went to its head, and in many cases workmen talked and acted in an unreasonable manner. Now the situation has changed. Many manufacturers are "taking it out" on their workers. There are plants within two blocks of here that are squeezing the blood out of their workers right now. Many others are taking this chance to get back at labor.

Any employer who adopts this policy of "taking it out" on his workers at this time is merely lowering himself to the level of the arrogant labor leaders whom he professes to despise so much and whom he says are unintelligent. He not only degrades himself in this way, but he lays up trouble for himself and his fellow employers in the future.

Even enlightened self-interest indicates that this is the time for the manufacturer to get the loyalty of his men, treat them fairly and gain their co-operation by exercising a justice of spirit and action that the labor leaders have not seemed able to understand. You don't have to treat labor right at this time, but for that very reason you will gain greater results by so doing.

The Individual Worker

Besides these general factors, however, there are important individual factors to be considered within every plant. The most important is that of making the man like his job. If I can get a man to like his job, I never have to worry about production. To accomplish this means attention to every individual worker. Many small factors of tangible and intangible character affect the situation in any given case. What these factors are and what is their relation to one another cannot be definitely stated. To discover them, however, constitutes another of the major problems before industrial managers.

Comfortable working conditions will help and should be provided in so far as possible. The psychological factors must also be considered. We had a department in which the men were laying down on the job because they felt that they would be out of a job as soon as the one was finished on which they were at work. We told them there was more work, but we couldn't convince them. I didn't blame them much, as most of them had been fooled elsewhere. Then I told the foreman to get the material for the next job and pile it up in the end of that department, where the men could actually see the advance work before them. He did this, although the new material wouldn't be needed for a week, and there was a definite increase in production the next day.

Then there is the matter of developing leaders. The foreman is, perhaps, the most important link in the management chain. I find that many men promoted from the ranks to foremanship cannot stand prosperity. Authority goes to their heads. I like to give a foreman as much authority as possible, but only in a few cases can much be given them, as the average foreman is likely to exceed his authority. Still it is the problem of the executive to train foremen for responsibility.

I happened to be going through the shop this morning, for instance, and I heard one of our foremen "bawling out" one of his workers at the top of his voice. He called him everything under the sun.

Just before you came in I had that foreman in here. I talked to him straight from the shoulder. I called him everything under the sun. He became angry. I meant that he should. Then I said, "You're sore, aren't you? But you had every bit of it coming to you. Don't you think Jones was sore out there this morning when you bawled him out before the whole department?

"The only reason he didn't step out and hit you be tween the eyes is that he was afraid he'd lose his job. He has a wife and several kiddies at home, and he doesn't dare take a chance on his job at this time. You made him lose his self-respect. Why don't you talk like that to other foremen? Because you know they wouldn't stand for it; they'd lay you out flat before you got half of it out of your mouth. You are simply a coward to talk that way to a workman whom you know can't hit back. This is your second offense, and there won't be any third. . . ."

And that is the only way to talk to a foreman of that kind. Workmen must be lead, not driven. Only in this way can they be expected to put that spirit into their job which produces the best quantity and quality results. Men who are driven can never be developed into leaders, and it is leaders that are greatly needed in our industrial organizations.

Too many men have a tendency to get into a rut and stay there. It has been my experience, which may not coincide with that of all others, that many men like to get on a single job and stay there. It is always a question, of course, whether the job dulls the man's mind and makes routine acceptable, or whether the mind was originally dull. Whichever may be the case, it is undoubtedly true that each job must be thoroughly understood if the best results are to be obtained from the worker.

An incident occurred here the other day which illustrates this point. There is one man whose task it is to hammer a rivet on a certain part of a body. He has been doing that job for several years. Recently the design was changed slightly in such a way that this rivet was placed one inch higher than previously.

It sounds almost absurd to say it, but that man found it almost impossible to adjust himself to striking that piece one inch higher. So mechanical had the operation become that he automatically struck the piece in the old place. The foreman kept close tab on him, but he continued spoiling piece after piece. Finally I went down and put under him a square piece of board one inch high. Standing on that board and striking as usual, he is now getting along all right.

These thoughts, expressed by a man skilled in production methods and experienced in handling men, are worth serious consideration. The incident just cited of the man striking a rivet illustrates the great lengths to which monotony work may go. It illustrates in a somewhat extreme manner the general tendency of all such work and indicates the tremendous problem which faces industry in this regard.

Such monotony jobs are multiplying rather than decreasing in industry. Their effect on the human mind is indicated by this example. It is inconceivable that means of remedying this situation shall not be found. Undoubtedly a long period of careful study and thoughtful experiment will be necessary. But the problem is the most important one which faces industry. And it is a problem of studying the individual worker.

Such individual studies far outrank in importance the more common investigations dealing with more general problems. The general studies are more usual, probably because they are easier to make, but the results obtained are not as permanent nor as useful. Practical production men are coming to recognize this fact more fully.

Government Data Helpful to Automobile Industry

At a recent meeting with a committee representing automobile manufacturers, Secretary Hoover indicated his desire to have the opinion of the industry as regards the figures which might be supplied by the Department of Commerce. The letter in this article answers that request.

RECENTLY a committee representing the automobile industry met with Secretary Hoover to discuss the gathering of data that would be of value to industry. Mr. Hoover said at that time that he was quite willing that the N. A. C. C. should be the chief agent in gathering statistics and that he had no desire to force figures from the industry. He also expressed a desire to know what figures might be compiled by his department that would be of value to the automobile industry. At Mr. Hoover's suggestion a list of such data has been prepared. This list is included in the following letter written to Secretary Hoover by Alfred Reeves, General Manager of the N. A. C. C.

AT the suggestion of Mr. J. Walter Drake, the chairman of the committee appointed by the National Automobile Chamber of Commerce to co-operate with you, we are specifying some of the data that the Department of Commerce might compile and that would prove most helpful to the motor vehicle manufacturers.

Trend of Business

In deciding on a correct production schedule, the manufacturer would be greatly aided by a report on general trend of business, which for the purposes of the motor vehicle maker, should include the following:

(A) Monthly pig iron production.
(B) Crop production in season compared with preceding years, with relative prices.
(C) Monthly advance orders on steel.
(D) Income tax statistics for latest preceding quarters, classified as to number of persons in various income groups in each State.
(E) Monthly railroad passengers and passenger-miles, also freight tonnage and freight ton-miles.
(F) Sales of packing-house products, shoes and textiles by months.
(G) Production, consumption and reserves of gasoline by months, compared with preceding years.

Much of the above material is separately available, but its consolidation in a single report would save individual labor and give a good index of general business conditions.

Car Uses

A report is now in course of preparation on the use of automobiles and trucks on farms and will be made part of the farm census. Similar investigation, but relating to economic uses of motor vehicles in other fields of work, would be most welcome.

Export Statistics

Manufacturers would be interested in export statistics of motor vehicles so classified as to differentiate between different priced passenger cars and motor trucks of different capacities.

At present these figures are grouped according to COMPLETE MOTOR VEHICLES and CHASSIS and specified by NUMBER and VALUE.

The classifications more suitable to the manufacturers in gauging their percentage of foreign trade should be as follows:

COMPLETE PASSENGER AUTOMOBILE OR CHASSIS

Costing up to $800 inclusive		From $801 to $1501		From $1501 to $2500		From $2501 to $3500		From $3500 up	
No.	Value	No.	Value	No.	Value	No.	Value	No.	Value
..	..	..	..	..	..	..	..	..	..

COMPLETE MOTOR TRUCKS OR COMMERCIAL CHASSIS

Up to ¾ ton inclusive		From 1 to 1½ tons		From 2 to 3 tons		From 3½ to 5 tons		From 5½ tons and up	
No.	Value	No.	Value	No.	Value	No.	Value	No.	Value
..	..	..	..	..	..	..	..	..	..

Foreign Production and Prices

Especially interesting to the American manufacturer would be definite data on the production, specifications and prices of cars made and sold abroad in competition with the U. S. product, also the number of workmen employed in the various foreign motor vehicle factories.

Re-Imported Cars

Because re-imported American automobiles and motor trucks have a direct bearing on the domestic as well as foreign markets, it would be helpful if the Department of Commerce were to issue monthly statistics on the extent of this trade. Two statistical groups would be sufficient for this purpose and would show the number of American passenger cars and motor trucks that were originally part of the U. S. war equipment, then sold to the Allied Governments, and are now being re-imported into the United States.

Uniform Statistics

It is desirable to have a uniform method of classifying statistics of motor vehicle exports from principal manufacturing nations. If England, France, Belgium and Switzerland could be induced to compile their monthly export statistics according to passenger cars and Commercial trucks and specify by number and value as is done by the other manufacturing nations, it would be easier to determine the world-wide movement in motor vehicle trade.

Promptness Essential

The value of these reports to the manufacturer depends solely on the promptness with which they are issued. Emphasis is put on this point in full realization that the Department of Commerce was inadequately supplied with funds necessary to carry out the work effectively.

The foregoing suggestions as to means in which the Department of Commerce can aid the automobile industry relate solely to statistical compilations. There are numerous other ways in which the Department can be helpful to our industry and concerning which we shall write later and thus avail ourselves of your courteous offer of co-operation.

Government Helps to Build 22,030 Miles of Highway

On March 1 of this year 22,030 miles of highway, extending into every State, had been completed or were in process of construction, says the chief of the Bureau of Public Roads, United States Department of Agriculture, at a total estimated cost of $361,946,868. The percentage of this total estimated cost which will be incurred for each type, and the mileage of each type, based upon the records of plans approved, are as follows:

Per Cent and Mileage of Each Type of Road:

	Per cent of total estimated cost.	Mileage.
Type 1, including earth, sand, clay and gravel	32.2	15,300
Type 2, including water bound and bituminous macadam	9.0	1,530
Type 3, including brick, bituminous concrete, Portland cement concrete	48.8	4,890
Miscellaneous	4.0	310
Bridges	6.0	...
	100.0	22,030

The states initiate the road projects, but before Federal aid is granted an engineer of the bureau makes an inspection of the roads to be improved, studies the local conditions, consults with the State highway department, and no projects are approved which are not considered suited to the conditions to be met. Many popular fallacies exist as to road improvement, and there have been many misconceptions as to the types of roads on which Federal aid funds may be used. Properly built earth roads, say specialists of the department, are the fundamental requirement in all highway improvement. Regardless of the material or type of surfacing which is to be placed, the preparation of the roadbed requires the highest engineering skill and experience. The department considers that the use of adequate sums for the securing of proper location, thorough drainage, permanent bridges and culverts and the elimination of railroad crossings is demanded if enduring improvements are to result.

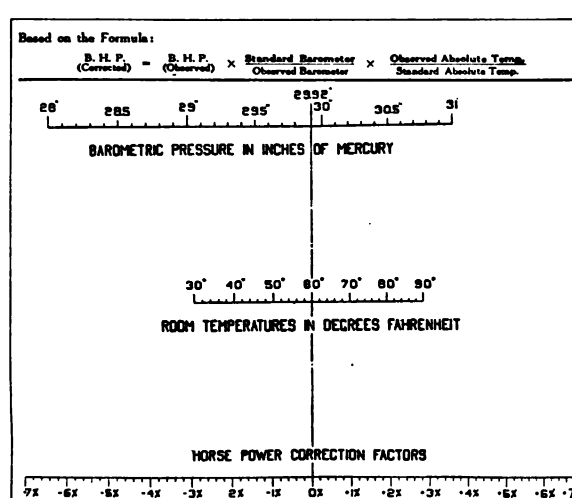
Federal aid is allotted to the improvement of earth roads, but only with the stipulation that a suitable surfacing will be placed as soon as funds become available. This allows the roadbed to be prepared and become thoroughly consolidated before the surfacing is placed, which is highly desirable from a construction viewpoint. To follow such a course, however, is out of the question when a road is heavily traveled and some form of surfacing must be provided. To care for traffic under these conditions, frequently a sand clay or gravel surfacing is provided, which will serve for several years and yet allow the road to be maintained under reasonably heavy traffic.

Horse Power Correction Alignment Chart

An alignment chart designed to afford a ready means of determining the correction factor for bringing dynamometer test data to a common basis of air temperature and barometric pressure has been published by the Zenith Carburetor Co. This graph allows of a direct comparison between runs made under different atmospheric conditions. It is based upon the assumption that brake-horsepower at full throttle varies directly with the atmospheric density, and is computed from the formula which appears above the chart. The standard barometer is taken at 29.92 in. of mercury and the standard temperature at 60 deg. Fahr. The absolute zero of the temperature scale is taken at minus 459.5 deg. Fahr.

To use the chart, a straight edge is placed on the graduations of the barometric pressure and room temperature scales corresponding to the observed pressure and tempeature during the test. The point where this straight edge crosses the lower scale gives the correction factor in per cent, plus or minus. If the sign is plus, the correction should be added; if minus, it should be subtracted.

For example, for 29.80 inches of mercury barometric pressure and 46.0 deg. Fahr. temperature, the correction factor is minus 2.3 per cent. Assuming that the dynamometer balances at 108.7 lb., the correction is 2.3 per cent of 108.7, or 2.5 lb. Subtracting 2.5 from 108.7 gives 106.2 lb., the corrected pull. It should be noted that the correction factor is equally applicable to torque, brake horsepower and mean effective pressure.



1—Zenith alignment chart for dynamometer, torque, and brake horsepower correction factors for standardization of engine test data.

Sales Charts Based on Average Life of a Vehicle

The charts presented here depict in graphic form the various points discussed in an article concerning the average life of cars published recently. The semi-logarithmic scale used in some of these graphs shows clearly both the actual and relative values of the various factors involved.

Charts by W. C. Marshall

TAKING into account all the factors involved, P. M. Heldt presented an analysis of the average life of cars and trucks in AUTOMOTIVE INDUSTRIES of March 17, 1921. That article took the yearly production, registration and export figures and with them as a basis computed the average life of cars and trucks during the last seven years.

Production figures were available from 1905, but registration figures were available only from 1912, when AUTOMOTIVE INDUSTRIES first began to compile them. With these figures as a basis, the average active life of a car was determined at 5.3 years.

This article proceeded purely upon the discussion method, the results being reasoned out and presented in logical sequence. There is a definite advantage, however, in bringing out these various points by graphic means to show more clearly the relation between the various factors and to form a basis for extending the ideas for future probabilities.

The accompanying charts fulfill this purpose. They were prepared by W. C. Marshall on the basis of the figures in Mr. Heldt's article. They show in an interesting way the comparative relationship between the various factors involved.

It is not necessary to go into a detailed discussion of the various charts since the individual purpose of each one is definitely stated in the caption. Some of the data is plotted on regular rectangular coordinate paper with regular spacing between the lines, while others are plotted on a semi-logarithmic scale.

This latter method has distinct advantages in showing relative gains or losses and in indicating the true relative

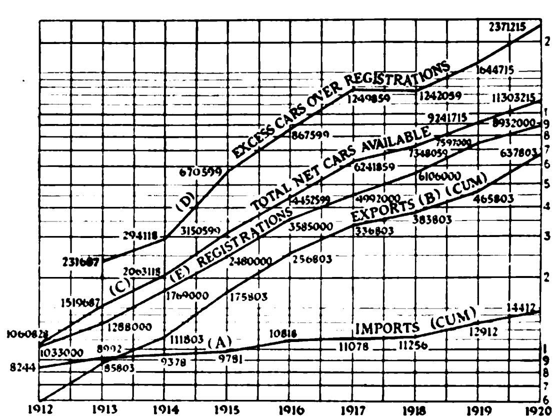


Chart 1 is a plot on semi-log paper of (A), the imports of cars beginning in 1912 with the total sum for the years 1906-1912 inclusive equal to 8244. The cumulative curve of exports beginning with 2200 in 1906 is shown by curve (B). The number 58,914 plotted for 1912 is the total number exported up to Dec. 31, 1912. The cumulative number to Dec. 31, 1920, is 637,803. Curve (C) is a cumulative curve of cars manufactured plus the imports minus the exports. This is called the net prod. The number 1,060,828 represents all the cars available in the U. S. up to and including 1912. The total at the close of 1920 is 11,303,215. Curve (E) shows the cars registered each year and is not cumulative. Curve (D) shows the excess total cars made over the registrations. This chart shows by the slope of the lines the percentage increase over that of the previous year. Parallel lines in different curves show the same rate of increase or decrease and can be readily compared.

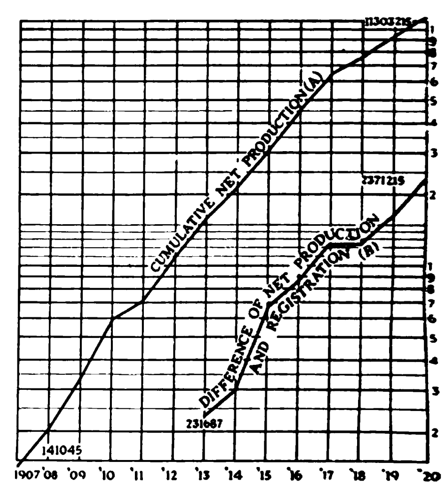


Chart 2 (right) plot on semi-log paper of (A) the total production plus imports minus exports and is cumulative. Curve B shows the excess of cumulative available production plus imports minus exports, over registrations. By running back horizontally to curve A and measuring the intercept between the two curves A and B we find the average life of cars up to the year taken on the B curve and the year at the bottom of the chart below the intersection on the A curve which shows the date of manufacture of the oldest cars in service in the year taken on curve B

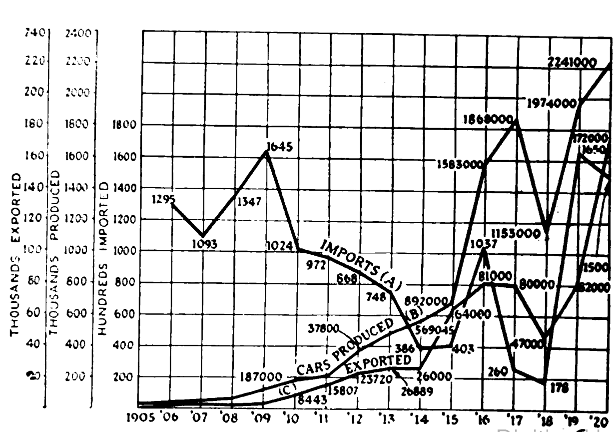


Chart 3 (left) shows fluctuations in yearly production, imports and exports from 1906 to 1920. This shows the marked decrease of imports in 1914 and 1915, 17 and 18, the increase in exports in 1920, and the increase in manufacture in 1917 and 19, as well as the slump in 1918. The last year of the war shows the most marked decrease in production, imports and exports, and the year following the greatest increase of all three

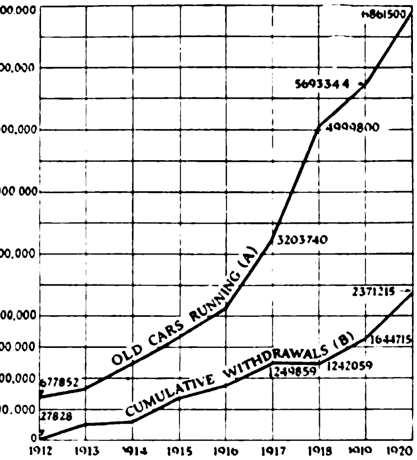


Chart 4—Curve A shows the old cars in service each year. The increase yearly is quite marked from 1916 to 1918, and drops off in the following years. Curve B shows the total number of cars withdrawn from service due to old age and storage causes. It is a cumulative curve. From 1919 to 1920 shows a marked increase in number over any preceding year.

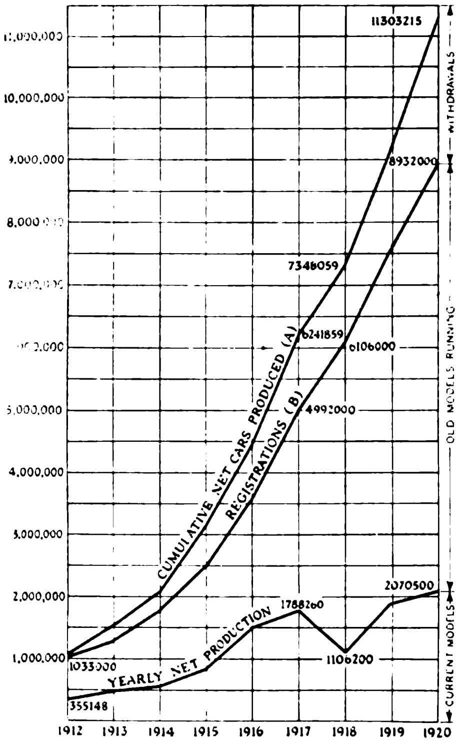


Chart 5 shows the cumulative net car production since automobiles were first manufactured and the B registrations each year from 1912. The difference between these curves each year shows the cars withdrawn from service that year. The net yearly production curve C shows how many of the registrations are new car owners. The difference between the registration B and yearly production curve C gives the old cars running.

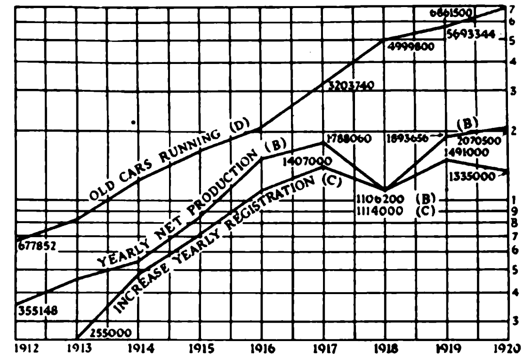


Chart 6—This chart is plotted on semi-log paper, the slope of the lines showing the percentage increase of each item. Curve D shows a pretty uniform per cent increase, except from 16 to 18, when it increased much more than any other period. At the same time the per cent of cars produced fell off as well as the percentage of registrations. These two decreases affected the use of old cars by causing the owners to use them a year longer than they ordinarily would. 1919 shows the per cent of old cars to have decreased and the per cent of production and registration to have risen again nearly to normal

value of the various sets of figures. It differs from the full logarithmic paper in that only the vertical coordinates are plotted logarithmically, while the horizontal coordinates are arithmetical.

An interesting discussion of the advantages of this semi-logarithmic method of charting is given by W. C. Brinton in his volume on "Graphic Methods for Presenting Facts." Part of this is worth quoting here:

"The principles involved," Brinton says, "are the same as those embodied in the slide rule. . . . No matter what the location of the chart, if the logarithmic spacing is used in the ver-

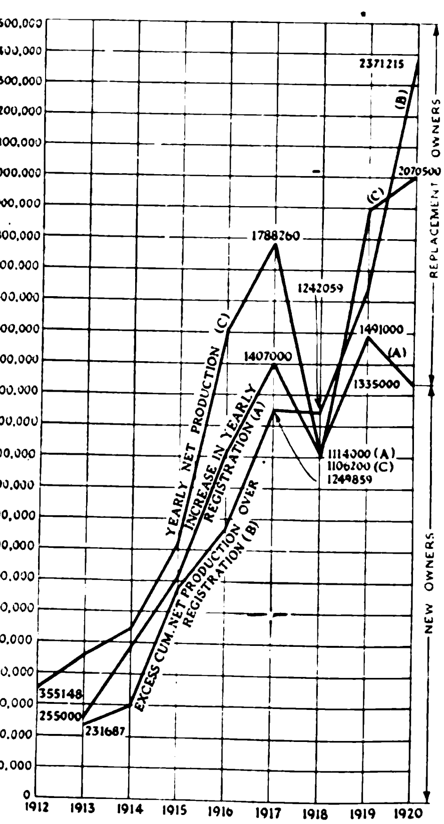


Chart 7—Curve A shows the variation in registration from year to year. Curve B shows how the total production of cars varied in excess of the registrations each year. As this excess is made up of new car owners and replacement owners, the increase in registrations is due to new car owners, and the difference shows the old cars which have been relegated to the scrap heap. The yearly production curve C shows the great falling off during the last year of the war, with resultant increase the following year.

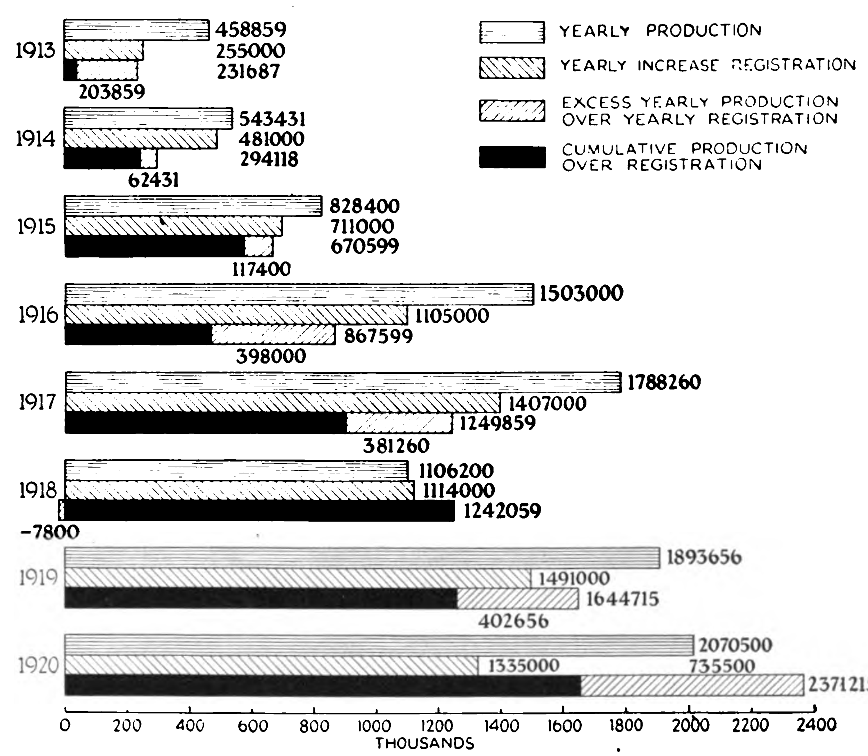


Chart 8 is a barograph showing the relation between yearly production, yearly increase in registrations, excess of production over registrations and total number of cars withdrawn since the period of automobiles began. The shaded portion at the end of the last-mentioned bar represents the number of cars withdrawn during that year. The standstill of the whole industry is brought out very plainly by the shortening of the bars during the year 1918, except the bar representing cumulative production over registrations and the number of cars withdrawn, which disappears entirely and even becomes a minus quantity, showing that all the old cars in storage and the ones barely able to run were gotten out and made to go through that year.

tical scale for curves, the angle of the upward or downward inclination is the same for all curves affected by the same percentage of change. . . . The logarithmic scale permits the exhibition of both actual and relative values and actual and relative fluctuations.

"It is unfortunate that there is so much difficulty in obtaining paper having logarithmic ruling in one direction and arithmetical ruling in the other direction. The arithmetical ruling is essential in statistical work, since we ordinarily must plot as one scale data representing years or other subdivisions of time. In statistical work we cannot well use a paper having logarithmic ruling in both directions, yet that is the only kind of logarithmic paper which can be obtained in most stores selling drawing materials and engineering supplies."

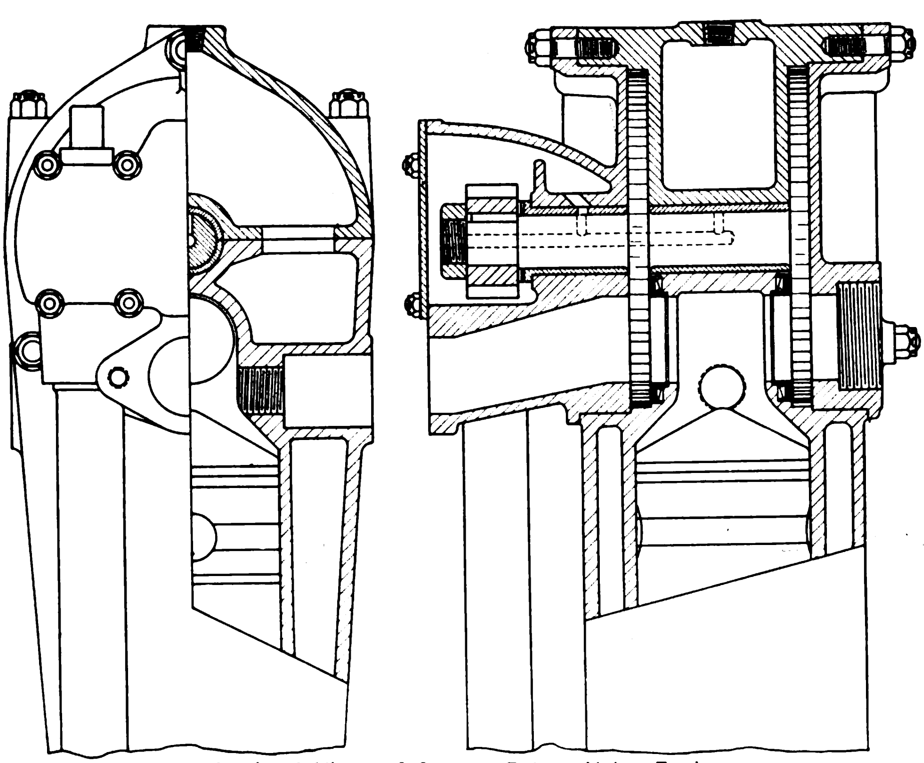
From this discussion it is evident that this sort of chart is particularly adapted to the material presented.

The value of the charts lies largely in the possibility of prejudging future trends on the basis of past performances as shown. Some such attempt was made in the charts recently shown prepared by the Commercial Research Department of the Franklin Automobile Co. A study of the charts shown here, however, will bring out certain different points, while future prediction can take into account current business and economic conditions as well as theoretical projection of the curves.

A New Rotary Valve Engine

A RATHER unusual type of rotary valve engine has been designed by H. P. Stevens. In order to develop some of the details of the valve mechanism in an experimental way, Mr. Stevens built a single cylinder upright engine, and two sectional views of the upper part of this engine are shown herewith. The compression space is in the head and is of inverted U-section with flat end walls which contain the inlet and exhaust ports. The valve functions are performed by two large diameter disks, both on the same shaft, the disks being located on opposite sides of the compression chamber. In order to get the two disks with their shaft into position, the upper part of the cylinder is split through the valve shaft axis. Each of the disks has a port cut in it, and when this port comes opposite the port in the compression chamber wall, intake or exhaust takes place. The valve shaft is rotated at uniform speed by means of a vertical shaft and helical gears, consequently, the valve mechanism is practically noiseless. The two valve disks are backed up by the circular end plates which contain the passages to which the inlet and exhaust pipes are secured and one of which also carries a bearing for the valve shaft.

The spark plug is screwed into the combustion chamber wall between the two valve disks. It proved a difficult problem to seal the disk valves, but a form of sealing ring is said to perform this function effectively. These rings are set into ring grooves in the valve seats surrounding the valve ports therein. Another important problem in connection with an engine of this kind is the lubrication of the valve mechanism. In the engine here shown this is effected entirely by pressure. In a four-cylinder engine with this valve construction it is necessary to cast the cylinder head separately and split it through the valve shaft axis.



Sectional Views of Stevens Rotary Valve Engines

Measuring Surface Tension

THE common method of determining surface tensions, by means of capillary tubes, is subject to the disadvantage that long capillary tubes of uniform bore are hard to find as well as to keep clean; besides, the meniscus is subject to cooling which has a strong effect on the surface tension. A new method which overcomes these difficulties was described in two papers recently presented to the Faraday Society by Allan Ferguson and P. E. Dowson of Manchester College of Technology.

Instead of measuring the rise of the liquid, Ferguson and Dowson force the liquid down to the lower end of the capillary, dipping vertically into the liquid, and they measure the pressure required for this in a suitable manometer. The liquid is placed in a beaker resting on a movable table. The capillary tube, which is dipped into the liquid, may be short; it is fused to another glass tube leading over to a mercury bottle; by raising this bottle the air in the glass tube forces the liquid, which had risen in the capillary, down to the edge of the tube at the point where the meniscus is formed.

The actual measurement is transferred to a U-tube gauge, branched off from the horizontal portion of the glass tube. Very concordant results have been obtained by this reversed method, and the fact, noticed by Ferguson, that benzol gave a surface tension of 29.6 dynes per centimeter when examined immediately after purification, but a higher value (29.9) after a day or so, testifies to the delicacy of the method.

Benzol is hydroscopic and increases its surface tension by absorbing water.

Manufacturing as Well as Statesmanship Subject to Impractical Idealism

The manufacturing organization should be thoroughly sold on the merits of the product, but it should temper its enthusiasm for perfection with an understanding of practical production methods and possibilities. Co-operation saves money. Some actual instances are related here.

By Norman G. Shidle

THE final success of an automobile concern rests upon the selling of its product. The real opinion of the car held by members of the manufacturing organization, however, is an important factor in contributing to that final success. Most manufacturers have realized the importance of this and the visitor to almost any automobile plant finds the entire organization thoroughly sold on its product. This is as it should be, but moderation is desirable.

Statesmen and writers have been accused by business men of "impractical idealism." There is such a thing as impractical idealism in the manufacture of automobiles as well. Enough is as good as a feast. It is well to imbue the manufacturing organization with the necessity for perfection, but care must be taken to provide that all the members of that organization recognize what is perfection and what is not; that they understand the practical limitations of manufacturing processes as well as the theoretical elements of automobile design.

An incident occurred recently in connection with a certain car that illustrates to some extent the dangers of an "over-sold" manufacturing organization. The body for a new model was designed. Presumably all the factors of body and chassis construction were carefully considered before the design was completed and the finished drawings were made ready for production. Much of this body was to be made of pressed metal and the construction of expensive dies was necessary.

The drawings were submitted and the dies made up by an outside concern. Production was about to begin, when the manufacturer decided on certain minor changes in body design. The expensive dies had to be altered. Production was started finally, but still further changes were desired by the manufacturer. Production was delayed and the expensive dies were altered again. Probably these changes in design were deemed necessary by the car manufacturer in his effort to make a car "just a little better" than that of any of his competitors. Yet the changes did cost money, and to some whose long experience might constitute them competent judges, they did not seem in keeping with the increased cost.

Another instance of similar nature occurred when a certain car manufacturer was equipping part of his product with disc wheels of a standard make. The inspection department of the car manufacturer complained continually concerning the quality of fit of certain bolts on the wheels. Finally the engineer of the wheel maker journeyed half way across the continent to the car manufacturer's plant. The inspection man objected that the bolts in question did not fit snugly and perfectly and desired certain changes in design.

The wheel engineer stated that this was the standard wheel that was being made in quantity and that any change in design would greatly increase the cost. He explained, moreover, that the bolts in question would fit properly when an inflated tire was placed on the wheel. The inspection man said they would not. The wheel engineer suggested that the experiment be tried to prove his statement. The inspection man said that it would be useless to do that since, the pressure of a tire would not force the bolts into their proper place and refused to make the experiment. He said that for this car the thing must be exactly perfect and that what might do for others would not do for them.

Just then one of the chief executives happened along. The wheel engineer explained the situation and again demanded that a test be made. The executive immediately acceded to his request. A tire was placed on the rim and pumped up with a hand pump. The bolts slipped neatly into their proper place and the wheel was shown to be perfectly constructed. Even then the inspection man objected that there was probably about 100 pounds pressure in the tire, which was more than the ordinary tire should carry. A pressure gage was applied, however, and showed the pressure to stand at 40 pounds.

Had it not been for the insistence of the wheel engineer, the entire shipment of wheels probably would have been rejected as defective and unfit for use. An organization, apparently green in the particular work, might have caused considerable trouble and expense to the company.

Other parts makers, as it happens, had similar experiences with this same organization. Pieces were rejected because of unimportant abrasions on unexposed surfaces, and for various other reasons, none of which had been discussed when the contract had originally been made. The result of such experiences is to generate some ill-feeling between the manufacturer and the parts maker and to increase the price which the manufacturer will have to pay for future orders of parts.

It is, of course, the undoubted right of the manufacturer to demand whatever quality of work he desires, but there is a practical limit to what can be expected for a reasonable cost. This cost can often be lowered without impairing an essential feature of quality if the co-operation of the parts makers is solicited and a fuller relation of confidence is established throughout the operations.

Moreover, it is obvious that as the degree of confidence between the manufacturer and the parts maker increases the many petty irritations and difficulties will diminish. As suspicion decreases, minor troubles di-

minish in proportion. A big truck manufacturer, for example, was telling recently of the men which his organization maintained during peak production times in the plants of various parts makers. These men were there as inspectors and in some cases almost as directors on the manufacture of the parts. Every care had to be taken that defective material was not used and that the parts were up to standard.

"We also had a lot of parts made by the Blank Company," the manufacturer continued. "No," in answer to a question, "We didn't have a man there. We didn't need to. We have done a lot of business with them, we know them and they know us well, and we know that we can depend upon them to do the job in every way as well as it can be done."

Money can be saved by an increase in confidence and co-operation. Every manufacturer knows that it costs him more money per unit to deal with certain firms than with others even though the quoted price on the article be the same. Sometimes this is the fault of the parts firm. Sometimes, however, it is the fault of the manufacturer. The interdependency of the various units of modern industry makes co-operation a paying proposition and a practical necessity.

Restoration of Worn Machine Parts

A NEW process for building up worn machine parts, known as the Fescol process, is described in *Engineering*. The worn part is built up by depositing on it a coating of nickel of suitable thickness, and the treatment employed is said to give a coating so adherent that it is practically impossible to remove it from the core by any ordinary means. The process is due to R. J. Fletcher of London and has been in use for more than a year.

Parts such as crankshafts, spindles, axles, pistons and similar objects, which have been reduced in diameter or rendered oval by wear, can be made perfectly serviceable by depositing the nickel where necessary, keyways, screws and other parts on which the deposit is not required, being protected as will be explained later. Motor-car engine cylinders which have been scored by the wrist pin, and lathe leading screws badly worn in the working portion, are other examples of repairs satisfactorily effected by the process at a small fraction of the cost of replacement.

The metal deposited has good wearing properties, its Brinell hardness number, as determined by tests at the National Physical Laboratory, being about 360 when coated to a thickness of 0.04 in. on a steel with a hardness number of 298. The corresponding figure for the hardness of a mild steel having an ultimate tensile stress of 32 tons per square inch would be 150. The adhesion of the nickel coating is remarkable, a longitudinal pull of 11.95 tons having been found necessary to shear a ring of nickel 0.215 in. wide from the surface of a steel cylinder 1 in. in diameter, on which it had been deposited. These figures, which were also obtained from a test at the National Physical Laboratory, indicate that the adhesion amounted to 17.6 tons per square inch of adhering surface.

In working the process, the article to be treated is first placed in an alkaline electrolytic bath, in which all traces of grease are removed, and, after rinsing and drying, it is dipped bodily into a bath of molten wax. The wax, which rapidly cools when the article is lifted out of the bath, is then removed from those parts on which the deposit is required and left adhering to the other parts. The article is next placed for a few minutes in an acid electrolytic bath which removes any metallic oxides from the exposed surfaces, renders them chemically clean, and also brings them to a suitable molecular state to receive and retain the deposit. This acid bath is an essential part of the process, and is that to which the exceptional adherence is due. The nickel depositing bath, to which the article is then transferred, is of the usual composition, and is worked at a temperature of about 85 deg. F. The current density used is about 15 amperes per square foot, and, at this density, nickel is deposited at the rate of about 0.001 in. per hour, so that if a deposit 1/8 in. in thickness is required the article must remain in the bath for over five days. This slow rate of deposition is, perhaps, a drawback, but it could probably be improved by raising the temperature of the bath and also by agitating the objects while the deposition is proceeding.

Summary Concerning the Motorcycle and Bicycle Industry in 1919

A PRELIMINARY statement of the general results of the 1919 census of manufacturers with reference to the motorcycle and bicycle industry has been issued by the Bureau of the Census, Department of Commerce. It consists of a detailed statement of the quantities and values of the various products manufactured, prepared under the direction of Eugene F. Hartley, Chief Statistician for Manufactures.

Reports were received from 51 establishments engaged in the industry during 1919, with a total value of products of $53,105,995. At the census of 1914 there were 78 establishments with products valued at $22,234,262. Of special interest is the increase in the production of bicycles, the number reported in 1919 being 470,675, as compared with 299,029 in 1914, an increase of over 57 per cent.

In 1919, 9 establishments were located in Ohio, 8 in Massachusetts, 7 each in Illinois and New York, 5 each in Indiana and Wisconsin, 4 in Pennsylvania, 3 in Connecticut, 2 in Michigan, and 1 in Washington.

The statistics for 1919 and 1914 are summarized in the following statement. These figures are preliminary and subject to such change and correction as may be necessary from a further examination of the original reports.

COMPARATIVE SUMMARY OF STATISTICS FOR THE MOTORCYCLE AND BICYCLE INDUSTRY, 1919 AND 1914

	1919	1914
Number of establishments	51	78
Value of products[1]	$53,105,995	$22,234,262
Motorcycles:		
Number	59,214	62,154
Value	$16,176,055	$12,161,775
Bicycles:		
Number	470,675	299,029
Value	$12,277,341	$3,757,318
Tricycles, value	$625,522	
Motorcycle parts, including delivery and side car attach.	$10,646,480	$6,315,169
Bicycle and tricycle parts	$4,814,668	
All other products, including repair work	$8,565,929	

[1] In addition, in 1919, motorcycles and bicycles, including parts, to the value of $2,205,743 were produced by establishments engaged primarily in the manufacture of other products; in 1914, to the value of $4,647,798 by establishments of a similar character.

The FORUM

Four-Wheel Brakes Not Too Severe

Editor, AUTOMOTIVE INDUSTRIES:

I have been reading with a great deal of interest your various articles regarding the use of four-wheel brakes abroad, and have noticed in your issue of June 16 some letters on the subject from prominent American automotive engineers.

The first letter from W. R. Strickland, chief engineer of the Peerless Motor Co., headed "The Disadvantages of Four-Wheel Brakes," convinces me that Mr. Strickland has had no experience with a car on which the four-wheel brakes are properly designed. He states that it is very uncomfortable for the passengers when the car is suddenly stopped.

With the Delage, which is, of course, the only car I know anything about, I claim that there is a great deal less discomfort in short stopping than would be possible with any car having two wheel brakes only. As a matter of fact, there is practically no tendency to throw passengers forward.

We have demonstrated with one car upward of 24,000 miles. The original brake lining is still on the brakes and, as you probably know, were there any weaknesses in this braking system they would have developed long since. I can assure you that these brakes have been subjected to a great deal more strain than would be the case under normal conditions, and yet I claim we can stop this car in unusually short distances with a great deal less discomfort to the passenger than is possible under any other braking system.

A. A. ROST, President,
Delage Concessionaires (U. S. A.), Inc.

Factors Affecting Fuel Economy

Editor, AUTOMOTIVE INDUSTRIES:

The paper entitled Elements of Automobile Fuel Economy, by W. S. James, read at the summer meeting of the S.A.E., was so comprehensive in its nature that some of the salient points are likely to become absorbed without full appreciation. The average user perhaps does not realize that an expenditure of power, and consequently of fuel, is necessitated in order to drive a car on a bumpy road in excess of that required for a smooth road. The magnitude of the excess can be measured by the power required to accelerate vertically the mass of the unsprung weight and some proportion of the sprung weight, the number and distance of the accelerations per unit time being determined by the nature of the road surface. I have found that loss of speed of the car in a horizontal direction accompanied an increase in the number and amplitude of vertical motions imparted to the body of the car. By fitting suitable springing devices the energy previously expended wastefully was turned to good account.

Does not much of the fuel wastage in every day life result from driving cars and their occupants vertically as well as horizontally? I am sure of it. We have tables of road resistance such as are reproduced in Mr. James' valuable paper, but we would also like to have some definite data as to the effects of different types of springing upon fuel consumption.

I have measured the power expended upon propelling the various parts of the car body at different speeds and the resulting cost of using a wind screen, etc., in cents per mile.

These costs vary very considerably not only from moment to moment but from day to day.

Tests of one car I have made on the track show at 30 m.p.h. and different weather conditions a variation in resistance to car motion from 125 to 180 lb. For this reason it becomes difficult to make accurate deductions based upon road or track measurements, though they are sometimes helpful.

I cannot too strongly deprecate, as I have always done, the practice of some engineers of placing horsepower output on a pedestal and treating all other considerations as of minor importance. How often has the fact been pointed out that the maximum power is seldom if ever used, and that seldom is the test bench performance attained in ordinary usage due to many causes which need not be gone into here? Mr. James and Mr. Nelson have helped forward the argument in favor of giving a better consideration to the actual requirements in service. A great deal of time and effort is expended upon futile argument or upon the third place of decimals while there remain with us major problems the solution of which would help forward the objects of economy to a much greater extent.

If fuel were not so cheap, engineers and others would be more careful about how it was used.

R. W. A. BREWER.

Metal-to-Metal Clutch Lubrication

Editor, AUTOMOTIVE INDUSTRIES:

I have read with interest Mr. Chase's article on American and British practice in clutch design.

He is, however, in error when he states that clutches of the type shown in Fig. 18 as used on the Vauxhall car must needs be run in oil. The Vauxhall clutch has been in successful use since 1910, the only lubricant used being powdered graphite. For this reason the somewhat formidable list of disadvantages of this type of clutch presented by Mr. Chase. do not exist.

An additional advantage of the metal-to-metal disk clutch is that no provision need be made for adjustments of the clutch spring pressure, and as the total wear after prolonged use is negligible, there is also no necessity for providing any adjustment for the position of the clutch pedal itself.

LAWRENCE H. POMEROY.

The reference to the Vauxhall clutch as being one which runs in oil is evidently in error. It is true, however, that metal-to-metal clutches require lubrication, graphite being used in place of oil in this case, with consequent reduction in the coefficient of friction. For this reason a greater number of plates is required as compared to fabric-faced disks to carry a given torque with a given spring pressure and size of disk. The cost and the spinning weight are therefore higher, hence the metal-to-metal type is not without disadvantages. Some other makes of metal-to-metal clutches use oil for lubrication, and are subject to the other disadvantages cited in the paper referred to.—EDITOR.

Determining a Better Basis for Wage Payments

The American Federation of Labor has asked its executive council to attempt to determine a sound basis of wage adjustments. Service rendered by individual is only logical basis, but practical application must come slowly. Manufacturers should take up this problem.

By Harry Tipper

THE convention of the American Federation of Labor has brought forward many interesting matters for the man who desires information on the general ideas of the labor leaders prominent in that body.

The importance of the presidential honor in this organization is indicated by the fight which took place for a change in the situation. The character of the politics in labor organizations is indicated by the character of the campaigning and some of the statements that have been made regarding the support of the candidates.

The political character of these organizations is very definitely indicated in the suggestions of resolutions, in the actions of the various committees and in the attempt being made to have the American Federation of Labor lend the strength of its endorsement to proposed legislative matters, matters of international policy and matters of general political character.

For the industrial executive, however, the most important items are those dealing with the policy of the American Federation in regard to industrial matters.

One of these marks a departure from the usual program of this organization and is interesting because of its admission that the present system is not satisfactory. This refers to the method of fixing wages, and calls upon the executive council to investigate the manner in which wages are fixed with a view to getting a better basis than the cost of living for determining wage scales.

"Fixing wages by the cost of living," the executive council report said, "brings death through a perpetuation of a static condition." The object of this investigation is stated to be the discovery of "a sounder basis for our social life as a whole." Unfortunately, the American Federation of Labor is committed to uniform scales of wages, and the general tendency of the movement of trade unionism is toward uniformity all through the occupation, irrespective of local conditions.

The statement has been made in these articles that the cost of living is not a sound basis for the consideration of wages, and to this extent the investigation of the Executive Council of the American Federation is justified in its proposed examination. It is hard to see any possibility of a sounder method of adjusting wages, with the tendency definitely developed toward uniformity along these lines. There is evidence of an incomplete examination of the situation in the statement that wages are fixed on the cost of living, because this is not entirely true.

Wages have been fixed by the available "supply and demand," and, while they have a general tendency to agree with the reasonable requirements to maintain life, the particular wages in any occupation have been the wages which the manufacturer was obliged to pay, either because of the relation between supply and demand, or because of the power of the organized forces among the workers in that industry.

However, the fact that the American Federation of Labor is to conduct an investigation into wage systems with the idea of suggesting a sounder basis is quite important. It indicates the existence of general dissatisfaction among the leaders, not only with wages, but with the methods of computing wages.

Whether the conclusions arrived at are of importance or not, the investigation itself will undoubtedly suggest matters that will be of advantage to the industrial leader in his study of the wage question. Of course, the only logical basis for wages is the service rendered by the individual, and the relation between that service and the social advantage. There is no hope of any practical application of this logical ideal in the immediate future, and any adjustments of the wage system must be based upon the present methods of determining wages and the present general relations between the different occupations and industries.

The fabric of industry would not be able to withstand any severe change in its general methods of development. It can be improved only by the change in one detail after another, so that the machinery will continue to function through all the changes that must be made.

The investigation proposed by the American Federation of Labor will be affected by the practical necessities of the case. It is not likely that conclusions reached will depart materially from present practices, and for this reason any suggestions can be weighed more easily.

The practical ability of the labor leader to sense developments as they become visible is indicated again in this proposed investigation of wage systems. Manufacturers have been aware of the unsatisfactory character of wage adjustments and the necessity for better methods of determining wage scales. No investigations of importance have been made by professional organizations or manufacturers' associations.

It is evident that new considerations must be given to wage systems and methods of wage adjustment. These studies must take into account the elements affecting the efficiency of the individual worker and the extent to which they are related to the wage system. The elimination of the fluctuations in the efficiency of the indi-

vidual, the increase in the individual efficiency and the decrease in the waste must be measured in connection with any examination of wage systems looking to suggested changes.

It is unfortunate that professional societies and manufacturers' associations have done nothing along these lines, because investigations from this side will be necessary before any practical advance can be made in the wage systems themselves.

To be effective the reward should be based upon the service, it should satisfy the sense of justice, increase the incentive for improvement and develop confidence in the future. The reward must suggest safety in the permanence of the work and the removal of economic fear. Any moves that are made to change the wage systems in these directions will have a beneficial effect upon industry and upon the relations between management and labor.

It is interesting that the representatives of labor should have seen the necessity for this investigation before the representatives of capital and management have indicated their desire to improve things along this line, particularly as the examination of all factors is necessary to any just conclusions.

Industry would be well served if the leaders in professional and manufacturers' organizations, and the leaders of labor opinion could contribute their influence to an impartial investigation so that all the elements of inefficiency could be determined, the practical limitations in the systems examined and the possibilities of improvement considered.

The present investigation proposed by the American Federation of Labor will be limited by the traditions and precedents of that organization, and any of its conclusions will be discounted and discredited among manufacturers because of the source from which these conclusions come.

A great deal of progress could be made if the leaders in the professional and manufacturing groups would religiously study all suggestions for improvement, no matter where they came from, including particularly the investigations to be carried out under this resolution, by the executive council.

Despite the difficulties in the case and the probable limitations of the investigation, this proposed examination of the wage systems is likely to be the most important development from the present convention of the American Federation of Labor.

Classes of Research

PROF. LEONARD BAIRSTOW, speaking recently before the National Union of Scientific Workers, distinguished between scientific research, applied research, and experiments and tests. The three branches naturally merge into one another; yet Mr. Bairstow's main definitions will be accepted. Scientific research had, at the time it was carried out, no industrial bearing at all, he considered. A long period might elapse between the work of a Faraday or Maxwell and the stages of financial benefit. Scientific research needed an atmosphere of complete freedom from the anxieties of making both ends meet; the freedom implied communication of ideas with friends, unrestricted by national boundaries. Secrecy was extremely undesirable. Applied research had at the outset a definite industrial bearing owing to the difficulties of manufacturing processes. The work was allotted to research associations, to private laboratories and to Government departments; whether or not it should be secret was a controversial point. With certain safeguards the conduct of applied research could be materially helped by committees. The work, if worthy of the name, was slow and hazardous, and required co-ordination. By experiments and tests, Mr. Bairstow indicated the work necessary to meet a specific order after it had been placed. That work was of little general value, it was unsuitable for committees, and generally considered was confidential and urgent. For the routine tests of finished products, private institutions were better suited than highly-developed laboratories. Very special tests justified a certain number of central government laboratories empowered to issue certificates, but their range should be very carefully circumscribed. "If experiments and test work be carried out by a staff also allotted to applied research, the latter will suffer and tend to become extinct under existing systems of administration."

Speaking from his own experience, Professor Bairstow pointed out that applied research had difficulties in keeping alive in an establishment which used the same staff for experiments and tests. The latter were urgent, research was slow. The tendency was to push extra-experiment in ahead of research until the postponement of research was indefinitely prolonged. In order to keep research alive staff and apparatus should be specially provided for it. Further, the administrator responsible for finance had an additional temptation to favor tests which produced fees. A capable committee could here do much. If, however, the terms of reference of the committee covered both tests and research, the temptation to secure immediate results might prove too strong. That argument against intermingling applied research and experiments in the same establishment might also be made in the case of universities, though it carried less force there.

AN interesting opinion on motorcycle racing was expressed recently by the British journal, *The Motor Cycle*. Since it applies here, as well as abroad, the opinion is worth quoting:

"Does racing improve the breed? Undoubtedly; provided that the means by which races are won can be rendered applicable to touring machines without detriment to reliability or comfort. Such events as the Tourist Trophy and many of the long-distance races at Brooklands have done much to improve the cooling, reliability and general efficiency of the touring motorcycle; but what of the short-distance records? Let it be understood that we have no intention of disparaging the fine performances which have been accomplished over short distances. On the contrary, these phenomenal speeds are most interesting and instructive, and are productive of new ideals and new standards of performance. At the same time, it is evident that some of these records are of little immediate advantage to the average motorcyclist, since they are incapable of being sustained for any useful period. Provided the manufacturer of the record-breaking machine sets to work to incorporate the lessons he has learned in his touring mounts, well and good; but if he merely concentrates on obtaining an extra mile per hour on the track but little progress will be made."

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Planning

IT sometimes seems as though manufacturers do not sufficiently recognize the importance of the old adage, "Be sure your right, then go ahead." Automotive manufacturers cannot be criticized for neglecting the latter part of the admonition, but expensive design changes, made after dies have been constructed, indicate that the "be-sure-you're-right" part is not always appreciated.

To draw a design, submit it to the parts maker, allow him to construct expensive dies and begin production is an expensive but legitimate part of manufacturing. To make frequent changes in that design after production has started is not fair either to the parts maker or the public. Such changes are sometimes rather arbitrary in character. They result in men being thrown out of employment, human hardships, production losses, increased costs and increased selling prices.

All of these things are to the detriment of industrial progress in general as well as to the manufacturer himself. Careful planning and a greater degree of co-operation by all men, companies and departments concerned will aid greatly in reducing or eliminating such unnecessary troubles and costs.

Heat Treatment Here Saves Trouble Hereafter

TWO cases have recently come to our notice in which failure to properly heat treat engine parts during the process of manufacture has lead to serious difficulty when the part has been placed in service with the result that articles possessing real merit have been blacklisted and will long be condemned as worthless, whereas a little intelligent forethought and care in development would have enabled the makers to benefit through recognition of intrinsic value of their product.

The first case is the aluminum piston. Many of the failures registered by pistons of this material were unquestionably due to failure to heat treat the piston prior to the final machining operation. As a result the pistons were put into service with casting strains unrelieved. Under the influence of heat in the engine the casting strains were relieved, the piston warped and much trouble resulted. To avoid this excessive clearances were sometimes allowed. Had the casting strains been relieved by heat treatment during the manufacture, the effect of distortion could have been canceled by later machining.

The second instance has to do with the tungsten steel valve. Some, at least, of the manufacturers who made these valves reasoned as follows: why bother to heat treat an exhaust valve when it is immediately subjected to high temperature when put in service? So many such valves were produced without heat treatment and placed in service. Forthwith they warped, for the internal strains had not been relieved and were quickly destroyed or rendered unfit for service until refaced. Obviously the warping should have been brought about by proper heat treatment before the final machining operation in production. Failure to do this has resulted in prejudice against the tungsten valve, though valves of this alloy possess considerable inherent merit and perform well in service when properly made.

Similar conditions apply in the manufacture of other parts subjected to heat or sometimes only to vibration during service, and should be borne in mind by the manufacturer if he desires satisfactory service from his product. Particulars of interest in this connection are given in the article by Dr. Rosenhain on Problems and Possibilities of the Aluminum Piston, which appeared in the recent Engineering Number of AUTOMOTIVE INDUSTRIES.

Recognizing Essential Factors

"WHEN employers have thoroughly defeated and broken the union organizations — if such a thing is possible—they will be far from a solution of the labor problem. The essential factors involved in human relationships lie much deeper and are much more complex than the mere battle between

employers' associations and union organizations." This is the opinion of a superintendent in charge of an open-shop plant employing more than one thousand men.

Similar opinions are being expressed by other far-seeing executives in various parts of the industry. The purpose of a labor policy is to get better quantity and quality production through the gaining of co-operation and enthusiastic work from the men. The purpose is not to win a victory or fight a battle to satisfy the employers' pride. In the long run it will be necessary to get the workers to go along with the management of their own free will. Hard times will not last forever, and the man whose only incentive is fear of unemployment is not the best workman at any time.

There is a certain manufacturers' association which meets every year and which devotes one session at each meeting to a discussion of the labor problem. These labor discussions are very private; no stenographic notes are taken, and the papers read are not published. The entire discussion at these sessions centers around the various methods of fighting the unions, the use of "scabs" during strikes, and many other practical defensive and offensive tactics of industrial warfare. To judge from the chief speakers' ideas, the millennium will have arrived when all unions and union leaders have been strung up to lampposts. When hard times frighten labor into temporary submission, a note of jubilation is sounded and progress is predicted. When times are good and labor comes into its own, there is weeping and wailing and gnashing of teeth.

The attitude and tenor of discussion of this manufacturers' association is still reflected too strongly in certain parts of industry. Permanent progress toward solving labor difficulties rests in a study of the individual, the various factors influencing his life and work, and achievement lies along the lines of careful study and thoughtful experimentation.

Needless Waste of Lubricants

A MARK of careless design or assembly is the pool of oil left on the garage floor or roadway by many cars even though they be new and presumably in good repair. A floor pan is required in many cases to prevent the floor of the show room from becoming stained, while our highways are black with oil dropped from cars and trucks which use them. A dollar a gallon is, one would think, a rather high price to pay for road oil, yet that is about what the average motorist pays for oil, a large proportion of which is ultimately deposited on the roadways wherever cars are used.

This would be bad enough, simply because it represents a waste which is in large part preventable, were lubricating oils cheap and the natural supply unlimited, but when the price of good oil is high and the supply decidedly limited the waste is not to be condoned, especially when there are many ways of minimizing if not eliminating the waste; such as thrower rings and flanges, felt washers, return threads, proper gaskets, better inclosure, with return ducts for oil, etc.

It is rightly considered a mark of poor design, construction or repair to see oil leaking from any machine in a well-kept shop or power plant. The mere fact that in the modern car the oil leak is hidden is no excuse for continuing a design known to be defective in this regard. This is a subject that may well receive more study on the part of the engineering, production and service departments of all producers of automotive equipment.

"Seek and Ye Shall Find"

HAVING once taken a certain side of an argument, it is a common human trait to maintain the justice of that side through thick and thin. Sometimes this takes the form of trying merely to prove that the other side is wrong. Frequently the desire to win the argument becomes so strong and the struggle of wits and resources so interesting that the actual purpose of the struggle is forgotten in the mix-up.

The relations between manufacturers and employees have arrived at this stage in many instances. Abuses on both sides have had the effect of emphasizing the struggle and obscuring its purpose. It is easy to point out the many faults of organized labor; it is easy to cite numerous individual instances in which the attitude and actions of the worker have been unfair. To do this merely proves that the way out suggested by organized labor is not feasible.

In reply to these criticisms, labor leaders oppose similar statements which show the unfairness of employers. Both sides have been rather successful in convincing their own groups. But the fundamental aim of each group seems to be to win the argument with the other.

Fundamentally, that is not the problem at all. The chief aim is to produce permanently harmonious industrial relations. This end can be achieved through seeking for truth, for basically correct facts, and for sound interpretation of those facts. So long as both sides seek and interpret facts with the idea of simply proving their side of the argument little progress can be made.

In his recent address to the S. A. E., President Beecroft quoted Rene Descartes, the French philosopher, as follows; the thought expressed applies equally well to the attitude necessary in considering industrial relationships:

". . . there is nothing so far removed from us as to be beyond our reach, or so hidden that we cannot discover it, provided only we abstain from accepting the false for the true and always preserve in our own thoughts the order necessary for the deduction of one truth from the other."

To realize this ideal fully in our mental processes may be impossible, but to approach the problem of human relationships with that thought in mind will make for practical progress; for more study and less propaganda; for more analysis and less argument. In this field, especially, we are still uncertain as regards the fundamental facts upon which to base extensive action. The time is ripe for a period of analysis and experimentation.

Banker Urges Price Stabilization

Big Market Waiting Final Adjustments

Gotham Bank President Says Makers Should Assure Present Price Values

NEW YORK, June 28—Henry H. Bizallion, president of the Gotham National Bank, which handles the accounts of more automobile dealers than all the other banks of New York combined, has written a letter to Alfred Reeves, general manager of the National Automobile Chamber of Commerce, suggesting that a marked advance could be made in the stabilization of the industry if car manufacturers would give assurances that present prices are excellent values and that no more changes are to be expected unless they are upward. He asserts that a survey made by the bank indicates that there is substantial purchasing power available for motor cars, but that buyers are waiting for the final adjustment of prices.

Reeves has asked members of the N. A. C. C. to comment on the suggestions made by Bizallion, whose letter follows:

"June 25, 1921.

"Dear Sir—As we handle more automobile merchants' accounts than all other banks in New York combined, we are deeply interested in the continued prosperity of the retail automobile business. This interest is very direct in that many of these dealers have been our customers for the past ten years.

Glad Adjustments Orderly

"Price adjustments in the automobile business, the same as in other lines of industry, were inevitable, and we are very glad to see that these adjustments came in much more orderly fashion than they did in other industries. According to your price lists all the readjustments seem to have been accomplished except for a few announcements that I understand will be made around July 1. The object of this letter is to learn whether you have any assurance from manufacturers that all price readjustments shall be made by July 1, so that the public will realize that the new prices are to continue over a substantial period.

"Would it not be well to suggest to all manufacturers that while no guarantee may be necessary, it would seem highly important to the prosperity of the retail trade that manufacturers endeavor to prove to the public that the present prices are excellent values, that in some cases they are made at a substantial but necessary loss during the readjustment period, and that for these reasons no further changes may be expected unless they are upward?

"During the past few years the banking fraternity has been led to look upon the automobile industry with the greatest respect, not alone because of its volume, but because of the energetic manner in which it has been conducted and our high appreciation that cars and trucks are now permanent necessities in our American life. Banks generally have been liberal with their credits to the industry, curtailment coming only in a few districts and in a few cases where the dealer was not entitled to credit, irrespective of the product he was selling.

No Loss on Dealer Business

"We take pride in the fact that in ten years of financing automobile dealers to the extent of many millions of dollars, we have never had a dollar's loss, except in one instance where fraud was committed.

"Our interest in the retail selling field has led us to make a survey, which shows:

"1. That there is a substantial purchasing power available for motor cars in particular, and to some degree for motor trucks, particularly in connection with new building operations that are now getting under way.

"2. Buyers generally are waiting for the final adjustment of motor car prices, to be assured that when they do buy the price will not change a few weeks later.

"3. It is the hope among dealers that all manufacturers who contemplate price adjustments will do so promptly and with the full understanding of the requirements of the next six or eight months.

"4. While guaranteeing prices may have many bad features, the makers should endeavor to impress the public with the new values in motor cars and

(*Continued on page* 1450)

British Car Makers in Market for Parts

LONDON, June 10 (By mail)—The Rover Co. of Coventry has established a precedent for British automobile makers by advertising in the newspapers for bids on practically all materials used in the manufacture of its 8 hp. light car. Hitherto the practice in the British automobile trade has been to invite a selected list of firms to bid. In some cases this does not insure competitive prices. The conditions require ability to quote close prices and guarantee delivery. There are intimations that American companies might find it to their advantage to compete for the reason that since the war British manufacturers have found themselves up against combinations in the castings and stampings trade.

Mexican Peace Big in Car Opportunity

Distributer Predicts Tripled Sales With Continuance of Present Normal Conditions

NEW YORK, June 27—The number of automobiles in Mexico to-day will be tripled or quadrupled within the next two or three years in the event that peaceful conditions continue throughout the Republic. This statement was made here to-day by F. G. Canton, the distributor in Mexico City of the Cole, Oakland and Cunningham cars and Brockway trucks.

The greatest drawback to increased use of automotive equipment in that country has been the danger in driving outside of Mexico City, Guadalajara, Tampico and a few of the other cities. Conditions have changed so materially in recent months, Canton stated, that this fear is being overcome and, when all parts of the Republic are again open for motor traffic, a great gain in the number of cars is expected because, as Canton added, Mexico has need of the transportation facilities offered by the automobile.

Road construction and highway improvement during the last six or seven months has been greater than during any similar period for many years. Practically all of the streets in the capital have been put in good repair and the highway activities outside of Mexico City have been large.

Canton is one of the backers of the new Association of Mexican Automobile Importers which was recently formed in Mexico City and numbers the principal firms engaged in automotive trade. The association has mapped out a big program for the next few years and it is expected that co-operative effort will enable the dealers of that city to overcome many of the present business difficulties.

WORCESTER BUYS STENMAN

WORCESTER, MASS., June 28—The Worcester Electric Tool Corp. has taken over the business formerly conducted by the Stenman Electric Valve Grinder Co., Inc., the Stenman Electric Tool Co. and the Consolidated Machine Tool Co., all of Worcester. The Worcester Electric Tool Corp., which was organized to take over the three concerns, is headed by H. P. Gleason. A. G. Sandberg is treasurer, J. J. Kelleher is sales manager and Harold Paine, advertising and service manager. The principal products which will be featured for the present is the Hus-kee service tools and drills.

Tractors Prove Superior to Horses

Fargo Farmers Get Impressive Lesson

Heat Forces Three Teams Out—One Machine Disabled—Attendance Small

FARGO, N. D., June 28—Forty tractor outfits and ten horse outfits started at 8 o'clock this morning in the first national tractor demonstration in this country in which a fair amount of work will be done by each. There is a ten-acre plot each tractor must plow and seed. It will take a tractor pulling three plows approximately ten hours to do the work and some with six plows expected to finish in half a day.

The ten-horse outfits were not entered by the Horse Association as tractor makers hoped would be done, but it was necessary for tractor makers to scurry around and get horse entries. Officials of the Horse Association refused to be drawn into a contest in which tractor makers drew up the rules without consulting with them.

The horse outfits belong to local farmers who, in most cases, are going to fare well, as some tractor makers are presenting them with machinery, such as plows, harrows and other tools used, in addition to approximately $1,000 cash prizes. It is questionable if any comparative results of horse and tractor efforts will be given the authority they should carry.

Only 26 different makes of tractors are competing, as compared with upwards of 70 makes at former demonstrations, the condition of the times being responsible for the reduced numbers. The most important makers are present except Samson and Moline. Among those competing are Fordson, Cletrac, Case, Wallis, Avery, International Harvester, Bates, Twin City, Emerson-Brantingham, Allis-Chalmers, Best, Deer, Huber, Gray, Hart-Parr, Aultman-Taylor. Holt, Rumely, Lauson, Nilson, Titan, Townsend, Rock Island, Fox, Liberty-Eagle and Grain Belt. The French cultivator, Souma, which takes the place of a plow will perform.

There is a growing feeling that the demonstration will not provide as good cost figures at it was hoped. The amount of fuel used and the time required will be obtained, but many of the factors entering into cost cannot be considered. Each tractor must be handled by one man, instead of a group of men, as at some former demonstrations, and the tractor operator must handle the plow without any outside help. Repairs on the tractor must be made by the operator. The ground to be plowed is dead level and is a black gumbo, covered knee high with weeds. Some trouble is expected in plowing it five inches deep, as required.

The very hot weather caused three of the horse outfits competing to withdraw before the first day was over.

The tractors competing gave a good performance, all starting at 8 a.m. and working on the hardest soil ever plowed in a national demonstration. Only one machine was disqualified for breakage. This was a Titan which had a defective driving gear that could not be repaired in the 30 minutes allowed for such work.

The three plow tractors finished their 10 acres in less than 10 hours and compared with the six horse team which pulled only two plows and did not plow half as much, they gave a good lesson to the farmers on the great economy in motor equipment.

The attendance was very small and even worse than last year. The novelty of the tractor has passed and whereas two years ago several hundred spectators followed the Fordson and other popular makes across the fields, scarcely half a dozen showed such interest today. Unless the attendance picks up in the last two days of the demonstration it scarcely can be regarded as a success, considering the cost.

Dakota farmers are not yet ready to buy. It will be July 20 before the status of the present crop is known definitely and farmers intend to wait.

N. A. C. C. Truck Survey Shows Farms Big Market

NEW YORK, June 28—The truck committee of the National Automobile Chamber of Commerce has completed its survey of motor trucks in use on farms in the states of Rhode Island, Maryland and Pennsylvania. The data shows that in Pennsylvania on 186,863 farms, only 12,631 trucks are in use and that there are only 11 counties in which there is no need for more trucks. Smaller sizes are preferred. In Maryland there are only 2817 farmers who use trucks. Most of them are of the 1-ton variety. It is evident that motor vehicles are popular in Rhode Island, because 1350 of them are in use on 3500 farms in Providence and Newport counties. It is stated that additional trucks are needed in Providence County.

DENY STINNES FIAT PURCHASE

NEW YORK, June 28—Reports from Turin, Italy, state that officials of the Fiat company deny that Hugo Stinnes, the German industrial magnate, has purchased a large block of Fiat stock. It is admitted that negotiations for the purchase of this stock were in progress, but are said to have been abandoned.

Congress to Impose High Aluminum Duty

Will Increase Tariff from Two to Five Cents Per Pound on Crude

WASHINGTON, June 27—It appears that the appeal of the National Automobile Chamber of Commerce to the House Committee on Ways and Means for low duties on aluminum products has been unavailing. It is stated in authoritative sources here that the permanent tariff, which the committee will report out by July 5, will carry a duty of 5 cents per pound on aluminum, aluminum scrap and alloys. The N. A. C. C. has asked that paragraph 143, under section 3, be left unchanged, or preferably, taken out entirely, as the present duty is 2 cents per pound. It was contended that the manufacturers of automobiles would use more aluminum if the price could be reduced by lower tariff rates.

Under the Payne-Aldrich Act, the duty on this material was 7 cents per pound, and in the Underwood-Simmons Act, 2 cents. Aluminum plates, sheets, bars, strips and rods were said to have been given a duty of 9 cents, as compared with 11 cents carried in the Payne-Aldrich Act and 3½ cents in the Underwood-Simmons law. The Ways and Means Committee was recently informed that the total production of aluminum in the United States is about 200,000,000 lb. per year, of which the automobile industry consumes approximately 100,000,000 lb., or 60 per cent.

It was charged that the Aluminum Co. of America owns and controls more than 90 per cent of the bauxites in the United States suitable for the manufacture of aluminum, and that it produces approximately 80 per cent and consumes about 90 per cent of all the aluminum in the United States. It was pointed out that if the duty is increased the foreign manufacturer will hardly be able to compete because of the additional custom charges when, with the margin at 2 cents, duty is already exceedingly small.

QUALITY TIRE MAKES OFFER

ANDERSON, IND., June 27—Stockholders of the Quality Tire & Rubber Co. have voted in favor of a proposal that the company issue bonds to the amount of $600,000 and that present stockholders take $100,000 of the issue. Creditors will be expected to take the remainder of the bonds to satisfy their claims and the subscription of the stockholders will be used as operating capital. The liabilities approximate $500,000.

Parts Business Slow Despite Car Sales

Heavy Retail Buying Not Yet Reflected in Orders from Manufacturers

NEW YORK, June 28—Notwithstanding the almost phenomenal sales of motor cars at retail in most sections of the country, the excellent trade of distributers has not been reflected fully in the business of parts and accessory makers. This would seem to indicate that numerous car manufacturers had on hand a considerable number of surplus cars when they suspended, in a large measure, the buying of materials late in May.

The business of parts makers is exceedingly spotty. Some of them are keeping fully abreast of their May business while others report there has been a sharp falling off in orders. Most of them have two or three motor car companies which are good customers, but are getting little business from others which previously have been on their books. It is probable, however, that the latter half of June will show a greater volume of business than the first half.

Reports from Detroit and other cities are to the effect that some parts plants which had contemplated a shutdown at the beginning of July, ostensibly for inventory purposes, will continue operations through the month, although on a reduced scale. Many of the car makers have found it necessary to increase their schedules to meet the demand for cars resulting from increased sales due to price reductions and this ultimately will reach back to the men who supply them.

It is certain that the slowing up of the industry in July will not be so marked as was expected a month ago. Underlying conditions are thoroughly sound and there is reason to believe that after the middle of September there will be a steady upward trend.

Credit conditions, especially in the smaller cities, are not entirely satisfactory. While the banks have more cash available than for many months, they are loaning it with the utmost caution and many manufacturers are having considerable difficulty in obtaining funds with which to finance the orders they are receiving. There is a tendency on the part of many bankers to send their surplus funds to New York.

Parts makers generally, however, report collections for June better than for any month this year. There has been a continued whittling down of past-due accounts.

New Orders to Keep Timken Plant Operating

DETROIT, June 29—Decision to close the Timken Detroit factory for a month July 1 has been altered as the result of orders coming in steadily, which will necessitate operation of the plant on the present basis of 1/3 normal for the next 60 days at least, according to General Manager Fred Glover. Orders are coming through every day, said Glover, and though in small volume are sufficient to keep the factory working.

The same is true of Continental Motors, which, although no definite closing date had been fixed, had anticipated a slowing up around July 1 with a possible temporary shut down. Vice-President G. W. Yeoman said the plant would continue to operate on the present basis and all indications point to a steady demand. Yeoman reiterated his statement that the company would operate just as long as compelled to by incoming orders and from time to time might shut down for two or three day periods, though no general closing down was anticipated.

Hupp Favors Short Closings

The same attitude is apparent at the Hupp Motor Car Corp. plant. Hupp has been building 80 cars a day, basing production strictly upon sales demand and it is the intention of Hupp executives to close down for short periods from time to time as the market fluctuates. President Hastings said demand is brisk and there is no indication to-day that the plant will have to slow up.

Employment figures for the last week in 79 factories in Detroit show 559 less men at work than during the week previous. The total employed was 109,621 in the 79 factories which includes practically all the automobile plants. Short time schedules were in force in 25 concerns which were working 6391 men on an average of 21¼ hours weekly. The figures are for the week of June 21.

Upstate concerns appear to be in good shape as far as production is concerned, due to the stimulation in sales as a result of the price cuts. This is true particularly of the Wilson Foundry & Machine Co. at Pontiac. Orders bringing production close to the maximum of last year are reported by D. R. Wilson, general manager.

"We passed the 1000 mark on the payroll last week," said Wilson, "and we are so busy trying to keep up to the demands of the Overland plant that we expect to be compelled to work a Sunday shift. Rush of business at the Willys-Overland plant is keeping up, and reserve orders have grown to such an extent the plant is assured of its schedule through August.

"We have orders to turn out 550 jobs a day and that number is going through the shop. The Overland plant, however, will use that number, so we have little chance of getting ahead of it. This will necessitate our working on Sunday. We have been summoning former employees wherever it was possible to locate them, and the total number on the payroll has been substantially increased within the last two weeks."

FISK ADDS NIGHT SHIFT

CHICOPEE FALLS, MASS., June 27—The Fisk Rubber Co. has added a night shift of 300 men to its force and has increased the day force by 250. Increased demand for certain sizes of tires is the reason for the expansion of production.

Milwaukee Plants to Resume July 1

Accumulation of Finished Stocks in Factories Now Sold—Expect Steady Demand

MILWAUKEE, June 27—Between July 1 and 5 there will be a general revival in the operation of passenger car factories in this and other centers of production, while at the same time some shops which have been virtually closed down for a number of weeks will resume work. The recent accumulation of finished stocks has been worked down to the point where new production is necessary and new orders from distributors and dealers are being received in a relatively generous measure.

The trade has received material assistance in moving goods by the recent price reductions and this good influence is being passed on to the factories. Makers of parts and accessories and general equipment are proceeding at a fair rate of output and expect to be in position to make steady progress. In general, the opinion is expressed that with the resumption after July 1, factories will be able to run steadily until the end of the year at least.

Business and Financial Comment, a monthly review of local industrial and commercial conditions, issued by the First Wisconsin National, the largest bank in Milwaukee, says the following concerning the automotive industries:

"With one or two exceptions, business in automotive parts and accessories fell off in May compared with April. Gratifying as the gain in this line has been during the spring months, the business done falls 40 or 50 per cent short of the same months last year. The recent and rather abrupt decline in motor car sales is to a considerable extent seasonal.

"The experience of the spring season, however, has shown the industry that cars were priced too high for the buying power of the country. The letting down in prices of most of the leading companies may bring out a better demand in the fall selling season, especially if general business revives.

"The tendency of prices in automotive lines, to a large extent, hinges upon stabilization in the steel industry. Demand for motor trucks parallels new construction work. Demand from that source this year so far has been limited, as the carry over of trucks from last year is nearly sufficient to take care of needs until new construction of all kinds expands."

DODGE LINES UP WITH N. A. D. A.

ST. LOUIS, June 28—Following the action of Charles W. Matheson, sales manager of Dodge Bros., in recommending that all Dodge dealers become affiliated with the National Automobile Dealers' Association, General Manager Harry Moock announces that there are now 297 Dodge dealers enrolled.

Durant Sold Ahead on Eastern Output

Orders for 20,000 Schedule at Long Island Plant Placed—Car Details Given

NEW YORK, June 28—Production of the new Durant car will be started at the Long Island City plant about Aug. 1. It is understood that approximately 20,000 orders for the car already have been received from the Eastern territory. This will keep the plant running at full capacity for a year. Experimental work on the four-cylinder car, which will sell for $890, has been completed and it is practically ready for inspection.

One of the main advantages of the car, its makers contend, is the low maintenance cost which will result from the remarkable accessibility of its various parts. Another point in its favor is said to be the unusual number of refinements in body design. More than the usual amount of leg room is provided in the front seats and the same is true in the rear. The car, which will weigh 2300 lb., fully equipped, will be rated at 24 hp. and will develop a speed of 50 m.p.h. on a level road. Tests have demonstrated that it will average 17 miles per gallon of gasoline.

One of the principal features of the chassis construction is the use of two tubular struts between the cross frame members. These are used not only to stiffen the frame and take out a good deal of the weave, but are also used in place of the exhaust pipe and muffler. These simply act as an expansion chamber and there are no baffle plates used in the construction.

Special Continental Engine

The engine is a four-cylinder block type, made by Continental especially for the Durant car. The valves are of the overhead type, are inclosed, and the exterior of the engine is very smooth and clean. Ignition is by a battery system and the coil is mounted on top of the timing gear case. Servicing has been very carefully considered and all the members, including engine, clutch and gearbox, can be removed without disturbing any of the other members. The oil pump is of the rotary type, very small, and is on the outside of the crankcase at the right, with the water pump on the left side. Aside from these, and the coil, there is practically nothing on the outside of the engine.

The clutch is of the plate type, with a single steel disk, which is slotted, to allow for expansion under heat and prevent warping of the plate. The plate has a molded asbestos floating ring on each side, and the entire assembly is taken out by taking the cap screws out of the cover plate, which carries also the expanding fingers.

The instruments are mounted on a sheet steel instrument board, painted, varnished and grained to represent Circassian walnut to correspond with the rest of the woodwork. The steering wheel is solid walnut and the spider is partly aluminum and partly walnut, giving a very handsome appearance. Upholstery is in real leather.

The axles are fitted with Timken bearings, and the rear is of the three-quarter floating type. The carburetor is a Tillotson. Springs are semi-elliptic and the extra tire carrier on the rear is so mounted as to make a very stiff job. The tires are 31 x 4 and are on artillery wood wheels.

The body appointments are very well looked after and there are pockets in each door, each one accommodating the curtain which goes directly above it. The rear deck is double, with the straps concealed between the plate glass rear window.

TWO NATIONAL SHOWS ARE SET FOR JANUARY

NEW YORK, June 27—Dates for the 1922 New York automobile show have been tentatively fixed for Jan. 7 to 13. The show will be held in Madison Square Garden. The Chicago show will open in the Coliseum Jan. 28.

Warner to Reincorporate as Delaware Corporation

TOLEDO, June 27—Preliminary notice of the dissolution of the T. W. Warner Co. of Muncie, Ind., has been filed at Indianapolis preparatory to turning over the assets of the Indiana company to a new corporation of the same name which will be incorporated under the laws of Delaware. Explaining the plan to-day, T. W. Warner said:

"Our business has been enlarged to such an extent that new corporate powers were needed. We will be affiliated with Durant Motors, Inc., but will not become a corporate part of it for some time at least. Manufacture of parts for the new Durant car is going forward and production is increasing from week to week."

DURANT IN NEW QUARTERS

NEW YORK, June 28—W. C. Durant and the headquarters organization of Durant Motors, Inc., is now settled in its permanent location on the eleventh floor of the new Gotham National Bank Building at Broadway and Fifty-ninth Street. Admirers of Durant signalized the move by sending him quantities of flowers, which greeted him when he reached his office Monday morning.

GERMAIN DENIES REPORT

DETROIT, June 28—Leon R. Germain, vice-president of the Old Motor Works, denies that he will resign to join Edward Ver Linden, former president of Olds, in the development of the Durant Motors of Michigan, in Lansing.

Overland to Make 12,000 Cars in July

Sales for Month to June 15 Reported 18,000—Other Toledo Plants Busy

TOLEDO, June 27—The automotive business increase which has forced the enlargement of working forces at the Electric Auto-Lite Corp., the Champion Spark Plug Co., and has necessitated the working of a night force at the plant of the Mountain Varnish Co., was emphasized when Willys-Overland officials gave out the word that the July production schedule was for 12,000 cars as a minimum.

If production can be speeded up as the month rolls along it will top this number by several hundred. And then orders will not be met. In June the Overland has gone far in building up its organization. Production of cars for the month was fully 100 per cent above the number turned out for May.

Sales Manager A. C. Barber announced this week that the Overland sales from May 16 to June 15 had amounted to 18,000 cars. Actual delivery in the first two weeks of June exceeded 6500 cars, according to his report.

For the first time in months the Willys-Overland Co. is advertising for all kinds of mechanics. They are being absorbed into the forces at the plant here at the rate of about 200 a day. A drive-away of 150 cars on Friday illustrated the way things are going. Of these cars 35 went to Columbus and 25 to Cincinnati and the rest to intermediate and smaller towns.

The Mountain Varnish Co. is practically a subsidiary of the Overland. The calls for paint and varnish for the automotive trade has forced the plant to get into top speed production this week.

The Auto-Lite factory here has been crowded with work for more than a month and it is noticing a gradual increase every week.

Overland Price Change Creates Business Rush

PHILADELPHIA, June 25—Passenger cars are being shipped by factory to Philadelphia in large numbers, which promises well for the industry.

For instance, the Overland-Harper Co., according to H. B. Harper, president, is enjoying an increase of more than 40 per cent over the business done for this period in 1920 and a 70 per cent increase over that done in the corresponding period of 1919. Since the price reduction, Harper says, orders are coming in so fast that they cannot be filled. A solid trainload of Overlands and Willys-Knights has arrived.

"The first eight days' business in June is the greatest for the period that I have ever had," said Harper.

Ninety per cent of the cars on the way, added Harper, are promised.

June Sure to Lead Year's Sales to Date

New York District Far Behind on Deliveries—Summer Outlook Improved

NEW YORK, June 27 — This month unquestionably will be the biggest month of the year to date in passenger car sales in the metropolitan area. Cars on which recent substantial reductions were made are selling heavily and others whose reductions were announced in May, have not yet lost entirely the impetus given by lower prices. Business as the month closes indicates that the July and August let-down in sales will not be any more serious proportionately than it has been in past years. Practically all dealers expect sales to drop off materially during those two months, but that is a perfectly natural condition in any community which is intensified in New York by the fact that a large percentage of the people who own or are able to own automobiles spend the heated months out of town.

Buick, Studebaker and Dodge, whose salesrooms have been flooded with orders since their recent reductions were announced, are still considerably behind on deliveries and some of their disappointed customers are turning to other makes of cars, which is helping business generally. Maxwell ran behind on deliveries in May but has been able to catch up this month.

In Brooklyn, where some of the motor car establishments rival those of New York proper in importance, sales have been heavy throughout the month. Dealers there are also having a fairly lively service and accessory business.

The Bronx and Westchester Counties and Newark, N. J., also report big sales.

Richmond County, which comprises Staten Island, lying in New York harbor, has had a fine May and June business in practically all lines. Buick, Overland and Ford dealers are oversold and are forced to ask customers to wait.

Motor truck business in the metropolitan area, which was not as good in May as it was in April, is picking up again.

The used car business has been seriously affected by repeated reductions in new car prices and the public is showing a hold-off attitude. A fair number of sales are being made but in many cases these are at a sacrifice, owing to sudden new car reductions depreciating values of used cars in dealers' hands.

FAR WEST OUTLOOK BETTER

RACINE, WIS., June 27—John Tainsh, general sales manager of the Mitchell Motors Co., Racine, Wis., has returned from a tour of investigation of business conditions and prospects along the Pacific Coast. Concerning his findings he said: "Things look decidedly better in the Far West and Pacific slope and I feel sure that within a few weeks the whole automotive industry will be in much better shape. My swing out to the Pacific has shown me that already buying has become much better and that the interest in motor cars, the growing tendency to regard the automobile as an essential part of our economic structure is just as great."

Bank President Urges Quick Price Action

(*Continued from page* 1446)

to show that the industry has now been stabilized after these midseason price changes, that no more changes are probable, and moreover, that if there should be any further price changes it would more than be offset by the reduced value of the car which the average buyer now has to trade.

"From our survey of the field it would appear that the new prices represent extraordinary values in motor cars, because they are so little above the pre-war prices, to say nothing of the fact that many of these new models are better equipped, better made and better finished than the products of five years ago.

"While I appreciate the difficulty of concerted action by nearly two hundred manufacturers of motor cars and motor trucks in an industry as big as yours, the National Automobile Chamber of Commerce has been such a constructive force for so many years and the automobile industry is in so much better shape than the majority of trades in this country, that I hope your organization will undertake to convey to its members some of those things which I am prompted to suggest because of our high interest in the motor car sales in the eastern territory.

"Can you, or through you, can the manufacturers, give us any assurance of a continuation of operations by the manufacturers on the present basis of prices and values? Some certainty along these lines will materially help the dealer in his plans for maintaining his organization and sales work that would permit broader plans for financing his requirements on the part of banks and ultimately be for the best interest of the public, the manufacturer and the retailer.

"Please be assured of the readiness of our bank to render every possible assistance in the solution of this problem for further stabilization of the automobile industry."

FORT WAYNE BUSINESS GOOD

FORT WAYNE, IND., June 27—While the automobile business in this city is not as good as it was a year ago, the leading dealers seem to be pretty well satisfied with the business they are doing under present conditions.

S. F. Bowser & Co., pump manufacturers, have put on a night shift of seventy men and the Wayne Oil Tank & Pump Co. has been working overtime for some time. The Dudlo company, manufacturer of magnet wire, is also showing a good increase.

Fall Outlook Cheers Cleveland Dealers

Feeling Unanimous for Profitable Business—Buying Starts in Rural Communities

CLEVELAND, June 28—Cleveland retail automobile dealers are a unit in saying that the business so far in June is better than it was in May. A great many of the dealers visited said that the record for June this year is better than it was a year ago. Others made the statement that deliveries of cars for the first six months of this year are greater than a year ago in the same period, and their net profits are running higher this month than in June, 1921.

The big point about the Cleveland retail dealer is that he is cocky about his prospects for the next six months. Every man along Euclid Avenue is dead certain that he is going to enjoy better business the next six months than he did a year ago; in fact he expects to go way ahead of the figures for the last half in 1920.

Wholesale dealers have been cheered by an increased demand by Ohio farmers for cars. They are buying better than they did earlier in the year. The crops are soon to be harvested and that is said to have an influence on the market. Dealers in small towns throughout the Buckeye State are coming here more frequently for cars this month than they did in May or in June a year ago. Long strings of new cars that are being driven away may be seen daily on the streets.

WESTERN SUPPLY ADDS STORES

SEATTLE, June 27 — The Western Auto Supply Co., operating a large chain of automobile tire and accessory stores in the western half of the United States and capitalized at $3,000,000, has just completed negotiations for the purchase of the eight large stores owned and operated by the Autoparts Supply Co., a half-million-dollar corporation, operating in Seattle, Portland, Tacoma, Spokane, Yakima, Bellingham, Walla Walla and Boise.

For the present the stores of the Autoparts Supply Co. will be operated as a subsidiary company, and there will be no radical change in management or personnel.

PREMIER SEES CLOSED DEMAND

INDIANAPOLIS, June 27—H. E. Doty, sales manager of the Premier Motor Corp., believes closed body jobs will increase during the present year and will be in greater demand next year than ever in the history of the industry. Because of this belief, production schedules at the plant have been changed so that now about 40 per cent of the cars produced are closed cars. According to Doty, orders during the past month or six weeks indicate a decided change to this type of body

Plenty of Business Reported in Kansas

Principally Matter of Salesmanship—Price Cuts Encourage Dealers—Harvest Near

TOPEKA, KAN., June 25—Business in Kansas in largely a matter of what the dealers make it. Live dealers everywhere are selling cars, and this does not mean necessarily dealers in cars whose prices have been slashed in the present reductions. There appears to be business where it is properly gone after, even in the oil producing section of the State, which is now in considerable of a slump due to low crude prices.

General business in the northern part of Kansas is in better condition than in the southern oil territory. Whatever sales resistance there is in this section is being dispelled by the live dealers. There are some complaining of lack of business and a few who speak of cutting into some other line after July 1, but most dealers are keeping busy.

Wheat is in good shape in practically all sections of the State, but there will be no definite reactions based on the crop until after the harvest which starts now at any time. Business in Kansas is bound to be better after the harvest. It always was before and it will be now.

Price reductions seem to have had a greatly beneficial effect in all towns. Dealers are going after business greatly fortified by the price argument and are closing sales which were impossible under the old prices. Many buyers were known to be merely waiting for the reductions and their closing was a mere matter of form. One dealer whose weekly sale average was two sold fourteen in the first week after his car was cut.

The morale of dealers as a whole is good. There has been some discouragement from various causes during the past few months, but they have been holding on well and are now regaining their former pep.

REPORT MORE SALES FOR CASH

QUINCY, ILL., June 25—Automobile trade is fast returning to conditions of two years ago, according to R. H. Patterson, local Overland dealer, who adds that there has been "more business in the last two weeks than in the last two years."

Recognition that the automobile trade has hit rock bottom in prices, he believes, has encouraged buying and purchasers come into the market with more free money, less chattle mortgages and promissory notes than in late months.

PRICES HURRY PURCHASERS

FORT WAYNE, IND., June 25—The recent price reductions in some of the leading makes of cars brought a veritable rush of orders and to the local dealers handling these cars. The Shryock Automobile Co. sold nine Buicks on the first day after the price reduction went into effect to purchasers who came to the company's salesroom without solicitation. The Hayner Co., dealers in Ford, reports that the Ford reduction quickened business immensely. It is expected that the present boom in the selling of cars in this city will continue for some weeks at least. Dealers believe that a great many local people who have really been wanting cars have been holding off buying on the hunch that the price reductions were sure to come.

Grain Harvest Brightens Trade Outlook in Texas

DALLAS, TEXAS, June 27—The automotive industry in Dallas and this district continued to show an improvement generally during the first half of June. There was not a line of the business but reported improved conditions and brighter outlook. The prediction is being made freely in Dallas that the industry in Texas will be back to normal before the snow flies.

Dealers reported more cars sold during the first fifteen days of June than any other month of the year. This was even true of the used car dealers. An important point is the dealers are selling for cash. Truck dealers reported increased sales and deliveries.

Tire men declare business looks like old times.

There has also been an increase in the business of the implement and tractor dealers. This probably was due to harvest time or necessities for new farm machinery. In these lines prospects are much brighter. In some instances it was said grain farmers are now paying accounts more than a year old. The implement and tractor dealers believe with a $40,000,000 grain crop being harvested in Texas their business as well as that of the motor industry generally will be much better during the remainder of the year.

Approximately $100,000,000 worth of roads are under construction or will be before the year is gone.

NASH REOPENS "FOUR" DIVISION

MILWAUKEE, June 27—The four cylinder car division of the Nash Motors Co. at Milwaukee, which was virtually shut down June 1 pending readjustment of materials and stocks, will reopen July 5 at the same capacity. About 850 men are being called back to work. The Milwaukee plant is under the general management of B. W. Twyman.

DETROIT BODY PLANT SOLD

DETROIT, June 28—Hugh O'Connor, president of the Michigan Wire Cloth Co., was high bidder for the property of the Detroit Weatherproof Body Co. sold by the Security Trust Co. as receiver under an order of the Federal court. O'Connor bid $140,000 for the property as a going concern and his offer will be submitted to Judge Tuttle for acceptance or rejection.

California to Keep Sales at High Point

Dealers Turn Down Proposals for Week End Closing—Registrations Heavy

LOS ANGELES, June 25—During the four months beginning Feb. 1, California has been buying automobiles at a heavy increase over the corresponding period of 1920. Feb. 1 is picked because that date starts the registration year in this State. Fees exceeding $6,000,000 have been collected by the motor vehicle department in that period. These have been paid by 540,000 automobiles, 30,757 trucks, 2,456 trailers and 14,427 motorcycles. The increase in fees over the first four months of 1920 has been $1,150,000. Motorcycles show a reduction in numbers and a corresponding loss in fees.

In Southern California during May, 4888 new passenger cars and 632 new trucks were registered, a total of 5520. The gain in passenger cars over April was 727. The total registration from Jan. 1 to June 1 in this part of the State was 21,125, which includes a gain of 2274 passenger cars over May, 1920. A very interesting fact revealed by the registrations is that more higher price trucks have sold than passenger cars of an equal number of makes and corresponding prices. The leading passenger car gains made in May over April were: Buick 50, Ford 246, Chevrolet 133, Hupmobile 51, Oakland 69.

Comparatively few price cuts had been put into effect during May and the brisk business is to be attributed more to hard work on the part of dealers than anything else. The buying public has not been allowed to become pessimistic and lose sight of the need for motor vehicles. With price cuts to help out, it is predicted that June will be a record breaking month.

That the dealers propose to keep on working at top speed was demonstrated at the meeting of the association to-day, when it was voted against Saturday afternoon closing. Some salesrooms are remaining open at night and a few have gone so far as to advertise they are open Sundays, too. The latter has not become a general practice but there is no foretelling what the precedent may bring about.

TEXAS TAKES BUICK TRAINLOAD

DETROIT, June 25—Col. B. B. Webb, Buick branch manager at San Antonio, Texas, left an order this week at the factory in Flint for a train load of Buicks. Col. Webb declares automobile sales in Texas are picking up rapidly and the section is fast recovering from the slump which appeared to be more acute there than any other place in the country. George S. Schroeder, general manager of the Vesper-Buick Co. at St. Louis, also was at the plant this week arranging for a 400 car shipment to the dealers in his territory.

Big Nitrate Plant May Go to Ford

Visit to Muscle Shoals Admitted at Offices as View to Purchase —Power Facilities Large

DETROIT, June 28—Henry Ford has inspected the immense Government nitrate plant at Muscle Shoals with a view to buying the property. This was admitted at his offices to-day, but all further information was refused. There has been no intimation as to what disposition would be made of the plant if he acquired it. Completion of the great Wilson dam and carrying to a conclusion of the original plans of the Government for the production of nitrate, would provide enormous quantities of nitrate for fertilizer and would be a great boon to the farmers of the United States.

Favorable Steel Supply

BIRMINGHAM, ALA., June 28—Henry Ford recently went to Muscle Shoals incognito and examined the Government property. He was discovered just about the time he was ready to leave, but refused to give out any information, simply saying that he was inspecting the Government property.

Aside from the advantages to be gained in operating an automobile manufacturing plant at Muscle Shoals, the two nitrate plants, now completed, furnish a splendid opportunity for money making and service. The plants, with slight alterations, will manufacture fertilizer, leaving them intact for the manufacture of nitrate for gunpowder in case of another war.

The power house, which is already complete, is the second largest in the world, engineers estimating that the Government spent millions in making it modern in every way.

Many advantages would be realized by the purchaser of Muscle Shoals, especially if he happened to be an automobile manufacturer. Freight rates, both by water and rail, are lower than at other inland points. Sheffield and Florence have three furnaces from which materials for steel can be had, eliminating the necessity of hauling iron from some distant point.

The Tennessee River is a larger stream than some of the principal waterways of the country, and but for the obstacle of Muscle Shoals would be navigable from Knoxville, Tenn., to the Mississippi River.

Muscle Shoals offers an ideal site for a hydro-electric plant. It is 18 miles in length and has a fall of approximately 100 feet. By damming the river at the end of the shoals immense power would be developed, and at the same time the dam would open the river to navigation for its entire length. Wilson dam, as planned, is a gravity section structure about four miles east of Sheffield and two and one-half miles from Florence.

The dam crest is 80 feet above the elevation of the river bed, carrying gates 18 feet high and raising the water level to a height of 98 feet above the stream bed. This creates an available maximum of 500,000 hp. Four units of 30,000 hp. each have been contracted for, and space for 14 additional units have been provided for in the power house design, each carrying 30,000 hp.

Experiments on products which heretofore came from Germany could, if the property was purchased by a manufacturer, be continued as nitrate plant number 1, which was built for experimental purposes and which has been used for testing and making dyes and other experimental work.

Central Products Group to Double Work Force

DETROIT, June 27—Central Products Division of General Motors Corp. contemplates doubling its working force in Detroit within the next 30 days. From 2000 to 2500 men are employed at present by that unit and this number will be increased to at least 4000 in the next month. Within five months the new plant of the Central Products Co. will be completed and the working force increased to about 6000.

The information was disclosed in a request of the corporation made to the City Council Saturday in a petition asking for the widening of Holbrook Avenue from St. Aubin Avenue to the Grand Trunk Railroad. The petition asked that the street be widened to 86 feet and paved with asphalt. the corporation offering to give a strip 10 feet wide on each side, but asked that it be relieved from any special assessment and that the city replace the present sidewalk.

The Central Products Division includes the three factories located along the section which the corporation seeks to have widened, and are the Central Axle Co., the Central Gear Co., and the Central Storage Co. The new factory in process of construction is the Central Motor Co., also a part of General Motors.

The petition to the council was signed by L. B. Robertson, general attorney for General Motors Corp. The petition states further that at the end of 10 months it will be necessary to put on night shifts, increasing the corporation's working force in the Central Products Division to 9000.

R. & V. OPENS FACTORY BRANCH

EAST MOLINE, ILL., June 27—R. & V. Motor Co. has opened a factory sales and service branch at Cincinnati, operated by a corporation separate and distinct from the manufacturing company, but controlled by the same interests. It will be known as the R. & V. Motors of Cincinnati, Inc. Paul Andree, who has been associated with the company for twenty years, has been appointed manager. and will be in charge of the retail and service division. Formal opening will be Aug. 1.

Denby Creditors Act on Company's Future

Meeting to Decide on Receivership or Continued Operation Held in Detroit

DETROIT, June 29—The future of the Denby Truck Co. will be decided at a meeting to-morrow afternoon of the 55 creditors whose claims remain unsatisfied. While no definite plan has been outlined, it is the belief of the creditors committee that continued operation, even under the present market conditions, would be better than liquidation, which it is declared would be suicidal.

Application for a receiver, in the opinion of E. R. Ailes, treasurer of the Detroit Steel Products Co. and a member of the committee, could mean only liquidation, for it is considered highly improbable that a court would authorize continuance of business under market conditions now prevailing.

"We have not had a meeting for six months," Ailes said, "and we want the creditors to get together to talk over the situation and decide upon the best move to make. We want them to say whether the plant shall continue in the hope of better times or liquidate the property.

"All but 55 of the creditors have been paid off by Major Edwin Denby and J. Walter Drake, but of course their claim stands against the company. The total indebtedness, including banks, approximates $650,000. There are no bonds outstanding, however, and the plant is free and clear. The only need now is working capital, but no one can be found at this time in a position to advance the money needed.

"We have abandoned the idea of refinancing at present. We could, of course, raise money by means of a stock issue, but that is out of the question, particularly at this time with Major Denby in the Cabinet. My idea is that it is better to keep going and turning over as much as possible, losing a little each month. but that is up to the creditors to decide. The company is no worse off than others which are operating at a continued loss.

"Creditors who attended the last meeting were highly satisfied. Naturally there are disgruntled creditors, one of whom started suit, but we satisfied him, and I am inclined to believe it will be decided to continue operations. The company has a splendid plant, a good product and an opportunity to make money when business conditions improve.

TIMKEN BEARING ADDS MEN

COLUMBUS, June 27—C. N. Repogle, general manager of the Columbus branch of the Timken Roller Bearing Co., has increased the force at the plant from 250 to 450 men. He is of the opinion that still further additions to the working force will be necessary.

Offers Resolution to Bar Trucks

Graham Asks Tax to End Reimports

Proposes 300 Per Cent Duty on All Supplies Sold Abroad by Government

WASHINGTON, June 29 — Congressman Graham of Illinois, formerly chairman of the select committee of the House to investigate expenditures in the War Department, has introduced a joint resolution which would specifically prohibit the reimportation of surplus war supplies except at a duty of 300 per cent, which in effect would be an embargo.

In a statement to AUTOMOTIVE INDUSTRIES to-day, Graham stated that the resolution covered all supplies sold abroad by the Government and was drafted in order to expedite legislative action. He expects its passage in the Senate and House before the tariff bill has completed the circuit.

The permanent tariff bill, as reported out by the Ways and Means Committee to-day, contained no specific reference to reimportation of trucks as had been anticipated in some quarters. It is possible that this situation may be remedied on the floor of the House during the tariff debate when the bill is subject to amendments.

Congressman Graham stated that he was convinced his resolution would prove more effective. Assurances have been given, he said, that the Ways and Means Committee would approve it as a special measure looking toward the protection of domestic markets.

The joint resolution fixes a duty of 300 per cent ad valorem on all goods, wares, merchandise, military and naval supplies of any kind whatsoever originally exported from the United States for use of the American Expeditionary Forces or their Allies, when reimported into this country. Graham is acquainted with the practices of European and American speculators in buying this equipment at extremely low prices, generally below cost, and reselling in this country after slight alterations or remanufacture. The flat rate will apply at American valuations.

Provides Retaliatory Motor Vehicle Duty

WASHINGTON, June 29 — Retaliatory duties against countries which erect tariff barriers to stop importations of American automobiles has been provided in the permanent tariff as reported by the House to-day by the Committee on Ways and Means after six months' study.

The bill proposes a 25 per cent ad valorem duty on imports of automobiles, automobile bodies, automobile chassis and parts of automobiles including tires. Special provision has been made for the establishment of reciprocal relations under the direction of the President, a plan approved by the National Automobile Chamber of Commerce.

The rates on automobiles are 59 per cent lower than the N. A. C. C. had recommended but sufficiently high to prevent effective competition from foreign manufacturers. The duties had been 45 per cent on higher priced cars and 30 per cent on medium priced machines.

The retaliatory measure is not confined to automobiles, but it is aimed at the French and Italians who put up tariff barriers last summer with specific rates for motor cars. It is provided in that if there be imported into the United States any of the articles manufactured in or exported from any country which imposes a duty greater than 30 per cent ad valorem upon similar articles exported from the United States, there shall be levied on such articles a duty equal to the duty imposed by such country upon such articles imported from the United States, but not to exceed in any case 50 per cent ad valorem.

A rate of 30 per cent is applied to imports of aircraft as a retaliatory duty.

Dowell Road Bill Is Passed by House

WASHINGTON, June 29—Highway legislation has struck a snag here owing to the passage of the Phipps-Dowell bill in the House this week, providing for continuation of the Federal aid system with a system of interstate roads and a commission to direct the work.

The Senate has this bill and the Townsend bill pending. It is a question of parliamentary tactics which shall have the right of way in the Senate. It is believed that Senator Townsend will effectively block the Dowell bill in the Senate unless the essential principles of his measure, endorsed by the National Automobile Chamber of Commerce and other automotive organizations are accepted in amendments.

Truck Auction Bids Appear Fictitious

NEW YORK CITY, June 29—Auction of 200 reconditioned army trucks reimported into this country by the Truck Co. of America was started here to-day and will continue until July 1. Judging from to-day's sales there was very little participation in the bidding by the public and the sales prices were seemingly fictitious. Macks of 5½-ton capacity sold

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Congress Clears Way to Action on Trucks

May Include Protective Principle in Anti-Dumping Provisions of Tariff

WASHINGTON, June 27—Indications are that the House Committee on Ways and Means will dispose of the reimportation evil, which has affected automobile dealers more than anyone, by a special clause in the permanent tariff bill as a principle of protection rather than a specific class legislative measure. Incorporated in the anti-dumping provision, it would become one practicable and available method of checking the re-sale of American trucks in this country by foreign sales agencies which purchased them as surplus army equipment. The Class Journal correspondent was advised by high official sources that diplomatic efforts to adjust the situation had failed and it became solely a legislative matter.

It was learned that this government had made representations to the Government of France but was subsequently advised that the French authorities were powerless to prevent reshipment of American trucks and other goods. The correspondent was informed that the admission into or exclusion from the United States of these products is not covered by contract or treaty stipulations under the administration of the State Department. It is not accurate to imply that the State Department objects or has objected to efforts looking toward restriction of sales of trucks or other army supplies.

Dealer Action Unopposed

In other words, the State Department has entered no objection to the campaign of American automobile dealers and manufacturers to prevent reimportations, as had been currently rumored in the trade. The fact that they had discussed the matter diplomatically with the representative of the French Government shows that they were endeavoring to present the American business man's side of the problem to foreign governments, whose nationals had purchased Army supplies for speculative purposes.

It is understood that members of the Ways and Means Committee are in sympathy with the plan to protect the American market. As nothing has been adduced to show that the Commission which disposed of the surplus material made it obligatory upon the purchasers to sell in countries other than the United States, it is a matter which Congress alone has the power to control by specially designed legislation.

Tire Dealers Draw Protective Measures

Will Seek Handling of Bargain Stocks—Convention and Show in Cleveland

CLEVELAND, June 28—The first convention of the National Tire Dealers Association will be held in this city on Oct. 18, 19 and 20 at the Hotel Winton, which will be headquarters for the delegates.

A tire and tire accessories exhibition—the first of the kind to be held—will be conducted while the convention is in session.

These two decisions were reached at a meeting of the board of directors of the National Tire Dealers Association, which was held in this city June 21 and 22.

Resolutions placing the association on record against producers of tires or their representatives holding financial interest in retail stores and pledging the officers of the association to obtain data on offerings of standard tires at attractive prices and then forward same to members of the trade body, were adopted by unanimous vote.

Members of the board present included Thomas F. Whitehead, Chicago, president of the association; R. F. Valentine, Cleveland, vice-president; H. O. Stenzel, Milwaukee, treasurer, and Philip O. Deitsch, Cleveland, secretary.

The offer of the Cleveland branch of the national organization to finance the expense of the convention and to arrange an attractive program was responsible for the decision to meet here. The proximity of Akron, the center of the rubber tire industry, also was a controlling factor. There will be from 700 to 900 delegates in attendance, and Secretary Deitsch announced that a general invitation to all wholesale and retail tire dealers, regardless of whether they are affiliated with the organization, to attend the convention would be issued.

To Visit Akron Factories

Akron manufacturers will provide motor transportation for a trip by the delegates to the rubber city, and part of a day will be spent in the larger tire producing factories in that city so that all delegates may return home with some new talking points for their products and a better understanding of production methods.

To Valentine was delegated the responsibility of arranging the program for the convention and also for the tire and tire accessories show. He will announce committees shortly. Efforts will be made to obtain exhibits from every tire and tire accessory producer in America. While the features of the show have not been decided upon, already there is talk of inducing some producers to stage various phases of production. Educational features, such as lectures and demonstrations, to help the wholesale and retail tire dealer in his work are to have places on the program of the convention.

Under a resolution adopted, the secretary was directed to compile each month inventories of stocks in business establishments of dealers and distributers. The record so made up is to be given members of the association and manufacturers as a means of informing both on conditions in the trade.

Officers of the association have received many complaints from dealers relative to a certain producer of tires being financially interested in service stations scattered throughout the larger cities and along highways that are traveled to a large extent. It is charged that this concern gives free maintenance service to the detriment of the bona fide retail dealer who maintains a service department. Autoists who have been held up by flat tires in the country and have had a service truck come out from this concern's nearest branch and make free repairs or adjustments have complained when dealers charge for similar service.

Executives of the association also were instructed to watch keenly for opportunities to purchase standard tires at low prices. It frequently happens, according to information received at headquarters here, that producers of automobiles when forced to cut production of cars are caught with large stocks of tires. When their bankers ask them to liquidate their inventories, they proceed to dump tires on the market at reduced prices. The dealers want the first opportunity to purchase these tires.

Copies of the resolutions adopted will be mailed to car makers, tire producers and the national trade organizations of each.

Receiver Is Named for Republic Rubber

YOUNGSTOWN, June 27—G. H. Booth, vice-president, has been appointed receiver for the Republic Rubber Corp. by Judge D. C. Westenhaver of Cleveland. Suit was filed against the Republic Rubber Co. by Elizabeth Hines Gates of New York, a preferred stockholder, and against the Republic Rubber Corp., by Arthur L. Irish, a former Republic official, who claims to hold 90 per cent of the common stock.

The company claims to have purchased large quantities of cotton and rubber at high prices and that price declines were such that they could not manufacture and sell profitably. They have outstanding commitments on these goods amounting to $2,000,000. A. L. Irish alleges that the company owes $500,000 in past due notes. Bank loans are reported to aggregate about $2.000.000. Other loans will amount to several hundred thousand dollars.

Reports are to the effect that much of the company's losses are represented by new contracts made after much of the original loss had been largely cleared away by former president, E. F. Jones.

The manufacturing plants will be operated for a time at least, it was stated to-day. The receiver is working on a policy to be pursued in handling the property.

Akron Well on Way to Normal Business

Factory Schedules Placed Higher for July—Would Avoid 1920 Peak Conditions

AKRON, June 28—Present conditions in the industry do not assume the aspect of a boom and the tire industry is far from normal. But the marked improvement of the past four weeks both in car manufacturers' original equipment specifications and in the steadily increasing volume of dealers' sales affirms the opinion that the curve of tire production definitely and permanently is upward.

June 20 Goodyear called for 1200 tire builders. Two days later Goodyear called for 1500 more tire builders, and took on even additional men, absorbing approximately 3000 men during the week. Just what Goodyear's production will mount to has not been determined. Before re-employing the 3000 men, however, the company had climbed to a production ticket of 20,500 tires a day. That the Goodyear increase will approximate 50 per cent of present production is almost certain. This will carry the company back to a position far above normal and closely approaching peak production of a year ago last May.

Officials of the company claim that dealers' sales compare favorably with any normal week in the company's history and are larger than the corresponding weeks of last year. In addition car manufacturers have unexpectedly doubled and some have trebled tire specifications for July.

The Firestone factories, in order to handle increased dealers' orders and car makers' orders, have gone to two full 9-hour shifts daily and a 5½-day week. This will carry Firestone back to at least 20,000 tires a day. Goodrich continues at about 15,000 tires daily and has announced no contemplated production increase.

General Business Better

Business conditions in Akron already show the reflection of the improvement in the tire industry. The reinstatement of the 24-hour daily schedule has necessitated augmented street car service to East Akron. Business houses report that retail business shows the stimulation already. Financial conditions are tight and apparently immobile, but the general impression exists that Akron is well on the way to normal conditions.

The city, however, does not want a return to peak conditions. Akron does not want a floating population. It does not want thousands of transient laborers—the "suit case chaps," as they were called—increasing labor turnover, causing congestion in residential districts and swelling the city's crime record and night life. All manufacturers re-employing men are showing preference to Akron men now out of work.

Tire Demand Heavy in Chicago District

Price Reductions Influence Resumption in Buying—Farmer Sales Reported Better

CHICAGO, June 27—Direct reports from the large tire distributors in the Chicago territory, which in most cases covers three or four States (Indiana, Illinois, Wisconsin and Iowa), range through all the degrees of business activity from "good," which represents zero, to "three times the volume of business we were doing a year ago," which is the summer heat point without any shade. It is confusing to try to account for these widely ranging reports of business conditions and it is just as satisfying, perhaps, not to try to account for the statements and say that the tire business in this territory is unusually good and far beyond anything that the distributors thought they had a right to expect. The pick-up came very suddenly and at once grew into steady sales.

Price reductions in all the standard makes of tires have had the heaviest influence in stimulating sales. Cars that were running without "spares" are fast adding extra tires; old tires that were given long mileage during the long open winter are now being replaced.

Throughout the corn belt in the Middle West there is a disposition on the part of the farmers to buy. This tendency on the part of this enormous potential market is taking hold slowly, but is noticeable and growing steadily. This condition is particularly encouraging in the Northwest.

There are reports from spots in the rural sections where buying is at a standstill caused, it is said, by the fact that country banks have begun to realize on the farmers' notes they have been holding. With all conditions taken into consideration farmer trade is on the increase and by early fall it is thought this trade will have reached its climax.

AMAZON RUBBER OFFERS PLAN

AKRON, June 27—The Amazon Rubber Co. has asked its creditors to accept 75 per cent of their claims in full settlement. The proposal is for payment of 10 per cent in cash and 5 per cent each month thereafter until the amount is paid. If this plan is not accepted it is understood that the company will be forced into bankruptcy.

G. M. C. DECLARES DIVIDEND

NEW YORK, June 30—Directors of the General Motors Corp. at a meeting this afternoon declared the usual dividend of 25 cents a share on the common, $1.50 a share on the 6 per cent preferred and the 6 per cent debenture, and $1.75 a share on the 7 per cent debentures. The resignation of R. H. Collins as a vice-president and director was accepted, and Fred J. Fisher was elected a vice-president and director.

HORSES IN CITIES SHOW BIG DECREASE

WASHINGTON, June 28—The Bureau of the Census, Department of Commerce, announces that 56,539 horses were reported in the city of New York at the census of 1920, as compared with 128,224 reported at the census of 1910. There has been a similar marked decrease in the number of horses in all the principal cities in the United States so far as heard from. Chicago had 30,388 horses in 1920, as compared with 68,122 in 1910; Philadelphia, 19,472 in 1920 and 50,461 in 1910. In Baltimore the number of horses reported at the censuses of 1920 and 1910 was respectively 7378 and 15,346; in Boston, 10,093 and 23,007; in Pittsburgh, 6032 and 12,845; in Cincinnati, 5031 and 13,901; in Cleveland, 4924 and 16,839.

Barton Axle Company Goes Into Receivership

MILWAUKEE, June 27 — Henry J. Griessel, cashier of the State Bank of Barton, Wis., has been appointed receiver of the Barton Axle Co. of the same place, on the application of a number of local creditors. Within the last 18 months the corporation was organized and promoted, and built and equipped a plant to manufacture passenger car and motor truck axles. The complaint recites that the concern sold between $400,000 and $500,000 of capital stock supposedly to return 8 per cent, but that these shares have since proved to be worthless.

It was to have sold its product through the American Axle Co. of Chicago, at a large profit, but the American company never was actually organized, it is declared. When the Barton company set out to dispose of its own production, it was found that the axles were not salable, the complaint says. The County Court at Fond du Lac, Wis., which heard the complaint on a change of venue from Washington County, denied the request of the officials of the corporation for more time to straighten up accounts and general affairs, and a receiver was then appointed.

ANTIGO BUILDS NEW TRACTOR

ANTIGO, WIS., June 27—The Antigo Tractor Corp. expects to complete the first model of a new design of the Antigo Quad-Pull tractor on July 15, and have the first ten commercial machines ready for delivery by Aug. 1. Production is being carried on at outside points pending the construction and equipment of permanent works in Antigo during the fall and winter months. Parts are being made in Milwaukee, Fond du Lac and Oshkosh, and assembled at Fond du Lac, under the personal supervision of Herman Freudenberg, general superintendent.

Hydraulic Company Defers Merger Plan

Option on Detroit Pressed Steel to Lapse Unless Directors Reconsider

CLEVELAND, June 27—Upon recommendation of the directors, stockholders of the Hydraulic Steel Co. decided to take no action on the plan for a merger with the Detroit Pressed Steel Co. This automatically holds up the proposed increase in the stock of the corporation to enable it to purchase the stock of the Detroit company, according to R. D. Mock, vice-president of the Cleveland corporation. It is understood the option on the Detroit property will be allowed to lapse but there may be another meeting.

The letter which the Hydraulic Steel Co. submitted to its stockholders stated that an option to buy the Detroit plant had been obtained. There were two provisos attached to the exercise of the option on or before July 1, as follows: "The directors are not committed to the purchase of this property and will only do so on or before July 1 provided in their judgment (a) the purchase is a distinct advantage to this company in every respect, and, (b), they believe the financial condition of the Detroit company to be such as to sustain its own operation."

Under the option obtained the local company was to deliver three shares of common stock for four shares of the Detroit corporation. This would require the issuance of 54,000 shares of common stock. It further provided that payments for the Detroit plant's 50,000 shares of series A common (second preferred) of the par value of $1,250,000 may be made by the issuance of $850,000 par value of a second preferred stock of this company. The Detroit plant's net worth is $5,100,000 from which must be deducted $600,000 of bonds and $1,500,000 of preferred stock outstanding, leaving a net worth of $3,000,000. This equity the Hydraulic company would obtain by payment of $850,000 of its second preferred and 54,300 shares of common stock. Interest requirements of the Detroit plant's bonds and preferred stock amount to $141,000 per year. Earnings have been on an average of $505,000 for 5½ years.

The Detroit Pressed Steel Co., manufactures frames, brake drums, housings and wheels. The Hydraulic Steel Co. took over and operates the plants of the Hydraulic Pressed Steel Co., this city, the Canton Sheet Steel Co., Canton, Ohio, the Cleveland Welding Mfg. Co., and the Hydraulic Steel Craft Co., this city.

BRAZIL RUBBER EXPORTS DROP

WASHINGTON, June 27—April exports of Brazilian rubber amounted to 3,244,080 lb., 2,566,753 lb. of which were shipped to the United States, the remainder going to Europe. Consul George H. Bevan points out that this is a decrease of 6,292,258 lb.

Defiance Truck Gets Chinese Concession

Will Supply Trucks and Equipment Over Twenty Year Period —Arranges Financing

TOLEDO, June 25—Charles H. Kettering, president, and J. C. Ayres, general manager of the Defiance Motor Truck Co., at Defiance, near here, were in Toledo this week conferring with bankers regarding financing a large increase in the business of their company.

It was announceed earlier in the week that the truck company had secured 20-year concessions from the Chinese Government to ship trucks and automotive equipment into the far-eastern territory. All the shipments will be imported under the direct supervision of the Chinese Government.

Similar concessions have been granted to great American companies manufacturing textiles, locomotives, agricultural machinery and other products.

During the life of the concession it is believed that the Chinese Government will take a share in the profits of the business rather than any duty charge on the products imported.

The details of the financing scheme have not been announced yet. It is hinted, however, that the Chinese Government will float a bond issue of $100,000,000 in this country to carry out the program.

The Defiance Truck Co., however, is planning on sending thousands of trucks to China as its part of the plan.

Financiers in Detroit and Cleveland, as well as Toledo, will probably be appealed to for help in the project.

Peruvian Business Best in Car Parts

LIMA, PERU, May 31 (By Mail)—Business in automobiles in Lima is a little more lively on account of the approach of the 100th anniversary of Peruvian Independence (to be celebrated the latter half of next July) than it otherwise would be under existing conditions.

Existing conditions consist of a currency that has lost in exchange value from one-third to one-quarter of its purchasing power; and a public without money to buy on account of the fall in the price of cotton, wool, sugar and copper, the chief products and exports of the country.

Very few automobiles are being imported on account of the unfavorable exchange. In addition there is talk of a scientific revision of the tariff, which makes merchants doubly cautious about buying. Then there is expectation of price reduction of automobiles in the United States.

At the present time in Peru, the best market is for repair parts and repair materials. Instead of buying new automobiles and new tires, people are repairing the old ones.

Very few tractors are being sold. Not even Fordson is moving. This is due to the fact that cotton is not being planted this year, the farmers holding what they have and not producing more, in the hope of causing cotton to go up in price.

Mexico Wants Service; Used Cars Not Selling

CHICAGO, June 27—The Koehler Dean Truck Co., distributor for Federal trucks in Texas and Mexico, writing from its Tampico, Mexico branch, expresses the desire to correct the impression that there is a lively market for used cars in Mexico.

"Mexico is a very poor market for used cars," says the letter. "It is nearly impossible to sell any make of cars that are not well represented by a good stock of parts and a service station. Many dealers are bringing automobiles and trucks to Mexico and selling them at a great loss. Lack of service is the big question. Where parts stocks are kept cars and trucks sell readily. Mexican, people who are able to buy machines usually want something high class and brand new."

Exchange Helps Renault Undersell in Sweden

WASHINGTON, June 27—Dealers in American automobiles in western Sweden are much concerned over the activity of the French motor car industry in Sweden, according to a report from Consul Walter H. Sholes, Goteborg. The low value of the French franc has made it possible for the Renault company to place in the Swedish market a four-seated 22-horsepower car with self-starter, electric lights and other modern equipment at 8000 kroner. The cheapest American car of the same class cannot be sold for less than 12,000 kroner. Automobile dealers insist that the Renault product is not of the high pre-war standard.

Renewed activity on the part of German motor car manufacturers also is in evidence. The Benz concern is entering upon an advertising campaign, and it would seem that dealers in Benz cars are financially supported and given large credits by the Benz factory.

DELCO MAKES GAINS IN FRANCE

PARIS, June 12 (By Mail)—Delco lighting and starting equipment is now built completely in the factory of the Continsouza company at Levallois, near Paris, for the French and Continental Europe markets. The annual report of this company, which holds Delco licenses for the Continent of Europe, declares that despite the general trade depression prospects are bright for Delco ignition. Even in France, where the magneto appeared to have an unassailable position, battery ignition is making considerable headway and the Delco system is being used on several high grade cars.

Emerson Sentences Are Upheld by Court

Promoters Must Serve One to Seven Years for Fraudulent Stock Sale

NEW YORK, June 27—The United States Circuit Court of Appeals has affirmed the convictions in June, 1918, of Nicholas Field Wilson, Robert T. Matches, William Loomis and C. R. Berry & Co. for using the mails to defraud in connection with the sale of stock in the Emerson Motors Co. It was charged that $1,500,000 was realized by boosting to $7 a share stock that had been bought for 17c. a share. The company was shown to have a plant worth not more than $100,000.

Wilson, who was the promoter, was sentenced to seven years in prison, while Matches, who handled the stock in Boston, was sentenced to three years. Loomis was given one year and Berry & Co. was fined $13,000. Since their conviction the defendants have been at liberty on bail.

The original allegations of the stockholders who filed a petition for a receiver in bankruptcy were that the company was originated as a "stock jobbing scheme." At the time the petition was filed the liabilities were "far in excess of $500,000."

The promoters of the company claimed they intended to manufacture a car which would sell at retail for $395, and that they had orders for 60,000 cars. It was asserted in October, 1916, that a plant had been purchased at Kingston, N. Y., and that 500 cars would be built that year with 30,000 in 1917. Manufacture really was begun on a small scale, but no dealer contracts were made.

The car was designed by R. C. Hupp, who formerly was with the Hupmobile Co., but he retired as vice-president and general manager before the affairs of the company were taken to the court.

COURT RETURNS LIQUOR CAR

INDIANAPOLIS, June 27—Restoration of an automobile to Otto S. Wilson of Chicago was ordered by Judge Geiger in Federal court this week. It had been confiscated by revenue agents when James Schaller of Chicago was arrested charged with illegal transportation of liquor. Evidence placed before Judge Geiger was that the revenue agents had turned the car to their own private and official use. He gave a severe reprimand to the agents in ordering the car restored to Wilson, who proved his innocence of complicity. Wilson is suing the revenue agents for $700 damages to the car while in their possession.

STUTZ OFFICIAL DIES

INDIANAPOLIS, June 28—Announcement is made of the sudden death of Maynard Chase, 53 years old, employment manager of Stutz Motor Car Co.

NEW CAR PRICES

BRISCOE MAKES $200 CUT

JACKSON, MICH., June 27—A cut of $200 on all models, effective July 1, is announced by the Briscoe Motor Corp. Cars at the new prices will be equipped with windshield wings, front and rear bumpers, running board pads and nickel radiators, if desired. The new prices are: Touring car and roadster $1,085, coupé and sedan $1,685, panel type delivery $1,160, screen type delivery $1,085. Prices are f.o.b. Jackson.

NATIONAL MAKES BIG CUT

INDIANAPOLIS, June 27—Price reductions ranging from $760 to $960, effective July 2, are announced on its various models by the National Motor Car & Vehicle Corp. The schedule of new and old prices follows:

	Old Price	After July 1, '21
Seven-pass. Touring.	$3750	$2990
Four-pass. Phaeton..	3750	2990
Two-pass. Roadster.	3750	2990
Four-pass. Coupe....	4900	3990
Seven-pass. Sedan...	4950	3990

STEPHENS SALIENT SIX CUT

FREEPORT, ILL., June 27—Price reductions running as high as $600, effective July 1, are announced by the Moline Plow Co. on all models of the Stephens Salient Six. The schedule follows:

	Old Price	New Price
92 Roadster..............	$2400	$1900
B-92 Roadster (Sport)....	2600	2000
94-B-94 Four Passenger Touring	2400	1985
94-A Four Passenger Touring (Sport)........	2600	2085
96 Six Passenger Touring	2400	2065
93 Four Passenger Sedan	3400	3100
95 Seven Passenger Sedan	3400	3100

LIBERTY PRICES REDUCED

DETROIT, June 28—The Liberty Motor Car Co. announces price cuts on all models effective July 1. The touring car and roadster are reduced from $1,795 to $1,595; the sport model from $1,985 to $1,675; the coupé from $2,825 to $2,400; and the sedan from $2,850 to $2,495.

STUTZ PRICES DOWN $650

INDIANAPOLIS, June 27—A reduction of $650 on all models is announced by the Stutz Motor Car Co., effective immediately. The roadster and "bearcat" models are cut from $3,900 to $3,250 and the four and six passenger open types from $4,000 to $3,350.

BARLEY MOTORS CUTS PRICE

KALAMAZOO, MICH., June 29—Cuts ranging from $100 to $650 effective July 1, were announced to-day by the Barley Motor Car Co. on its various models. The reductions follow: Four passenger touring from $3,250 to $2,985, roadster and four passenger sport from $3,375 to $3,150, seven passenger touring from $3,400 to $3,250, four passenger coupé from $4,250 to $3,985, five passenger sedan from $4,250 to $4,100; five passenger limousine from $4,500 to $4,000, five passenger landaulet from $4,650 to $4,000.

COLE CUTS $455 to $700

INDIANAPOLIS, June 29—Price reductions ranging from $455 to $700 on its different models were announced today by the Cole Motor Car Co. The new prices of the various models were not disclosed.

HATFIELD CAR REDUCED

NEW YORK, June 27—Cortland Cart & Carriage Co., Sidney, N. Y., manufacturer of the Hatfield car, has reduced prices on its 4-pass. model from $1,695 to $1,495, and on its sedan from $2,595 to $2,395.

HUBER CUTS TRACTOR PRICE

MARION, OHIO, June 27—The Huber Mfg. Co. has made a reduction of $200 in the price of its light four tractor. This takes the price back to the pre-war level.

MILLER CUTS TRUCK TIRES

AKRON, June 27—New prices on heavy duty pneumatic tires are announced by the Miller Rubber Co. The new schedule, as compared with the old, follows:

Size	Old Price	New Price
36 x 6	$119.35	$91.85
38 x 7	168.85	127.35
40 x 8	217.50	164.00
42 x 9	272.25	262.50
44 x 10	380.75	367.00

FORD CUTS PARTS PRICES

DETROIT, June 28—The Ford Motor Co. announces price reductions on parts ranging from 12½ to 50 per cent. The reductions cover more than 400 parts and in dollars and cents range from 1 cent on nuts and bolts to $12 on transmission assemblies.

Small Buying Continues in General Motors Stock

NEW YORK, June 29—One out of every five General Motors common stockholders is a woman. On April 15, 1921, there were 8110 women common shareholders compared with 3459 on Oct. 5, 1920, an increase of 4651. Women owned 1,467,368 shares of common April 15, an average holding of 180 shares each, compared with 1,201,334 shares Oct. 5, 1920, an average of 347 shares; an increase of 266,834 shares in the aggregate, but a decrease of 167 shares in the average.

On April 15, the date of record for stockholders who received May dividends, there were 37,787 individual common stockholders, compared with 16,681 on Oct. 5, 1920, the date of record for November, 1920 dividends. The changes during those six months are significant.

METAL MARKETS

STEEL consumers have grown unduly accustomed to the "official" method of price changes. This is a legacy of the War, when the War Industries Board, "with the approval of the President," would issue proclamations covering maximum prices, and these were considered first page stuff by the newspapers. Popular interest in the leading steel producing interests, because it is the largest industrial corporation of the land, continues to make price announcements by the United States Steel Corporation "must, first page." Important changes in the price of steel products, however, are coming to pass these days without being deemed worthy of scareheads. This is especially true of the kinds of steel in which the automotive industries are vitally interested. Cold-rolled strip steel is obtainable at fully $10 a ton less than a month ago. A similarly sharp price decline has taken place in fine-finished sheets. All of these downward price changes, however, fail to arouse any enthusiasm on the part of the buyer, who holds that they result from apathy on the part of the leading steel producers, who are permitting the market to drift, when, in the consumer's opinion, they should set their house in order as speedily as possible and announce the lowest possible price at which they can sell steel and make both ends meet. In spite of the seemingly lackadaisical attitude of steel producers, a change is coming over the situation, however, and, with production down to a quarter to a third of normal, the visible supply of steel is being constantly diminished. The major market in the last few weeks has been the resale market. Manufacturers with much steel and few orders on hand have been disposing of as much of their surplus as they possibly could to other manufacturers with a more immediate outlet for it. Jobbers have in some instances reduced their prices to a point where they could compete successfully with production steel. Daylight is beginning to dawn more and more. For all that, the belief is general that before long the leading interest will see fit to announce a reduction in prices. This impression is strengthened by the sharp criticism which one of the independent producers recently applied to the chief interest's price policy. The new iron ore price, which is $1 a ton below the 1920 level, is merely a trial kite. It looks as though 1921 ore demand would be negligible. The new ore price was established on the basis of a sale to Canada. There have been no domestic transactions at the new figure, nor are there any in sight. Theoretically speaking, $1 cut in the price of ore should imply a $2 per ton reduction in production cost of pig iron and steel.

Pig Iron.—Malleable is offered at $23, valley, and foundry $1 less. Even these low prices can be frequently shaded.

Steel.—Automotive parts makers are placing occasional orders for cold-drawn bars. Youngstown reports 5.20c. for fine finished sheets with 15 per cent seconds for 22 gage.

Aluminum.—The market continues utterly neglected, although some automotive interests are endeavoring to obtain a line on contract prices for 1921-1922 delivery.

Lead.—Spanish lead continues to come in. In the "outside" market metal as low as 4.05c., East St. Louis basis, is offered.

Zinc.—In the absence of consuming demand, the market is continually sagging with the nominal price at around 4.25c., East St. Louis.

FINANCIAL NOTES

Standard Parts Co. business totaled $600,000 in March, $1,000,000 each in April and May, and will aggregate $600,000 in June, according to a statement issued by Receiver Scott. All the receiver's debts have been paid excepting current accounts, and the company has $1,000,000 in the bank.

Miller Rubber Co., in a comparative balance sheet as of Dec. 31, shows total assets of $23,271,274, a gain of about $5,000,000 over 1919. The assets include cash of $2,012,388; accounts and notes receivable, $2,755,327, and an inventory of $9,321,803.

Chandler Motor Car Co. is in strong financial position, declares President F. C. Chandler, decrying rumors that the company would cut its October dividend. "Directors will not discuss the October dividend in June," he said.

Cincinnati Finance Co. moved last week into its permanent offices in the Dixie Terminal Building, Cincinnati. The company specializes in discounting automobile and truck installment payment notes from dealers.

Detroit Motorbus Co. has declared a dividend of 1½ per cent, payable July 15. This will be the first dividend since the company was organized. It now has 48 buses operating and 20 more soon to start.

Jackman Motors Co., Joliet, Ill., has been cited in a petition in bankruptcy filed by creditors. Liabilities are placed at $70,000 and assets at $60,000.

Kelsey Wheel Co. has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable August 1.

Republic Motor Truck Co. directors have voted to pass the 1¾ per cent quarterly preferred dividend due July 1.

Motor Wheel Corp. paid a cash dividend on common stock of 2 per cent on June 20.

HOLTON TO CHANGE HANDS

INDIANAPOLIS, June 27 — Contract for the transfer of the Holton Tractor Co. of this city to the Kokomo company which will take over the tractor company's business will be effected as soon as Elwood Haynes of the Haynes Automobile Co. returns from New York. Negotiations for the transfer are being carried forward with the receiver here. The transaction will involve approximately $350,000. The Holton tractor company will probably be moved to Kokomo and it is understood that the strong features of a tractor manufactured at Elwood will be combined with the Holton invention. Others interested in the new company besides Haynes are A. G. Seiberling, George J. Marott of Indianapolis, Simeon McQuiston of Greentown and others.

MONARCH TRACTOR PLANT SOLD

WATERTOWN, WIS., June 27—E. D. Caldwell of New York was the highest bidder for the assets of the Monarch Tractor Co. of Watertown, Wis., at the public auction conducted at the plant by the trustee in bankruptcy, William B. Roys of Madison, Wis. The price of $44,000 was accepted subject to approval by the bankruptcy court. The Monarch company, together with its parent corporation, General Tractors, Inc., Paulsboro, N. J., recently was made defendant in bankruptcy proceedings and the entire properties were ordered sold. Caldwell is a large stockholder in the General Tractors company and a principal creditor as well. The Monarch plant at Watertown is carried for 1921 on the assessment roll of the city of Watertown at a valuation of $168,000. Inventory appraisal in bankruptcy proceedings gave the value as $40,000.

INDUSTRIAL NOTES

American Grinder Mfg. Co., manufacturer of wrench sets, portable tool grinders and similar specialties, is moving into a new factory, comprising the entire second floor of the Milwaukee Terminal Building, affording about 50,000 sq. ft. It will be ready to resume operations July 1 or 5 in the new quarters.

Link-Belt Co. of Chicago, headed by Charles Piez, has acquired all the capital stock of the H. W. Caldwell & Son Co. Frank C. Caldwell has been elected a director by the Link-Belt Co. and operation of the Caldwell plant as a separate unit will be continued.

John Broenen Co., Milwaukee, has let contracts for the erection of a two-story brick and concrete addition, 50 x 75 ft. It is a manufacturer of passenger car and motor truck bodies.

Hebb Motors Works at Havelock, Neb., were sold at auction to W. H. Ferguson of Lincoln for $110,000, subject to the approval of the court. The plant cost $3,000,000.

Paige-Detroit Motor Car Co. has declared the regular quarterly dividend on preferred stock of 1¾ per cent, payable July 1 to stock of record June 15.

Kant-Score Piston Co. has acquired the Cincinnati plant of the D. T. Williams Valve Co.

Cadillac Tool Co. has increased its capital stock from $40,000 to $200,000.

JORGENSON RESUMES JULY 1

WAUPACA, WIS., June 27—The Jorgenson Mfg. Co., a large manufacturer of priming devices and brass castings for the automotive industries, will resume production on a normal scale shortly after July 1. The machine shops were closed late in May after a steady day and night run for nearly a year's time to enable the company to overhaul the plant, rearrange equipment for greater efficiency and to do some retooling. The foundry was kept in continuous operation to insure a casting supply when the machine departments resume. The interruption was a seasonal one, as demand for priming devices usually falls off after the cold weather is over. Manufacturers and jobbers are now placing orders for fall and winter deliveries and it is expected to maintain steady production for a year.

CAROLINA WOODWORK HIGH

COLUMBIA, S. C., June 25 — South Carolina now has more miles of Federal aid highways completed or under construction than any of the five Southern States, Tennessee, South Carolina, Georgia, Florida or Alabama, with the exception of Georgia.

BANK CREDITS

Written exclusively for AUTOMOBILE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, June 30—The improvement in the reserve position of the New York Federal Reserve Bank attracted much interest last week. The ratio of gold reserves to Federal Reserve notes in circulation after setting aside 35 per cent against deposit liabilities, increased from 90.8 per cent to 103 per cent. The ratio of total reserves to deposit and Federal Reserve note liabilities combined, increased from 60.6 per cent to 68.9 per cent. This improvement was largely a result of a $132,682,000 decline in total deposits and a $25,106,000 increase in gold reserves. Federal Reserve notes in circulation in this district also declined $13,541,000. This improvement furnishes substantial background for the further reduction from 6½ per cent to 6 per cent of the bank's discount rate on commercial paper. Similar action was taken by the Dallas Federal Reserve Bank, and, as a result, all Federal Reserve Banks of the system now have a 6 per cent rate on commercial paper, with the exception of the Minneapolis and Chicago banks, which still maintain a 6½ per cent rate.

The action of the New York bank was followed by similar action on the part of the Bank of England, which reduced its discount rate from 6½ per cent to 6 per cent on June 23, after having reduced it a short time ago from 7 per cent to 6½ per cent. The effect of the reduction by the Bank of England on trade has apparently been minimized somewhat by the continuance of the coal strike. This strike was settled on June 28 and should allow England to proceed uninterruptedly towards a normal recovery of its economic life. There appears to be ample evidence that the banking situation is laying the foundation for easier credit in the future.

The local call money market gave evidence of considerable ease last week when the renewal rate reached 5 per cent on the Stock Exchange for the first time since October 27, 1919. The range for the week was 5 per cent to 5½ per cent as against 5½ per cent to 6 per cent the previous week, although 5 per cent was the maximum rate on all days except Monday. There were said to be large supplies of unloadable funds at the end of each day for which no market was found, and on the "outside" market considerable business was done at 4 per cent. Time money was unchanged at 6½ per cent for 60 and 90 days' and 4 months paper, and 6 per cent to 6½ per cent for 5 to 6 months' paper. There was little activity and most of the trades were restricted to renewals for short periods. The commercial paper market was dull, with rates unchanged at 6½ per cent to 6¾ per cent for 60-90 days' endorsed bills and 6 months' names of prime character.

The market continued the decline characteristic of recent weeks.

MEN OF THE INDUSTRY

Earl B. Spencer has been appointed production manager of the Leach Biltwell Motor Car Co., Los Angeles. He was formerly a plant engineer at the Pierce-Arrow factory and later assistant general superintendent. During the war he was in charge of the organization manufacturing Hispano-Suiza aircraft.

D. F. Hulgrave has been appointed manager of purchases for the Cadillac Motor Car Co., succeeding J. H. Main, who has been named director of the purchase section of the General Motors advisory board in Detroit. Hulgrave has been with the company for thirteen years, the latter three being assistant to Main.

John A. Cleary has resigned as advertising manager of the Cadillac Motor Car Co. to become advertising manager for the new Collins car. Cleary has been with Cadillac for a number of years, serving as sales promotion manager with the Philadelphia distributor before making the factory connection.

M. J. Flannery, formerly of the General Motors Export Corp. and the John N. Willys Export Corp., has been named assistant export manager for the Haynes Automobile Co. His office will be at 1715 Broadway, from which all foreign sales of the Haynes, except in Mexico, will be handled.

L. M. Rankin, vice-president and general manager of the Duesenberg Automobile & Motors Co., has appointed Harry W. Anderson as general sales manager of the company, with headquarters at the new Duesenberg plant in this city. He will begin upon his duties immediately.

R. S. Schaap, sales manager of the Schaap Co., Brooklyn, has left on a western trip, on which he will inspect several locations as the site of the company's proposed western plant. He will also appoint a number of western distributors for his company's products.

Thomas Mair, former comptroller for the Chevrolet company, has been transferred to the Oakland Motor Car Co., where he will succeed E. H. Tinsman, who has been transferred to the general comptroller's office of the General Motors Corp. at Detroit.

Frederick C. Horner, for several years transportation engineer of the Packard Motor Car Co., New York, is leaving the company to spend two years in Europe studying transportation practice in England, France, Belgium and Germany.

F. R. Robinson, secretary of the Packard Motor Car Co., has assumed also the duties of treasurer. He has been in the Packard organization for the past twelve years, holding successively the positions of auditor, comptroller and secretary.

W. B. Kelly, for 13 years works manager of the Oakland Motor Car Co., has resigned. He states that he has no definite plans for the future, but it is presumed he will join the Durant forces.

H. R. Hyman has resigned as advertising manager of the Cole Motor Car Co., Indianapolis. He will rest for several months before announcing plans for the future.

C. B. Rice, New York, who has been manager of exports for the Hamilton Motors Co., will also assume control of domestic sales of the company.

J. K. Harness has resigned as patent counsel for the Ford Motor Co. to resume private practice.

J. G. White has been appointed district sales manager at Detroit of the Sharon Pressed Steel Co., Sharon, Pa.

OTTAWA CAR BUILDER DIES

W. W. Wylie died here June 24 at the age of 61. He was for twenty years manager of the Ottawa Car Co. and manufactured the first street cars to run in the city as well as the first snow plows for use in clearing street-car tracks in winter. He built and ran the first motor car to speed through the city in 1894, the seat being pitched high on four very heavy solid wheels and the electric motor fitted to the box under the seat. The trial spin was the cause of much interest and amusement to pedestrians who watched the rather uncertain movements with some misgiving. In 1912, Mr. Wylie resigned the managership of the company which was later incorporated and now operates one of the best motor showrooms in the city as well as a large repair department.

INVENTOR SUES VAN BRIGGLE

INDIANAPOLIS, June 27—Suit has been filed in Circuit Court by George G. F. Boswell, inventor, asking for an injunction restraining Lilburn Howard VanBriggle of the VanBriggle Motor Device Co. and promoter of the interests of several manufacturing concerns of this city from making or selling shock absorbers or parts of shock absorbers.

Boswell charges in his complaint that he entered into an agreement with VanBriggle, April 12, 1918, for handling and making shock absorbers, on which he held patent rights. Full patent letters on the shock absorber were received in December, 1919, but since that time no shock absorbers have been manufactured by VanBriggle, and notice was served on him April 21, 1921, of the cancellation of the contract, according to Boswell. In the complaint, Boswell charges that VanBriggle is making the shock absorbers and he has, therefore, asked that such a restraining order be issued.

NEW PATENT BILL HELD UP

WASHINGTON, June 27 — Efforts to amend the patent law providing that foreigners shall within two years manufacture the article in the United States, or, in the discretion of the department, some other person may be granted a license to manufacture it, failed to pass the Senate to-day on objection of Senator Brandegee of Connecticut. His objection was based upon the protest of Frederick P. Fish, of Boston, a patent lawyer well known in the automotive trade, who declared that the amendment was dangerous because it established a precedent and opened up the question of a time limit upon when the granting of a patent must result in putting the article or commodity so patented upon the market. The Senate committee on patents has asked the views of the Commissioner of Patents and the Secretary of War before considering the bill in open session.

Truck Auction Bids Appear Fictitious

(*Continued from page 1453*)

for $2,500; 3½-ton Packards sold for $2,000; chain-driven 3-ton Whites for $1,900; and 4-ton Rikers for $1,800.

In the opinion of prospective buyers on the floor, to-day's prices did not indicate anywhere near the true valuation of the trucks. A representative of one of the large truck manufacturers stated that his company was given the opportunity to purchase a certain make of truck in lots for $350 each.

Each truck was sold with a guarantee against defective parts within 30 days of the purchase. Arrangements were made by the auctioneers for the sale of the trucks under the part payment plan, representatives of finance companies being on the floor.

OLDSMOBILE REVISES PRICES

NEW YORK, June 30—Price reduction on several models of the Oldsmobile, ranging from $45 to $575, and increases on two models, will be effective July 2. There will be reductions all along the line on the Model 43-A, the 4-cylinder car, and on the Model 46, big 8-cylinder. On the light 8, Model 47, the coupe is reduced, while the sedan is increased $30 because it could not be built at a profit at the old price. The light 8 touring car, a four-passenger job, is increased $30 because of the change from fabric to cord tires.

Prices of the 6-cylinder model will be unchanged.

PREMIER PRICES SLASHED

INDIANAPOLIS, June 30—The Premier Motor Car Corp., beginning July 1, will cut the prices of its cars from $710 to $910. The reductions are: Four-pass. touring from $4,600 to $3,690; 4-pass. sedan from $6,000 to $5,090; 7-pass. touring from $4,600 to $3,890; 7-pass. sedan from $6,100 to $5,190, and coupé from $5,600 to $4,690. There will be practically no changes in design and construction of the 1921 model.

WESTCOTT PAYS DIVIDEND

SPRINGFIELD, OHIO, June 29—Directors of the Westcott Motor Car Co. and the H. G. Root Co., automobile supplies, have authorized the payment of the regular quarterly dividend of 2 per cent on the preferred stock payable June 30.

BURY SHIFTS JOBS

DETROIT, June 29—G. R. Bury, general sales manager of the Packard Motor Car Co., has resigned on account of ill health and will go to Los Angeles to become associated with the Packard distributor in that territory. His successor has not been named.

Calendar

SHOWS

Sept. 5-10—Indianapolis, Automobile and Accessory Show in conjunction with Indiana State Fair, conducted by Indianapolis Automobile Trade Association, John B. Orman, Mgr.

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Sept. 23-Oct. 2—Berlin, German National Automobile Show, Auspices of German Automobile Mfg. Ass'n and German Automobile Club.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

July 4-9 — Mackinac Island, Mich., Summer Meeting Automotive Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

Dec. 27-29—Chicago, American Society of Agricultural Engineers, Auditorium Hotel.

RACES

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

Mixed Fuel Exempted from French Gas Tax

PARIS, June 12 (By Mail)—Gasoline mixed with alcohol or with benzol is now exempt from the French State tax of 20 centimes per litre. The decree declares that the mixture can be either 50 per cent alcohol and 50 per cent gasoline, or a mixture in equal proportions of gasoline, alcohol and benzol.

The French State gasoline tax initiated last year, always has been very unpopular and has brought forth innumerable protests from both manufacturers and automobile users, without, however, moving the authorities. All the big trucking interests are in favor of the use of a fuel composed of gasoline, alcohol and benzol, which experiments have shown can be satisfactorily employed in present engines. To get this on the market, however, it is essential that the price of the mixture should be lower than straight gasoline, and this has not been possible up to the present owing to the instability of alcohol prices and variations in the supply. The abolition of the State tax is a certain step in the direction of the adoption of this mixture.

As a further effort, a competition is now announced, with $50,000 in cash prizes for devices which will encourage the use of alcohol in internal combustion engines. Agricultural experts are also at work endeavoring to convince farmers of the advantage of occasionally raising beet crops in order to improve their land for wheat crops. The beets will be used for distilling alcohol, and at the same time the yield in wheat will be increased, it is declared, from 20 to 30 per cent.

Plane Service Connects Paris with Le Havre

PARIS, June 12 (By Mail)—Regular airplane service between Paris and Le Havre, a distance of 130 miles will be established this week in order to carry passengers to and from Atlantic liners using this port. This airplane service is being organized by the Compagnie des Messageries Aeriennes in conjunction with the French Line steamship company, whose liners sail from this port.

A protest has been made by the French aerial navigation companies against the Government plan of forming elaborate aerial stations, with sheds, equipment, and an expensive staff, on the main aerial routes. The operating companies maintain that all that is required is a chain of suitable landing grounds at intervals of not less than 30 miles along the entire route between Paris and London and Paris and Brussels. On the Belgian portion of the Paris-Brussels air line this view has been accepted, and the Air Ministry is now preparing emergency landing grounds at 30 mile intervals.

Lack of Roads Hurts Car Sales in Formosa

WASHINGTON, June 28 — American manufacturers of automobiles, trucks and tractors having the best success in Formosa are those whose agents have branches there equipped to give demonstrations, according to a report by Consul Henry B. Hitchcock, Taihoku, Taiwan, Japan, relating to conditions affecting the sale of these vehicles in Formosa. It also is urged that the value of judicious advertising should not be overlooked.

He states that the market for passenger vehicles and trucks in Formosa is as yet but a small one. Roads in the rural districts are not wide enough or sufficiently well maintained to be used for motor vehicles. In the large cities, however, the streets are generally wide and well kept up. The use of passenger automobiles and trucks is consequently confined to the large cities, of which there are but three with a combined population of 270,478. While the financial depression has not been felt so much in Formosa as in Japan, it will nevertheless have an effect on the sales of passenger automobiles and trucks for some time.

NASH MAKES CUT IN SALARIES

KENOSHA, WIS., June 27—At a mass meeting of all straight-time workers in the plant and offices of the Nash Motors Co., Kenosha, Wis., it was announced that the entire salaried force would receive a slight reduction effective July 1.

South Africa to Make Gasoline Substitute

WASHINGTON, June 27 — Penrol, South Africa, Ltd., is marketing 85,000 shares of stock to secure initial working capital for the production and sale of "Penrol," a gasoline substitute, according to a report made to the Bureau of Foreign and Domestic Commerce. This new fuel will be made principally from alcohol which will be produced from locally grown maize or mealies (corn). It has been patented in the Union of South Africa and its name registered. The advantages claimed are as follows:

It can be manufactured in South Africa solely from ingredients and constituents produced locally; the selling price will be considerably below that of gasoline; in power and driving force it is practically equal to gasoline; it has no smell and does not carbonize; it is non-corrosive, smokeless and stainless. Penrol has been subjected to trials and experiments for a considerable period in motor cars, motor cycles, motor trucks, and airplanes over a distance of 10,000 miles, with excellent results, according to reports from experts and leading firms.

The total gasoline consumption of the Union of South Africa is estimated at 12,000,000 gal. annually by the company, but the total for the past year was only about 11,000,000 gal. By-products of cattle feeds and other lines are also contemplated.

FORD LOWERS HOUSE PRICES

DETROIT, June 28—In line with his determination to bring about price readjustments in accordance with business conditions, Henry Ford has announced substantial price cuts on Ford homes in Dearborn. These suburban residences now are selling at low figures and at terms which are making them attractive to investors who naturally are numbered chiefly among the Ford employees. Ranging between $6,900 and $8,500, according to type, prices are considerably below market value for property in this section. The terms being allowed make the offers unusually attractive, Ford permitting down payments as low as 10 per cent and monthly installments varying from $38 to $85.